Sick-leave and disability pensions among female assembly workers

B. PÄLSSON, V. HORSTMANN, R.G. ATTEWELL, K. OHLSSON, S. SKERFVING *

Sick-leave in 1984–1989 was higher in 269 women with industrial work involving repetitive movements (total 76,540 days), than in 290 referents with varying work tasks (26,421 days). The medians of the individual ratios of the observed number of days of illness versus expected (according to background population) were 1.26 and 0.24 respectively. Sick-leave with diagnoses in the musculoskeletal system dominated in the exposed group, particularly for neck/shoulders (5.3 versus 0.6% of observed time, p<0.001) and arms/hands (2.4 versus 0.5%, p<0.001). Women leaving for new jobs had, during the exposed employment, a higher sick-leave than those who stayed ('healthy worker selection'), and afterwards lower sick-leave. The risk of disability pensioning 1980–1989 (observed/expected: 2.8 versus 0.7) was also higher among exposed women. Repetitive, industrial work causes extensive suffering and huge costs. Preventive measures are urgently needed.

Key words: work environment, female assembly workers, sick-leave, disability pension, musculoskeletal disease

The extent of sick-leave and disability pensions increased very quickly in Sweden during the 1980s. The increase in long-term sick-leave and in disability pensions was greater among women than in men.1–5 Sick-leave lays a heavy economic burden on companies and society.6 The work environment is an important risk factor for long-term sick-leave, in particular as far as musculoskeletal disorders are concerned.3,7,8 Certain tasks in industry, which are characterized by repetitive movements and constrained working postures, are associated with a great risk for musculoskeletal disorders, in particular among women.9–11 Further, repetitive work tasks are often performed by women.12 There is thus an urgent need for preventive measures in this type of industry. However, to expedite such activities, a clear picture of the problem, including its proportions, medical nature and social consequences is required. Therefore, in this study, we have investigated sick-leave and disability pensions among female assembly workers.

STUDY GROUPS

The exposed group consisted in total of 379 women, who had worked for at least 3 months, either during an 8 year period (1980–1987) in a factory (E1) producing and assembling small ceramic parts for electrical equipment or during a 7 year period (1980–1986) at a factory (E2) producing and assembling plastic components, e.g. for electrical equipment and for the automobile industry. The work of the subjects was highly repetitive with arm and hand movements in constrained work postures and usually performed with a flexed neck.

Three women were on leave from work, receiving a parent's allowance; they did not participate in the study. A total of 325 women agreed to participate (4 not contactable and 47 refusals; 14%). Twenty-five women left the exposed work during 1980–1983 because of a disability pension or retirement. Thus, 300 women were studied for sick-leave. The mean age at the start of employment was 28.2 (range 15–62) years and at the start of the observation period for sick-leave (1 January 1984) 37.6 (range 15–64) years. The mean employment time at the end of the study was 13.2 (range 0.3–48) years. Thirty-one women left the exposed work for other employment during 1980–1983; they are included in the study as far as sick-leave in their new employment is concerned. One woman died during the follow-up period. During the period 1984–1989 66% of the women in the exposed group worked full-time (35 hours per week or more). The number of immigrant women (with present or former foreign citizenship) was 22.

The corresponding referent group was composed of 371 women, employed for at least 3 months during 1980–1987 at other selected work-places in the areas surrounding the 'exposing' factories: a supermarket (but not cashiers), a canteen kitchen, offices (but not subjects solely occupied with typewriting or computer terminal work), a laboratory, homes for old people (nurses were studied), day nurseries, a canteen kitchen and women taking care of children from other families, in their homes.

The main criterion for selection of referents was that the work was mobile and varied. A total of 331 women agreed to participate (2 not contactable, 38 refusals or non-responders; 11%). Twelve women left the referent work during 1980–1983 because of a disability pension or retirement. Thus, 319 women were studied for sick-leave.

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METHODS

Sick-leave

Information about sick-leave (number of days with sickness benefit, including diagnoses) during 1984–1989 in the exposed and referent groups was collected at the local social insurance offices (SIO). The length of the sick-listing periods within calendar years was recorded. Thus, 365 days was the maximum length. This has introduced a minor bias, since periods including New Year were divided into shorter periods, but division was necessary in order to make a comparison with the background population.

Sick-leave during half of a work day – a very minor fraction – has been recorded as a full sick day, according to the standard of the official figures.

The observation period for each individual ended at the time when she was no longer entitled to sick-leave compensation or on 31 December 1989, whichever occurred first.

From the National Swedish Social Insurance Board (NSIB) we collected sex-, age- and calendar-year-specific figures about the number of days with sickness benefit and the number of insured, employed persons in the surrounding county. Self-employed subjects were excluded, as the figures for these are not comparable to our exposed and referent groups. Compared to the county, the sick-leave in the country was only marginally higher and will not be considered in the following.

For each woman, we were thus able to calculate, based on the official figures and on her age and observation period, her expected number of days with sickness benefit. By dividing her total number of observed days by her expected number, we obtained an individual ratio, measuring her individual liability to sick-list.

Before 1 December 1987, sickness benefit was not paid for the day when a person reported sick. From that date on, the reporting day was also compensated. Thus, figures obtained before and after this change are not entirely comparable. However, the effect on the number of sickness allowance periods is small and the same change occurred for the study groups and in the background population used for comparisons. In cases of illness lasting less than 6 days, sickness allowance is generally not paid for non-working days whereas in cases of more prolonged illness it is paid for all days.

When subjects were on sick-leave for at most a week (usually 5 days with sickness allowance), the only available information on diagnoses was their own report. Cases lasting more than 1 week had a physician’s certificate, containing 1 or more diagnoses. The diagnoses were divided into 4 main groups: neck/shoulder, arms/hands, other musculoskeletal disorders and non-musculoskeletal disorders.

Disability pensions

The observation period was now 1980–1989. For this part of the study, 325 exposed and 331 referent women were involved. Information about disability pensions awarded in the cohorts was collected from the SIO. From the SIOs and NSIB, we collected sex-, age- and calendar-year-specific figures for the number of newly awarded temporary and permanent disability pensions under different diagnostic groups, for the county and country respectively; since there was almost no difference, the latter will not be considered in the following. When a whole disability pension is awarded to a person, who already receives half a pension, the benefit is not considered as a newly awarded disability pension.

The observation period for each woman ends when she receives her first disability pension, when she retires, or on 31 December 1989, whichever occurred first.

Statistics

It is well known that most individuals have none or only a few days of sick-leave per year, whereas a small proportion of individuals has many sick days. Thus, with regard to the number of obtained days of sick-leave, the population is very heterogeneous. When the liability for sick-listing is to be compared for 2 or more groups of individuals, it is thus necessary to account for this heterogeneity. We do this by calculating the individual ratios of observed versus expected number of days with sick-leave benefit.

The calculation of the ratios of observed versus expected number of sick days with sickness allowance is based on varying amounts of observation time. It is therefore necessary to ensure that large ratios are not particularly frequent for small observation times, thus representing measures with a large uncertainty. However, from a scatter plot it was seen that large ratios combined with small observation times mainly occur for those who achieved a disability pension, that is, individuals really having many sick days; thus, the problem does not appear to be serious. The individual ratios between the observed and expected days with sickness allowance were used in many calculations. It is important to observe that the distribution of the ratio for all groups considered here is very skewed; this is also true in the background population, where the median is considerably below 1, since the majority have none or just a few sick days per year. Comparisons between groups, based on these ratios, are thus tested by means of the Wilcoxon 2-sample rank sum test. For each of the separate groups considered, we estimated the median of the ratios of observed versus expected number of
RESULTS

Sick-leave

The exposed women had a higher observed total number of days with sickness allowance 'during employment' than expected (67,050 observed in 269 subjects versus 29,540 expected; table 1) and also higher than the referents (26,421 observed in 290 subjects). On the contrary, the referent women had a lower observed total number of days during their employment than expected (38,646 days). The individual ratios between the observed and expected numbers of days with sickness allowance were statistically significantly above 1 for the exposed women and significantly lower than 1 for the referents (table 1). Between the exposed and referent subjects, there was a five-fold difference in the medians of the ratios.

Of the women in the exposed group, 126 left their work, 31 before and 95 during the observation period, to continue to work elsewhere ('quitters'). It turned out that all but 4 of them obtained more varied work tasks. During employment, the median of their individual ratios was significantly higher than 1, while in their new work, the median of the ratios differed only slightly from 1 (table 1). Among those women, who stayed in the exposed work throughout the observation period ('stayers'), the median of the individual ratios was significantly lower than that among the 'quitters' during their exposure.

Among the referent women, 78 left their employment, 29 before and 49 during the observation period, to continue in other work (table 1). Only 2 of the 'quitters' changed to work similar to the exposed one. There was no statistically significant difference between 'stayers' and 'quitters' with regard to the individual ratios. Nor was there any difference for the 'quitters' during employment, as compared to afterwards in their new jobs.

A number of women left work and became entitled to a disability pension, temporary or permanent or partial or full. Before the pension, both the exposed and referent groups had very high individual ratios of observed versus expected; 78 among the exposed and 29 among the referents. The significance level was 5%: all tests are two-tailed.

Table 1 Total number of days with sickness allowance cash benefit (sick days) 1984-1989 among women exposed to repetitive work and referents

<table>
<thead>
<tr>
<th>Cohort (employment status)</th>
<th>Persons at risk</th>
<th>Observation time (person years)</th>
<th>Sick days</th>
<th>Individual ratios (O/E)</th>
<th>Median 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Observed</td>
<td>Expected</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>O</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>Exposed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>During employment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>269</td>
<td>1,094</td>
<td>67,050</td>
<td>29,540</td>
<td>2.27</td>
</tr>
<tr>
<td>Stayers</td>
<td>124</td>
<td>716</td>
<td>30,053</td>
<td>19,346</td>
<td>1.58</td>
</tr>
<tr>
<td>Quitters for other jobs</td>
<td>95</td>
<td>216</td>
<td>11,974</td>
<td>4,406</td>
<td>2.88</td>
</tr>
<tr>
<td>Disability pensioner</td>
<td>45</td>
<td>146</td>
<td>24,452</td>
<td>5,216</td>
<td>5.04</td>
</tr>
<tr>
<td>Others</td>
<td>5</td>
<td>15</td>
<td>571</td>
<td>573</td>
<td>1.00</td>
</tr>
<tr>
<td>Quitters in new jobs</td>
<td>126</td>
<td>404</td>
<td>11,448</td>
<td>10,099</td>
<td>1.13</td>
</tr>
<tr>
<td>Referents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>During employment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>290</td>
<td>1,438</td>
<td>26,421</td>
<td>38,646</td>
<td>0.68</td>
</tr>
<tr>
<td>Stayers</td>
<td>223</td>
<td>1,276</td>
<td>21,002</td>
<td>34,377</td>
<td>0.56</td>
</tr>
<tr>
<td>Quitters for other jobs</td>
<td>49</td>
<td>121</td>
<td>1,383</td>
<td>2,578</td>
<td>0.55</td>
</tr>
<tr>
<td>Disability pensioner</td>
<td>9</td>
<td>19</td>
<td>3,743</td>
<td>743</td>
<td>5.05</td>
</tr>
<tr>
<td>Others</td>
<td>9</td>
<td>22</td>
<td>293</td>
<td>947</td>
<td>0.31</td>
</tr>
<tr>
<td>Quitters in new jobs</td>
<td>78</td>
<td>313</td>
<td>5,671</td>
<td>7,617</td>
<td>0.63</td>
</tr>
</tbody>
</table>

a: Stayers were still employed at the end of the observation period, while quitters had left for other jobs. Disability pensioners became entitled to disability pension during the observation period, others left for home work or studies; these were no longer entitled to sickness allowance.
b: Expected from county rates
c: 95% CI: 95% confidence interval of the median
d: The low number of individuals in this category does not permit the calculation of a confidence interval with a degree close to 95%
e: Quitters for other jobs plus subjects who left for other jobs 1980-1983
expected numbers of days with sickness allowance (medi-
ans 5.18 and 5.97 respectively). There was no significant
difference between the exposed and referent groups re-
garding the individual ratios (table 1). However, 53
women in the exposed group obtained a disability pen-
sion, compared to only 14 in the referent group.
When sick-leave with physician’s certificates was con-
sidered (>1 week), there was an almost five-fold differ-
ence between the exposed and referent groups re-
garding the average prevalence of sick-
leave due to diagnoses concerning musculoskeletal dis-
eases (table 2). For necks/shoulders, the difference was
ten-fold (5.21 versus 0.55), for arms/hands five-fold (2.31
versus 0.46) and for other musculoskeletal disorders three-
fold (4.61 versus 1.60). For diagnoses other than muscu-
oskeletal there was a two-fold difference (4.37 versus 2.01).
When looking at the situation during employment, the
exposed ‘quitters’ had higher average prevalences than
‘stayers’ for all diagnoses except the necks/shoulders (table
2). On the contrary, among the referents, the ‘quitters’
had lower average prevalences than ‘stayers’ for all diag-
oses except arms/hands.
When comparing the average prevalences in the new
jobs, ‘after employment’, to those ‘during employment’,
the exposed ‘quitters’ had lower average prevalences for
all diagnoses in their new jobs. On the other hand, among
the referents the average prevalences in their new jobs
were higher for all diagnoses except the arms/hands.

**Disability pensions**

As mentioned before, more women in the exposed
group than in the referent one obtained a disability pension
(table 3). Some women (9 in the exposed and 4 in the
referent group) were awarded a partial disability pension
during the observation period of 1980–1989, temporary
or permanent, and continued working part-time. Five
were later awarded a full pension during the observation
period. However, only the first pension awarded adds to

Table 2 Sickness allowance (prevalence-average fraction of observation time) 1984–1989 (periods >1 week) under different physicians’
diagnoses (often several) among a total of 300 women exposed to repetitive work and 319 referents

<table>
<thead>
<tr>
<th>Cohort (employment status)*</th>
<th>Observation time (person years)</th>
<th>Sick-leave under diagnoses</th>
<th>Non-musculoskeletal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exposed</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>During employment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (days)</td>
<td>1,094</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence (%)</td>
<td>5.21***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stayers (days)</td>
<td>716</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence (%)</td>
<td>2.86***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quitters for other jobs</td>
<td>216</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence (%)</td>
<td>1.48**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disability pensioners (days)</td>
<td>146</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence (%)</td>
<td>22.10*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quitters in new jobs</td>
<td>404</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence (%)</td>
<td>1.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Referents</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>During employment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (days)</td>
<td>1,438</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence (%)</td>
<td>0.55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stayers (days)</td>
<td>1,275</td>
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<td></td>
</tr>
<tr>
<td>Prevalence (%)</td>
<td>0.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quitters for other jobs</td>
<td>121</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence (%)</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disability pensioners (days)</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence (%)</td>
<td>2.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quitters in new jobs</td>
<td>313</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence (%)</td>
<td>0.17</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*** p<0.001, ** p<0.01, * p<0.05 denote significant differences between the exposed and the referents
a: Stayers were still employed at the end of the observation period, while quitters had left for other jobs. Disability pensioners became entitled to a disability pension during the observation period. The group others (table 1) were not included because of few subjects.
the number of observed disability pensions, according to the background figures on newly awarded pensions. Among the 53 exposed women who obtained a disability pension, 37 had diseases of the musculoskeletal system. Of the corresponding 14 referents, 9 had musculoskeletal diseases.

The exposed women had an observed total number of disability pensions which was higher than expected, both for all diagnoses (observed/expected, 2.8; table 3) and because of musculoskeletal disease (observed/expected, 3.6). The excess risks among the exposed women were pronounced in the elderly age strata.

The risk of disability pension was lower than expected among the referents except for the oldest age group, 60–64 years, where the observed number of pensions versus the expected was 2.3 and 2.8 (all diagnoses and musculoskeletal diagnoses respectively).

Only 5 of the exposed women with disability pensions were or had been foreign citizens.

**DISCUSSION**

The present results showed that for sick-leave periods lasting at least 1 week, a group of women occupied with repetitive industrial work had more days with sickness allowance per year (three-fold), than a group of referent women with more varied work tasks. In particular, the average prevalences of sick-leave because of diagnoses in the necks/shoulders and arms/hands were much higher (ten-fold and five-fold respectively) than in the referents. Further, there were indications of selective quitting by exposed women, since the average prevalence for the 'quitters' was reduced in their new jobs. Moreover, the risk of disability pensioning was much higher among the exposed women than in the background population. The referent group had numbers of days with sickness allowance and disability pensions considerably below the expected ones. Thus, comparisons between the exposed and referent groups further stress the risk among the exposed.

The higher degree of sick-listing in the exposed women compared to the referents (both for total and musculoskeletal disorders) is in accordance with the results of questionnaire-assessed musculoskeletal complaints and diagnoses based on physical examination in some of the women.15,16

**Sick-leave**

It should be stressed that sick-leave is not a reliable indicator of somatic disease. Thus, the liability to take sick-leave is, besides presence of disease, dependent upon socioeconomic conditions.7,17 Hence, it has been claimed, that over-use of the welfare system is an important explanation of sick-leave. On the other hand, several observations contradict this.3 In particular, there is reason to believe that the same somatic medical condition will more often result in sick-leave in a subject with a high physical work-load than in one with a low physical work-load. The total number of days with sickness allowance includes days for periods lasting less than 1 week, where no certification of disease is needed. Sick-listing for periods longer than 1 week requires a physician's certificate and is thus a more reliable indicator of disease. The most impressive feature in the present study, the excess sick-listing under certain diagnoses in the exposed women, is based only on periods lasting more than 1 week.

It may be claimed, however, that the information given by the woman to the social insurance office about her complaints and even the diagnoses on the physicians' certificates, are not high-quality data. Thus, the information is often scarce. In addition, the certificates were written by several physicians, both in the exposed and referent groups. It is not highly likely that the differences between exposed and referent women are due to bias though, in particular since the differences between the exposed and referent groups as regards sick-listing under musculoskeletal disease are very large.

The very high absenteeism because of total long-term sick-leave in the present exposed group is similar to earlier observations, regarding the exposure, in less well-defined groups.3,7,8,18 In particular, sick-leave under musculoskeletal diagnoses in the present exposed group was very frequent; thus, the present figures were much higher than those reported earlier, probably because the current work

<p>| Table 3 Disability pensions (temporary and permanent) 1980-1989 among 325 women exposed to repetitive work and 331 referents, under all and musculoskeletal diagnoses |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| Age at pensioning (years) | Cohort | All diagnoses | Disability pensions | Musculoskeletal diagnoses |</p>
<table>
<thead>
<tr>
<th></th>
<th>Observed (O)</th>
<th>Exposed* (E)</th>
<th>O/E</th>
<th>95% CI</th>
<th>Observed (O)</th>
<th>Exposed* (E)</th>
<th>O/E</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposed</td>
<td>15-49</td>
<td>9</td>
<td>5.16</td>
<td>1.7</td>
<td>(0.8-3.3)</td>
<td>6</td>
<td>2.26</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td>50-59</td>
<td>24</td>
<td>9.32</td>
<td>2.6</td>
<td>(1.7-3.9)</td>
<td>18</td>
<td>5.39</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td>60-64</td>
<td>20</td>
<td>3.93</td>
<td>5.1</td>
<td>(3.2-8.0)</td>
<td>13</td>
<td>2.22</td>
<td>5.9</td>
</tr>
<tr>
<td>Total</td>
<td>53</td>
<td>18.71</td>
<td>2.8</td>
<td>(2.1-3.7)</td>
<td>37</td>
<td>10.37</td>
<td>3.6</td>
<td>(2.5-5.0)</td>
</tr>
<tr>
<td>Referents</td>
<td>15-49</td>
<td>3</td>
<td>7.78</td>
<td>0.4</td>
<td>(0.1-1.1)</td>
<td>1</td>
<td>3.54</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>50-59</td>
<td>4</td>
<td>9.20</td>
<td>0.4</td>
<td>(0.1-1.1)</td>
<td>3</td>
<td>5.49</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>60-64</td>
<td>7</td>
<td>2.99</td>
<td>2.3</td>
<td>(0.9-4.8)</td>
<td>5</td>
<td>1.77</td>
<td>2.8</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>19.97</td>
<td>0.7</td>
<td>(0.4-1.2)</td>
<td>9</td>
<td>10.89</td>
<td>0.8</td>
<td>(0.4-1.6)</td>
</tr>
</tbody>
</table>

* Expected from county rates
95% CI: 95% confidence interval
Sick-leave among female assembly workers

tasks were more extreme. The very skewed distributions are similar to the ones reported earlier. The exposed/referent group difference, in terms of sick-days, was much less impressive as regards short-term sick-leave, which is also in accordance with earlier reports. One explanation is that subjects already on long-term sick-leave are not at risk of short-term sick-leave. However, it may also indicate that the present long-term sick-leave is mainly due to the physical work-load and not to psychosocial work-environment factors, which would probably affect short-term leave more.

The referent group contained a somewhat lower fraction of subjects with full-time employment than the exposed one. It might be argued that the lighter strain on the part-time employees would result in a lower risk of disease and, thus, of sick-listing. However, other studies show that the risk of being long-term sick-listed is not dependent upon work time, for neither sick-leave in general nor for musculoskeletal disease.

It could be added that, in the present study, the marital status as well as the number of children did not differ (although studied only in groups El and R1). Further, the exposed and referent women lived in similar small-size communities.

The employment status of the referents is similar to the average Swedish woman (52% working 35—40 hours per week). The referents had fewer days of sick-leave than expected, which could be due to the fact that the general population of women includes subjects with work tasks similar to the ones among the present exposed women. There was a large difference in physical work-load between the exposed and referent groups. The deleterious effect of this work-load on the musculoskeletal system is probably the most important explanation of the differences between the groups.

However, in addition to the pure physical work-load, a series of associated work-environment factors may be of importance for the liability to sick-list. Thus, jobs with a low decision latitude (control) and high demands (strain) are strongly associated with sick-listing. Further, sick-listing was more extreme. The very skewed distributions are similar to the ones reported earlier. On the other hand, the fact that the differences in sick-leave prevalences were highest for diagnoses in the neck and upper limb, indicates that the physical load of the repetitive work is a major causal factor.

In a very split-up job, sick-listing may be a coping strategy, the only readily available way to reduce the pain in the musculoskeletal system. On the other hand, the differences between exposed and referent women were mainly for long-term sick-leave. However, some of the higher short-term sick-leave periods in young as compared to elderly women may be due to such a coping behaviour; the young women stay at home to maintain their working ability for the future, while the elderly force themselves to work, because they are anxious to keep their jobs until retirement. Thus, the short-term sick-leave may have a positive effect for the individual. However, long-term sick-leave is often destructive, as it frequently leads to social isolation from work-mates, and a risk of never returning to working life.

In studies of disease associated with work-environment factors, there is always a risk of underestimating effects, through selective quitting by subjects with complaints (‘healthy worker selection’). Thus, in the present study efforts were also made to obtain information about subjects who had left the work sites during 1980—1983. Interestingly, sick-leave ‘during employment’ was higher in the exposed women who left than in the ones who stayed. There are, thus, strong indications of a healthier worker selection and a study of the still working population only, would have underestimated the effect. This is in accordance with earlier observations of complaints and diagnoses in the present groups.

Interestingly, after a change of work the sick-leave rate for women who left no longer differed from the expected. This may indicate that they recovered rather soon after end of the exposure, which, thus, did not cause an irreversible disease. Of course, this may be true only for young women, who left for a new job, which in most cases was more varied. However, we do not know what happens to elderly women, who leave for retirement or to work at home; they may very well have a less favourable prognosis. One factor, which has probably magnified the effect of the work on long-term sick-leave (as well as on disability pensions) is that the factories were located in areas with few other possibilities for women to obtain jobs. Thus, they probably stayed at the job, in spite of pain, until they could no longer manage.

Disability pensions

There is the possibility of obtaining a disability pension without having been employed. This affects the comparability between the exposed and general populations, resulting in too low risk estimates. However, this effect is minor. Moreover, the observation period as regards disability pensions started 10 years before the collection of data in 1 of the factories (E2). Thus, there is a risk that the information on subjects, who left with a disability pension, may be incomplete. In addition, there were non-responders (18%), which leaves some uncertainty. During the observation period, persons aged 60—64 years had a possibility of obtaining a pension because of local under-employment. Thus, in factory E, 12 persons left. They may also have suffered from work-related disease; thus, this possibility may have decreased the number of disability pensions. However, this problem also affects the expected values. Thus, it is not possible to know the sum effect on the risk.

Social consequences

In particular because of their musculoskeletal complaints, the women’s ability to do their housework decreased and
an accordingly heavier burden was laid on other members of the families. In addition, their ability to do needlework and knitting was affected, a pleasure and amusement, which many of the women missed. Further, their social life deteriorated, which leads to isolation from friends and relatives. Thus, the disease underlying the sick-leave and disability pension is often a very heavy burden for the individual woman and her surroundings.

As mentioned above, sick-leave and disability pensions are consequences of, _inter alia_, the social insurance system. There have been major changes in Sweden since the observation period and the short-time sick-leave compensation has been reduced. This has been associated with a decrease in the number of days with sickness benefit, but an increase in disability pensions. However, it is not known whether this decrease in sick-leave has affected all branches to the same extent, in particular how high-risk factories of the present type are affected. In addition, the effect on the total cost of these changes is difficult to assess, as the disability pensioning increased during the same period.

**Prevention**

It is obvious that there is a need for actions against the present problem. The Swedish society is presently reducing the social welfare system with regard to sick-leave and work diseases. Further, large resources have been set aside for rehabilitation activities. However, this is only occasionally effective in patients of the present type. First, many of the women had such great medical problems that rehabilitation had a limited chance of success. Second, as mentioned above, the present factories were located in areas with few other possibilities of employment for women. Third, if the patient moved to another job, her place would be taken by a new woman – a strong candidate for disease. Fourth, too little is known about the prognosis of the disease, even if the exposure is reduced. Thus, the only really adequate measure is extensive improvements in the work environment. In Sweden, large resources have been devoted to such changes in the last few years. However, improvement is not easily achieved, in particular in small places of work. It requires far-reaching reorganization of the work. In addition, the identification of the factors in the work situation which are critical for the development of disease is insufficient.

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