SHORT REPORT

Is physical activity protective against hip fracture in frail older people?

ROBYN NORTON, GEETHA GALGALI1, A. JOHN CAMPBELL2, IAN R. REID3, ELIZABETH ROBINSON4, MEG BUTLER1, HARLEY GRAY5

Institute for International Health, University of Sydney, PO Box 576, Newtown, Sydney, NSW 2042, Australia
1Injury Prevention Research Centre, Department of Community Health, University of Auckland, Auckland, New Zealand
2Faculty of Medicine, University of Otago Medical School, PO Box 913, Dunedin, New Zealand
Departments of 3Medicine and 4Community Health, University of Auckland, Auckland, New Zealand
5Surgical Services, Middlemore Hospital and University of Auckland, Auckland, New Zealand

Address correspondence to: R. Norton. Fax (+61) 2 9351 0008. Email: r.norton@iih.usyd.edu.au

Abstract

Background: there is limited evidence of a protective effect of physical activity in preventing hip fractures among older people living in institutions and in those aged 80 or over.
Objective: to examine the relationship between physical activity and risk of hip fracture in frail older people.
Design: a case–control study.
Setting: Auckland, New Zealand.
Subjects: a random sample of individuals hospitalized with a fracture of the femoral neck (n=911) and 910 randomly selected age- and sex-matched individuals from the lists of a random sample of general practitioners.
Methods: we sought information on physical activity and other potential risk factors for hip fracture from cases and controls, using a standardized interviewer-administered questionnaire. We conducted multivariate analyses, separately for those living in private homes and residential institutions.
Results: increasing hours of physical activity per week protected against the risk of hip fracture among individuals living in private homes, including those who are over 80. However, among individuals living in institutions, physical activity levels were extremely low (<15% participated in ≥2 h per week) and there was limited evidence of a protective effect.
Conclusions: efforts to prevent hip fractures in individuals living in care homes and institutions should focus on passive interventions which are known to be effective.

Keywords: hip fracture, institutions, physical activity, older people

Introduction

Increasing levels of physical activity have consistently been shown in observational studies to protect against hip fracture in older people [1]. More recently, evidence from randomized controlled trials among older people at home shows that individually-tailored physical activity programmes that incorporate balance and training exercises protect against the incidence of falls [2]. However, the extent to which physical activity is protective for frail older people is uncertain, as few observational risk factor studies have included both individuals living in nursing homes and other residential institutions and those aged 80 or older.

We report findings from a study that examined the relationship between physical activity and risk of hip fracture in both older people at home and those living in care homes.

Subjects, methods and results

Between July 1991 and February 1994, we contacted a random sample of all older individuals (≥60 years) hospitalized with a radiographically confirmed fracture of the proximal femur post-operatively but before discharge and invited them to participate in the Auckland Hip Fracture Study [3]. We randomly selected controls...
who were age- and sex-frequency-matched to the cases from the practices of a random sample of all general practitioners in the region [3].

We sought information on physical activity and potential confounding factors from all participants (and from proxy respondents for those individuals who were too sick or cognitively impaired [3]), using a structured, face-to-face, interviewer-administered questionnaire. We ascertained physical activity in terms of average number of hours per week spent on both housework-related physical activities (gardening, general housework, shopping or home maintenance) and leisure-time physical activities (walking for exercise, playing bowls or doing structured exercise). We also obtained information on the number of hours spent standing per day, taking an average over the previous 3 months. The information we sought was comparable to that obtained in other studies that have examined physical activity levels in older people [4].

We conducted multivariate analyses using logistic regression to estimate odds ratios and 95% confidence intervals. We did this separately for those living in private homes and those in residential institutions.

We obtained information on 911 cases (97.3% response rate), of whom 66.1% were aged $\geq$ 80 years, and 910 controls (81.4% response rate), of whom 58.2% were aged $\geq$ 80 years. Complete information on all the variables used in the models was available for 1788 subjects (98.2%).

Among those living in private homes, increasing hours of physical activity per week were shown to protect against the risk of hip fracture; those participating in $>20$ h per week had a 76% reduced risk of hip fracture compared with those participating in $<3$ h per week (95% confidence intervals 0.15–0.40; Table 1).

Among those living in institutions, physical activity levels were extremely low ($<15\%$ participated in $\geq 2$ h per week) and there was limited evidence of a protective effect with increasing levels of activity. However, those who spent $\geq 3$ h per day on their feet were 6.6 times more likely to have a hip fracture than those who spent $\leq 1$ h on their feet (95% confidence intervals 3.1–14.0; Table 1).

**Discussion**

Our findings confirm that, among older people living at home, involvement in $>3$ h of physical activity each week is associated with a reduction of at least 50% in risk of sustaining a hip fracture. This risk is decreased not only among those under 80, but also among those aged 80 years and above. While it is possible that the magnitude of the decrease may be overestimated (given the exclusion of other potential confounding factors), the consistency of the evidence from a number of studies suggests that their omission is unlikely to change the overall suggestion of benefit. The implications of these findings are thus consistent with the US Surgeon General’s report, *Physical Activity and Health* [5], in suggesting that increasing physical activity levels (to a minimum of 30 min of moderate physical activity per day) may lead to important health benefits, not only among the younger old, but also among those who are over 80.

**Table 1.** Physical activity levels in individuals with hip fractures and in controls, by residential status

<table>
<thead>
<tr>
<th>Measure of activity</th>
<th>No. of subjects (%)</th>
<th>Adjusted odds ratio$^a$ (95% CI)</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individuals living in private homes</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Time per week engaged in activities, h</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$&lt;3$</td>
<td>170 (31.0)</td>
<td>90 (11.5)</td>
<td>1</td>
</tr>
<tr>
<td>$\geq 3$ to $&lt;10$</td>
<td>165 (30.0)</td>
<td>230 (29.6)</td>
<td>0.46 (0.30, 0.70)</td>
</tr>
<tr>
<td>$\geq 10$ to $&lt;20$</td>
<td>140 (25.5)</td>
<td>233 (30.0)</td>
<td>0.43 (0.27, 0.69)</td>
</tr>
<tr>
<td>$\geq 20$</td>
<td>74 (13.5)</td>
<td>225 (28.9)</td>
<td>0.24 (0.15, 0.40)</td>
</tr>
<tr>
<td>Individuals living in residential institutions</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Time per week engaged in activities, h</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>$&lt;1$</td>
<td>254 (75.8)</td>
<td>94 (75.8)</td>
<td>1</td>
</tr>
<tr>
<td>$\geq 1$ to $&lt;2$</td>
<td>33 (9.8)</td>
<td>12 (9.7)</td>
<td>0.76 (0.35, 1.67)</td>
</tr>
<tr>
<td>$\geq 2$</td>
<td>50 (14.8)</td>
<td>18 (14.5)</td>
<td>0.58 (0.27, 1.21)</td>
</tr>
<tr>
<td>Time per day on feet, h</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>$&lt;1$</td>
<td>36 (10.7)</td>
<td>35 (28.2)</td>
<td>1</td>
</tr>
<tr>
<td>$\geq 1$ to $&lt;2$</td>
<td>112 (33.2)</td>
<td>38 (30.7)</td>
<td>3.30 (1.80, 6.19)</td>
</tr>
<tr>
<td>$\geq 2$ to $&lt;3$</td>
<td>71 (21.1)</td>
<td>27 (21.8)</td>
<td>3.31 (1.61, 6.32)</td>
</tr>
<tr>
<td>$&gt;3$</td>
<td>118 (35.0)</td>
<td>24 (19.3)</td>
<td>6.59 (3.11, 13.98)</td>
</tr>
</tbody>
</table>

$^a$ Adjusted for age, sex, cognitive status, self-reported current smoking, functional independence (Katz activities of daily living score), self-reported current arthritis and heart disease; interactions between age and activity were not significant and were excluded in the final models.

CI, confidence intervals.
By comparison, among those living in residential institutions, in whom levels of physical activity were extremely low, any muscle strengthening or gait and balance benefits associated with physical activity appeared to be outweighed by the increased exposure to risk associated with spending time standing. While levels of physical activity were self-reported and thus potentially subject to recall bias, it seems unlikely that individuals who had sustained hip fractures would be more likely to overestimate time spent on their feet compared with controls.

Consequently, these findings suggest that, among frail older people, efforts to reduce hip fractures should focus more on passive interventions (such as the use of vitamin D and calcium [6] and the use of hip protectors [7]) rather than interventions that might inadvertently have effects opposite to those that were intended.

**Key points**

- Little is known about the effects of physical activity on the risk of hip fracture among those living in care homes or those over 80 years of age.
- >3 h physical activity per week is associated with a 50% or more reduced risk of hip fracture among older people living at home, including those who are older than 80.
- Levels of physical activity among those living in institutions are very low.
- The potential protective effects of such low levels of activity appear to be outweighed by the increased risks of falling.

- Passive interventions are more likely than active interventions to prevent hip fractures in people living in residential institutions.

**References**


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