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Stability and change in physical activity in old age: the role of changes in disability

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Abstract The objective was to examine whether stability and change in physical activity in older men and women are influenced by (1) changes in disability and by (2) social relations and psychological well-being. The study is based on baseline, 3 and 4.5 year follow-up data on 917 older men and women. Changes in physical activity were measured through self-reported frequencies of vigorous physical activity at the three measurement points. The analyses were carried out for two outcomes—decline in physical activity versus sustained high level of physical activity (from high to low) and sustained low physical activity versus improvement in physical activity (from low to high). The main results were: older adults with onset of tiredness or continuous tiredness in daily activities during 4.5 years are more likely to have a concurrent decline in their physical activities during the same period. Older adults with onset of need of help and sustained need of help are more likely to have a decline in physical activities or to sustain a low level of physical activities during the same period. The associations between the psychosocial factors and change in physical activity are attenuated by the concurrent changes in disability. The present study supports that health promotion projects should be aware that development of tiredness and continuous tiredness are strongly related to a decline in physical activity and that onset of and sustained need of help are strongly associated with both a decline in and sustained low physical activity.

Keywords Older adults · Changes in physical activity · Tiredness · Social relations · Psychological factors

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Introduction

It is important to identify factors which promote a sustained or increased physical activity in old age, because lack of physical activity is one of the most important independent risk factors for onset of disability in older adults (Schroll et al. 1997; Stuck et al. 1999; Avlund et al. 2000; Brach et al. 2003; Schroll 2003).

Although several studies have identified factors related to physical activity measured at one point in time in older adults (for a review, see Schutzer and Graves 2004) we have only been able to find three population-based studies with focus on factors related to changes in physical activity in older persons. Burton et al. (1999) made several analyses for determinants of (1) increased vs. sustained low brisk physical activity and (2) sustained high versus decreased brisk physical activity. They did not include a measure of disability but found that health status at baseline was related to both decline and improvement in physical activity. Berger et al. (2005) analysed patterns of changes in physical activity in an older population using the most recent recommendations from American College of Sports Medicine, which suggest that “all people over the age of 2 years should accumulate at least 30 min of endurance type physical activity, of at least moderate intensity, on most—preferably all—days of the week” (Physical Activity and Health 1996; Pedersen and Saltin 2003). They found that changes in disability was the most important factor related to changes in physical activity. However, Berger et al. (2005) measured disability very roughly by one single question about difficulty walking a quarter of a mile. Visser et al. (2002) showed significant associations between change in physical activity and decline in mobility performance in older men and women during 3 years. Visser et al. (2002) and Berger et al. (2005) did not examine whether disability influenced stability and change in physical activity. It is possible that factors which are related to decline in physical activity (vs. sustained high) vary from factors related to sustained

low physical activity (vs. increase in physical activity). There is a need to get more knowledge about how changes in different levels of functional ability are related to stability and change in physical activity.

Several cross sectional studies have found that social relations and psychological well-being are related to physical activity among older adults (Wolinsky et al. 1995; Simonsick et al. 1999; Booth et al. 2000; McAuley et al. 2000; Bourdeaudhuij and Sallis 2002; Satariano et al. 2002). Significant others may be particularly important as models of appropriate behaviour and normative influence on regular participation in physical activity (Seeman 2000). Also poor psychological well-being, depressed mood and poor self-efficacy may discourage persons from engaging in health behaviours such as exercising (Schutzer and Graves 2004). It is thus important to study at population level whether psychosocial factors are also related to stability and change in levels of physical activity.

The objective was to examine whether stability and change in physical activity in older men and women are influenced by (1) changes in disability and by (2) social relations and psychological well-being.

Material and methods

Study population

The study is based on secondary analyses of the control group of a randomized intervention study on preventive home visits, which had the main aim to examine whether education of home visitors has any influence on the functional status of older people (Vass et al. 2002, 2004, 2005).

The baseline study in 1998 included all non-institutionalized citizens born in 1918 (80 years old) and 1923/1924 (74–75 years old) in 34 municipalities in Denmark ($n=4,060$). The present analyses are restricted to participants living in the control municipalities ($n=1,956$). We excluded 59 participants who had not answered the question about physical activity ($n=1,897$). At 3-year follow-up 227 persons had died and 280 persons were non-responders ($n=1,390$). At 4.5-year follow-up 151 persons had died and 183 persons were non-responders ($n=1,056$). (See flow diagram in Fig. 1). The present study is based on the 917 persons who survived and answered questions about physical activity at all three measurement points.

The data were collected by questionnaires at baseline, 3- and 4.5-year follow-up with questions about social relations and psychological factors at baseline and disability at all three measurement points.

Outcome measure

Physical activity was measured by the question “Do you practice any form of vigorous physical activity: e.g.

sports, gymnastics, dance, long bicycle rides, long walks, heavy garden work?”: never, rarely (not every month), once or twice per month, several times per month and several times per week. We distinguish persons with vigorous physical activity several times per month (high) and persons who practice vigorous physical activity more seldom (low). Patterns of changes in physical activity were first analysed by descriptive three-point-analyses based on information of physical activity at baseline, 3 and 4.5-year follow-up (Elkjaer and Poulsen 2004). Preliminary analyses showed the same patterns of associations between the independent variables and changes in physical activity when physical activity at 3-year follow-up were included as ‘high’ and as ‘low’. Consequently we combined the change variable into four categories as shown in the last column in Table 1. The analyses were carried out for two outcomes—decline in physical activity versus sustained high level of physical activity (from high to low) and sustained low physical activity versus improvement in physical activity (from low to high).

Covariates

Age: 80 years versus 74–75 years.

Disability: Measured in two ways as *tiredness in daily activities* by the Mob-T Scale (Mobility-Tiredness) and *need of help in daily activities* by the Mob-H Scale (Mobility-Help) (Avlund et al. 1996). The scales are formed by answers to questions about the following six activities: transfer, walk indoors, going outdoors, walk outdoors in nice weather, walk outdoors in poor weather, and climb stairs. The Mob-T Scale describes whether the participants perform the activities with or without tiredness afterwards and counts the number of items performed without tiredness. High scale value describes better function. The Mob-H Scale describes whether the participants manage the activities with or without need of help and counts the number of items managed without help. High scale value describes better function. In the present analyses the scales are dichotomized into persons with maximum and persons below maximum score. The Mob-T Scale can be regarded as a measure of early signs of mobility-related disability, whereas the Mob-H Scale can be regarded as a measure of actual mobility-related disability. Reliability tests on the Mob-T Scale showed agreement per cents 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 (Avlund et al. 1995). With regard to the Mob-H Scale reliability tests showed agreement per cents from 88.1 to 1.0 and kappa values from 0.94 to 1.0 for the included items on intra-rater and inter-rater tests (Avlund et al. 1995). The construct validity of the included items has been tested by the Rasch model of item analysis (Avlund et al. 1996). Analyses of criterion-related validity concluded that mobility as measured by the scales was strongly associated with diagnosed diseases (Schultz-Larsen et al.

Fig. 1 Flow diagram of the study population

1992), isometric muscle strength (Avlund et al. 1994), postural balance (Era et al. 1997) and physical performance (Avlund et al. 1994). Changes in disability from baseline to 4.5-year follow-up are described in the following four groups on the two scales: (1) sustained good, (2) deterioration, (3) improvement, and (4) sustained poor.

Social relations measured at baseline: Social diversity is measured as number of categories with which the participants have personal contact at least once a month: children, grandchildren/great-grandchildren, siblings, other relatives, friends/acquaintances (range 0–5). We distinguish persons with high (4–5) and low (0–3) social diversity. *Social participation* is measured by

Table 1 Changes in physical activity during 4.5 years among the old participants

Baseline–3 years–4.5 years	(N)	Percentage	Baseline–4.5 years	(N)	Percentage
High–High–High	(281)	31	Sustained high	(319)	35
High–Low–High	(38)	4	Decline	(161)	18
High–High–Low	(49)	5	Increase	(70)	8
High–Low–Low	(112)	12	Sustained low	(367)	40
Low–High–High	(42)	5			
Low–Low–High	(28)	3			
Low–High–Low	(47)	5			
Low–Low–Low	(320)	35			

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). We differ between low social participation (0–1) and high social participation (2–3 points). A test-retest study of the included items of social relations showed that the agreement per cents were between 72 and 100 and the kappa values between 0.50 and 1.0 (Due et al. 1999). Further, in-depth interviews demonstrated high face and content validity of the social relations measures used (Due et al. 1999).

Psychological resources measured at baseline: *Psychological well-being* is measured by three questions: (1) feeling down, (2) being aggressive and (3) feeling tired—without specific reason. We distinguish persons with high (seldom or never in two out of three categories) and low psychological well-being (other combinations of answers). *Sense of coherence* is measured by three questions about sense of manageability, meaningfulness and comprehensibility: usually versus sometimes or not (Lundberg and Peck 1995).

Ethics

The regional Ethical Committee involved approved the study.

Statistical design considerations

All analyses were performed both on the total sample and stratified by sex. The first step in the analysis was to test whether the independent variables were related to (1) decline in physical activity (vs. sustained high physical activity) and (2) sustained low physical activity (vs. increase in physical activity) at the bivariate level by chi-square tests. The variables found to be individually related to one of the outcome measure of physical activity ($P < 0.20$) were then incorporated as independent variables in the logistic regression analyses. The following factors were entered in the regression model: (1) age and sex, (2) changes in tiredness in daily activities, (3) changes in need of help in daily activities, and (4) psychosocial factors at baseline.

Results

In total, 78–79% of the men and women were 75 years old and 21–22% were 80 years old at baseline. Table 1 shows the distribution of changes in physical activity from baseline to 3- and 4.5-year follow-up. The table shows a large variety of patterns of changes in physical activity with nearly equal proportion with sustained high and sustained low physical activity.

A significantly larger proportion of the men (43%) had a high level of sustained physical activity during

4.5 years compared to the women (29%) and a significantly larger proportion of women (48%) had sustained low physical activity during the 4.5 years compared to men (30%) ($P < 0.0001$) (not shown in table).

Table 2 shows the characteristics of the male and female participants in the study. A large proportion of participants managed their daily activities without tiredness and without need of help during the 4.5-year follow-up period. Compared to the male participants a significantly larger proportion of women developed tiredness and need of help during follow-up or had continuous tiredness and need of help during follow-up. Significantly more men than women had low social participation and low psychological well-being at baseline.

Decline in physical activity

Table 3 shows the bivariate associations between the included characteristics of the participants and stability and change in physical activity during 4.5 years (columns 2–5). Older age, changes in tiredness and need of help, low diversity in social relations, low psychological well-being and low sense of coherence were related ($P < 0.20$) to a decline in physical activity during 4.5 years. Consequently these variables were included in the multivariate logistic regression analysis.

Table 4 shows the results of the multivariate logistic regression analyses with decline in physical activity during 4.5 years as dependent variable. The adjusted analysis shows that development of tiredness, continuous tiredness, onset of need of help and sustained need of help are independently associated with decline in physical activity. In the adjusted analyses

Table 2 Characteristics of the participants in the study by sex

	Men, % (N = 402)	Women, % (N = 515)	P
75 years	78	79	0.846
80 years	22	21	
Changes in tiredness			< 0.0001
Not tired–not tired	58	35	
Not tired–tired	21	26	
Tired–not tired	5	7	
Tired–tired	15	32	
Changes in need of help			< 0.0001
No help–no help	82	59	
No help–help	10	20	
Help–no help	2	4	
Help–help	5	17	
Baseline characteristics			0.641 0.028 0.002 0.344
Low social diversity	44	46	
Low social participation	50	43	
Low psychological well-being	35	45	
Low sense of coherence	49	53	

P Pearson's χ^2 -test for equal distribution of covariates among men and women

Table 3 Bivariate associations between covariates and changes in physical activity during 4.5 years

	<i>N</i>	Sustained high physical activity (%)	Decline in physical activity (%)	<i>P</i> ^a	<i>N</i>	Increased physical activity (%)	Sustained low physical activity (%)	<i>P</i> ^b
Men	251	69	31	0.315	151	20	80	0.111
Women	229	64	36		286	14	86	
Younger (75 years old at baseline)	396	69	31		323	18	82	
Older (80 years old at baseline)	84	54	46	0.006	114	11	89	0.063
Changes in tiredness during 4.5 years								
Not tired–not tired	299	78	22	< 0.0001	115	29	71	< 0.0001
Tired–not tired	24	58	42		32	19	81	
Not tired–tired	95	49	51		124	15	85	
Tired–tired	62	39	61		166	8	92	
Changes in need of help in mobility during 4.5 years								
No help–no help	407	73	27	< 0.0001	227	25	75	< 0.0001
Help–no help	14	64	36		98	14	86	
No help–help	46	28	72		14	8	92	
Help–Help	13	8	92		98	3	97	
Baseline characteristics								
High social diversity	292	70	30	0.077	111	18	82	0.403
Low social diversity	188	62	38		226	15	85	
High social participation	301	68	32		195	16	84	
Low social participation	151	64	36	0.429	242	16	84	0.951
High psychological well-being	329	70	30	0.011	213	20	80	0.040
Low psychological wellbeing	151	58	42		224	13	88	
High sense of coherence	268	69	31		179	14	86	
Low sense of coherence	121	63	37	0.180	256	18	82	0.330

P^a Pearson's chi-square test for equal distribution between sustained high and decline in physical activity

P^b Pearson's chi-square test for equal distribution between increased and sustained low physical activity

the effect of low social diversity on decline in physical activity are attenuated to very marginal associations and the influence of low psychological well-being and low sense of coherence on decline in physical activity disappears.

Improvement in physical activity

Table 3 shows that female sex, older age, changes in tiredness and need of help and low psychological well-being were related ($P < 0.20$) to sustained low physical activity during 4.5 years (columns 6–9). Consequently these variables were included in the multivariate logistic regression analysis.

Table 5 shows the results of multivariate analyses with sustained low physical activity as dependent variable. The significant odds ratios for development of tiredness and continuous tiredness during the 4.5-year follow-up on sustained low physical activity during 4.5 years are attenuated when adjusted by changes in need of help during the same period. The final result is that onset of need of help and sustained need of help are strongly associated with sustained low physical activity during the 4.5-year follow-up. The effect of low psychological well-being becomes insignificant in the adjusted analyses.

We repeated the analyses and stratified by gender. The results showed the same patterns of associations in men and women (not shown in table).

Discussion

We have examined whether changes in disability during 4.5-year follow-up and baseline psychosocial factors are related to stability and change in physical activity level during the same period.

The first important result is that older adults who develop tiredness or who continuously feel tired when performing their daily activities during 4.5 years are more likely to have a concurrent decline in their physical activities during the same period. This is in line with the study by Crombie et al. (2004) which showed that lack of energy is one reason for not participating in physical activity. It has earlier been shown that tiredness in daily activities is an early indicator of later disability and mortality (Avlund 2004) and that tiredness may reflect both the consequences of diseases and/or the consequences of age-related physiological and biological changes, which are not disease-based. Tiredness may thus be defined as a subjective measure of frailty, defined as a physiologic state of increased vulnerability to stressors that result from decreased physiologic reserves and even dysregulations of multiple physiologic systems (Fried et al. 2004). The present finding points to the need for more individually based health promotion strategies in older adults with these early signs of disability. As the reasons for tiredness in daily activities may be multifold (Avlund et al. 2006) it is important always to examine tired individuals for e.g. diseases, use of medication,

Table 4 Odds ratios for sex, age, changes in tiredness and need of help, social relations, and psychosocial factors on decline in physical activity (vs. sustained high) during 4.5 years. Logistic regression analyses ($n = 480$)

	Crude OR (95% CI)	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)	Model 5 OR (95% CI)
Women vs. men	1.22 (0.83–1.78)	1.24 (0.85–1.82)	1.02 (0.68–1.53)	1.04 (0.69–1.57)	0.96 (0.63–1.47)	0.98 (0.64–1.45)
Older vs. younger	1.95 (1.21–3.14)	1.97 (1.22–3.18)	1.54 (0.92–2.58)	1.42 (0.83–2.41)	1.34 (0.78–2.31)	1.34 (0.78–2.31)
Changes in tiredness during 4.5 years						
Not tired–not tired	1.0		1.0		1.0	1.0
Tired–not tired	2.57 (1.09–6.06)		2.54 (1.08–6.01)		2.52 (1.02–6.29)	2.40 (0.95–6.10)
Not tired–tired	3.68 (2.26–5.98)		3.61 (2.21–5.90)		2.60 (1.51–4.48)	2.61 (1.51–4.51)
Tired–tired	5.70 (3.19–10.18)		6.23 (2.89–9.47)		3.00 (1.47–6.13)	2.80 (1.33–5.92)
Changes in need of help in mobility during 4.5 years						
No help–no help	1.0			1.0	1.0	1.0
Help–no help	1.48 (0.49–4.52)			1.44 (0.47–4.41)	0.71 (0.21–2.38)	0.73 (0.22–2.46)
No help–help	6.77 (3.44–13.33)			6.21 (3.10–12.44)	3.25 (1.51–7.00)	3.19 (1.48–6.88)
Help–Help	32.0 (4.11–248.97)			29.77 (3.81–232.53)	13.89 (1.65–116.91)	13.43 (1.59–113.42)
Baseline characteristics						
Low social diversity vs. high	1.42 (0.96–2.08)					1.29 (0.85–1.97)
Low psychological well-being vs. high	1.69 (1.13–2.52)					1.18 (0.73–1.93)
Low sense of coherence vs. high	1.30 (0.89–1.90)					0.96 (0.62–1.48)

Model 1 Adjusted by sex and age; *Model 2* Adjusted by sex, age and changes in tiredness; *Model 3* Adjusted by sex, age and changes in need of help; *Model 4* Adjusted by sex, age, changes in tiredness and changes in need of help; *Model 5* Adjusted by sex, age, changes in tiredness, changes in need of help and the psychosocial factors

depressive symptoms. However, the present finding underlines that it may be important to be aware that one way of postponing disability in old age may be to give individual advice about physical activity among older persons who feel tired on their daily activities. In an

adult study population Eriksen and Bruusgaard (2004) actually showed that leisure time physical activity may prevent persistent fatigue.

The second important result is that older adults with onset of need of help and sustained need of help are

Table 5 Odds ratios for sex, age, changes in tiredness and need of help, psychosocial factors on sustained low physical activity during 4.5 years by logistic regression analyses ($n = 437$)

	Crude OR (95% CI)	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)	Model 5 OR (95% CI)
Women vs. men	1.53 (0.91–2.57)	1.55 (0.92–2.61)	1.14 (0.66–1.99)	1.04 (0.60–1.80)	1.0 (0.57–1.74)	1.02 (0.59–1.78)
Older vs. younger	1.86 (0.96–3.61)	1.88 (0.97–3.66)	1.56 (0.79–3.08)	1.46 (0.73–2.90)	1.43 (0.72–2.85)	1.46 (0.73–2.90)
Changes in tiredness during 4.5 years						
Not tired–not tired	1.0		1.0		1.0	
Tired–not tired	1.74 (0.66–4.63)		1.64 (0.61–4.40)		1.51 (0.54–4.21)	
Not tired–tired	2.37 (1.25–4.51)		2.23 (1.16–4.28)		1.51 (0.75–3.04)	
Tired–tired	4.74 (2.36–9.50)		4.28 (2.08–8.82)		1.34 (0.56–3.22)	
Changes in need of help in mobility during 4.5 years						
No help–no help	1.0			1.0	1.0	1.0
Help–no help	2.01 (0.44–9.26)			1.93 (0.42–8.99)	1.65 (0.32–8.42)	1.88 (0.40–8.74)
No help–help	3.77 (1.72–8.25)			3.58 (1.62–7.94)	3.03 (1.26–7.31)	3.51 (1.58–7.79)
Help–Help	10.61 (3.24–34.81)			9.99 (3.00–33.27)	9.08 (2.26–36.45)	9.38 (2.79–31.62)
Baseline characteristics						
Low psychological well-being vs. high	1.72 (1.02–2.89)					1.23 (0.71–2.13)

Model 1 Adjusted by sex and age; *Model 2* Adjusted by sex, age and changes in tiredness; *Model 3* Adjusted by sex, age and changes in need of help; *Model 4* Adjusted by sex, age, changes in tiredness and changes in need of help; *Model 5* Adjusted by sex, age, changes in tiredness, changes in need of help and psychological well-being

more likely to have a decline in physical activities or to sustain a low level of physical activities during the same period. This is not surprising, but underlines the importance of specific training programmes for disabled older persons. This is in line with earlier population-based findings (Visser et al. 2002; Berger et al. 2005) and findings from an intervention study, which showed that an increase in physical activity as part of an intervention program was significantly influenced by functional status (Kerse et al. 1999).

The odds ratios for weak social relations and poor psychological well-being on stability and change in physical activity were attenuated when adjusted by change in the two disability measures. This is in disagreement with several cross-sectional studies in older people, which showed that social relations and psychological factors are related to physical activity (Wolinsky et al. 1995; Simonsick et al. 1999; Booth et al. 2000; McAuley et al. 2000; Satariano et al. 2002; Bourdeaudhuij and Sallis 2002). It has earlier been shown that social relations and psychological well-being are related both to tiredness in daily activities (Avlund et al. 2006) and to onset of disability (Avlund et al. 2003, 2004). These findings indicate a pathway from poor social relations and well-being via tiredness to a decrease in physical activity. Tiredness may thus be seen as a kind of chronic reaction to the accumulated chronic strain of dealing with the effects of cumulated negative impact of stressful social relations or lack of social relations or poor psychological well-being in addition to the physiological and biologic decline that characterizes aging.

We did not find gender differences in the main results. Nevertheless compared to men, women had more sustained low physical activity, more continuous tiredness and more sustained need of help during the 4.5-year period. This is in agreement with other studies, which found that women had consistently higher rates of prevalent and incident disability compared to men (Newman and Brach 2001) and also have lower rates of physical activity (Bennett 1998; Armstrong and Morgan 1998).

The gender differences may have several explanations. It is known that, compared to men, women have higher rates of disabling, non-fatal chronic disease, e.g. musculoskeletal diseases, such as arthritis and osteoporosis (Leveille et al. 2000; Newman and Brach 2001) and depression (Macintyre et al. 1996), which may contribute to disability in old age. In addition, women have higher rates of comorbidity (Leveille et al. 2000), which also predict incident mobility disability, suggesting a dose-like effect for these conditions on future occurrence of disability (Boult et al. 1994). Constitutional factors related to body composition may predispose more women than men to becoming disabled. The higher risk of osteoporotic fracture in women compared to men is related to lower peak bone mass in women and accelerated bone loss beginning at menopause (Malkin et al. 2002). Women have poorer pulmonary function and lower aerobic capacity than men (Era et al. 2001) and

the age-related declines are larger for women compared to men (Era et al. 2001). Women also have more loss of muscle mass and higher percentages of body fat than do men (Newman and Brach 2001). Lower initial muscle strength in women, compounded by further strength losses that occur with aging may place older women at greater risk of mobility problems in old age, and help explain gender differences in disability.

There is evidence that regular participation in physical activity or exercise can minimize many of these physiological changes associated with typical aging and can be used as primary or adjunctive treatment for certain chronic diseases (Singh 2002). The shown gender differences in patterns of change in physical activity and in aspects of disability may imply that it is especially important to promote physical activity in older women.

Some methodological aspects should be considered in the interpretation of our results. The response rate at follow-up was relatively high (83.4%). We deal with a healthy participant effect: baseline participants had better functional ability than non-participants, and loss to follow-up was smallest among those with good functional ability. However, there is no reason to believe that the associations found would be systematically different in non-participants compared to participants. It is more plausible that the estimates would have been stronger without the attrition to follow-up, especially in the analyses among persons who were sedentary at baseline.

Regarding the design of the study, no causality of the observed associations can be inferred. Although changes in tiredness and need of help in daily activities have been shown to be related to concurrent changes in physical activity, it is also well-known that lack of physical activity will lead to changes in tiredness in daily activities (Schroll et al. 1997) and to onset of disability (Schroll et al. 1997; Visser et al. 2002). Tiredness/need of help and physical activity may be mutually reinforcing, causing a downward spiral leading to loss of disability in older persons.

Physical activity can be investigated in several ways. The used measure of physical activity in the present study is based on a single questionnaire item, which defines physical activity as practising vigorous physical activity several times per months. Unfortunately the data set does not include questions which more accurately resemble the recommendations of at least 30 min of endurance-type physical on most days of the week (Physical Activity and Health 1996; Pedersen and Saltin 2003).

We used a global question about physical activity with specific examples of physical activity and with broad answering categories. It may be questioned if this gives a reliable picture of the physical activity of the older adults. Some older people may practice different kinds of physical activity, which are not mentioned in the questions. Also, the answers do not give information about the type of activity, e.g. strength or aerobic training, and about the more exact dose of activity. It

might have given a more differentiated picture of the habits of physical activities in older men and women if we had asked separate questions about specific physical activities, about the type of activity and with more precise categories of dose of physical activity. Another possibility could have been to measure their present fitness in different types of tests, e.g. Timed Up and Go (Podsiadlo and Richardson 1991). It is a strength of the study that the analyses included well-validated measures of tiredness in daily activities, actual disability and of social relations (Avlund et al. 1996; Due et al. 1999).

Other studies have shown that physical activity is influenced by knowledge (Schutzer and Graves 2004), education (Burton et al. 1999), self-efficacy (Schutzer and Graves 2004), neighbourhood socio-economic environment (van Lenthe et al. 2005), other environmental characteristics such as aesthetics, safety, foot-paths (Schutzer and Graves 2004; Duncan and Mummery 2005) and other health behaviours such as diet (Lim and Taylor 2005). One way of getting further knowledge could be to examine whether these factors are related to actual changes in physical activity and to examine for different patterns of associations among men and women. However this was not possible in the present data set.

The present study supports that health promotion projects should be aware that onset of and sustained tiredness is strongly related to a decline in physical activity and that onset of and sustained need of help is strongly associated with both a decline in and sustained low physical activity.

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