Physical and psychosocial working conditions as explanations for occupational class inequalities in self-rated health

Risto Kaikkonen1,2, Ossi Rahkonen2, Tea Lallukka2, Eero Lahelma2

Background: Socio-economic health inequalities are well documented, but efforts to explain health inequalities are less. However, previous studies suggest that working conditions provide potential explanations for inequalities in health. Methods: Cross-sectional questionnaire survey data, collected from municipal employees of the City of Helsinki, aged 40–60 years (n = 8960, response rate 67%) in 2000–02, were examined using binomial regression analysis. Socio-economic position was measured by six occupational social classes ranging from top managers to manual workers, and the outcome was self-rated health (SRH). Key physical and psychosocial working conditions and work arrangements were included as explanatory factors for inequalities in health. Results: Occupational class inequalities in SRH were clear among women [prevalence ratio (PR) 1.89, 95% confidence interval (CI) 1.54–2.32] and men (PR 1.78, 95% CI 1.40–2.25). Heavy physical workload explained a half of the health inequalities among women and almost one-third among men. Physical and chemical exposures at work explained one-fifth of the health inequalities among women and a half among men. Job control explained 24% of the men’s and 40% of women’s inequalities, whereas job demands widened the inequalities by 13–14%. The effects of shift work and working hours were negligible. In the fully adjusted model, 60% of the women’s and 32% of the men’s inequalities in SRH were explained. Conclusion: Physical working conditions explained a large part and job control, a somewhat smaller part of socio-economic inequalities in SRH. Improving physical working conditions and increasing job control provide potential routes to reduced inequalities in health among employees.

Keywords: physical working conditions, psychosocial factors, self-rated health, socio-economic position, work arrangements.

Introduction

Numerous studies have shown that socio-economic inequalities are associated with poor health, morbidity and mortality, but efforts to explain these inequalities need more research. Working conditions provide potential explanations for inequalities in health, and they have increasingly received attention in research. Most recent studies have focused on psychosocial working conditions, such as job strain and its dimensions, i.e. job demands and job control. However, few studies have simultaneously examined both physical and psychosocial working conditions as explanations for health inequalities.

Although the role of various working conditions as explanations for health inequalities is not yet fully understood, previous studies suggest that physical working conditions and job control explain a large part of the inequalities in self-rated health (SRH), morbidity and musculoskeletal disorders. Conditions associated with physical work, such as heavy physical workload, repetitive trunk movements and heavy lifts, explain health inequalities. Physical working conditions have explained 16–83% of inequalities in SRH, physical illness, psychosomatic symptoms and long-term sickness absence. Psychosocial working conditions, job demands and job control in particular as explanations for health inequalities have produced varying results. Job control has explained a substantial part of health inequalities in SRH, coronary heart disease, myocardial infarction and depressive or anxiety disorder. Also inconsistent results have been documented on cerebrovascular disease and the simultaneous examination of job control and job demands, has shown contrasting effects on health inequalities. Job control has explained health inequalities, whereas job demands have widened the inequalities in SRH.

Work arrangements, such as shift work, have shown substantial effects on inequalities in cerebrovascular mortality and SRH whereas employment contracts and long working hours have had negligible effects on inequalities in SRH. However, in another study, work arrangements explained a substantial part of inequalities in SRH.

Previous studies have largely focused on psychosocial working conditions although their role as explanations for health inequalities has been inconsistent. Only a few studies have focused on both physical and psychosocial working conditions as explanations for health inequalities and a broader picture of the importance of various explanatory factors is still lacking. Therefore, this study aimed to examine whether occupational class inequalities in SRH health can be explained by a variety of physical and psychosocial working conditions.

Methods

Study population

The data for this study were derived from postal surveys of the Helsinki Health Study, which were collected from 40-, 45-, 50-, 55- and 60-year old employees of the City of Helsinki,
Finland, in 2000, 2001 and 2002. The total number of respondents was 8960 in the pooled data, of whom 80% were women corresponding to the target population. The overall response rate was 67%. The data were largely representative of the target population although manual workers, young men and those with long sickness absences were slightly underrepresented.

The City of Helsinki is the largest (single) employer in Finland with almost 40,000 employees. In addition to general administration, the main branches include health care, social welfare, culture and education, public transport, technical and construction branches.

**Socio-economic position**

Socio-economic position was based on the respondent’s current occupation, which was obtained from the employer’s register (80%), or obtained from the questionnaire data for those who did not give their permission for register linkage. Occupations were categorized into six hierarchical classes: managers, professionals, semi-professionals, routine non-manual workers and skilled and unskilled manual workers. The largest class for women was routine non-manual workers (42%) and that of men was professionals (26%) (table 1).

**Health outcome**

SRH was used as the outcome measure. The SRH question was taken from the Short Form 36 (SF-36) health inventory and reads: ‘In general, would you say your health is: excellent, very good, good, fair, or poor’. In this study, we examine SRH as less than good, i.e. ‘fair’ or ‘poor’ health.

**Working conditions**

Potentially harmful working postures and other physical working conditions were inquired about using an 18-item inventory developed at the Finnish Institute of Occupational Health. Four response options were included: ‘does not occur’, ‘appears but does not trouble at all’, ‘appears and troubles somewhat’ and ‘appears and troubles considerably’. The last two options were used in the analyses to indicate harmful working conditions. Principal component analysis was used to group these work-related exposures. A three-factor solution was reached: (i) physical strenuousness, such as repetitive trunk rotation, and movements, lifting and carrying (six items, Cronbach’s α 0.85); (ii) computer display/terminal-aided work such as working with displays, mouse and sitting (three items, Cronbach’s α 0.81); (iii) work environments including potential exposure to hazardous chemicals or climate, excessive noise and vibration (nine items, Cronbach’s α 0.79) (for details, see Laaksonen et al.).

Work arrangements were working overtime and doing shift work. Working overtime equals regularly working >40 h per week. Shift work includes two or three shifts that employees normally have to work. Shifts can take place during the day or the night time.

Job demands and job control were scored using the Framingham version of Karasek’s Job Control Questionnaire. This version included five job demand items and nine job control items with five response alternatives from fully agree to fully disagree. Items on job demands relate to working pace and conflicting demands in work. A summary score was calculated using Karasek’s Framingham procedure for job control (Cronbach’s α 0.82) and job demands (Cronbach’s α 0.71).

**Statistical methods**

All analyses were carried out separately for women and men. Prevalence percentages and their 95% confidence intervals (CIs) for SRH were calculated using direct age standardization (5-year age groups). The results from the binomial regression analyses are presented as prevalence ratios (PRs) and their 95% CIs. We also calculated the percent change in less than good SRH between the highest and the lowest occupational class after adjustments using parameter estimates from binomial regression analysis: \( \frac{\text{estimate for model 1} - \text{estimate for extended model}}{\text{estimate for model 1}} - 1 \). In tables 2 and 3, changes between the managers and the intermediate routine non-manual employees can also be seen. PRs shown in the tables are logarithmic transformations from the parameter estimates, which were used in calculating the explanation percentages provided by each nested model.

Age was first adjusted in the base models. Nine models were fitted adjusting for the following factors: (i) physical work load, (ii) work environment, (iii) physical work load and work environment, (iv) computer-aided work, (v) work arrangements, (vi) job control, (vii) job demands, (viii) job strain and (ix) fully adjusted model. Models were fitted using SAS (version 9.1) statistical packages.

**Ethical considerations**

The protocol of the Helsinki Health Study was approved by the ethical committees at the Department of Public Health, the University of Helsinki, and the City of Helsinki health authorities. The study follows Finnish data protection legislation and ethical regulations of the University of Helsinki and the City of Helsinki.

**Results**

Age-adjusted prevalence for less than good SRH was 28% for women and 29% for men. SRH followed a steep occupational class gradient for both women and men (table 1).

About 20% of the female and male managers and professionals reported less than good SRH. However, among

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**Table 1** Age-adjusted prevalence (%) and 95% confidence intervals (95% CI) for less than good SRH by socio-economic position (occupational class) among 40- to 60-year old municipal employees (women and men)

<table>
<thead>
<tr>
<th>Socio-economic position</th>
<th>Women</th>
<th>Men</th>
<th>Women 95% CI</th>
<th>Men 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managers</td>
<td>6</td>
<td>17</td>
<td>20</td>
<td>22</td>
</tr>
<tr>
<td>Professionals</td>
<td>21</td>
<td>26</td>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td>Semi-professionals</td>
<td>19</td>
<td>19</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>Routine non-manual workers</td>
<td>42</td>
<td>10</td>
<td>31</td>
<td>32</td>
</tr>
<tr>
<td>Skilled manual workers</td>
<td>3</td>
<td>9</td>
<td>35</td>
<td>34</td>
</tr>
<tr>
<td>Unskilled manual workers</td>
<td>9</td>
<td>19</td>
<td>37</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>N = 7168, 100%</td>
<td>N = 1755, 100%</td>
<td>N = 6986, 28%</td>
<td>N = 1744, 29%</td>
</tr>
</tbody>
</table>

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### Table 2 Working conditions as explanations for occupational class health inequalities in less than good SRH; binomial regression analysis, age-adjusted PRs and 95% CIs among men

<table>
<thead>
<tr>
<th>Occupational class</th>
<th>Model 0</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
<th>Model 7</th>
<th>Model 8</th>
<th>Model full</th>
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</thead>
<tbody>
<tr>
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<td>95% CI</td>
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<td><strong>Men</strong></td>
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<tr>
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<td>1.00</td>
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<td>0.85</td>
<td>1.29</td>
<td>1.03</td>
<td>0.84</td>
<td>1.27</td>
<td>1.01</td>
<td>0.82</td>
<td>1.24</td>
<td>1.00</td>
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<tr>
<td>Semi-professionals</td>
<td>1.23</td>
<td>1.00</td>
<td>1.50</td>
<td>1.03</td>
<td>0.84</td>
<td>1.27</td>
<td>1.03</td>
<td>0.96</td>
<td>1.47</td>
<td>1.03</td>
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<tr>
<td>Routine non-manual workers</td>
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<td>1.28</td>
<td>1.86</td>
<td>1.21</td>
<td>1.00</td>
<td>1.47</td>
<td>1.46</td>
<td>1.21</td>
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<tr>
<td>Skilled manual workers</td>
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<td>2.23</td>
<td>1.29</td>
<td>1.00</td>
<td>1.66</td>
<td>1.58</td>
<td>1.23</td>
<td>2.04</td>
<td>1.25</td>
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<td>2.32</td>
<td>1.39</td>
<td>1.13</td>
<td>1.71</td>
<td>1.63</td>
<td>1.32</td>
<td>2.01</td>
<td>1.31</td>
</tr>
<tr>
<td>Percent change (%)a Reference</td>
<td>- &amp; 48%</td>
<td>- &amp; 57%</td>
<td>- &amp; 23%</td>
<td>- &amp; 14%</td>
<td>- &amp; 60%</td>
<td>- &amp; +34%</td>
<td>- &amp; 0%</td>
<td>- &amp; -45%</td>
<td>- &amp; +38%</td>
<td>- &amp; -24%</td>
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<tr>
<td>Percent change (%)b Reference</td>
<td>48%</td>
<td>23%</td>
<td>58%</td>
<td>60%</td>
<td>34%</td>
<td>0%</td>
<td>-45%</td>
<td>24%</td>
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<td>Model 1, physical workload; model 2, work environment; model 3, physical workload and work environment; model 4, computer-aided work; model 5, working overtime and shift work; model 6, job control; model 7, job demands; model 8, job strain; model full, physical workload, work environment, physical workload and work environment, computer-aided work, working overtime and shift work, job control, job demands and job strain</td>
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</table>

- Model 1: physical workload; model 2: work environment; model 3: physical workload and work environment; model 4: computer-aided work; model 5: working overtime and shift work; model 6: job control; model 7: job demands; model 8: job strain; model full: physical workload, work environment, physical workload and work environment, computer-aided work, working overtime and shift work, job control, job demands and job strain

- Percent change describes the difference in model between the lowest and the highest SEP from the baseline model (estimate for model 1 - estimate for extended model) / (estimate for model 1) - 1 = change in %

- Percent change describes the difference in model between the middle and the highest SEP from the baseline model (estimate for model 1 - estimate for extended model) / (estimate for model 1) - 1 = change in %

### Table 3 Working conditions as explanations for occupational class health inequalities in less than good SRH; binomial regression analysis, age-adjusted PRs and 95% CIs among men

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<th>Model full</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>95% CI</td>
<td>95% CI</td>
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<td>95% CI</td>
<td>95% CI</td>
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<tr>
<td><strong>Men</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Managers</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
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<td>1.00</td>
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</tr>
<tr>
<td>Professionals</td>
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<td>0.85</td>
<td>0.65</td>
<td>1.11</td>
<td>0.83</td>
<td>0.63</td>
<td>1.09</td>
<td>0.82</td>
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<tr>
<td>Semi-professionals</td>
<td>1.33</td>
<td>1.04</td>
<td>1.71</td>
<td>1.24</td>
<td>0.97</td>
<td>1.59</td>
<td>1.21</td>
<td>0.95</td>
<td>1.57</td>
<td>1.17</td>
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<tr>
<td>Routine non-manual workers</td>
<td>1.40</td>
<td>1.04</td>
<td>1.88</td>
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<td>1.53</td>
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<tr>
<td>Skilled manual workers</td>
<td>1.52</td>
<td>1.24</td>
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<td>1.07</td>
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<tr>
<td>Semi-skilled workers</td>
<td>1.78</td>
<td>1.40</td>
<td>2.25</td>
<td>1.51</td>
<td>1.19</td>
<td>1.92</td>
<td>1.31</td>
<td>1.01</td>
<td>1.70</td>
<td>1.26</td>
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<tr>
<td>Percent change (%)a Reference</td>
<td>- &amp; -29%</td>
<td>- &amp; -53%</td>
<td>- &amp; -60%</td>
<td>- &amp; +39%</td>
<td>- &amp; -2%</td>
<td>- &amp; -24%</td>
<td>- &amp; +14%</td>
<td>- &amp; -8%</td>
<td>- &amp; -32%</td>
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<tr>
<td>Percent change (%)b Reference</td>
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<td>-27%</td>
<td>-64%</td>
<td>+47%</td>
<td>-2%</td>
<td>-20%</td>
<td>+30%</td>
<td>+15%</td>
<td>+10%</td>
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</tr>
</tbody>
</table>

- Model 1: physical workload; model 2: work environment; model 3: physical workload and work environment; model 4: computer-aided work; model 5: working overtime and shift work; model 6: job control; model 7: job demands; model 8: job strain; model full: physical workload, work environment, physical workload and work environment, computer-aided work, working overtime and shift work, job control, job demands and job strain

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- Percent change describes the difference in model between the middle and the highest SEP from the baseline model (estimate for model 1 - estimate for extended model) / (estimate for model 1) - 1 = change in %
manual workers, 40% reported less than good SRH. The other occupational classes fell gradually in between the extreme categories.

In binomial regression analysis, the base model for both women and men confirmed a similar steep gradient in SRH as already seen in the prevalence table 1. Thus, unskilled manual women (PR 1.89, 95% CI 1.54–2.23) and men (PR 1.78, 95% CI 1.40–2.25) were at highest risk for less than good SRH (tables 2 and 3).

First, adjusting for physical workload in model 1 reduced the inequalities by 48% for women and by 29% for men. Next, adjusting for work environment factors in model 2 reduced the inequalities by 23% for women and 53% for men. After simultaneously adjusting for both physical workload and work environment exposures, more than half of women’s and of men’s inequalities in SRH were explained. In model 4, computer/terminal-aided work widened the inequalities by 34% for women and 39% for men. After adjusting for work arrangements in model 5, only slight reductions in health inequalities were observed. In model 6, job control reduced the inequalities by 40% for women and by 24% for men. In contrast, adjusting for job demands in model 7 widened the inequalities by 13% for women and 14% for men. But when simultaneously adjusting for job control and job demands, the explanation provided was 24% for women and 8% for men. Finally, after simultaneously adjusting for all explanatory variables in the final model, the inequalities in SRH attenuated by 60% for women and 32% for men. Also the percentage changes between the managers (highest class) and the routine non-manual employees (intermediate class) can be seen in tables 1 and 2. Overall, the percent changes were very similar to the changes between the highest and the lowest class. However, in the fully adjusted model, including all explanatory variables the inequalities were widened, especially for non-manual employees (intermediate class) men.

Discussion
This study aimed to examine working conditions as explanations for occupational class inequalities in health. Heavy physical workload explained almost a half of women’s and one-third of men’s inequalities in SRH. Moreover, work environment exposures explained a substantial part of the health inequalities. These physical working conditions together explained more than half of women’s and almost two-thirds of men’s health inequalities. Job control only explained a smaller part of the health inequalities. Otherwise, psychosocial factors had only minor and partly contrasting effects on health inequalities.

Physical workload and exposures produced results similar to those of many other previous studies, but not all earlier studies, and explained more of health inequalities than inequalities in mortality. Psychosocial factors had mostly minor and partly contrasting effects on health inequalities. In accordance with some but not all earlier studies, job control explained some of health inequalities, whereas adjusting for job demands widened the inequalities.

In our study, work arrangements had only minor effects, which is in accordance with some but not all previous studies. Other studies have not included computer/display-aided work when explaining inequalities with working conditions. We found that adjusting for computer/terminal-aided work widened the inequalities substantially for both sexes.

Only a few previous studies have simultaneously examined different types of physical and psychosocial working conditions in an effort to find maximally large explanations for health inequalities. However, simultaneous examination of two different groups of explanatory factors pose difficulties for interpretation due to their counteracting effects. Therefore, different working conditions should be considered separately when trying to explain health inequalities. Further studies concerning interactions among physical and psychosocial working conditions in addition to work arrangements are warranted. There is also a need for additional and more accurate and objective measures for working conditions such as weights of lifts, noise levels, adequacy of lighting and exposure times.

Further, work-related factors potentially explaining health inequalities include organizational fairness, as well as job insecurity. Our control analyses using data from 2001 to 2002 examined the contribution of further psychosocial working conditions to health inequalities (data not shown) only. Adjusting for organizational justice reduced the inequalities for women by 9% and men by 28%. Bullying at the workplace, work–family interface, job insecurity, in turn, narrowed the inequalities by 17% for women and 31% for men.

Other control analyses were conducted by using SF-36 Physical Component Summary as the health outcome. The results were due to and large identical with those for SRH. Identical results were also obtained when occupational social class was replaced by educational attainment (data not shown). In this study, the correlation between the education and occupational class is found to be 0.73.

Methodological considerations
Due to the cross-sectional design, causal interpretations should be avoided. Our study is based on self-reports, and people with poor SRH may also tend to report worse physical or psychosocial conditions leading to reporting bias. Some selection and ‘healthy worker’ effects may have occurred, and persons with physical or psychosocial work exposures may have shifted to jobs where they can manage even with compromised health and work ability. Further prospective studies with more objective health measures, such as medically confirmed diseases, should be done.

The strength of our study was that it is based on a relatively recent and large dataset representative of middle-aged municipal employees. The participants worked for only one employer, and 90% of them were full-time employees. The data also included a large segment of female employees. The study questionnaire provided a large variety of self-reported conditions and a soundly based categorization of employees to occupational classes.

Conclusion
Physical working conditions substantially explained the health inequalities. Instead, the effects of job demands and job control were contrasting. Therefore, to reduce health inequalities, lessening the burden of physical working conditions should be promoted. More studies are needed to deepen our understanding of how to reduce health inequalities by improving physical working conditions and increasing job control of the employees.

Acknowledgements
The Helsinki Health Study is supported by grants from the Academy of Finland (Grant numbers 205588, 1121748), the Finnish Work Environment Fund (Grant number 107187), and participating organizations, THL and University of Helsinki. Preliminary results have been presented as oral presentations at the SSM/IEA joint meeting in Cork, Ireland.
Key points

- Working conditions provide potential explanations for inequalities in health.
- More evidence on a broad variety of work-related factors as explanations for socio-economic health inequalities is needed.
- Large inequalities were found in municipal employees of the City of Helsinki.
- Physical work conditions explained a large part of health inequalities.
- Improving physical working conditions and increasing job control should be promoted at workplaces and in health policies.
- Working conditions have potential routes to smaller health inequalities.

References


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