Injuries after falls at work in the United Kingdom and Sweden with special reference to fractures in women over 45

R McNamee, K Kemmlert, L Lundholm, N M Cherry

Abstract
Objectives—To describe the relation with age of risk of reported injury after a fall among women at work in two countries, the United Kingdom and Sweden, with particular emphasis on fractures, and to interpret these data.

Methods—Rates of accidents compiled under the national reporting regulations of each country during a two year period were described by age, sex, cause (fall on the level, fall from a height, other), and occurrence of fracture, with emphasis on the relative risk (RR) in workers aged 45 years and over compared with those aged under 45. For fractures (major fractures only in the United Kingdom) among women, RRs were calculated for all occupations, with the three digit occupational classification schemes of each country. Summary RRs for older versus younger women, directly standardised for occupation, were derived.

Results—Among women, RRs for injury after a fall on the level and fall from a height were 2.77 and 1.77 respectively in Sweden and 2.28 and 1.54 in the United Kingdom. When restricted to fractures, the RRs became 4.75 and 3.66 respectively in Sweden and 3.35 and 1.97 in the United Kingdom. When restricted to fractures, the RRs became 4.75 and 3.66 respectively in Sweden and 3.35 and 1.97 in the United Kingdom. Standardisation for occupation gave RRs for fractures of 4.87 and 3.75 in Sweden and 3.43 and 2.16 in the United Kingdom. Almost all occupational groups with enough fractures for analysis showed an excess of fractures related to falls among older women. A different age pattern was seen for all injuries or fracture after other types of accidents and for all types of accident in men.

Conclusion—It is argued that, for fractures at least, the results for women are unlikely to be due to reporting bias and unlikely to be explained by a greater exposure to workplace hazards among older women. Whether there is an increased risk of falling, as distinct from sustaining a fracture, is not clear. The generality of the increased risk suggest that efforts should be made to minimise hazards in all occupational sectors, particularly those using many women.

Since 1990 in the United Kingdom, falls on the level have accounted for one third of major injuries and about 20% of lesser injuries reported by employees under the United Kingdom Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 1985. In 1990–1 in Sweden, falls accounted for 17% of all occupational accidents reported under the Swedish Occupational Injury Information System (ISA). A recent article by Leamis and Murphy found that falls accounted for 24% of the total cost of claims to a workers’ compensation insurance scheme which covered about six million workers in the United States.

For accidents at work in general, there are considerable differences in the rates for men and women, probably reflecting the predominance of men in the higher risk occupations in western countries. For example, the United Kingdom RIDDOR data suggest that men are about three times more likely to sustain an injury at work than women. Swedish ISA data suggest a relative risk (RR) of about 2.3 for men compared with women. Leamis and Murphy reported similar rates for men and women from falls on the level but almost three times as many falls from a height among men.

The variation in the rate of occupational accidents due to falling, as a function of both age and sex, has received little attention. In a review of the literature on aging and occupational accidents, Laflamme and Menckel found that older workers were more likely to fall, whereas Leamis and Murphy found the highest rate of fall accidents in younger workers. Neither paper distinguished between men and women. Agnew and Suruda, who concentrated on fatal work-related falls among men as recorded by United States national registers, found that the rate increased after age 45. A recent internal document by the United Kingdom Health and Safety Executive showed that the rate of reported major injuries due to falls rose sharply after age 45 in women but not in men. This pattern had not hitherto been noted in the United Kingdom or elsewhere. The present work, which used data from national reporting schemes in two countries—the United Kingdom and Sweden—stems from this initial observation.

It has been estimated that perhaps only one in three reportable accidents were actually reported under the United Kingdom RIDDOR scheme. Therefore one hypothesis to be considered here is whether the age related

Keywords: age; fractures; falls
trend in falls among women might be due to reporting bias—that is, an increased likelihood of reporting among older women. A second question is whether the apparent age effect in women might be an artefact of job differences between older and younger women. Thirdly, it was noted that injuries classified as major under the RIDDOR scheme were mainly fractures; this raised the question of whether any excess risk represents an increased likelihood of falling or an increased risk of fracture during a fall, or both. Finally, if the trend with age was considered to be real, then the identification of key occupations which accounted for the excess cases would be important.

Initially, the investigation was carried out with data from the United Kingdom collected under that country’s national reporting regulations, RIDDOR 1985. The advantage of comparison with data collected under a different system was soon recognised and the enquiry was subsequently extended to the Sweden national reporting scheme, ISA. Another objective was then identified: to see whether the occupational distribution of falls at work among women was similar in the two countries. Neither dataset contained information which might be used to consider the role of personal characteristics, other than age and sex, in the causation of accidents at work.

**Methods**

**UNITED KINGDOM**

Under the United Kingdom RIDDOR 1985 scheme, three categories of work related injuries were required to be reported by employers to the relevant enforcing authority: fatal injuries, other major injuries, and injuries resulting in absences of more than three days away from work. Appendix 1 shows the definition of the category major injuries as used under RIDDOR. For the present study, data on all injuries among male and female employees during April 1991 to March 1993, (except the few fatal injuries), were obtained and classified by sex, age, cause, and whether or not a fracture occurred. Causes of injuries were classified in three groups: falls on the same level, falls from a height, and other causes.

Occupational data from the United Kingdom census 1991 had been coded according to that country’s 1990 standard occupational classification (SOC), but unfortunately the same system had not been used for RIDDOR data. To enable injury rates by occupation to be calculated, recoding of occupational information with the SOC scheme was necessary. This was carried out by an experienced coder for major injuries among women only, as women were the main focus of the study. Some occupational sectors (commercial, retail, leisure, and the entertainment businesses) had to be excluded from this analysis as these were not required under RIDDOR to supply job title information. Furthermore, as most major injuries were fractures, it was decided to concentrate on these in the occupational analysis. The SOC three digit coding system distinguishes almost 400 occupational groups; the first digit alone enables a classification into nine major groups.

The number of employed women by age (two groups, 16–44 and 45–64) and SOC group in the United Kingdom in 1991 was estimated with a combination of data from the 1991 census and from the United Kingdom labour force survey. (Available census data gave only the total number of women in each SOC group, and these percentages were applied to the census data.) Rates of injury in each SOC group by age and cause were found by combining RIDDOR (numerator) data with these estimates as the denominators.

**SWEDEN**

Under the Swedish Work Injury Insurance Act 1976,4 Swedish employers are required to send details of all occupational accidents to the social insurance office, which forwards copies to the labour inspectorate, the field organisation linked to the National Board of Occupational Safety and Health. All occupational accidents resulting in at least one day away from work, or in a dental injury, are registered in the National Board’s information system, ISA.

For the present study, all injuries registered in Sweden during January 1990 to December 1991 were obtained and classified as for the United Kingdom data. Under ISA, there is no equivalent to the Health and Safety Executive defined major injury group; for comparison with the United Kingdom occupational analysis of major fractures, an analysis of all fractures among women by occupation, age, and cause was carried out. The occupational classification system for injuries and for the 1990 Swedish census is the Nordisk Yrkes Klassificering (NYK) scheme. As in the United Kingdom system, this uses a three digit code which distinguishes almost 400 occupations; the first digit of the code defines 10 major groups.

Underreporting of injuries is acknowledged in both countries, with the problem being greater in the United Kingdom (see earlier) than in Sweden (small scale studies have estimated reporting rates in the range 77%–100% depending on the occupation). Therefore the absolute rates given here will underestimate the true rates of such injuries. Also, differences in the reporting regulations mean that rates of reported injuries for Sweden will tend to be higher than for the United Kingdom, when the true rates are equal. Furthermore, in the United Kingdom, certain business sectors (commercial, retail, etc) were excluded from the numerators of rates but not always from the denominators. Overall therefore, limited reliance can be placed on the absolute rates, and differences between countries or occupations should be interpreted cautiously. However, contrasting rates of RRs in women aged 45 and over with those under 45 within the same occupational group, will not
Injuries

Populations studied
United Kingdom 1/90-12/91 employees
Men
1 460 945
Women
1 380 432

United Kingdom 4/91-3/93 employees only:
Men
7 474 099
Women
6 795 738

Table 2 Reported accidents at work in two countries by sex, cause, and age*

<table>
<thead>
<tr>
<th>Cause</th>
<th>Age 16–44 n</th>
<th>Age 45–64 n</th>
<th>Age + cause</th>
<th>Age + cause + occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falls from height</td>
<td>142</td>
<td>479</td>
<td>1.09</td>
<td>1.04 (1.02 to 1.12)</td>
</tr>
<tr>
<td>Other causes</td>
<td>4845</td>
<td>3540</td>
<td>0.73</td>
<td>0.72 (0.74 to 0.79)</td>
</tr>
</tbody>
</table>

Reported under RIDDOR, United Kingdom 1991–93:
Women:
Falls on level 361 408 1.13 (1.11 to 1.15)
Falls from height 199 248 1.31 (1.27 to 1.35)
Other causes 1476 1338 0.91 (0.90 to 0.92)

Men:
Falls on level 158 361 2.28 (2.22 to 2.35)
Falls from height 40 61 1.54 (1.45 to 1.63)
Other causes 422 503 1.19 (1.17 to 1.22)

Table 3 Fracture rates due to falls at work as reported in two countries, by sex, cause, and age*

<table>
<thead>
<tr>
<th>Cause</th>
<th>Age 16–44 n</th>
<th>Age 45–64 n</th>
<th>Age + cause</th>
<th>Age + cause + occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falls from height</td>
<td>122</td>
<td>182</td>
<td>1.49 (1.39 to 1.60)</td>
<td></td>
</tr>
<tr>
<td>Other causes</td>
<td>423</td>
<td>416</td>
<td>0.98 (0.94 to 1.03)</td>
<td></td>
</tr>
</tbody>
</table>

Reported under RIDDOR, United Kingdom 1991–93:
Women:
Falls on level 34 115 3.35 (3.21 to 3.57)
Falls from height 9 19 1.97 (1.76 to 2.19)
Other causes 36 37 1.01 (0.94 to 1.09)

Men:
Falls on level 61 78 1.27 (1.21 to 1.33)
Falls from height 57 80 1.40 (1.33 to 1.47)
Other causes 176 154 0.87 (0.85 to 0.90)

* To simplify the presentation, only rates are shown; the numbers of accidents in the various categories can be calculated from these given the sizes of the populations at risk (see Table 1).
† United Kingdom data excludes fatal accidents and accidents among the self-employed.

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Women in each country, adjusted for any difference in their jobs as given by the national occupational classification scheme, directly standardised RRs were calculated. In these calculations, the standard population in each country was defined as the occupational distribution, at the three digit coding level, of all women combined. Table 1 summarises the analyses.

To calculate 95% confidence intervals (95% CIs) for RRs, the numbers of events in any subgroup was assumed to follow a Poisson distribution.

The analysis by occupation was also used to identify occupational groups which contributed particularly high numbers of reported fractures due to falls. Although it is acknowledged that the reported rates are only estimates of the true rates, in the absence of any other indicators these were used to highlight groups worthy of further investigation. For each occupation the excess number of falls among women aged 45 and over, was defined as follows:

excess number = O − E

where O = observed number of events in women over 45, and E = expected number in women aged 45 and over, based on the rate for women under 45 in the same occupation. This measure may also be expressed as:

excess number = (number of women aged ≥ 45) × (rate in women aged < 45) × (RR−1).

Results

SWEDEN

There were 44 484 reported accidents among Swedish women aged 16–64 in the two year period 1990–1, of which 9289 (21%) were falls. The risk of a reportable fall at work among women aged 45–64 years was 2.51 times that for women aged 16–44; the age gradient seemed to be sharper for falls on the level (RR 2.77) than for falls from a height (RR 1.77). There was no increase with age in the risk of accidents due to other causes (RR 0.99).

As expected, Swedish men tended to have a higher risk of a fall than Swedish women; this was particularly true for falls from a height (Table 2). However, there was a much smaller increase with age in the risk of either type of fall among men. This meant that, although young men had a higher risk than young women of a fall on the level, after age 45 the positions of men and women were reversed. On the other hand, the risk of a fall from a height was higher among men than women in both age groups, despite the greater age related RR for women.

Table 1 Scheme of analysis: type of injury by factors analysed in each country

<table>
<thead>
<tr>
<th>Populations studied</th>
<th>Analysis by</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age 16–44 n</td>
</tr>
<tr>
<td>Sweden 1/90–12/91 employees + self-employed:</td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>1 380 432</td>
</tr>
<tr>
<td>Men</td>
<td>1 460 945</td>
</tr>
<tr>
<td>United Kingdom 4/91–3/93 employees only:</td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>6 795 738</td>
</tr>
<tr>
<td>Men</td>
<td>7 474 099</td>
</tr>
</tbody>
</table>

* To simplify the presentation, only rates are shown; the numbers of accidents in the various categories can be calculated from these given the sizes of the populations at risk (see Table 1).
† United Kingdom data excludes fatal accidents and accidents among the self-employed.

suffer from biases to the same extent; consequently these are the main focus of the study.

The main purpose of the analysis by occupation was as a means of (partially) controlling for confounding by occupation. If occupational differences explain the increased rate among older women then, in theory, a comparison between older and younger women doing the same job would show no difference between the two age groups. To estimate the overall RR for older women compared with younger
UNITED KINGDOM
In the United Kingdom there were 76,589 non-fatal reported accidents among women employees in the two year period, of which 37% were falls. Age was unknown for 7309 (9.5%) and a further 291 were outside the age range 16–64. Among the rest, trends with age and cause were broadly similar to those in Sweden—RRs for women aged 45–64 years old compared with younger women for a fall on the level and a fall from a height were 2.28 and 1.54 respectively (table 2). There was a much smaller increase with age in the risk of accidents due to other causes among women. As in Sweden, men in the United Kingdom had higher absolute risks than women but the age gradients were much weaker than for women.

When the analysis was restricted to accidents which resulted in fractures, the age gradients among women both from Sweden and the United Kingdom became steeper—RRs for falls on the level and falls from a height were, in Sweden, 4.75 and 3.66 respectively, and in the United Kingdom, 3.35 and 1.97 respectively (table 3). There was a small increase with age in the risk of fractures due to other causes in Sweden (RR 1.41) but not in the United Kingdom (RR 1.01).

A more detailed analysis by age of the fracture data from United Kingdom women showed that the risk associated with falls on the level more than doubled in the age group 45–54 (RR 2.58 compared with women aged 16–44) and continued to increase at ages 55–64 (RR 4.98 compared with women aged 16–44). A similar age trend occurred for fractures due to falls from a height (RRs of 1.57 and 2.83 for 45–54 year olds and 55–64 year olds respectively).

In each country, there was also evidence of an increase with age among men in the risk of a fracture after a fall on the level, but the RRs were much smaller than for women. In both countries, as was the case in Sweden for all falls on the level, older women had a higher risk of fracture after a fall on the level than older men, whereas the opposite was true for the younger age groups. On the other hand, men had the greater risk of fracture after a fall from a height in both age groups.

RRS STANDARDISED FOR OCCUPATION
Occupational information was available for 93% of fractures reported in younger Swedish women and 97% of those in older women, giving a total of 4640 events for analysis. (This difference meant that the crude RRs for fractures based on those with occupational information were slightly biased upwards: 4.91 for falls on the level, 3.76 for falls from a height, and 1.49 for other causes.) Standardisation for occupation hardly changed the estimates of RRs: these became 4.87 (95% CI 4.40 to 5.39) for falls on the level, 3.75 (95% CI 3.08 to 4.53) for falls from a height, and 1.56 (95% CI 1.42 to 1.71) for other causes.

There were 6465 reported major fractures among women aged 16–64 in the United Kingdom for whom age was recorded. Occupational information had not been recorded for the 27% in the excluded sectors (see methods) and there was insufficient detail for occupational coding of a further 373 fractures, leaving a total of 4346 (67% of the total) for analysis. Most of these (3129) were caused by falls on the level.

For those with occupational information, the crude RRs for major fractures reported in the United Kingdom resulting from falls on the level, from falls from a height, and from other causes were 4.10, 2.47, and 1.01 respectively. Standardisation for occupation reduced these to 3.43 (95% CI 3.18 to 3.70), 2.16 (95% CI 1.78 to 2.64), and 0.88 (95% CI 0.75 to 1.03) respectively. The reduction in the estimated age effect after standardisation can be explained by the high rate of accidents in major group 9 (which comprised mainly unskilled manual jobs in sales and services) combined with the unequal proportions of older and younger women employed in these jobs: 16% of women aged 45–64 compared with 8% of women aged 16–44.

RRS FOR SPECIFIC OCCUPATIONAL GROUPS
Figures 1 and 2 show the RRs for older women compared with younger women, of accidents involving a fracture (major fracture only in the United Kingdom) for each type of accident and each major occupational group in the two countries. These occupational groups are: in Sweden, code description:
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may be classified in either SOC major group 3 or major group 6 depending on seniority, whereas they would all be classified as group 1 in Sweden. The United Kingdom data refer to major fractures only. Nevertheless the overall picture in the two countries is similar in that the RR of fracture due to a fall on the level, for older versus younger women, is increased in all groups (range of RRs, 2.8–8.0 in Sweden and 2.6–5.8 in the United Kingdom). Relative risks of fractures due to falls from a height were significantly increased for all groups in Sweden except group 4 (agriculture, forestry, and fishing) and all groups in the United Kingdom with the exception of group 5 (craft and related occupations). The increase in risk of fracture due to falls from a height tended to be less than for those due to falls on the level (range of RRs, 1.2–5.6 in Sweden and 1.0–4.2 in the United Kingdom).

Finally, for fractures resulting from other causes, the RRs were much lower again (range, 0.9–2.1 in Sweden and 0.6–2.5 in the United Kingdom). Many of the Swedish groups showed significant increases with age, whereas in the United Kingdom one group (group 9, other occupations), showed a clear decrease in risk among older women (RR 0.6, 95% CI 0.4 to 0.7).

Figures 3 and 4 show RRs when occupation is classified at the three digit level; RRs for occupational groups with at least five fractures in total and at least one fracture in the younger group are included. The generality of the increased risk in older women of fractures after falls on the level is notable with only a few groups in either country having RRs less than one. For the smaller number of groups with sufficient fractures after falls from a height, the RRs also tended to be increased although the increase in the United Kingdom was not as notable as for falls on the level. On the other hand, the RRs for fractures from other causes were much lower, being centred around unity in the United Kingdom and around 1.4 in Sweden.

When fractures resulting from falls (any type) were classified by the site of the injury, an increased risk in older women was seen across the board: however, there was some evidence that the RR varied with site of injury. In Sweden, 32% of fractures in women were to the hand or wrist (excluding fingers) and for these the RR in older women was greatest at 6.39. In the United Kingdom, 40% of major fractures in women were of the wrist (other hand injuries were not classified as major fractures), and these also showed the greatest RR (4.85).

Some information on the events immediately preceding the fall—for example, slipped, tripped, was pushed, vertigo—was available for Sweden but there were no striking differences between older and younger women.

**EXCESS NUMBER OF FALLS**

If it is accepted that the increased risk among older women of fracture from falling at work is real, then it may be useful to highlight those occupational groups in whom the excess, in absolute terms, is greatest. Occupational

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**Figure 3** Relative risk of fracture by cause in selected female occupational groups: Sweden.

- 0 Professional and technical work
- 1 Health, nursing, and social work
- 2 Managerial and administrative work
- 3 Sales work
- 4 Agriculture, forestry, fishing work
- 5 Transport and communication work
- 6 Production work I
- 7 Production work II
- 8 Service work

Swedish major group 5 (mining and quarrying) is very small and was therefore omitted.

In the United Kingdom; code description:

- 1 Managers and administrators
- 2 Professional occupations
- 3 Associated professional and technical
- 4 Clerical or secretarial
- 5 Craft and related occupations
- 6 Personal and protective services
- 7 Plant and machine operators
- 8 Other occupations.

As injuries in the United Kingdom retail sector did not supply occupational information that could be used, major group 7 (sales occupations) was omitted.

Comparisons between major sectors in the two countries are problematic as the classifications have a different structure. Unlike the Swedish system, the United Kingdom classification depends on the status of the job as well as area of work. Nurses, for example,
The relative risk of fractures among occupational groups in each country were ranked according to their excess number of fractures among women over 45, a statistic which depends on the size of the occupational group and its absolute level of risk, as well as the relative increase in risk compared with younger women (see methods).

The total excess number of fractures after a fall, added across all occupational groups in Sweden, was 1410; thus 79% (1410/1767) of the total events among older women might be said to be partly attributable to age related factors. The top ranking groups accounting for the excess were home helps, shop assistants, cleaners, nurses, and teachers (table 4).

In the United Kingdom, the total excess major fractures attributable to age was 1523; this represents 67% (1523/2261), these figures are based on those with occupational information, as the calculation of excess number was done separately for each three digit occupational group) of the total events among older women. The top ranking group was cleaners, among whom the RR for older women (3.6) was similar to the overall value when standardised for occupation (3.4); however, as they constituted 11.1% of female employees aged 45 years and over, the excess number among older cleaners was particularly high. Overall, cleaners contributed 15% of all fractures due to falls on the level. The other important groups in this ranking were school teachers, care assistants, and nurses. Rates among three figure SOC groups ending in the

Figure 4. Relative risk of fracture by cause in selected female occupational groups: the United Kingdom.

Table 4. Fractures among women due to falls: occupational groups with greatest excess number (O-E) * among women over 45

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Women aged 45-64</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code† Description</td>
<td>Events (n)</td>
</tr>
<tr>
<td>Reported under ISA, Sweden 1990-1:</td>
<td></td>
</tr>
<tr>
<td>154 Home helpers</td>
<td>156</td>
</tr>
<tr>
<td>333 Shop assistants</td>
<td>128</td>
</tr>
<tr>
<td>932 Cleaners</td>
<td>130</td>
</tr>
<tr>
<td>249 Clerical and related work nec</td>
<td>94</td>
</tr>
<tr>
<td>107 Assistant nurses and hospital aids</td>
<td>84</td>
</tr>
<tr>
<td>033 Primary education teachers</td>
<td>82</td>
</tr>
<tr>
<td>153 Children's nurses</td>
<td>80</td>
</tr>
<tr>
<td>400 Proprietors in agriculture and forestry</td>
<td>75</td>
</tr>
<tr>
<td>103 Registered nurses</td>
<td>52</td>
</tr>
<tr>
<td>913 Kitchen and restaurant assistants</td>
<td>60</td>
</tr>
<tr>
<td>241 Secretaries, stenographers</td>
<td>47</td>
</tr>
<tr>
<td>036 Nursery education and recreational activities teachers</td>
<td>43</td>
</tr>
<tr>
<td>232 Financial managers, accountants</td>
<td>38</td>
</tr>
<tr>
<td>039 Educational workers nec</td>
<td>35</td>
</tr>
<tr>
<td>Total</td>
<td>1104</td>
</tr>
</tbody>
</table>

| Occupation                              |                  |                   |              |    |
| Reported under RIDDOR, United Kingdom 1991-3: major fractures only: |                  |                   |              |    |
| 958 Cleaners, domestics                 | 114              | 285 (19)          | 124          | 3.2 |
| 235 Secondary, primary, and nursery education teachers | 167 | 98 (6) | 220 | 2.2 |
| 644 Care assistants, attendants         | 124              | 93 (6)            | 139          | 4.0 |
| 340 Nurses                              | 103              | 74 (5)            | 88           | 3.6 |
| 430 Clerks nec                          | 102              | 72 (5)            | 70           | 3.4 |
| 620 Chefs, cooks                       | 67               | 55 (4)            | 131          | 5.8 |
| 459 Other secretarial, typist nec       | 63               | 53 (3)            | 38           | 6.1 |
| 953 Counterhands, catering assistants   | 94               | 51 (3)            | 123          | 2.2 |
| 952 Kitchen porters, hands             | 64               | 51 (3)            | 192          | 4.7 |
| 919 Other labourers in making           | 91               | 49 (3)            | 2055         | 2.2 |
| 659 Other childcare and related nec     | 47               | 39 (3)            | 115          | 6.0 |
| 293 Social workers, probation officer   | 42               | 30 (2)            | 170          | 3.5 |
| 652 Educational assistants              | 35               | 25 (2)            | 222          | 3.5 |
| 640 Assistant nurses, nursing auxiliaries | 46           | 25 (2)            | 79           | 2.1 |
| Total                                   | 1459             | 1000 (66)         |              |    |

* See text for definition of excess number.
† Swedish occupational classification (NYK) or United Kingdom standard occupational classification as appropriate.
‡ Not elsewhere classified.
§ Percentages are of the total excess for each country.
digit 9 may be particularly unreliable: in theory these are jobs which do not belong in any of the more specific categories in the same field (not elsewhere classified). However these categories may have been overused in coding RIDDOR data (numerator data) due to lack of detail. Overall, the groups selected are similar to Sweden with the exception of shop assistants, who were not included in the United Kingdom occupational analysis.

Discussion
Rates of injuries resulting from falls at work among women in two countries, which have different reporting systems, have been presented. Although the underlying rates in the two countries are quite different, as expected, there are striking similarities in the age trends. Both showed an increased risk of injuries associated with falling at work among older women which was not matched in magnitude either for other types of accidents in women or falls in men; the increase was more notable when attention was restricted to fall accidents resulting in fractures, and became higher still when restricted to major fractures in the United Kingdom. There was a higher increase for falls on the level than for falls from a height.

In each country, the overall increase in the rates of fractures remained after adjusting for differences in occupation (as measured by the three digit code of the national classification systems) between older and younger women. Furthermore, the increase was seen in almost all three digit occupational groups.

REPORTING BIAS
These analyses suggest that the excess associated with falls is not wholly explained by a greater willingness among older women to report accidents, for if this were the case, there should be a similar excess due to other causes. (A small excess for other causes was seen in older Swedish women but no excess at all in the United Kingdom women.) It might be argued, however, that reporting levels vary with the type of injury, which in turn may be related to the type of accident; however it is a reasonable conjecture that for a specific type of injury—for example, fracture—the level of reporting would not be influenced by the direct cause of injury or by age. As the difference in RRs between falls (high RRs), and other causes (low RRs) was maintained when the analysis was confined to fractures, reporting bias does not seem a likely explanation for these results. Also, the similarity of the results from two countries, which might be expected to have different attitudes to reporting, suggests that the age trend is real.

WORK RELATED CAUSES
In reviewing the literature, Laflamme and Menckel¹ considered that systematic differences in exposure to hazards was a plausible explanation for age related trends in either sex, albeit less so in comparisons within occupations. In this study the excess risks for falls on the level and falls from a height remained after standardising for occupation classified by three digit codes in each country. If it could be assumed that work conditions were uniform within any three digit category, then such analyses would have controlled for workplace hazards; hence the excess could not be attributable to them alone. Of course such uniformity is unlikely—for example, cleaners can be employed in a wide range of premises and with different hours of work. The possibility that older women carried out different tasks and were exposed to more hazards than younger women with the same job title cannot therefore be excluded, in which case these analyses have not completely controlled for confounding by occupation.

However, an increased risk was found in practically all occupations; to explain this in terms of work factors, it is necessary to hypothesise a general trend in employment whereby older women find themselves doing the more hazardous tasks in each case in each country. (Hazard prone activities could include standing rather than sitting.) The opposite case, that older workers are given less physically demanding tasks, seems equally plausible. In the absence of more information, these arguments must remain conjectures. An alternative explanation is that older women are as likely as younger women to be exposed to hazards, but that factors associated with age make them more vulnerable to injury. Even if this is true, workplace factors may be important in determining why the excess is greater in some groups than in others.

RISK OF FALL AND RISK OF FRACTURE
Postmenopausal women have an increased risk of osteoporosis and of fracture. The present results on fractures at work are consistent with this knowledge although most evidence has been from studies of much older women. Whether there is also an increased risk of falling (as opposed to fracturing having first fallen) is not clear from these data. Analyses from the two countries of fall accidents which did not result in a fracture were carried out (data not shown); these showed an increased risk in older women although the gradients were less strong than for fractures only (RRs for falls on level in Sweden and the United Kingdom were 2.28 and 1.99 respectively). However, although we have argued that differential reporting by age is unlikely to account for the fracture gradient, this seems more likely for other, lesser injuries. Older workers may take more time off work to recover, so increasing the chances that the accident will be reported. On the other hand, an increased risk of falling is supported by a study⁸ which showed a dramatic decline in muscle strength around the time of the menopause.

Laflamme and Menckel¹ argued that age trends in occupational risk would depend on the extent to which job experience could compensate for decline in physiological capacity, and that this would itself depend on the nature of the job. This theory assumes a continuity in employment whereby older workers are more experienced, and this may not necessarily be true for women. Ginger and colleagues⁹
suggested that older workers might be more prone to accidents preventable by rapid response than they are to those preventable by judgement. Falls on the level, which are often the result of slipping or tripping, would seem to belong to the rapid response category. In this study, there was a small increase in risk of falls on the level among older men compared with younger men in Sweden but not in the United Kingdom.

Work is underway in both countries to consider the question of cause. In Sweden, where full textual descriptions of the events leading up to the accidents have been recorded by ISA since 1994, preliminary evidence suggests that there is no difference in the distribution of these events among older and younger women. If correct, this would imply that general prevention strategies are appropriate but need to be intensified in older groups, particularly in the occupational sectors already highlighted.

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Appendix 1: Major injuries defined under RIDDOR 1985

(a) Fractures of the skull, spine, pelvis;
(b) Fractures of any bone:
   - In the arm or wrist, but not a bone in the hand, or
   - In the leg or ankle, but not a bone in the foot (collar bones and ribs also excluded);
(c) Amputation of:
   - A hand or foot or
   - A finger, thumb, or toe or any part thereof if the joint or bone is completely severed;
(d) Loss of sight of an eye or a penetrating injury to the eye, or a chemical or hot metal burn to an eye;
(e) Either injury (including burns) requiring immediate medical treatment, or loss of consciousness, resulting in either case from any electric shock from any electrical circuit or equipment whether or not due to direct contact;
(f) Loss of consciousness resulting from lack of oxygen;
(g) Decompression sickness (unless suffering from an operation to which the Diving Operations at Work Regulations 1981 (a) apply);
(h) Either acute illness requiring medical treatment, or loss of consciousness, resulting in either case from the absorption of any substance by inhalation, ingestion, or through the skin;
(i) Acute illness requiring medical treatment where there is reason to believe that this resulted from exposure to a pathogen or infected material;
(j) Any other injury which results in the person injured being admitted immediately into hospital for more than 24 hours.