the social security system which are currently implemented in Germany, including implementation of a DRG-based prospective payment system.

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fracture, varying between 12% and 31% in the following 12 months [7–10].

To our knowledge, there are no population-based cross-sectional studies among the oldest old comparing people with and without a history of hip fractures regarding their health, independence and mobility. The aim was therefore to study the impact of previous hip fractures on life among the oldest old, and to investigate associations between having had a hip fracture and housing conditions, the performance of personal activities of daily living (PADL), mobility, balance and falls.

Materials and methods

This study is part of the population-based cross-sectional Umeå 85+ study of the oldest old [11]. A random sample, including half the population born in 1915 (85 year olds, drawn by lots) and the total populations born in 1910 (90 year olds) and in 1905–1897 (≥95 year olds) living in the municipality of Umeå, Sweden (n=348), were selected for participation. Twenty-nine individuals (8%) died before they were invited to participate and 66 individuals (21%) declined to participate. The final study sample consisted of 253 participants.

Assessments were performed during two to three home visits at intervals of 1 to 2 weeks. Diagnoses were collected from the participants, relatives, caregivers, and from medical charts kept at the hospital, by general practitioners and/or the institutional care facility. The cognitive state was assessed from the participants, relatives, caregivers, and from medical charts. The cognitive state was assessed using the Mini-Mental State Examination (MMSE) [12]. Nutrition was assessed using the Mini Nutritional Assessment (MNA) [13] and a body mass index (BMI) was calculated.

Type of housing was dichotomised as living in institutional care, which includes both residential care and nursing homes, or living in one’s own house or apartment.

The Barthel ADL index [14] was used to assess dependency in PADL. Balance was assessed using the Swedish version [15, 16] of Berg’s Balance Scale (BBS) [17].

Information regarding the use of walking aids or a wheelchair, and falls during the preceding year was collected from the participants, relatives and staff and from medical charts at the time of the home visit. A geriatrician evaluated all the documentation of diagnoses, drug treatments and assessments for completion of the final diagnoses.

Among the participants with a history of a hip fracture, medical charts were reviewed before and after the fracture event up to the present investigation. Housing situation and dependency on walking aids or wheelchairs were classified as permanently changed if participants still lived in a place other than the one they lived in before the fracture, or still used mobility aids that they had not used before the fracture.

The proportions of those who had sustained earlier hip fracture are presented for each age group with 95% confidence intervals (CI).

Unadjusted comparisons between participants with and without previous hip fractures regarding descriptive variables were analysed for statistical significance using Student’s t-test, the chi-square test, and Fisher’s exact test.

The associations between hip fracture and the outcome variables were adjusted for possible confounding variables (e.g. sex, age) by multiple logistic and linear regression analyses. The selections of variables used in the adjustments were made in two steps. (1) Possible confounding variables for which the differences between participants with and without hip fractures were statistically significant were selected. (2) Selected variables were put in a factor analysis in order to extract a number of variables with low inter-correlations. The variables finally chosen for adjustments were those with the highest factor loading on separate factors. The factor analysis was made using varimax rotation, eigenvalue was preset at >1.0, and a factor loading of >0.6 was seen as significant.

A P value <0.05 was seen as indicating statistical significance.

Results

Of the participants, 58 (54 women and 4 men) had suffered a total number of 70 previous hip fractures. The prevalence (95% CI) was 16% (95% CI=9–23) among 85 year olds, 22% (95% CI=14–32) among 90 year olds and 33% (95% CI=23–45) among ≥95 year olds. Median time (interquartile range) between first fracture and home visit was 4.0 (2.0–10.0) years for 85 year olds, 8.0 (3.0–16.0) years for 90 year olds and 6.5 (3.0–16.75) years for ≥95 year olds.

Participants with hip fracture differed from those without with regard to age, sex, living alone, dementia, MMSE score, nutrition, BMI score and urinary tract infections during the preceding year (Table 1). A rotated factor analysis resulted in three separate factors. Dementia, MMSE score and urinary tract infections loaded on the first factor; age, BMI and MNA loaded on the second; and sex on the third factor. To adjust further analyses dementia, age and sex were selected as covariates.

Table 2 demonstrates large unadjusted differences between the groups in the outcome variables. After adjusting for the confounding effects of the selected covariates, having suffered a hip fracture was independently associated with PADL performance and mobility, including wheelchair use. The association with BBS bordered on statistical significance. However, no associations were seen with type of housing, use of walking aids or falls.

Of the participants with previous hip fractures, 28% (16) had been living in institutional care before the fracture incident, compared with 62% (36) at the time of home visits. Of those 20 who had moved to an institution between these time-points, 60% (12) had done so permanently after the fracture. Those who had changed their use of walking aids and wheelchairs did so in connection with the hip fracture in 62% and 32% of the cases, respectively.

Discussion

Having suffered a hip fracture seems to be associated with a decline in PADL performance and mobility among the oldest old people. Among a large proportion it seems that the suffering of a hip fracture earlier in their life had brought about a permanent change in their housing conditions and use of mobility aids.
In our study we found a prevalence of earlier hip fractures similar to that found in a longitudinal population-based study in northern Sweden [18]. On the other hand, a lower figure (11%) was reported from mid-Sweden [19]. However, this study reported a relatively small proportion living in institutional care. Among people aged 85 and older in the USA, the prevalence of previous hip fractures was also lower [6].

The high proportion of old people suffering the experience and consequences of having sustained hip fractures earlier in life should be viewed against the higher expected mortality after a hip fracture, which is described in many studies [2, 4, 7, 20, 21]. The fact that this mortality is higher among men [2, 7, 22] could explain why we found so very few men with previous hip fractures in the present study.

This study confirms the decline in function after a hip fracture, and that this decline remains after many years. We found that having had a hip fracture is a factor that may be separately associated with the ability to perform personal ADL and mobility. Hochberg et al. [6] found that hip fracture is associated with difficulty in performing the ADL among women not in institutional care, and Norton et al. [5] showed that hip fracture cases have a lower ADL performance and mobility 2 years after the fracture, compared with controls.

Our study indicates that this decline might be expected to remain until death, and that the occurrence of a hip fracture had brought about a permanent change in the life situation for many individuals.

The cross-sectional design with retrospective chart review results in a number of important limitations. The increased mortality among people having suffered hip fractures is likely to influence our findings. Also, one of the most important predictors for a positive outcome seems to be an active pre-fracture lifestyle [23–25], which we have not been able to include due to the study design. It is also known that those who suffer a hip fracture are frail with multiple diseases and often a pre-fracture functional decline. We cannot, therefore, positively declare that our findings on dependency in PADL and mobility can be explained exclusively by the hip fracture, but we can show that the fracture seemed to influence the participants’ situation in the long term.

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### Table 1. Descriptive characteristics among participants with and without an earlier hip fracture

<table>
<thead>
<tr>
<th></th>
<th>Subjects with hip fracture (n = 58)</th>
<th>Subjects without hip fractures (n = 195)</th>
<th>P valuea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (mean ± SD)</td>
<td>91.5 ± 5.0</td>
<td>89.6 ± 4.7</td>
<td>0.012</td>
</tr>
<tr>
<td>Female</td>
<td>54 (93%)</td>
<td>137 (70%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Living alone</td>
<td>56 (97%)</td>
<td>166 (85%)</td>
<td>0.020</td>
</tr>
<tr>
<td>Stroke</td>
<td>14 (24%)</td>
<td>42 (22%)</td>
<td>0.675</td>
</tr>
<tr>
<td>Heart failure</td>
<td>17 (29%)</td>
<td>47 (24%)</td>
<td>0.423</td>
</tr>
<tr>
<td>Diabetes</td>
<td>4 (7%)</td>
<td>27 (14%)</td>
<td>0.156</td>
</tr>
<tr>
<td>Dementia</td>
<td>27 (47%)</td>
<td>48 (25%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Depression (n = 56/186)</td>
<td>18 (32%)</td>
<td>47 (25%)</td>
<td>0.309</td>
</tr>
<tr>
<td>Urinary tract infection in preceding year</td>
<td>23 (40%)</td>
<td>47 (24%)</td>
<td>0.020</td>
</tr>
<tr>
<td>MMSE (n = 54/181)</td>
<td>17.5 ± 11.1</td>
<td>22.1 ± 7.4</td>
<td>0.001</td>
</tr>
<tr>
<td>MNA (n = 57/185)</td>
<td>19.7 ± 6.4</td>
<td>23.1 ± 4.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>BMI (n = 56/183)</td>
<td>22.7 ± 4.9</td>
<td>24.7 ± 4.4</td>
<td>0.007</td>
</tr>
</tbody>
</table>

aUnadjusted t-tests and chi-square tests.

### Table 2. Outcome variables between those with and without an earlier hip fracture, unadjusted and adjusted models

<table>
<thead>
<tr>
<th></th>
<th>Subjects with hip fracture (n = 58)</th>
<th>Subjects without hip fractures (n = 195)</th>
<th>Unadjusted P valuea</th>
<th>Adjusted P valueb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutional care</td>
<td>36 (62%)</td>
<td>76 (39%)</td>
<td>0.002</td>
<td>0.396</td>
</tr>
<tr>
<td>Barthel ADL, total index</td>
<td>12.1 ± 7.9</td>
<td>16.4 ± 5.6</td>
<td>&lt;0.001</td>
<td>0.024</td>
</tr>
<tr>
<td>Barthel mobility item, dichotomised to independent walking</td>
<td>33 (57%)</td>
<td>163 (84%)</td>
<td>&lt;0.001</td>
<td>0.040</td>
</tr>
<tr>
<td>Use of walking aids</td>
<td>53 (91%)</td>
<td>146 (75%)</td>
<td>0.007</td>
<td>0.106</td>
</tr>
<tr>
<td>Use of wheelchair</td>
<td>26 (45%)</td>
<td>36 (18%)</td>
<td>&lt;0.001</td>
<td>0.017</td>
</tr>
<tr>
<td>Berg’s balance scale (n = 46/167)</td>
<td>25.2 ± 20.6</td>
<td>38.0 ± 18.0</td>
<td>&lt;0.001</td>
<td>0.053</td>
</tr>
<tr>
<td>Fall during preceding year (n = 57/193)</td>
<td>32 (56%)</td>
<td>83 (43%)</td>
<td>0.080</td>
<td>0.293</td>
</tr>
</tbody>
</table>

aUnadjusted t-tests and chi-square tests.

bAdjusted by multiple logistic and multiple linear regression, respectively. Factors selected for adjustment were age, sex and dementia. All regressions had a P value <0.001.
the Borgerskapet in Umeå Research Foundation, the Detlof’s Foundation, the Västerbotten County Council, the Umeå University Foundation of Medical Research, Gun and Bertil Stohne’s Foundation and the Geriatric Centre at the Umeå University Hospital.

**Conflicts of interest**

There are no conflicts of interests in this study. The Ethics Committee of the Medical Faculty of Umeå University approved the study (dnr 99–326).

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15. Jensen J, Lundin-Olsson L, Lindmark B, Nilbrand A, Gustafson Y. Bergs balanssskal: prövning av interbedömarrelia-

The use of the Tempa.Dot thermometer in routine clinical practice

SIR—The Tempa.Dot single-use thermometer has been in use in the UK for over 10 years and in the USA for nearly 30 years. Over the last 7 years it has been marketed by 3M Health Care Limited [1]. Its use in the NHS followed the European Union Directive to reduce the medical use of mercury. It also has the advantages of lack of cross-infection risk and more rapid recordings. A sensor matrix at the tip of the thermometer consists of 50 temperature-indicating dots, each with a melting point separation of 0.1 °C. At any given temperature within the range 35.5–40.4 °C, all dots with a