Predicting catastrophic decline in mobility among older people

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Abstract

Objective: to investigate the associations between chronic health conditions, psychosocial and environmental factors and catastrophic decline in mobility among older people.

Design: longitudinal cohort.

Setting: national sample living in private households.

Participants: nine hundred and ninety-nine adults aged ≥65 years at initial interview, of which 786 agreed to take part in a follow-up survey 12 months later, and 531 responded to the questionnaire.

Measurements: catastrophic decline in mobility: inability to do any of the three activities of daily living items—walking 400 yards, climbing up and down stairs or steps and getting on a bus—having been capable of independently doing all three one year earlier.

Results: similar annual rates of catastrophic decline were reported for men and women: 4.8 [95% confidence interval (CI) 2.7–8.3] and 4.6% (2.4–8.6), respectively. Strong associations were found between catastrophic decline and age >70 years, hearing problems and health deterioration, odds ratio (OR) 3.7 (95% CI 1.1–11.8), 2.8 (1.1–7.3) and 4.3 (1.2–14.7), respectively. Poor perceptions of health, loss of control and feeling fearful also appeared to be important: below average summary psychological status, OR 6.5 (1.9–22.3). Inability to do heavy housework, carry heavy shopping or bend to cut own toenails, indicating poor functional reserve capacity, was strongly associated with decline, OR 6.8 (2.2–20.8).

Conclusion: psychosocial factors are as strongly associated with catastrophic decline as deterioration in health status. Interventions to reduce the risk of catastrophic decline may require management of psychosocial problems as well as health condition components.

Keywords: catastrophic decline, mobility, social engagement, physical reserve capacity, elderly

Introduction

Decline in functional ability among older people is of clinical relevance as a marker of potentially treatable clinical disease [1, 2] and is of public health importance in projecting the burden of disability associated with population ageing [3, 4]. Much attention has been given to risk factors associated with decline [5–7]. In these studies, decline in functional status has generally been defined using a composite made of a wide range of items that are not specific to one domain. Although valuable in the identification of predictors of decline in a general sense, such an approach cannot describe the determinants of decline in specific domains of functioning [1, 7]. Distinctions may be made between progressive and catastrophic disability in several activities of daily living (ADL) [8], or in a single item such as walking [9]. Both patterns of decline are associated with increased mortality [8, 9]. Finding predictors of decline is potentially useful for prevention and in better targeting of health and social services, as well as providing better understanding of the process of disablement. However, risk factors examined in previous studies have been dominated by a bio-medical model emphasising the new onsets of common diseases and associated lifestyle risk factors, such as body mass index and smoking habit. Our intention was to elucidate the associations between a wide range of medical, social and psychological...
risk factors and catastrophic decline in mobility, thereby identifying areas amenable to intervention.

**Methods**

Data were obtained from a national cross-sectional survey of 999 individuals aged 265 years, representative of British households, representing a 68% response rate. Further details were reported previously [10]. Of the sampled individuals, 789 (79%) agreed to further contact, and 531 (68%) responded to the postal questionnaire follow-up survey 12 months later, representing 36% of the original sample asked to participate. Their mean age was 73.4 (SD 6.4), and 46.5% were women.

Mobility dependency was defined as either needing help in doing or being unable to do any of the three ADL items—walk 400 yards, climb up or down stairs and get on a bus. Catastrophic decline in mobility was defined as change from independence in all three activities at baseline to needing help or being unable to do at least one of the activities at follow-up. We conceptualised the determinants of catastrophic decline in mobility as falling into the following groups, based on previous work demonstrating the importance of disease processes and lifestyle risk factors and expanded to take both social and psychological factors into account and also to include an indicator of an individual’s functional reserve capacity or ‘fitness gap’ [11].

At baseline, needing help and being unable to do heavy housework, carry heavy shopping and bend to cut toenails were combined into a single index, scored as able in all three or unable in one or more. This index indicates an individual’s functional reserve capacity in terms of stamina (doing heavy housework), muscle strength (carrying) and flexibility (bending to cut toenails). Major life changes were defined as any major events reported between baseline and follow-up. Reported changes included death of a spouse or a close relative or friend, experience of crime, moving house or other major social changes.

Health conditions were identified by a diagnosis checklist; these were grouped into circulatory conditions, respiratory conditions, mental health problems and musculoskeletal conditions. Hearing and vision problems were considered separately. A wide range of questions were also asked at baseline focusing on perceived control over one’s life, health expectations, safety of the environment, social support and social engagement indicated by voting and getting out and about. Further details were previously reported [10].

In our analysis, we focused on factors that were previously identified as significantly associated with long-standing illness or limiting long-standing illness. Associations with chronic health conditions and socio-demographic factors were individually examined. To improve the power of our relatively small sample, we reduced the number of parameters by grouping related variables. Psychological, social engagement, social support and physical environment domains were analysed by creating a score for each domain by summing all its binary items. The score was then dichotomised at its median to a binary variable coded 1 for poorer than median and 0 for median or better. In addition, the variables within each domain were treated individually to examine the independent importance of each.

From the 999 individuals investigated at baseline, 11 cases were excluded because of missing data. Of the remaining 988 participants, 19.5% of the women and 13.7% of the men were excluded because they were mobility-dependent. During the follow-up period, 19 people had died. The study was confined to 427 individuals who reported intact mobility at baseline and for whom information at follow-up was available. Comparisons of the baseline characteristics among those included and not included in analyses were made. In addition, a separate comparison was made between those who were and those who were not mobility-dependent at baseline.

The statistical package STATA (9.0) was used for all analyses. The annual incidence rates of catastrophic decline in mobility were calculated by gender and by age groups, 65–70 and >70 years old. The odds ratios (ORs) for catastrophic decline were adjusted for socio-demographic factors and health conditions. We have not adopted a significance level approach to this issue but feel that the 95% confidence intervals (CIs) provide the reader with an estimate of the precision of our findings. No adjustment for multiple comparisons was made, adopting Rothman’s position that such adjustments may not be necessary [12].

**Results**

Those included in this study tended to be slightly younger (mean age 73.4 versus 74.2 years), to have a higher socio-economic status than the total sample recruited at baseline (17.5 versus 30.9% living in rented accommodation, \(P<0.001\)) and to report below median levels of social engagement (32.2 versus 39.2%, \(P<0.01\)). There were no significant differences between those included and those not included in terms of self-rated health, functional reserve capacity, physical environment, psychological factors and social support.

The comparison made between people who were and those who were not mobility-dependent at baseline showed that the group excluded because of mobility dependency was different from that included with respect to various factors. Those excluded had a higher percentage of women, were older and had higher prevalence of circulatory, respiratory and musculoskeletal problems. They were also worse in their socio-economic status, psychological, social engagement, physical environment and functional reserve capacity scores.

The annual incidence rates of catastrophic decline in mobility were similar in men and women: 4.8 (95% CI 2.7–8.3) and 4.6% (95% CI 2.4–8.6), respectively. The incidence rate for those aged ≤70 years was 1.9% (95% CI 0.7–4.8) compared with 7.3% (95% CI 4.5–11.6) for the older group (>70 years). Table 1 summarises the distribution of socio-demographic factors, health conditions, factors from other domains including psychological, physical environment, social support and social engagement that might be potential predictors of catastrophic decline in mobility, classified by gender and age group. In addition, Table 1 presents...
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adjusted ORs, where adjustment was made for socio-demographic factors and health conditions. With exception of hearing, there was no strong associations between health conditions at baseline and catastrophic decline in mobility, although reports of deterioration in health, poor functional reserve, poor self-rated health, higher chances of falling and experiencing a major life change were strongly associated with catastrophic decline in mobility.

Participation in games or sports appeared to be protective, OR 0.3 (95% CI 0.1–0.8).

The unadjusted and fully adjusted ORs for catastrophic decline in mobility by summary variables for each of the major domains are summarised in Table 2. The only health condition that was significantly associated with catastrophic decline in mobility after controlling for possible confounders was hearing, OR 2.8 (95% CI 1.1–7.3). Respiratory problems were also fairly strongly associated with catastrophic decline in mobility, but the estimate was imprecise, OR 2.8 (95% CI 0.8–10.3). Functional reserve capacity and experience of any major life changes were strong predictors of...
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Table 2. Odds ratios and 95% confidence intervals (CIs) for catastrophic decline in mobility by summary variables of major domains

<table>
<thead>
<tr>
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<th>Odds ratios (95% CI)</th>
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<tbody>
<tr>
<td></td>
<td>Unadjusted</td>
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<tr>
<td>Socio-demographic factors</td>
<td></td>
</tr>
<tr>
<td>Age &gt;70</td>
<td>4.0 (1.2–12.9)</td>
</tr>
<tr>
<td>Health conditions</td>
<td></td>
</tr>
<tr>
<td>Hearing problems</td>
<td>3.0 (1.1–8.0)</td>
</tr>
<tr>
<td>Self-report of health deterioration</td>
<td>3.4 (1.2–9.2)</td>
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<tr>
<td>Functional reserve capacity</td>
<td>5.8 (2.2–15.5)</td>
</tr>
<tr>
<td>Psychological factors</td>
<td>4.7 (1.6–13.6)</td>
</tr>
<tr>
<td>Physical environment</td>
<td>1.2 (0.4–4.0)</td>
</tr>
<tr>
<td>Social support</td>
<td>2.5 (0.9–6.8)</td>
</tr>
<tr>
<td>Social engagement</td>
<td>3.1 (1.3–5.3)</td>
</tr>
</tbody>
</table>

Odds ratios adjusted for socio-demographic factors and health conditions.

catastrophic decline in mobility, ORs 6.8 (95% CI 2.2–20.8) and 5.4 (95% CI 2.2–13.9), respectively. Self-rated health and self-reported health deterioration were significantly associated with catastrophic decline in mobility, ORs 7.0 (95% CI 2.4–20.6) and 4.3 (95% CI 2.2–14.7), respectively.

For the psychological and the social engagement domains, summary scores poorer than median were strongly associated with catastrophic decline in mobility, ORs 6.5 (95% CI 1.9–22.3) and 2.9 (95% CI 1.1–7.1), respectively. None of the items indicating adversity in the physical environment showed significant associations with catastrophic decline in mobility, nor did the combined score. However, the directions of these associations were as expected.

Discussion

Our findings highlight the importance of older age, major life changes, psychological and social engagement factors in predicting catastrophic decline in mobility. Much less importance could be attributed to the experience of chronic health conditions than might have been anticipated. In addition, our newly defined index of functional reserve capacity was found to be a strong predictor of catastrophic decline in mobility.

Various definitions of intact mobility have been employed by previous studies, but walking and ability to climb stairs are most frequently used [1, 7, 9]. Rather than using solely one item, we assessed mobility using these two items together with ability to get on a bus. This provided a fuller assessment of mobility limitations and might be more sensitive to important changes in functional status than reliance on the single item of walking ability. We had conceptualised potential risk factors as falling into a range of likely domains—worsening of chronic health conditions and onset of acute conditions, removal or weakening of social support, psychological status, adversity in the physical environment, major life changes and poor physical reserve capacity. These factors were chosen as proxies for more general factors suggested by most theoretical models of disability [13, 14]. These models highlight the importance of multi-dimensional background affecting an individual’s capacity to function and to execute tasks and lead to the adoption of a bio-psycho-social model based on the integration of medical and social models.

The association between age and mobility decline, identified by this study, was expected and has been well established before [1, 5, 7, 15–18]. Younger women were at a higher risk of decline than men, but this pattern reversed at older ages. Previous studies have explained the higher prevalence of disability among women at older age as largely because of their longer survival with disability, rather than reflecting a higher incidence of disability [6, 8, 19]. However, other studies have suggested that women have greater rates of decline than men [5, 15, 17, 20]. Variations in definitions of decline, mobility, age grouping and follow-up times across studies would inevitably make some contribution to the gender differences. For these reasons, we conducted separate analysis for men and women but found that, with the exception of age, the predictors of catastrophic decline in mobility were similar for both sexes.

Self-rated health was found to be a strong predictor of catastrophic decline in mobility corroborating many previous studies where self-rated health was identified as a predictor of functioning and mortality [17, 20–22], survivors of advanced cancer [23], reduced vision [24], walking ability [25], severity of walking difficulty for women [18] and ADL involving mobility [26]. It is most likely that self-rated health acts as a proxy for multiple pathologies, integrating the cumulative functional effects of different pathological processes.

Functional reserve capacity, based on the performance of ADLs related to stamina, strength and flexibility at baseline, was also an important predictor. This simple composite is based on the concept of the ‘fitness gap’ between peak attainable performance in a domain, for example muscle strength, and the proportion of peak performance required to carry out everyday tasks [11]. Individuals who are operating close to the margin of their peak performance are more vulnerable than those who have a greater margin between what they can achieve at best and what they habitually do. Although direct formal tests of physical capacity, such as gait speed, are commonly conducted and are growing in popularity as means of assessing frailty [27] and predicting disability [28, 29], they are not conceptualised or analysed in terms of functional reserve capacity. It would also be useful to examine whether direct measures in the domains of stamina, strength and flexibility operate interactively to increase the risk of catastrophic decline, survival and other relevant outcomes.

Limitations

The process of functional decline is complex [8, 14, 30, 31], and longitudinal data with multiple evaluations would be required to track the entire process. Recent studies assessing ADLs monthly [30] suggested that shorter intervals (3–6 months) for follow-up would be required to avoid substantial underestimation of change in ADLs. However, previous reports on catastrophic decline have used a time interval of 2 years from baseline. We were limited by our design with a 1-year follow-up, but our annual rate of decline of almost 5% per year was about five times higher than reports of
catastrophic decline in walking and in three or more ADLs of about 1% per year in the Established Populations for Epidemiological Studies of the Elderly, although this difference may well be explained by differences in the age distribution of the two samples [8, 9].

Common health conditions such as heart attack, stroke, cancer and hip fracture have been identified as independent predictors of catastrophic decline in walking; in half of the cases of catastrophic decline, a stroke, hip fracture or a cancer had occurred [9]. In our sample, common disease categories, even in univariate analyses, appeared to have little association with catastrophic decline in mobility. This may reflect differences in the ascertainment of new onsets of disease, definition and timing of decline, population age structure and survivorship bias leading to loss through death of those affected by common diseases. The sample size gave 80% power to detect differences of 2-fold in relative risk for predictors affecting >10% of the sample; this fell to 2.5-fold for differences on predictors affecting only 5% of the sample. In multi-variable evaluations, it was clear that the self-ratings of health and deterioration in health were powerful predictors that probably integrate cumulative effects of multiple health conditions, providing a more useful way of examining the effects of health conditions along with the other determinants of decline.

It is possible that the relatively low-response rate to the follow-up questionnaire has biased our findings. Our comparison of baseline characteristics among those who were and those who were not included in these analyses shows that participants were on average less socio-economically and those who were not included in these analyses shows follow-up questionnaire has biased our findings. Our com-


ditions involving psychological and social support in addition to the known medical treatments.

Key points

- About one in 20 men and women aged 65 years who are mobile suffer catastrophic decline—rapid, global deteri-

oration in abilities—in their mobility over the following 12 months.
- Older age and self-reported health deterioration were strongly associated with catastrophic decline in mobility.
- Physical reserve capacity index, indicating muscle strength, stamina and flexibility at baseline, was a strong predictor of catastrophic loss of mobility.
- Those affected by catastrophic decline in mobility were more likely to have adverse psychological factors and poorer social engagement.

Conclusions

The contribution of our study to work in this area is in demonstrating the wide range of factors that are independently associated with catastrophic decline in mobility. Taking a disease-centred approach will result in only a partial understanding of the determinants of such declines. A recent landmark trial [32] of disease-oriented screening and intervention has produced disappointing results, which would be predicted if psychological and social factors make major contributions to serious declines in ability. To improve the quality of life of older people, we need to consider interventions involving psychological and social support in addition to the known medical treatments.

References

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