Associations of Length of Employment and Working Conditions with Neck, Shoulder and Arm Pain among Nursery School Teachers

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Abstract: A cross-sectional questionnaire study was carried out on nursery school (NS) teachers in public nursery schools in N city in Japan to determine the magnitude of associations of probable risk factors with neck, shoulder, and arm pain, adjusting for potential confounders in logistic regression models. Of 1438 subjects, responded to the questionnaire, 959 NS teachers in charge of a separate or mixed group of children were subjected to analyses. Prevalence of neck and/or shoulder pain was 33.6%–35.4% in NS teachers in charge of children aged 0, 0–1, 4, and 5 in contrast to 25.0–29.8% in those in charge of children aged 1, 2, and 3. The prevalence of neck/shoulder pain tended to increase with the length of employment in all groups classified according to the age of children under care. In a logistic regression model that simultaneously adjusted demographic and personal variables, length of employment and care for children aged 0 in the workplace were found significantly associated with musculoskeletal pain. In further logistic models, pain in the neck/shoulders and arms had associations with some specific variables: care for children aged 0, holding/lifting a child/material, overwork, and poorly supported job situations. The odds ratios for those variables varied from 1.37 to 2.41. This results suggest that pain in the neck/shoulders and arms is induced by a wide variety of risk factors in NS teachers that include high physical workload, long working hours, job demand-support imbalance, and cumulative influence of workloads.

Key words: Nursery school, Musculoskeletal disorders, Pain, Neck, Shoulder, Arm, Working condition, Risk factor, Length of employment

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Introduction

Great need of care services based on the rapid growth of the aged population and female workforce has increased the number of care-giving workers such as nurses at hospitals and home care service workers in many developed countries. This development in social welfare, however, has been accompanied by several reports of prevalent musculoskeletal problems among care-giving workers. In Japan, one of care-giving works, care for children in nursery schools had been viewed as having associations with elevated prevalence of neck, shoulder, arm and low back disorders. In 1990s, some studies done in western countries also indicated the risk of musculoskeletal disorders among nursery school (NS) teachers.

NS teachers perform many kinds of tasks including care for children, indoor play or group nurture, outdoor play or nurture, and tidying rooms. Repetitive mechanical load in holding or lifting children or materials has been suspected to be one of main risk factors of musculoskeletal problems in NS teachers, especially in those taking care of children aged 1 or less. However, conflicting findings have been reported on the association of care for children aged 0 or 1 with prevalence of musculoskeletal complaints. One of chief reasons of the disagreement between studies could be a confounding bias because multiple potential risk factors are not sufficiently adjusted in the analyses in most of studies.

Besides, high prevalence of musculoskeletal complaints was also reported among NS teachers having charge of children aged 4 or 5, which suggested other risk factors such as the number of children per worker, or stressful working conditions. Moreover, some researchers suggested diverse risk factors of musculoskeletal problems in working conditions and environment for NS teachers, that included overwork, lack of rest, and mental stress. It was reported that the prevalence of musculoskeletal complaints gradually increased with the length of employment in NS teachers. This implied that the length of employment is also one of risk factors of musculoskeletal problems. Recently, a wide range of potential confounders such as age, gender, body length, body mass index (BMI), and smoking, was suggested for consideration in epidemiological studies of work and musculoskeletal disorders. Thus, those potential risk factors and confounders should be included in the epidemiological analyses of musculoskeletal problems of NS teachers.

The aim of this study was to determine the magnitude of associations of probable risk factors with neck, shoulder, and arm pain in NS teachers, adjusting for potential confounders in logistic regression models.

Materials and Methods

A cross-sectional questionnaire study was carried out on NS teachers in public nursery schools in N city in Japan. The public welfare department of the city and its labor union agreed to participate in the study. A questionnaire was distributed to 1445 care-giving workers in October, 1995. Of the subjects, 1438 (99.5%) responded to the questionnaire. To ensure homogeneity of gender and working conditions of the subjects for analyses, 6 male workers, 27 nurses, 122 supervisors of the nursery schools, and 6 other workers for miscellaneous tasks were excluded. Among the remaining 1277 female NS teachers, 15 were eliminated because of the incompleteness of their response. Then, NS teachers in charge of a separate group of children aged 0 (less than 1 year), 1, 2, 3, 4, 5 or those in charge of a mixed group of children aged 0 or 1 (0–1) were subjected to analyses in order to study the effects of age of children under care on musculoskeletal pain (n=959). The means and standard deviations (SD) of the subjects' age and length of employment were 34.8 years (SD 8.0) and 13.2 years (SD 8.2), respectively.

The questionnaire contained demographic items, personal and working conditions, and outcomes. Demographic items included age, length of employment, and body length and weight (Table 1). Personal conditions included current smoking, exercise or sports, and care for a child aged less than three years or an adult person at own home (Table 1). Working conditions consisted of the age of the children under care (class group) in this year and the previous year, care for a handicapped child in the class group, commuting time, overwork, rest, frequency of holding and lifting children or materials, and some stress items (Table 1). Frequency of holding and lifting children or material consisted of three items with different cut-off levels according to the weight of the child and/or material and frequency of activities: 5–10 kg of weight and 10 times a day or more; 11–20 kg of weight and 6 times a day or more; and weight exceeding 20 kg and at least once a day. Stress items were comprised of need for too large effort at work, low latitude in deciding work contents or plans, and poor job support.

Outcome variables included pain in the neck and/or shoulders, and arms in the previous month. The severity of the pain was ranked into five grades: (1) no pain; (2) occasional mild pain; (3) pain severer than mild pain but not so intense as to make workers take an occasional break/rest during work; (4) pain severe enough to make workers take an occasional break/rest during work; and (5) pain severe enough to make workers take occasional sick leave. When
workers had the pain of grade 3 or more, they were defined as having the pain, in contrast to those with only occasional mild pain or no pain of grade 1 or 2.

Prevalence of musculoskeletal pain was compared among seven levels of the age of children under care. Then, original seven levels were classified into three groups: (1) a group made by combining a group for children aged 0 and a mixed group for those aged 0 or 1 (0–1) (Group 0); (2) that created by assembling three groups for children aged 1, 2, and 3 (Group 1–3); and (3) that made by assembling two groups for children aged 4 and 5 (Group 4–5). This classification was based on the following reasons. First, the workers in charge of the groups for 0 or 0-1 year old children were suspected to hold or lift children more frequently than those in charge of other groups of children16–18) . Second, many children in a group for 1 year old children become almost 2 years old or more in autumn season when this study was carried out, while most of children in a mixed group for 0–1 year old children are younger than those in the group for 1 year old children. Third, workers for children aged 4 or 5 were suspected of working in more hectic work environment than those for other children, because the number limit of children is far larger (30 children per worker) in the groups for children aged 4 or 5 than in those for children aged 3 or less (at most, 20 children per worker) under the law. Two dummy variables based on Group 0 and Group 4–5 were created in contrast to reference Group 1–3 for logistic regression models. They were created to study the effect of care for children aged 0 and aged 4 or 5 in comparison with that for those aged 1–3.

Relations between the length of employment and the prevalence of musculoskeletal pain were comparatively studied among these three Groups. In this analysis, some adjacent levels of the length of employment were pooled into one category so as to make the number of subjects more than 30 in one level. One-way analyses of variance (ANOVA) or \( \chi^2 \) tests were applied to examine differences in demographic and personal conditions among the levels of the age of children under care. Pearson or Spearman correlation coefficient was also calculated between variables.

Odds ratios (OR) and 95% confidence intervals (95%CI) of OR were calculated by logistic regression models in order to study associations of outcomes with demographic items, personal and working conditions. For the first step, associations of length of employment and care for children aged 0, and care for children aged 4–5 with neck/shoulder or arm pain were simultaneously studied by adjusting demographic and personal variables. As there was a very high correlation between age and length of employment (Pearson’s r=0.864, p<0.001), age was omitted from logistic regression analyses. Similarly, body weight was eliminated from analyses because of its correlation with BMI (Pearson’s r=0.445, p<0.001). Then, two types of models were applied: (1) An association of each independent variable with neck/shoulder or arm pain was studied by adjusting length of employment because it was regarded as one of main influential variables (Model 1). (2) An association of each independent variable with neck/shoulder or arm pain was studied by adjusting length of employment, care for children aged 0, and care for children aged 4–5 with neck/shoulder or arm pain was simultaneously studied by adjusting demographic and personal variables. As there was a very high correlation between age and length of employment (Pearson’s r=0.864, p<0.001), age was omitted from logistic regression analyses. Similarly, body weight was eliminated from analyses because of its correlation with BMI (Pearson’s r=0.445, p<0.001). Then, two types of models were applied: (1) An association of each independent variable with neck/shoulder or arm pain was studied by adjusting length of employment because it was regarded as one of main influential variables (Model 1). (2) An association of each independent variable with neck/shoulder or arm pain was studied by adjusting length of employment, care for children aged 0, and care for children aged 4–5 (Model 2).

Statistical calculations were done using the Statistical Analysis System (SAS) (SAS Institute Japan Inc.) on the mainframe (Fujitsu: GP7000Fm900) in the Computation Center of Nagoya University.

Results

Prevalence of neck and/or shoulder pain was 33.6%–35.4% in NS teachers in charge of children aged 0, 0–1, 4, and 5 in contrast to 25.0–29.8% in those in charge of children aged 1, 2, and 3 (Fig. 1). However, the prevalence was not significantly different among Group 0, 1–3, and 4–5 (\( \chi^2 \) test, p=0.107). As for arm pain, prevalence was 17.5%–17.7% in those in charge of children aged 0 and 0–1, while it was
9.1–12.1% in those in charge of children aged from 1 through 5 (Fig. 1). Difference in the prevalence of arm pain was statistically significant among Group 0, 1–3, and 4–5 ($\chi^2$ test, p=0.013).

Of demographic variables, only the length of employment was significantly different among levels of age of children under care (p=0.008) (Table 2). However, this difference disappeared when levels of age 0 and 0–1 of children under care were pooled into one group. Of personal conditions, significant differences among levels of age of children under care were found in two following variables: having a child aged two or less at home, and having an adult to be cared at home (Table 2). Many working conditions also significantly varied among levels of age of children under care (Table 3). In those in charge of children aged 0 and 0–1, the proportion of workers holding/lifting a child or material weighing 5–10 kg 10 times/day or more was very high (78.7 and 85.6%) as compared with that in others (Table 3). The Spearman correlation coefficient between care for children aged 0 and holding/lifting a child/material weighing 5–10 kg (10 times/day or more) was r=0.568 (p<0.001). On the other hand, the proportion of workers tended to be higher in those in charge of children aged 3, 4, or 5 than in others as for taking rest less than 30 min/day, having handicapped children, holding/lifting a child or material exceeding 20 kg everyday, and need of too large effort at work.

The prevalence of neck/shoulder pain tended to increase with the length of employment in all the Groups (Fig. 2). This tendency was also observed for the prevalence of arm pain in Group 0 and 1–3 (Fig. 3). In Group 4–5, the prevalence of arm pain tended to increase after 0–3 years until 4–11 years of employment but reached a plateau after 4–11 years.

In a logistic regression model that simultaneously adjusted demographic and personal variables, length of employment and care for children aged 0 in the workplace were found significantly associated with musculoskeletal pain (Table 4). ORs for care for children aged 0 were 1.41 (95%CI: 1.01–1.96) for neck/shoulder pain and 1.84 (95%CI: 1.18–2.86) for arm pain. Those for length of employment calculated for increments of 10 years were 1.37 (95%CI: 1.15–1.64) for neck/shoulder pain and 1.65 (95%CI: 1.30–

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**Table 2. Demographic and personal conditions of nursery school teachers**

| Age of children | (n) | 0 | 0–1 | 1 | 2 | 3 | 4 | 5 | p | p2* |
|-----------------|-----|----|-----|----|----|----|----|----|----|----|-----|
| Age mean (SD) (year) | 36.3 (7.8) | 33.7 (7.8) | 35.8 (7.0) | 34.3 (7.8) | 34.5 (8.4) | 35.7 (7.9) | 0.087 | 0.531 |
| Length of employment mean (SD) (year) | 14.7 (8.5) | 11.5 (7.1) | 14.2 (7.6) | 12.7 (7.7) | 13.0 (8.8) | 12.9 (8.5) | 14.9 (9.7) | 0.008 | 0.142 |
| Body length mean (SD) (cm) | 156.0 (4.6) | 156.3 (5.1) | 156.3 (4.9) | 156.6 (5.0) | 156.3 (5.3) | 156.4 (4.9) | 156.2 (5.0) | 0.967 | 0.950 |
| Body weight mean (SD) (kg) | 50.2 (5.6) | 51.0 (6.1) | 51.6 (6.9) | 51.5 (6.6) | 50.9 (6.8) | 51.3 (5.7) | 51.2 (7.1) | 0.744 | 0.763 |
| Body mass index (BMI) mean (SD) (kg/m²) | 20.6 (2.2) | 20.9 (2.3) | 21.1 (2.6) | 20.9 (2.3) | 20.8 (2.5) | 21.0 (2.2) | 20.9 (2.6) | 0.876 | 0.868 |
| Current smoking (%) | 2.1 | 1.8 | 2.8 | 1.6 | 3.3 | 0.9 | 0.815 | 0.711 |
| Exercise or sports (%) | 34.0 | 40.9 | 34.1 | 41.1 | 41.5 | 43.4 | 40.2 | 0.728 | 0.786 |
| Having a child aged two or less at home (%) | 22.7 | 23.8 | 28.4 | 23.4 | 4.9 | 7.4 | 1.7 | <0.001 | <0.001 |
| Having an adult to be cared at home (%) | 10.3 | 7.3 | 12.5 | 7.3 | 16.3 | 6.6 | 12.8 | 0.058 | 0.041 |

One-way ANOVA or $\chi^2$ tests were applied to examine the difference among levels of ages of children under care. *p2: p-values when levels 0 and 0–1 year of children under care were pooled into one group.
Table 3. Working conditions of nursery school teachers

<table>
<thead>
<tr>
<th>Age of children</th>
<th>0</th>
<th>0-1</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>p</th>
<th>p2*</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n)</td>
<td>(97)</td>
<td>(164)</td>
<td>(88)</td>
<td>(248)</td>
<td>(123)</td>
<td>(122)</td>
<td>(117)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In charge of 0 year children in the previous year
11.3  21.3  45.5  18.6  17.9  22.1  4.3  <0.001  <0.001
In charge of 4-5 year children in the previous year
16.5  17.7  8.0  14.5  9.8  7.4  68.4  <0.001  <0.001
Commuting time 1 hour or more
19.6  28.7  8.2  25.0  28.5  29.5  19.7  0.186  0.297
Overwork 4 hours/week or more
3.1  2.4  5.7  4.8  7.3  8.2  6.0  0.322  0.226
Taking rest less than 30 min/day
8.3  13.4  9.1  21.0  45.5  40.2  43.6  <0.001  <0.001
Having handicapped children in the class group
0.0  2.4  0.0  3.2  33.3  41.0  46.2  <0.001  <0.001
Holding/lifting a child/material weighing 5–10 kg 10 times/day or more
85.6  78.7  51.1  18.2  15.5  16.4  7.7  <0.001  <0.001
Holding/lifting a child/material weighing 11–20 kg 6 times/day or more
36.1  56.1  60.2  46.4  30.9  32.0  19.7  <0.001  <0.001
Holding/lifting a child/material exceeding 20 kg everyday
8.3  22.0  20.5  21.4  37.4  37.7  37.6  <0.001  <0.001
Need too large effort at work
54.6  70.7  65.9  67.3  81.3  77.9  87.2  <0.001  <0.001
Low latitude in deciding work contents or plans
11.3  7.3  12.5  6.5  4.1  3.2  1.7  0.009  0.008
Poorly supported by a supervisor or colleagues
27.8  26.8  25.0  25.0  23.6  20.5  18.0  0.560  0.436

χ² tests were applied to examine the difference among levels of ages of children under care. *p2: p-values when levels 0 and 0–1 year of children under care were pooled into one group.

Fig. 2. Prevalence of neck/shoulder pain following length of employment in three groups.
Three groups were comprised of Group 0, Group 1–3, and Group 4–5. Group 0 consisted of NS teachers in charge of a group of children aged 0 and a mixed group of children aged 0 or 1. Group 1–3 consisted of those in charge of children aged 1, 2, or 3. Group 4–5 is comprised of those in charge of children aged 4 or 5.

2.08) for arm pain. Body length, BMI and personal variables had no significant association with musculoskeletal pain. In Model 1 for neck/shoulder pain, two following variables had associations with pain: holding/lifting a child/material exceeding 20 kg everyday (OR: 1.47, 95%CI: 1.08–2.00), and poorly supported by a supervisor or colleagues (OR: 1.58, 95%CI: 1.15–2.15) (Table 5). In Model 2, care for children aged 0 in the workplace were also associated with neck/shoulder pain (OR: 1.40, 95%CI: 1.01–1.95) together with two aforementioned variables in Model 1 (Table 5). In Model 1 for arm pain, three variables were found associated with pain: care for children aged 0 in the workplace (OR: 1.92, 95%CI: 1.28–2.88); holding/lifting a child/material weighing 5–10 kg 10 times/day or more (OR: 2.00, 95%CI: 1.35–2.97); and poorly supported by a supervisor or colleagues (OR: 2.41, 95%CI: 1.60–3.60) (Table 6). Similar
Fig. 3. Prevalence of arm pain following length of employment in three groups. Three groups were comprised of Group 0, Group 1–3, and Group 4–5. Detailed explanation of the Groups is described in the footnote for Fig. 2.

Table 4. Association of musculoskeletal pain with length of employment, age of children under care, and personal conditions, examined by a logistic regression model

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Neck/shoulder pain 95%CI</th>
<th>Arm pain 95%CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR* Lower Upper</td>
<td>OR* Lower Upper</td>
</tr>
<tr>
<td>Length of employment**</td>
<td>1.37 1.15 to 1.64</td>
<td>1.65 1.30 to 2.08</td>
</tr>
<tr>
<td>Care for children aged 0 in the workplace (Group 0)***</td>
<td>1.41 1.01 to 1.96</td>
<td>1.84 1.18 to 2.86</td>
</tr>
<tr>
<td>Care for children aged 4 or 5 in the workplace (Group 4-5)***</td>
<td>1.05 0.96 to 1.14</td>
<td>0.96 0.83 to 1.09</td>
</tr>
<tr>
<td>Body length</td>
<td>0.99 0.96 to 1.02</td>
<td>0.99 0.95 to 1.03</td>
</tr>
<tr>
<td>Body mass index (BMI)</td>
<td>1.00 0.94 to 1.06</td>
<td>1.05 0.97 to 1.13</td>
</tr>
<tr>
<td>Current smoking</td>
<td>0.83 0.29 to 2.13</td>
<td>1.07 0.24 to 3.37</td>
</tr>
<tr>
<td>Exercise or sports</td>
<td>0.83 0.62 to 1.11</td>
<td>1.08 0.72 to 1.61</td>
</tr>
<tr>
<td>Having a child aged two or less at home</td>
<td>0.76 0.51 to 1.14</td>
<td>0.80 0.43 to 1.41</td>
</tr>
<tr>
<td>Having an adult to be cared at home</td>
<td>1.23 0.78 to 1.93</td>
<td>0.87 0.42 to 1.65</td>
</tr>
</tbody>
</table>

*A odds ratios (OR) and 95% confidence intervals (95% CI) were calculated by a logistic regression model that simultaneously contained all the independent variables in this table. **OR and 95% CI for length of employment were calculated for increments of 10 years. ***A dummy variable based on Group 0, Group 1–3, and Group 4–5 was created.

results were seen in Model 2 for arm pain but two additional variables were also significant: overwork 4 hours/week or more (OR: 2.24, 95% CI: 1.05–4.44); and holding/lifting a child/material exceeding 20 kg everyday (OR: 1.61, 95% CI: 1.04–2.47) (Table 6).

Discussion

In logistic models in this study, pain in the neck/shoulders and arms had associations with some specific variables: the length of employment, care for children aged 0, holding/lifting a child/material, overwork, and poorly supported job situations. The ORs for those variables varied from 1.37 to 2.41. This results suggest that pain in the neck/shoulders and arms is induced by a wide variety of risk factors in NS teachers that include high physical workload, long working hours, job demand-support imbalance, and cumulative influence of workloads.

The association of the length of employment with musculoskeletal pain could be interpreted as the effect of aging or a cumulative effect of workloads on musculoskeletal system of the workers. Age and length of employment were highly correlated in this study and it is difficult to clearly separate their effects. However, aging may not be a plausible
interpretation than aging.

Our finding of the association of the length of employment with musculoskeletal pain agrees with that by some studies\(^{11,12}\). Kurumatani \textit{et al.}\(^{12}\) reported that the prevalence of musculoskeletal pain increased with the length of employment in NS teachers, although subjects’ mean age

explanation because the mean age of the subjects was still 34.8 years with SD 8.0 that would be too young to develop highly prevalent symptomatic degenerative changes of musculoskeletal system or a reduction of muscular strength sufficient to induce frequent musculoskeletal injuries. Thus, the cumulative effect of workloads may be a more plausible

### Table 5. Association of neck/shoulder pain with working conditions examined by logistic regression models

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Model1*</th>
<th></th>
<th>Model2**</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>95%CI Lower</td>
<td>Upper</td>
<td>OR</td>
</tr>
<tr>
<td>Care for children aged 0 in the workplace (Group 0)****</td>
<td>1.29</td>
<td>0.95 to 1.75</td>
<td>1.40***</td>
<td>1.01 to 1.95</td>
</tr>
<tr>
<td>Care for children aged 4 or 5 in the workplace (Group 4–5)****</td>
<td>1.03</td>
<td>0.95 to 1.11</td>
<td>1.06***</td>
<td>0.97 to 1.15</td>
</tr>
<tr>
<td>Care for children aged 0 year in the workplace in the previous year</td>
<td>0.95</td>
<td>0.67 to 1.35</td>
<td>0.98</td>
<td>0.69 to 1.39</td>
</tr>
<tr>
<td>Care for children aged 4 or 5 years in the workplace in the previous year</td>
<td>1.08</td>
<td>0.77 to 1.52</td>
<td>1.04</td>
<td>0.72 to 1.47</td>
</tr>
<tr>
<td>Commuting time 1 hour or more</td>
<td>1.03</td>
<td>0.73 to 1.45</td>
<td>1.03</td>
<td>0.73 to 1.45</td>
</tr>
<tr>
<td>Overwork 4 hours/week or more</td>
<td>1.69</td>
<td>0.94 to 3.00</td>
<td>1.74</td>
<td>0.96 to 3.11</td>
</tr>
<tr>
<td>Taking rest less than 30 min/day</td>
<td>1.29</td>
<td>0.94 to 1.76</td>
<td>1.34</td>
<td>0.97 to 1.86</td>
</tr>
<tr>
<td>Having handicapped children in the class group</td>
<td>0.94</td>
<td>0.65 to 1.36</td>
<td>0.91</td>
<td>0.60 to 1.37</td>
</tr>
<tr>
<td>Holding/lifting a child/material weighing 5–10 kg 10 times/day or more</td>
<td>1.27</td>
<td>0.96 to 1.69</td>
<td>1.20</td>
<td>0.85 to 1.70</td>
</tr>
<tr>
<td>Holding/lifting a child/material weighing 11–20 kg 6 times/day or more</td>
<td>1.28</td>
<td>0.96 to 1.69</td>
<td>1.30</td>
<td>0.97 to 1.72</td>
</tr>
<tr>
<td>Holding/lifting a child/material exceeding 20 kg everyday</td>
<td>1.47</td>
<td>1.08 to 2.00</td>
<td>1.51</td>
<td>1.10 to 2.06</td>
</tr>
<tr>
<td>Need too large effort at work</td>
<td>1.06</td>
<td>0.78 to 1.45</td>
<td>1.07</td>
<td>0.79 to 1.46</td>
</tr>
<tr>
<td>Low latitude in deciding work contents or plans</td>
<td>1.00</td>
<td>0.56 to 1.74</td>
<td>1.00</td>
<td>0.56 to 1.74</td>
</tr>
<tr>
<td>Poorly supported by a supervisor or colleagues</td>
<td>1.58</td>
<td>1.15 to 2.15</td>
<td>1.58</td>
<td>1.15 to 2.16</td>
</tr>
</tbody>
</table>

*Adjusted for length of employment. **Adjusted for length of employment, care for children aged 0, and care for children aged 4–5 in the workplace. ***OR calculated in the model2 with only three independent variables of length of employment, care for children aged 0 and care for children aged 4–5 years in the workplace. ****A dummy variable based on Group 0, Group 1–3, and Group 4–5 was created.

### Table 6. Association of arm pain with working conditions examined by logistic regression models

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Model1*</th>
<th></th>
<th>Model2**</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>95%CI Lower</td>
<td>Upper</td>
<td>OR</td>
</tr>
<tr>
<td>Care for children aged 0 in the workplace (Group 0)****</td>
<td>1.92</td>
<td>1.28 to 2.88</td>
<td>1.82***</td>
<td>1.17 to 2.83</td>
</tr>
<tr>
<td>Care for children aged 4 or 5 in the workplace (Group 4–5)****</td>
<td>0.90</td>
<td>0.80 to 1.02</td>
<td>0.96***</td>
<td>0.84 to 1.09</td>
</tr>
<tr>
<td>Care for children aged 0 year in the workplace in the previous year</td>
<td>0.95</td>
<td>0.56 to 1.53</td>
<td>0.94</td>
<td>0.55 to 1.52</td>
</tr>
<tr>
<td>Care for children aged 4 or 5 years in the workplace in the previous year</td>
<td>1.04</td>
<td>0.63 to 1.66</td>
<td>1.13</td>
<td>0.67 to 1.84</td>
</tr>
<tr>
<td>Commuting time 1 hour or more</td>
<td>1.03</td>
<td>0.61 to 1.68</td>
<td>1.04</td>
<td>0.62 to 1.69</td>
</tr>
<tr>
<td>Overwork 4 hours/week or more</td>
<td>1.97</td>
<td>0.93 to 3.87</td>
<td>2.24</td>
<td>1.05 to 4.44</td>
</tr>
<tr>
<td>Taking rest less than 30 min/day</td>
<td>0.91</td>
<td>0.56 to 1.43</td>
<td>1.08</td>
<td>0.66 to 1.72</td>
</tr>
<tr>
<td>Having handicapped children in the class group</td>
<td>0.84</td>
<td>0.47 to 1.40</td>
<td>1.15</td>
<td>0.61 to 2.08</td>
</tr>
<tr>
<td>Holding/lifting a child/material weighing 5–10 kg 10 times/day or more</td>
<td>2.00</td>
<td>1.35 to 2.97</td>
<td>1.64</td>
<td>1.00 to 2.66</td>
</tr>
<tr>
<td>Holding/lifting a child/material weighing 11–20 kg 6 times/day or more</td>
<td>1.28</td>
<td>0.86 to 1.90</td>
<td>1.18</td>
<td>0.79 to 1.77</td>
</tr>
<tr>
<td>Holding/lifting a child/material exceeding 20 kg everyday</td>
<td>1.43</td>
<td>0.93 to 2.16</td>
<td>1.61</td>
<td>1.04 to 2.47</td>
</tr>
<tr>
<td>Need too large effort at work</td>
<td>1.00</td>
<td>0.65 to 1.55</td>
<td>1.09</td>
<td>0.71 to 1.71</td>
</tr>
<tr>
<td>Low latitude in deciding work contents or plans</td>
<td>1.07</td>
<td>0.45 to 2.23</td>
<td>0.97</td>
<td>0.41 to 2.04</td>
</tr>
<tr>
<td>Poorly supported by a supervisor or colleagues</td>
<td>2.41</td>
<td>1.60 to 3.60</td>
<td>2.34</td>
<td>1.55 to 3.51</td>
</tr>
</tbody>
</table>

*Adjusted for length of employment. **Adjusted for length of employment, care for children aged 0, and care for children aged 4–5 in the workplace. ***OR calculated in the model2 with only three independent variables of length of employment, care for children aged 0 and care for children aged 4–5 in the workplace. ****A dummy variable based on Group 0, Group 1–3, and Group 4–5 was created.
exceeding 143 months (about 11.9 years) that was the
We could analyze subjects with length of employment
into three groups according to the age of children under care.
employment was seen even when subjects were classified
this dependency of prevalence of pain upon the length of
(5.5 year, SD 3.2) was shorter than that in ours. In our study,
(27.6 year, SD 4.9) was younger and length of employment
children aged 0 in the previous year was not associated with
musculoskeletal pain. This suggests that the effect of the
care for children aged 0 in the previous year does not last
more than half a year.
As the number limit of children is very larger in the groups
for children aged 4 or 5 than in those for children aged 3
less, it was expected that complaints and musculoskeletal
symptoms related to working conditions and psychosocial
stress could be prevalent among workers in charge of children
aged 4 or 5. In this study, care for children aged 4 or 5 was
not a factor significantly associated with pain, although
prevalence of neck/shoulder pain in workers in charge of
children aged 4 or 5 tended to be higher than that in workers
in charge of children aged 1, 2, or 3. This seems in accordance
with some studies. Ono et al. reported that prevalence of
musculoskeletal and fatigue symptoms were almost similar
among the groups but that of neck/shoulder pain tended to
be slightly higher in workers for children aged 3–5 than in
others when 223 female NS teachers in private institutions
were divided into three groups based on the age of nursery
school children (0, 1–2, and 3–5 years). Kurumatani et al.
also reported that prevalence of the musculoskeletal
symptoms tended to be higher among teachers in charge of
children aged 0 or 4 than those in charge of other children.
However, they reported that prevalence of the arm pain was
significantly higher in workers in charge of children aged 4
than that in those in charge of children aged 3. Their finding
on arm pain was different from our study that found no
elevation of prevalence of arm pain in workers in charge of
children aged 4 or 5 as compared with those in charge of
other children. The reason of this difference is uncertain
and further studies on NS teachers in many areas in Japan
with larger sample size should be necessary.
Overwork was indicated as a factor having an association
with arm pain in our study. In general, exposure to workloads
would be increased and time for recovery from
musculoskeletal stress during work would be cut down if
working hours increase. Thus, overwork may accumulate
the effects of work on musculoskeletal system and accelerate
the development of disorders. This speculation is partly
supported by Wærsted et al. who compared the sick leave
statistics of sewing machine operators on full-time schedules
with that of part-time operators. In multivariate survival
analyses, they found that daily working hours were significant
factors in the development of musculoskeletal conditions
leading to sick leave.
In this study, the complaint “poorly supported by a
supervisor or colleagues” had associations with
musculoskeletal pain (ORs: 1.58–2.41). This is in accordance
with the concept of a stress model and studies on the relations
between psychosocial stress and musculoskeletal problems\textsuperscript{22–26}. Low job social support is one of main axes in the stress model in that high psychological demands and low decision latitude are other main axes\textsuperscript{22}. There have been reports suggesting that psychosocial stress is a risk factor of musculoskeletal disorders\textsuperscript{23–26}. However, other main stress factors in the stress model, i.e., need too large efforts at work and low latitude in deciding work content or plans, had no associations with pain in any logistic regression analyses in our study. One of the reasons why those factors were not associated with pain might be due to the frequency of complaints. Most of workers replied “yes” to the question about need of too large efforts at work and “no” to that about low latitude in deciding work content or plans. In this high demand and high latitude situations that were common to most of the subjects in our study, only a poor job support factor might have a differentiating influence on musculoskeletal symptoms of workers.

We did not find clear associations between personal conditions and neck/shoulder pain or arm pain. This agrees with a study by Kurumatani \textit{et al.}\textsuperscript{12} who found no statistical difference in prevalence between NS teachers having their own children aged under 2 and those having no such children, after age and length of employment were matched between subjects. Thus, it is suggested that neck/shoulder and arm pain are not largely influenced by personal conditions, even though NS teachers have care-giving activities in their homes.

In this study, relative importance of several factors is suggested in the prevention of musculoskeletal problems among NS teachers. The way of care for children aged 0 and holding/lifting a child or material should be improved by ergonomic measures or education of workers. Overwork should be minimized and supportive environment should be developed in the workplace.

There are some limitations in this study. As this study was based on a questionnaire, responder’s bias cannot be negligible. Pain in the previous month based on a severity scale (the pain of grade 3 or more) was used as an outcome. Thus, the comparison of our study with other studies with different outcomes from ours would often be irrelevant. Some probable ergonomic risk factors were not included in this study, that were carrying a child on the shoulders, blows and pounces on the shoulders by children, asymmetric lifting of a child or material, and maintaining one arm posture\textsuperscript{29}. These events during work should be taken into consideration in the future studies.

\textbf{References}


