Socio-economic and occupational determinants of work injury absence

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Background: Measures of socio-economic position, such as education, occupational class and income, are well-known determinants of ill-health, injury and sickness absence. The aim was to analyse socio-economic and occupational determinants of work injury absence and their contribution to overall socio-economic inequalities in all-cause sickness absence. Methods: A register-based follow-up study included municipal employees of the City of Helsinki aged 25–59 years in 2004. The number of participants was 16 471 women and 5033 men. The mean follow-up time was 3.0 years. Education, occupational class and individual income were used as measures of socio-economic position. The main outcome was medically confirmed work injury and all-cause sickness absence of ≥4 days. Inequality indices were calculated using Poisson regression analysis. Results: High education, occupational class and individual income were consistently associated with lower work injury absence among both women and men. The inequalities in work injury absence were larger than in all-cause sickness absence, especially among men, but the contribution to overall socio-economic inequalities was limited. Among women, bus drivers, cooks and hospital attendants had the highest rates of work injuries. Among men, youth mentors, firemen and janitors had the highest rates. Conclusions: Our results indicate that relative socio-economic inequalities in work injury absence are larger than in all-cause sickness absence. Prevention of work injuries provides a source of reducing socio-economic inequalities in health, but their effect is not very large. Prevention of work injuries should be targeted to lower white-collar and manual workers and vulnerable occupations.

Introduction

Work injuries in general and fatal work injuries in particular have decreased considerably in the past 2 decades in Finland¹ and in the European Union.² At the same time, consistent protective measures, such as more developed legislation, financial incentives for the employers, education, personal protection and improved work culture have been introduced. In addition, the structure of the economy has changed from more work injury prone agriculture and heavy industry to safer services. However, work injuries still remain an occupational health problem and a potentially avoidable source of ill health.

Most work injuries are due to falling, body movement with physical stress and body movement without any physical stress.¹,² Men, younger employees and those in lower occupational classes are more prone to work injuries.²–⁵ Certain occupations are particularly prone to work injuries, such as construction, food processing and agricultural and livestock work.¹ This is understandable, as different risk factors to work injuries are distributed unevenly between occupational groups.⁴

Socio-economic inequalities in health including sickness absence tend to be large and consistent in Western countries.⁶–⁹ As work injuries and different risk factors of work injuries vary considerably between occupations, this suggests that socio-economic differences in work injuries tend to be large.

A recent World Health Organization report reviewed socio-economic inequalities in injuries in general.³ This report showed that there is a large amount of studies on injuries, which also cover socio-economic position as a background indicator. However, the studies vary considerably in their setting, injury type and socio-economic indicators. The studies were usually descriptive. Their results confirm that low socio-economic position, either at individual or community level, increases the risk of various types of injuries. However, we practically lack specific studies on socio-economic inequalities in work injuries. A Swedish study showed that manual workers have more injuries than salaried employees, taking into account work setting.¹⁰ An American study showed that education is an individual risk factor for non-fatal work injury, even after various work- and occupation-related risk factors were taken into account.¹¹ In addition, very few studies have analysed the potential impacts of injuries on overall socio-economic health inequalities. No studies exist that have analysed education, occupational class and income together as socio-economic determinants of work injuries.

Medically confirmed sickness absence is a generic indicator of health¹²,¹³ and predicts future disability pensions¹⁴,¹⁵ and

References

mortality. Education, occupational class and income are interrelated to each other, but they are also partly independent determinants of sickness absence. In contrast to work injuries, overall sickness absence rates have increased in Finland. However, few scientific studies have analysed work injury absence in more depth. There is need for research, as especially long sickness absence causes largest expenses to the employers and losses of income to the employees.

The aims of this study were: (i) to examine socio-economic position, i.e. education, occupational class and income, as determinants of work injury absence; (ii) to study how work injury absence contributes to overall inequality in sickness absence; and (iii) to identify groups and occupations particularly vulnerable to work injuries.

### Methods

#### Data

This study is part of the Helsinki Health Study on health and well-being among employees of the City of Helsinki. The City of Helsinki is the capital of Finland with 40,000 municipal employees. The City of Helsinki operates mainly in health care, social welfare services, education, public transport and technical services. All permanent employees aged 25–59 years who were working full-time at the beginning of the year 2004 were included in this study and followed up until the end of 2007. Employees with part-time or secondary employment were excluded from the study. The study group included 16,471 women and 5033 men.

Individual-level information on the employees’ sickness absence and its determinants was obtained from the personnel and sickness absence registers included in the information system of the City of Helsinki. The registers include precise information on all employees and their work contracts including employment periods and sickness absence spells in an accuracy of 1 day. If an employee had more than one employment period during 2004, information on education, occupational class and individual income and other determinants was gathered from the longest period. All sickness absence spells of the staff of the City of Helsinki for the years 2004–2007 were included in the study. Consecutive and overlapping sickness absence spells were combined. Only sickness absence spells covered by the actual working time were included so the time of the employment was taken into account for each employee. The mean follow-up time was 3.0 years.

The outcome used was ≥4 days sickness absence, for which the City of Helsinki requires a medical certification from all employees. Sickness absences were categorized to all-cause sickness absence, work injury absence and other-cause sickness absence. All-cause sickness absence includes the work injury absence and other-cause sickness absence categories. Eurostat has harmonized the registration of work injuries and uses work injuries that cause ≥4 days work disability as an outcome in follow-up and reports. Analyses on work injury absence allow us to compare rates and contributions with all-cause sickness absence.

Educational level was classified as high, if the employee had graduated from the upper secondary school. Intermediate school and comprehensive school were classified as intermediate level. Employees with compulsory education only were classified as low-education group.

Occupational class was classified into four categories according to the job title of each employee: managers and professionals, such as teachers and physicians; semi-professionals, such as nurses and foremen; routine non-manuals, such as clerical employees, child minders and home assistants; and manual workers, such as technical and cleaning workers.

The employees were divided into income quartiles according to their monthly individual salary from the employment for the City of Helsinki. The income covers only own wage or salary and does not include income from other sources, such as secondary employment, investment income or income transfers. Individual income depicts more closely the individual socio-economic position than full household disposable income.

Information on occupational titles in different departments was also obtained from the registers.

#### Methods

Age-adjusted relative risks (RRs) and their 95% confidence intervals (CIs) for each socio-economic position group were calculated using Poisson regression analysis in accordance with previous sickness absence studies. Further analyses were made to examine measures of socio-economic position together. In addition, age-adjusted RRs were calculated for different occupations.

Also, inequality indices were calculated using Poisson regression models. In these analyses, indicators of socio-economic position were used as continuous variables as they are ordinal in nature and clear and consistent gradients are evident. In this way, a single index figure for the effect of each measure of socio-economic position on sickness absence was obtained. The inequality index has an interpretation as the average change in the RR of sickness absence for each level in each indicator of socio-economic position. The analyses were conducted in steps. Firstly, the age-adjusted gross effect of each indicator of socio-economic position on sickness absence was analysed. Secondly, the analyses were conducted with all three indicators of socio-economic position simultaneously to be able to assess the net effect of each indicator of socio-economic position at a time after taking account of the two other indicators of socio-economic position.

Net contribution of work injuries to the overall inequities in sickness absence was analysed by assessing the reduction of inequality indices after excluding work injuries.

All analyses were performed separately for women and men using SAS statistical software, version 9.1.
income group had 1.84 times higher RR as compared with the highest-income group.

Among men, the found socio-economic differences in work injury absence were even larger than among women. The differences were steepest between occupational classes, where manual workers had 6.15 times higher RR than managers and professionals. In the fully adjusted model, differences in education remained considerable, in occupational class large, whereas practically no individual effect remained in income.

Inequality indices for sickness absence

Inequality indices for sickness absence outcomes are presented in table 3. Among women, larger inequalities were present in work injury absence as compared with all-cause sickness absence. In the fully adjusted model, where education, occupational class and individual income were simultaneously adjusted for, the individual effect remained in all measures of socio-economic position. In the fully adjusted models, the individual effect of education and income were at the same level in work injury absence and all-cause sickness absence. However, the individual effect of occupational class was larger in work injury absence.

Consistent inequalities were also found among men. Inequalities were larger in work injury absence than in all-cause sickness absence. In the fully adjusted models, the independent effect remained in education, occupational class and income in all sickness absence outcomes. Among men, the inequalities in work injury absence remained much larger than in all-cause sickness absence. In work injury absence, the individual effect of occupational class remained strong, whereas the effect of individual income changed direction.

Table 1 Distributions of socio-economic position measures (%) and age-adjusted average numbers of medically confirmed all-cause sickness absence spells, work injury absence spells and other-cause sickness absence spells per 100 person years among the staff of the City of Helsinki in the follow-up time 2004–2007

<table>
<thead>
<tr>
<th>Education</th>
<th>Women</th>
<th></th>
<th></th>
<th>Men</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>%</td>
<td>All-cause sickness absence spells</td>
<td>Work injury absence spells</td>
<td>Other-cause sickness absence spells</td>
<td>%</td>
<td>All-cause sickness absence spells</td>
<td>Work injury absence spells</td>
</tr>
<tr>
<td>High</td>
<td>50</td>
<td>72 (70–74)</td>
<td>2.3 (2.0–2.5)</td>
<td>69 (67–72)</td>
<td>46</td>
<td>47 (43–50)</td>
<td>1.8 (1.4–2.1)</td>
</tr>
<tr>
<td>Intermediate</td>
<td>30</td>
<td>121 (117–125)</td>
<td>4.5 (4.1–5.0)</td>
<td>117 (113–121)</td>
<td>33</td>
<td>88 (82–94)</td>
<td>4.3 (3.5–5.1)</td>
</tr>
<tr>
<td>Low</td>
<td>20</td>
<td>134 (123–145)</td>
<td>5.0 (4.1–5.8)</td>
<td>129 (119–140)</td>
<td>21</td>
<td>107 (91–123)</td>
<td>4.2 (3.1–5.2)</td>
</tr>
</tbody>
</table>

Table 2 Medically confirmed work injury absence spells per 100 person years among the staff of the City of Helsinki in follow-up time 2004–2007

<table>
<thead>
<tr>
<th>Education</th>
<th>Women</th>
<th></th>
<th></th>
<th>Men</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>Age RR (CI)</td>
<td>Age + Education + Class + Income RR (CI)</td>
<td></td>
<td></td>
<td>Age RR (CI)</td>
<td>Age + Education + Class + Income RR (CI)</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Intermediate</td>
<td>2.05</td>
<td>(2.01–2.09)</td>
<td>1.34 (1.31–1.37)</td>
<td></td>
<td>2.37 (2.29–2.46)</td>
<td>1.36 (1.31–1.42)</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>2.52</td>
<td>(2.46–2.58)</td>
<td>1.39 (1.35–1.43)</td>
<td></td>
<td>3.97 (3.80–4.15)</td>
<td>1.81 (1.72–1.91)</td>
<td></td>
</tr>
<tr>
<td>Occupational class</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Managers and professionals</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Semi-professionals</td>
<td>1.65</td>
<td>(1.60–1.71)</td>
<td>1.28 (1.22–1.33)</td>
<td></td>
<td>1.30 (1.21–1.40)</td>
<td>1.01 (0.93–1.09)</td>
<td></td>
</tr>
<tr>
<td>Routine non-manuals</td>
<td>2.92</td>
<td>(2.84–3.00)</td>
<td>1.51 (1.43–1.58)</td>
<td></td>
<td>5.19 (4.90–5.51)</td>
<td>3.61 (3.31–3.93)</td>
<td></td>
</tr>
<tr>
<td>Manual workers</td>
<td>4.35</td>
<td>(4.22–4.49)</td>
<td>1.94 (1.84–2.05)</td>
<td></td>
<td>6.15 (5.84–6.47)</td>
<td>4.72 (4.33–5.13)</td>
<td></td>
</tr>
<tr>
<td>Individual income</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highest</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Second quartile</td>
<td>1.85</td>
<td>(1.80–1.91)</td>
<td>1.27 (1.22–1.33)</td>
<td></td>
<td>3.63 (3.45–3.81)</td>
<td>1.22 (1.13–1.31)</td>
<td></td>
</tr>
<tr>
<td>Third quartile</td>
<td>3.18</td>
<td>(3.09–3.26)</td>
<td>1.74 (1.66–1.83)</td>
<td></td>
<td>5.80 (5.52–6.10)</td>
<td>1.25 (1.16–1.35)</td>
<td></td>
</tr>
<tr>
<td>Lowest</td>
<td>3.85</td>
<td>(3.73–3.96)</td>
<td>1.84 (1.75–1.94)</td>
<td></td>
<td>4.61 (4.40–4.84)</td>
<td>0.82 (0.75–0.88)</td>
<td></td>
</tr>
</tbody>
</table>

Poisson regression analysis, RRs. a: 95% CIs.
Table 3 | Inequality index for medically confirmed all-cause sickness absence spells, work injury absence spells and other-cause sickness absence spells per 100 person years among the staff of the City of Helsinki by measures of socio-economic position

<table>
<thead>
<tr>
<th></th>
<th>All-cause sickness absence spells</th>
<th>Work injury absence spells</th>
<th>Other-cause sickness absence spells</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gross effect</td>
<td>Gross effect</td>
<td>Gross effect</td>
</tr>
<tr>
<td>RR (CIA)</td>
<td>RR (CIB)</td>
<td>RR (CIC)</td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>1.47 (1.47–1.47)</td>
<td>1.62 (1.60–1.64)</td>
<td>1.46 (1.46–1.47)</td>
</tr>
<tr>
<td>Occupational class</td>
<td>1.42 (1.42–1.43)</td>
<td>1.65 (1.63–1.66)</td>
<td>1.42 (1.41–1.42)</td>
</tr>
<tr>
<td>Individual income</td>
<td>1.40 (1.40–1.40)</td>
<td>1.56 (1.55–1.57)</td>
<td>1.39 (1.39–1.40)</td>
</tr>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>1.64 (1.63–1.64)</td>
<td>2.01 (1.97–2.05)</td>
<td>1.62 (1.62–1.63)</td>
</tr>
<tr>
<td>Occupational class</td>
<td>1.48 (1.48–1.49)</td>
<td>1.85 (1.83–1.88)</td>
<td>1.47 (1.47–1.47)</td>
</tr>
<tr>
<td>Individual income</td>
<td>1.42 (1.41–1.42)</td>
<td>1.53 (1.51–1.54)</td>
<td>1.41 (1.41–1.41)</td>
</tr>
</tbody>
</table>

a: All models adjusted for age.

b: 95% CIs.

We also calculated the contribution of work injury absence to the overall inequalities in sickness absence. If work injuries were eliminated altogether from all-cause sickness absence, no practical change in the total inequality by education or income would follow, but total inequality by occupational class would decline by 5% among women and 6% among men.

**Occupational differences in work injury absence**

Sickness absence rates in selected occupations were further analysed in tables 4 and 5. As the number of different occupations was high, results are presented for the largest occupations and for the occupations where the rates of work injury absence were highest and lowest.

Among women, bus drivers, cooks and hospital attendants had highest rates of work injury absence. Occupational therapists, assistant chief nurses and draughtsmen or designers had lowest rates of work injury absence.

Among men, youth mentors, firemen and janitors had highest rates of work injury absence, but the CIs were wide among youth mentors owing to their small number. There were several occupations, such as musicians, specialist teachers, special researchers or designers, that had no work injuries at all during the follow-up time.

In both genders, in high work injury groups, manual workers and routine non-manuals dominated. In low work injury groups, semi-professionals, managers and professionals were most common.

**Discussion**

This study examined socio-economic determinants of work injury absence and their contribution to overall inequality in sickness absence. In addition, specific groups and occupations for possible interventions were examined. Over 3 days long work injury absence spells were used as an outcome, in accordance with Eurostat recommendations.

The results showed that low education, occupational class and individual income predict high work injury absence during follow-up. Occupational class was the strongest determinant among both women and men. The socio-economic gradients were
determined by collective labour agreement, and by occupation, which in most of the cases requires certain educational qualifications. Education and occupational class precede individual income. Finnish legislation and compulsory insurance protects employees from adverse financial consequences of work injuries better than for other health problems. In addition, public sector as an employer provides, for example, easy access and free occupational health services to all employees.

Generally, the results of the independent effects of education, occupational class and individual income were in accordance with previous studies on sickness absence. The findings on manual workers were also in line with a previous Swedish study. No studies have examined the individual and simultaneous effects of these socio-economic determinants on work injuries before. However, future studies should take account for physical and psychosocial working conditions, which have been shown to mediate the effects of education and occupational position to work injuries.

The effect of work injuries on overall inequalities in sickness absence was limited. However, some potential for reducing inequalities exist, especially by occupational class. No studies have analysed this potential previously. Public sector in Finland represents post-industrial labour market, where less work is done in industry and agriculture, and more in services related to well-being, education and planning. The result could be different in less-developed economies, where protective measures, work legislation and other regulations and work culture are not as developed. The findings inside European Union show that there is still room for positive development in work injury prevention, especially in Eastern European and certain Western European countries.

Very large differences in work injuries were found between occupations. Certain occupations, such as bus drivers, cooks, firemen, janitors, hospital attendants and kindergarten attendants were at high risk of work injury absence. All these occupations belong to post-industrial labour market, where less work is done in industry and agriculture, and more in services related to well-being, education and planning. The result could be different in less-developed economies, where protective measures, work legislation and other regulations and work culture are not as developed. The findings inside European Union show that there is still room for positive development in work injury prevention, especially in Eastern European and certain Western European countries.

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This study had several strengths. The register-based data set was large and comprehensive, and can be regarded as reliable and accurate. The follow-up design for sickness absence incidence gives more insight into causal relationships than cross-sectional studies. There are also some limitations. The population comprises only public sector employees, although from a large workplace in Finland. One should thus be cautious in generalizing the results to the private sector or other countries. The number of men was lower than women, leading to smaller occupational groups and wider CIs among men. Using register-based data, no information was available on more proximate determinants of work injuries, such as psychosocial or physical working conditions.

The results of this study show clearly that inequalities in work injuries exist and they are large. Work injuries are potentially avoidable, as the results in selected occupations show, and they must be kept on the agenda in all workplaces. Work injuries can be reduced, for example, by adopting best practices, improving physical and psychosocial working conditions, adopting strict regulations and legislation and directing employers by financial incentives. Our findings suggest that to reduce both the absolute level and inequalities in work injuries, lower white-collar employees, manual workers and certain vulnerable occupations should be targeted.

More research is needed on the mechanisms and mediating factors through which socio-economic and occupational determinants affect work injury absence. Future studies could learn from other sickness absence and work injury research where more proximate explanatory models have been used. For example, specific work characteristics of professionals and semi-professionals could be studied in more detail. Large data sets are needed to enable the use of sophisticated statistical methods, as the work injury absence spells are infrequent events as compared with other sickness absence spells.

Conflicts of interest: None declared.

Key points
- Work injuries vary between socio-economic positions and are a potentially avoidable source of socio-economic inequalities
- Low education, occupational class and income predict subsequent work injury absence
- The socio-economic gradients were considerably steeper in work injury absence than in other cause sickness absence
- Prevention of work injuries should be targeted to lower white-collar employees and manual workers as well as vulnerable and large occupations such as bus drivers, firemen, janitors and hospital attendants

References