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Does a falling level of activity predict disability development in community-dwelling elderly people?

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Abstract

Objective: To investigate the predictive value of self-reported decline in weight, exhaustion, walking difficulty, grip strength and physical activity on development of disabilities in community-dwelling elderly people.

Design: A one-year follow-up study.

Setting: Participants were recruited via four Dutch general practitioners.

Participants: Community-dwelling elderly people aged 70 years or older.

Methods: A total of 687 participants received a questionnaire at baseline regarding weight loss, exhaustion, walking difficulty, grip strength, physical activity and disability. The same questionnaire was sent to them after one year follow-up. Disability was operationalized in two ways: as increased dependence and as increased difficulty in daily activities. Univariate and multivariate logistic regression analyses were used to determine whether self-reported decline in five physical indicators at baseline predicted development of dependence or increased difficulty in daily activities after one year. The analyses were controlled for age, gender and baseline disability.

Results: Four hundred and one participants with a mean age of 76.9 years (SD 5.2) were included in the analyses. Eighty-four of them reported increased dependence (21%) and 76 reported increased difficulty (19%) in daily activities at one-year follow-up. All physical indicators, except weight loss, were significant univariate predictors of disability. Multivariate analyses revealed that self-reported decrease in physical activity (e.g. walking, cycling, gardening) was a significant predictor of development of dependence (odds ratio (OR) = 1.89, 95% confidence interval (CI) = 1.02–3.51) and development of difficulty (OR = 1.98, 95% CI = 1.05–3.71) in daily activities.

Conclusion: Community-dwelling elderly people who report decreased physical activity have a higher risk to develop disability at one-year follow-up.

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Introduction

As people get older, their biological, physical, psychological or social functioning can decrease. The interplay between these decreasing functions is referred to as 'frailty'[1–4] and causes an elderly person to become more vulnerable to adverse health outcomes such as disability, falls, hospitalization and death.[5–9] The use of healthcare and community services is higher in this group of vulnerable elderly people.[10] Early identification followed by adequate interventions might therefore be beneficial to these elderly people and healthcare systems as a whole.

A recent review shows that physical indicators that are related to frailty, such as weight loss, low gait speed, low grip strength, low physical activity, poor balance and low lower extremity function, are predictors of disability in community-dwelling elderly people.[11] Disability is often defined as experienced difficulty in performing activities in any domain of life.[12] Monitoring the development of physical indicators may help to identify elderly people in healthcare who could benefit from disability prevention programmes. Previous research suggests that there are interventions that can positively influence disability in community-dwelling elderly people.[13–15]

Decline in physical indicators over time might only be well observed by healthcare professionals conducting performance tests on a regular basis. Due to the increasing number of elderly people and decreasing number of professionals this is very difficult, if not impossible, to accomplish in daily clinical practice. Professionals need easy instruments as a first step in determining who is at risk for disability.[16] Self-reported measurements on physical indicators might be such an easy instrument since they are easier and cheaper compared with performance-based measures.

Most previous studies on the predictive value of physical indicators on disability development had a follow-up of at least three years. When professionals who work in clinical practice want to decide whether a preventive intervention should be offered to their patient, it might be more useful to know the 'short-term' predictive value of the physical indicators. Once an elderly patient is considered to be at risk of developing disability within the next year, action should be taken in the short term to prevent this. In a situation where patients have an increased risk of disability development in, for example, the next 3 or 5 years, the (perceived) need for initiation of preventive interventions might be lower. Therefore the aim of this study was to investigate the predictive value of self-reported decline in weight, exhaustion, walking difficulty, grip strength and physical activity on the development of disabilities in daily activities in community-dwelling elderly people at one-year follow-up.

Methods

Design and participants

This paper reports analyses of data collected from community-dwelling elderly people from the panels of four Dutch general practitioners.[17] At baseline, all community-dwelling elderly people aged 70 years or older from the panels ($N = 687$) received an invitation letter from their general practitioner. No other inclusion or exclusion criteria were used. The letter was accompanied by a consent form and a questionnaire. Elderly people who decided to participate provided written informed consent and filled out the questionnaire. After two weeks, a reminder was sent to non-responders. One year later all respondents, except the ones who had been admitted to a nursing home, received the same questionnaire again. All collected data were handled confidentially.

Measurements

The questionnaire contained questions regarding age, gender, five indicators of physical functioning and disability.

Decline in five physical indicators in the past 3–6 months was measured by five questions with yes/no or agree/disagree answer categories. These questions were: 'Have you experienced high unintended weight loss, ≥6 kg in the past six months or ≥3 kg in one month?',[18] 'In the past 3–6 months everything took more energy/effort', 'In the past 3–6 months I experienced more difficulty with walking', 'In the past 3–6 months I had more difficulty grabbing things with my hands', and 'In the past 3–6 months I did not do as many strenuous physical activities as before (such as walking, working in and around the house, sports, cycling, gardening)'.

Disability in daily activities at baseline and at one-year follow-up was measured with the Groningen Activity Restriction Scale (GARS), which has been proven to be valid and reliable.[19] A copy of the GARS is provided in appendix. The GARS consists of two subscales. The first subscale measures disability in activities of daily living (ADL) and consists of 11 items (e.g. getting dressed, getting in and out of bed and washing yourself). The second subscale relates to instrumental activities of daily living (IADL) and consists of 7 items (e.g. preparing breakfast or lunch, shopping and ironing). Both ADL and IADL were measured with the GARS and this combination will be referred to as daily activities throughout this article. For each item, participants indicated on a 4-point scale whether they could perform the activity independently without any difficulty (1), independently with some difficulty (2), independently with great difficulty (3), or whether they could not execute the activity independently (4). So, if participants scored 4 they depended on other people for the performance of that activity. Disability total sumscores were calculated and range from 18 to 72 (ADL and IADL subscale sumscores range from 11 to 44 and 7 to 28, respectively).

Disability in daily activities (ADL and IADL combined) was operationalized in two ways. The primary operationalization focused on increased dependence in daily activities and the secondary operationalization focused on increased difficulty in daily activities. The secondary operationalization was constructed because it might be a more sensitive measure of disability that captures more subtle decreases in the performance of daily activities. According to the primary operationalization, disability was present at one-year follow-up if a participant was dependent in at least 1 more activity at follow-up compared to baseline. This was calculated by subtracting the number of activities in which a participant was dependent at baseline from the number of activities in which a participant was dependent at follow-up. According to the secondary operationalization, disability was present if the number of activities in which a participant suffered from increased difficulty of at least 2 points after follow-up exceeded the number of activities in which a participant improved by at least 2 points after follow-up.

Statistical methods

Descriptive statistics were used to provide information on the baseline characteristics of the participants. If participants had one or two missing values on the GARS, the mean score of the non-missing items of that participant on the relevant subscale was imputed. If there were three or more missing values on the GARS the participant was excluded from the analysis. The participant was also excluded if there were missing values on one or more of the physical indicators. Independent samples *t*-tests were used to investigate whether baseline characteristics of participants who were lost to follow-up differed from those who remained in the sample.

Eight univariate logistic regression analyses were conducted to investigate the predictive value of the five indicators at baseline, age, gender and total disability sum score at baseline on the development of dependence in daily activities at one-year follow-up. The same univariate logistic regression analyses were conducted with development of difficulty in daily activities at one-year follow-up as dependent variable. Odds ratios and 95% confidence intervals were calculated to determine the predictive value of each independent variable.

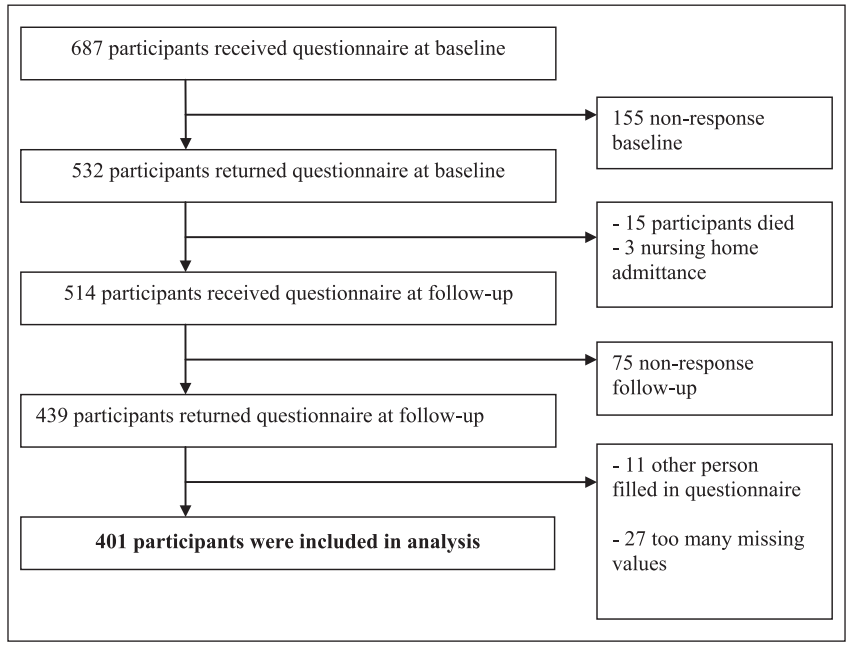

Figure 1. Flowchart of the study.

Two multivariate logistic regression analyses were conducted then to investigate which set of physical indicators at baseline is most predictive of the development of dependency in daily activities and the development of difficulty in daily activities at one-year follow-up, while adjusting for age, gender and baseline disability.

Results

Of the 687 elderly people who were invited, 532 (77%) returned the postal questionnaire for baseline measurement and written consent. The same questionnaire was sent to 514 of these 532 participants after one year (15 participants had died and 3 had been admitted to a nursing home). Of these 514 participants, 439 (85%) returned the questionnaire. Thirty-eight participants were excluded from the analyses because of too many missing values (n = 27) or because a different person filled out the questionnaire at baseline compared to follow-up (n = 11). Finally, 401 participants were included in the analyses. The follow-up of the participants is displayed in the flowchart in Figure 1.

In Table 1 information regarding age, gender, prevalence of physical indicators and level of disability of the study sample at baseline is presented. At one-year follow-up the level of dependence increased in 84 of the participants (21%), meaning that these participants needed help from another person with at least one more activity compared to baseline. Development of dependence was reported most frequent in the following activities: 30 participants developed dependence in taking care of feet and toenails (7.5%), 30 in shopping (7.5%), 24 in washing and ironing clothes (6%), and 24 in doing 'light' housework (6%). At one-year follow-up, 76 of the participants (19%) had increased difficulty in daily activities. Development of difficulty was reported most frequently in the following activities: 25 participants developed difficulty in washing and ironing clothes (6.2%), 24 in taking care of feet and toenails (6%), and 19 in doing 'light' housework (4.7%).

Some differences in baseline measurements were found between participants who were lost to

Table 1. Baseline characteristics of participants.

Characteristics	Mean (SD) or *n* (%)
Age in years	76.9 (SD 5.2)
Gender:	
Men	164 (41%)
Women	237 (59%)
Physical indicators:	
Self-reported weight loss	20 (5%)
Self-reported exhaustion	128 (32%)
Self-reported walking difficulty	163 (34%)
Self-reported low grip strength	48 (12%)
Self-reported low physical activity	140 (35%)
GARS total sum score (ADL + IADL)	23.9 (SD 7.9)
Disability:	
Dependent in 1 activity	44 (11%)
Dependent in 2 activities	32 (8%)
Dependent in 3 activities	32 (8%)
Dependent in 4 or more activities	36 (9%)

GARS, Groningen Activity Restriction Scale (range 18–72); ADL, subscale activities of daily living (range 11–44); IADL, subscale instrumental activities of daily living (range 7–28).

follow-up and participants who remained in the sample. Those lost to follow-up reported significantly more weight loss (11%) $P < 0.001$, walking difficulty (49%) $P = 0.004$ and low grip strength (21%) $P = 0.04$, and reported higher disability sum scores at baseline (28.6 (SD 12.4)) $P < 0.001$.

Table 2 presents the results of the univariate analyses. A significant association was found between four physical indicators at baseline and development of dependence in daily activities at one-year follow-up. Decreased physical activity at baseline was the strongest predictor of the development of dependence in daily activities at one-year follow-up (OR = 3.16, 95% CI = 1.93–5.19). Weight loss was the only non-significant indicator (OR = 1.67, 95% CI = 0.62–4.47).

Total GARS sum score at baseline also predicted development of dependence in daily activities at one-year follow-up (OR = 1.07, 95% CI = 1.04–1.10). Age (OR = 1.06, 95% CI = 1.00–1.12) and gender (OR = 0.78, 95% CI = 0.47–1.28) were not significant (univariate) predictors of increased dependence in daily activities.

The eight univariate regression analyses with increased difficulty in daily activities as dependent variable yielded similar results.

Table 3 shows the results of the two multivariate logistic regression analyses. Self-reported decreased physical activity at baseline (OR = 1.89, 95% CI = 1.02–3.51) and baseline disability as measured by the GARS sum score (OR = 1.04, 95% CI = 1.01–1.08) were the two independent variables that significantly

Table 2. Univariate association between single variables at baseline and disability development at one-year follow-up.

Independent variable at baseline	Dependent variable: Increased dependence in daily activities at follow-up[a] OR (95% CI)	Dependent variable: Increased difficulty in daily activities at follow-up[b] OR (95% CI)
Unintended weight loss	1.67 (0.62–4.47)	1.06 (0.34–3.25)
Increased exhaustion	2.67 (1.64–4.40)*	2.71 (1.63–4.51)*
Increased walking difficulty	2.26 (1.38–3.70)*	2.13 (1.29–3.54)*
Decreased grip strength	2.00 (1.03–3.92)*	2.88 (1.49–5.58)*
Decreased physical activity	3.16 (1.93–5.19)*	2.87 (1.73–4.78)*
Age	1.06 (1.00–1.12)	1.08 (1.03–1.13)*
Gender	0.78 (0.47–1.28)	0.63 (0.37–1.07)
GARS total sum score	1.07 (1.04–1.10)*	1.04 (1.02–1.07)*

*Significant predictor $P < 0.05$.

[a]Increased dependence was present in a participant if they were dependent in at least one more activity at follow-up compared to baseline.

[b]Increased difficulty was present in a participant if the number of activities with increased difficulty (of at least 2 points) after follow-up, exceeded the number of activities in which a participant improved (at least 2 points) after follow-up.

Table 3. Multivariate predictors of disability development at one-year follow-up.

Independent variables at baseline	Dependent variable: Increased dependence in daily activities at follow-up[a] OR (95% CI)	Dependent variable: Increased difficulty in daily activities at follow-up[b] OR (95% CI)
Weight loss	1.06 (0.37–3.07)	0.69 (0.21–2.26)
Increased exhaustion	1.35 (0.65–2.78)	1.59 (0.77–3.30)
Increased walking difficulty	0.93 (0.46–1.87)	0.97 (0.48–1.97)
Decreased grip strength	0.85 (0.38–1.92)	1.91 (0.87–4.20)
Decreased physical activity	1.89 (1.02–3.51)*	1.98 (1.05–3.71)*
Age	1.03 (0.98–1.08)	1.06 (1.01–1.12)*
Gender	0.90 (0.52–1.53)	0.82 (0.47–1.44)
GARS sum score	1.04 (1.01–1.08)*	0.99 (0.95–1.03)

*Significant predictor $P < 0.05$.
[a]Increased dependence was present in a participant if they were dependent in at least one more activity at follow-up compared to baseline.
[b]Increased difficulty was present in a participant if the number of activities with increased difficulty (of at least 2 points) after follow-up, exceeded the number of activities in which a participant improved (at least 2 points) after follow-up.

predicted increased dependence in daily activities at one-year follow-up. If an elderly person scored 10 points higher on the GARS at baseline, their risk for increased dependence at one-year follow-up increased by 1.54 (95% CI = 1.06–2.23). If an elderly person scored 20 points higher on the GARS at baseline, their risk for increased dependence at one-year follow-up increased by 2.36 (95% CI = 1.12–4.98). It should be noted that multivariate logistic regression analyses with increased ADL or IADL dependence as dependent variable, instead of a combination of the two as described above, yielded similar results.

The second multivariate logistic regression analysis revealed that self-reported decreased physical activity at baseline (OR = 1.98, 95% CI = 1.05–3.71) was also the only indicator of physical functioning that was a significant predictor of increased difficulty in daily activities after controlling for age, gender and baseline disability. In this model, age was also a significant predictor of increased difficulty in daily activities (OR = 1.06, 95% CI = 1.01–1.12).

Discussion

From the results it can be concluded that for community-dwelling elderly people who report decreased physical activity (e.g. walking, cycling, gardening) in the past 3–6 months at baseline, the risk of increased dependence and the risk of increased difficulty in daily activities at follow-up was significantly higher. Community-dwelling elderly people who answered 'no' to the question: 'Did you do as many strenuous physical activities as before in the past 3–6 months' were almost twice as likely to become more dependent or to suffer from increased difficulty in daily activities at one-year follow-up. These analyses were controlled for the four other physical indicators (weight loss, exhaustion, walking difficulty and grip strength), baseline disability, age, and gender. These findings are in line with previous research.[20]

Previous research has shown that physical indicators, such as weight loss, gait speed, grip strength and physical activity, are predictors of the development of disability.[21–32] In the multivariate analyses of this study, only physical activity was a significant predictor of disability development after one year. A possible explanation for this discrepancy might be that most previous studies did not include the same physical indicators in their multivariate analyses. In the current study, almost all indicators were significant univariate predictors of the development of disabilities, but when correcting for all indicators in one multivariate model, only self-reported physical activity was a significant predictor.

When comparing the results from the present study to previous research it appears that answering 'no' to a simple question provides us with disability-risk estimates of about the same magnitude as performance-based measures or multi-item questionnaires regarding indicators of physical functioning.[10,24,25,27,28,32,33] Self-reported physical activity predicts disability development in the next year, which is a relevant timeframe for professionals who are involved in the care of elderly people.

Limitations of the study

One might consider the use of only self-report data a limitation of this study. When community-dwelling elderly people are asked to report on their physical functioning, they often overestimate their own physical functioning.[34,35] Performance-based measures therefore might identify more limitations in physical functioning compared to self-report measures.[36] Furthermore, the questions that were asked in this study to retrieve information regarding physical indicators sometimes focus on surrogates of that indicator. For example, it might be difficult for people to tell whether their walking speed has decreased or whether they have lower grip strength, and therefore questions regarding these indicators focus on difficulty with walking or difficulty in grabbing things with your hands. Besides that, baseline status was measured as 'a single snapshot' which might have influenced the stability of the measurements. Also, the psychological state and self-perceived health status of a participant at the moment of filling out the questionnaire may have influenced the results because these concepts are related to the self-reported physical indicators that were measured.[37] However, this does not mean that self-reported measures are not valid. Previous research has shown that self-reported measurements of physical indicators can be used as a simple screening instrument.[38,39]

A limitation of this study was that participants who remained in our sample reported less weight loss, walking difficulty, decreased grip strength and disability at baseline compared with participants who were lost to follow-up. If these participants had not been been lost to follow-up, the level of disability and the variation in physical indicators and disability would possibly have been higher. Therefore it is likely that the results from our study underestimate the predictive strength of the indicators. However, this cannot be confirmed with the available data. Furthermore, the analyses were only adjusted for age, gender and baseline disability and not for other factors, such as medical condition, cognitive status or comorbidity, which can be considered a limitation of this study since these factors are related to functional status.[40]

Finally, a remark should be made regarding the operationalization of disability in this study. All regression analyses were performed twice, with a different operationalization of disability as outcome. This was done to check whether more subtle changes in performance of daily activities are predicted by the same physical indicators, which seemed to be the case. However the cut-off point that was chosen to define difficulty in daily activities (2 points increase on a GARS activity) was arbitrary and changing the cut-off point might lead to other risk estimates.

Implications for clinical practice and future research

Providing interventions aimed at preventing disability to elderly people at risk may be beneficiary to the health status of these people and healthcare systems as a whole.[41] This study shows that a simple indicator – self-reported decrease in physical activity – is a good predictor of disability development within the next year. For clinical practice this is a highly relevant finding. When an elderly person reports that he or she has stopped cycling or walking, this might be a strong signal that requires attention from care professionals. By monitoring the progression of indicators of physical functioning, healthcare professionals can select elderly people who can optimally benefit from an intervention that aims to improve their level of functioning in daily life.

Although there is no consensus yet on the effective components of interventions, previous research indicates that multifactorial and multidisciplinary treatment and prevention strategies are likely to yield the best results and can have a positive effect

on disability.[14–16,42] An example of such an intervention programme in primary care is described by Daniels et al.[43] Future research should focus on developing effective interventions that prevent or decrease disability in elderly people and systematic procedures that can be used to identify elderly people who could benefit from such interventions.

Clinical messages

- Community-dwelling elderly people who report decreased physical activity have a higher risk of developing disability at one-year follow-up.
- A simple question regarding physical activity can provide a useful disability risk estimate to professionals in clinical practice.

Author contributions

All authors have contributed equally to this article.

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Conflict of interest

All authors declare they have no conflict of interest.

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