The prognosis of falls in elderly people living at home

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Abstract

Background: there are few longitudinal studies of the prognosis of falling at home.

Objective: to determine outcomes in older people who fall once and more than once.

Design: longitudinal prospective cohort study.

Setting: primary care in the UK.

Subjects: 1815 subjects over 75 who had a standardized and validated health check.

Method: annual interviews over 4 years. Practice records were used to establish death and admission to institutions.

Results: risk of death was increased at 1 year [odds ratio (OR) 2.6, 95% confidence interval (CI) 1.4–4.7] and 3 years (OR 1.9, 95% CI 1.2–3.0) for recurrent fallers but not single fallers (OR 0.9, 95% CI 0.5–1.6 at 1 year; OR 0.97, 95% CI 0.7–1.4 at 3 years). Risk of admission to long-term care over 1 year was markedly increased both for single fallers (OR 3.8, 95% CI 1.8–8.3) and recurrent fallers (OR 4.5, 95% CI 1.7–12). Functional decline was not related to faller status, the latter being very variable from one year to the next.

Conclusions: the stronger relationship between falling and admission to long-term care rather than mortality supports the hypothesis that the perceived risks for those who fall only once are exaggerated.

Keywords: consistency, elderly, falls, institutionalization, outcomes

Introduction

One-third of those aged over 65 years living at home have at least one fall every year. Recurrent fallers have a high risk of death in the following years [1], particularly when falls are recognized by general practitioners or result in admission to hospital [2]. Community studies of all falls in elderly people show a limited relationship between falling and mortality [3, 4]. No study has reported annual re-interviews of subjects.

During an observational longitudinal study of disability in subjects aged 75 years and over living in Gloucestershire, we identified fallers and non-fallers during routine health check interviews in primary care. We report the prevalence of fallers, the mortality and morbidity in fallers and non-fallers, falling in later years, and admission to residential and nursing care.

Method

The Gloucestershire longitudinal study of disability is a prospective survey of 1815 persons over 75 who responded to an offer from their general practitioner of a health check using a reliable, validated instrument called the elderly at risk rating scale (EARRS) [5]. EARRS covers all areas specified for over 75 health checks, and comprises 20 questions, each with five categories of response. Interviews were carried out by practice nurses, usually in the subject’s home, and took between 20 and 40 min. Data on the completed form was transferred anonymously to a computer file.

Subjects were contacted for re-interview by the same observer during each of the following 3 years and any drop-outs were traced. The response rate to the first health check varied between 21 and 99% according to practice, with an overall rate of 78%. Re-interviews were successful in 71%, 55% and 41% of the original sample each year respectively. Figure 1 shows the numbers that dropped out (refused, died or moved away) at each stage. At the end of the study, of initial responders, 18% of men and 23% of women had refused re-interview, 30% and 25% respectively had died, and 6% and 5% respectively had moved away.

Non-responders to the original health check are similar to responders in age/sex profile, consultation rate with their general practitioner and subsequent
mortality rate [6]. Those who refused follow-up are similar to continuing participants in age/sex profile, original EARRS score and mortality rates in the year after refusal.

The information on falls derives from a single question in the EARRS instrument, which asks 'How many falls have you experienced in last 3 months?', with possible responses of none, 1, 2, 3 or more. The patients and nurses were not asked to distinguish blackouts from other causes of falls, and a fall was defined as any sudden collapse to the ground. The preceding 3 months were selected because we felt that recall over the previous year would be less accurate. The categories of '2', '3' and 'more' falls in the last 3 months were combined into a single category of '>1 fall' for the analyses of adverse outcomes and changes in fall status at subsequent interviews.

Mortality data were available for all subjects except those who had moved out of the area. The analysis on admission to long-term care excluded subjects already in care in the first year, as well as those who had moved away, but included subjects who refused repeat interview but remained in the area. Subjects admitted to care between interviews but dead before the next assessment were considered as deaths and not counted as admissions.

Changes in functional status the year after initially reporting falling were assessed only in those remaining in their own home, because admission to care is likely to alter dependency irrespective of health status.

Statistical analysis was by the \( \chi^2 \) and Mantel–Haenszel tests. Cluster analysis was performed using the centroid method, with the 20 variables divided into 4–5 groups that explained 52% of the total variance. An analysis to explain 74% of the variance produced 11 clusters and reduced falls to a single item ‘cluster’. Regression was by the Cox proportional hazards model with forward conditional removal of factors. Categories of ‘any falls’ and ‘>1 fall’ were used as binary categorical variables.

Results

The prevalence of any fall within the previous 3 months in the first year of the survey was 12%, which included 7.8% with a single fall and 4.2% with >1 fall. A positive response to the question on falls increased with age group (\( \chi^2 \) for trend \( P = 0.002 \)), and falling was more common in women than men (15.6% of women, 9% of men; \( P = 0.02 \)). This tendency was present in all age groups. Falling was not related to residence or the presence of a live-in companion, but was related to the need for a carer (\( P < 0.001 \)); subjects with a carer were three times more likely to have reported a fall. In univariate analysis, all domains of the EARRS (except having a companion) were associated with falling, with \( r \) values between 0.05 and 0.2 (all at least \( P < 0.05 \)).

Because most of the components of EARRS correlated with each other, cluster analysis was used to identify the closest relationships between recent falls and the other questions. The cluster which involved falling also included confusion and sadness, and this was consistent within the subgroups of men and women under the age of 85. The over-85s had a different cluster linking falls with joint pains and the need for chiropody.

Mortality rates in fallers and non-fallers

The risk of death in the year after the interview was examined for fallers and non-fallers for the interviews conducted in 1991, 1992 and 1993 (Table 1). Fallers who had >1 fall in the preceding 3 months had a greater 1-year mortality, as high as 2.6-fold [95% confidence interval (CI) 1.4–4.7] after 1 year following the interview compared with non-fallers, and an overall 1.9-fold increase in 3-year mortality (CI 1.2–3.0). Those who had reported >1 fall in the last 3 months had an average mortality of 16.4% in the next year (40.5% mortality over 3 years) compared with 8.5% (25.7% over 3 years) for non-fallers. The highest mortality was confined to those aged over 85 years (both genders). Overall mortality was not increased for single fallers (Table 1). Regression analysis using the Cox proportional hazards model confirmed that the relationship between falling more than once and mortality was significant after adjusting for age and sex. There was no relationship between a single fall and mortality. The age- and gender-adjusted relative risk of death in those who fell more than once was 1.62 (95% CI 1.1–2.4).

Functional decline in those reporting falling

Sixty-six percent of non-fallers, 62% of those who had fallen once and 63% of those who had fallen more than once were re-interviewed in 1992. Although the EARRS
score was initially higher in the fallers (i.e. fallers were more disabled), the mean change in EARRS score (subtracting the contribution made to the EARRS score by the question on falling) was not greater in fallers (Table 2). Similar results were found relating fall status in the 1992 and 1993 surveys to EARRS score 1 year later. A subscore of EARRS including five key areas of ADL (mobility, washing, dressing, toileting and nutrition) failed to show statistically significant differential deterioration in fallers and non-fallers. Twenty-five percent of fallers and 14% of non-fallers had increased the number of dependent ADLs between 1991 and 1992 ($P = 0.09$), while 32% and 16% respectively had increased areas of dependency between 1992 and 1993 ($P = 0.64$).

Institutionalization rates in fallers and non-fallers
Admission rates to care were low, with only 43, 19 and 21 subjects moving into institutional care in the year before the second, third and fourth years' health checks respectively, and remaining there until the time of the health check. Those who had reported >1 fall in the last 3 months had an average admission rate of 9.7% in the next year (13% over 3 years) compared with 1.4% for non-fallers (3.9% over 3 years). The figures for relative risk, shown in Table 3, demonstrate a consistent increase in risk of admission each year for single fallers as well as frequent fallers. The greater risk of admission was observed in both genders and all age groups. Using Cox regression to adjust for age and sex, the relative risk of admission to care in the next year was 3.1 (95% confidence intervals 1.5–6.6) for single fallers and 3.5 (1.4–9.0) for frequent fallers.

Consistency of reporting falling
About 70% of fallers no longer reported recent falls at next year’s interview, while 11% of non-fallers became new reporters of falling. Thus the report of falling was inconsistent from one year to the next, unlike all the other disability measures within EARRS. The presence of any falls had a year-on-year consistency $k$ value of 0.15, compared with 0.61 for indoor mobility (Table 4).

### Table 1. Reports of falling in the preceding 3 months, crude mortality rates and adjusted relative risk of mortality in the following year

<table>
<thead>
<tr>
<th>No. of falls</th>
<th>Interview</th>
<th>n</th>
<th>Rate (%)</th>
<th>Risk</th>
<th>n</th>
<th>Rate (%)</th>
<th>Risk (CI)</th>
<th>n</th>
<th>Rate (%)</th>
<th>Risk (CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991 (mortality 1991–92)</td>
<td>1560</td>
<td>8.8</td>
<td>1</td>
<td>139</td>
<td>7.9</td>
<td>0.9 (0.5–1.6)</td>
<td>75</td>
<td>20</td>
<td>2.6 (1.4–4.7)</td>
<td></td>
</tr>
<tr>
<td>1992 (mortality 1992–93)</td>
<td>1090</td>
<td>8.5</td>
<td>1</td>
<td>124</td>
<td>16</td>
<td>2.1 (1.3–3.6)</td>
<td>34</td>
<td>11.7</td>
<td>1.5 (0.5–4.8)</td>
<td></td>
</tr>
<tr>
<td>1993 (mortality 1993–4)</td>
<td>970</td>
<td>8.5</td>
<td>1</td>
<td>108</td>
<td>11.1</td>
<td>1.5 (0.71–2.6)</td>
<td>51</td>
<td>17.6</td>
<td>2.5 (1.1–4.9)</td>
<td></td>
</tr>
<tr>
<td>1991 (mortality 1991–94)</td>
<td>1509</td>
<td>25.7</td>
<td>1</td>
<td>132</td>
<td>25</td>
<td>0.97 (0.7–1.4)</td>
<td>74</td>
<td>40.5</td>
<td>1.9 (1.2–3.0)</td>
<td></td>
</tr>
</tbody>
</table>

*Mortality rate per 100 over 3 years.
CI, 95% confidence interval; risk adjusted for age and gender.

### Table 2. Change in disability scores (elderly at risk rating scale minus the question on falling) in fallers and non-fallers between first and second year

<table>
<thead>
<tr>
<th>No. of falls in 1991</th>
<th>Mean disability score</th>
<th>1991</th>
<th>1992</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>25.9</td>
<td>27.1</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>29.9</td>
<td>31.7</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>&gt;1</td>
<td>36.9</td>
<td>36.7</td>
<td>0.2</td>
<td></td>
</tr>
</tbody>
</table>

### Table 3. Reported falling in the preceding 5 months, crude admission rates and adjusted relative risk of admission to an institution in the following year

<table>
<thead>
<tr>
<th>No. of falls</th>
<th>Interview</th>
<th>Rate (%)</th>
<th>Risk</th>
<th>Rate</th>
<th>Risk (CI)</th>
<th>Rate</th>
<th>Risk (CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991 (admission 1991–92)</td>
<td>1.8</td>
<td>1.0</td>
<td>6.2</td>
<td>5.8 (1.8–8.5)</td>
<td>6.6</td>
<td>4.5 (1.7–12)</td>
<td></td>
</tr>
<tr>
<td>1992 (admission 1992–93)</td>
<td>1.0</td>
<td>1.0</td>
<td>3.2</td>
<td>3.4 (1.2–10.8)</td>
<td>9.7</td>
<td>10.2 (2.7–38)</td>
<td></td>
</tr>
<tr>
<td>1993 (admission 1993–4)</td>
<td>1.4</td>
<td>1.0</td>
<td>3.7</td>
<td>2.8 (0.9–8.6)</td>
<td>5.9</td>
<td>5.0 (1.4–18)</td>
<td></td>
</tr>
<tr>
<td>1991 (admission 1991–94)</td>
<td>3.9*</td>
<td>1.0</td>
<td>6.9*</td>
<td>1.8 (1.0–3.3)</td>
<td>13*</td>
<td>2.1 (0.85–5.2)</td>
<td></td>
</tr>
</tbody>
</table>

*Admission rate to institutional care per 100 over 3 years.
The detailed 1-year outcomes relating to initial falls status are shown in Table 5.

Combining all data from interviews in successive years provides 5111 comparisons. The probabilities of being initially a non-faller and a non-faller, single faller or recurrent faller the next year are 0.89, 0.08 and 0.03 respectively. Similarly, the probabilities are 0.77 (no fall), 0.18 (single fall) and 0.05 (multiple fall) for single fallers, and 0.56, 0.24 and 0.2 for recurrent fallers.

Thus, the report of multiple falls was a little more consistent than for single falls (k statistic, multiple versus single or no fall = 0.18).

### Discussion

The prevalence of fallers in this study was 12%—lower than in previous studies [7, 8] where figures of 20–40% have been reported. Those studies reported rates of falls over 1 year, whereas our study is based upon falls in the last 3 months. Cummings [9] reported that one-third of annual fallers had experienced a fall in the preceding 3 months. On this estimate, about 36% of our subjects may have experienced at least 1 fall in the first year. Poor recollection will underestimate the incidence of falls [9], and may have occurred in this study, but this may only weaken any relationships found.

We found that reported falling was associated with confusion and sadness between ages 75 and 84. Over the age of 85 falling was associated with joint pains and needing chiropody, associations that are easily explained on the basis of osteoarthritis and foot problems. Falling in the under-85s was also associated with these problems, although the cluster analysis emphasized psychological factors as being the strongest correlates. Almost all the areas covered by the EARRS questionnaire showed association with falling. Cross-sectional studies of fallers at home have identified associations between physical and mental health factors and the likelihood of reporting falls; cluster analysis has not been used before. Blake et al. [7] did not include confused subjects in their study, but found arthritis and foot difficulties, along with low strength and giddiness (not measured in our study), as independent predictor variables.

A report of >1 fall in the preceding 3 months was associated with a 1.9-fold increase in risk of death over the next year (95% CI 1.2–3.0). Our findings are in keeping with previous work: Dunn [10] reported increased 2-year mortality of 1.5-fold for single fallers and 2.2-fold for recurrent fallers; Tinetti [11] reported a slightly increased mortality only in those unable to get up after a fall, while Campbell [3] found a significant increase in mortality only in men.

Our conclusions are weakened by our incomplete

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### Table 4. Consistency in reporting falls and indoor mobility between 1991 and 1992

<table>
<thead>
<tr>
<th>Indoor mobility problem</th>
<th>1992</th>
<th>1991</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>116</td>
<td>99</td>
</tr>
<tr>
<td>No</td>
<td>42</td>
<td>901</td>
</tr>
</tbody>
</table>

### Table 5. Fall status (no. of falls) or alternative outcomes 1 year later for individuals (%) related to initial falls status, for the years 1991–92, 1992–93 and 1993–94

<table>
<thead>
<tr>
<th>Year of interview/</th>
<th>Fall status at previous interview</th>
<th>Reason for not being interviewed</th>
</tr>
</thead>
<tbody>
<tr>
<td>no. of falls</td>
<td>Total</td>
<td>0</td>
</tr>
<tr>
<td>1991 (previously interviewed 1992)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1584 (100)</td>
<td>980 (62)</td>
</tr>
<tr>
<td>1</td>
<td>145 (100)</td>
<td>76 (52)</td>
</tr>
<tr>
<td>&gt;1</td>
<td>76 (100)</td>
<td>35 (46)</td>
</tr>
<tr>
<td>1992 (previously interviewed 1993)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1094 (100)</td>
<td>790 (72)</td>
</tr>
<tr>
<td>1</td>
<td>126 (100)</td>
<td>69 (55)</td>
</tr>
<tr>
<td>&gt;1</td>
<td>51 (100)</td>
<td>12 (23)</td>
</tr>
<tr>
<td>1993 (previously interviewed 1994)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>984 (100)</td>
<td>606 (62)</td>
</tr>
<tr>
<td>1</td>
<td>109 (100)</td>
<td>60 (55)</td>
</tr>
<tr>
<td>&gt;1</td>
<td>51 (100)</td>
<td>12 (23)</td>
</tr>
</tbody>
</table>

NH/RH, nursing home or residential home.
follow-up, in particular of the 6% who moved out of the area and whose outcomes were unknown. However, those who moved away had a similar falls profile to the rest of the sample. The outcome was known in 28% of subjects who were alive but not interviewed, and the disability profile of subjects refusing follow-up was similar to those remaining in the study.

We have found a limited relationship between falling at home and subsequent functional decline. Others have shown a much stronger relationship when focusing on falls which present to hospital [2]. Tinetti [11] found a significant functional decline only in fallers who had been unable to get up from their fall. Wolinsky [12] found, like us, no association between single fallers and mortality or functional decline, but a relationship with admission to care.

Subjects who reported recent falls, even several falls, were more likely to report no recent falls when interviewed a year later than to report continued falling: the report of falling was very inconsistent from year to year, unlike mobility status. This may reflect our decision to question about falls in the preceding 3 months rather than over the whole year: sporadic occasional falls at a frequency of less than every 3 months may not display a year-on-year consistency. Alternatively, subjects may be unreliable at remembering whether a fall has occurred; indeed some falls associated with loss of consciousness might even not be recognized by the subject. The time frame of 3 months was chosen because accurate recall over 1 year was thought to be unlikely. During validation studies of the EARRS questionnaire, the reliability of reporting falls at interviews 1 week apart was extremely good (r value 0.92). However the frequency of the transition from reporting several recent falls one year to reporting no recent falls in the following year suggests that falling is an intermittent experience for many older people, and experiencing a single fall is more likely to lead to resolution or very occasional falls rather than progressing to regular falling the following year.

The stronger relationship between fallers and admission to long-term care than to mortality supports the hypothesis that the perceived risks to those who fall only once are exaggerated. Some decisions to enter care may be based as much on the fear of further falls as any increase in dependency. Families may fear their relative being stuck on the floor and unable to attract help. The strong relationship between single falls and admission to care suggests that this decision-making may occur even after an isolated fall. The high transition rate between 'faller' and 'non-faller' status each year should caution against using a recent fall as a reason for admission to care.

Prognosis of falls in elderly people at home

Key points

- Falling is associated with confusion and sadness in those under 85, and with joint pain in those over 85.
- There is a modest increase in mortality in recurrent fallers but not single fallers.
- There is a marked increase in admission rates to long-term care for all fallers.
- Report of falling varies considerably year-on-year.
- Decisions to enter care may sometimes be based on fear of further falls rather than increased disability.

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References


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