Biopsychosocial Factors and Musculoskeletal Symptoms of the Lower Extremities of Saleswomen in Department Stores in Thailand

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Abstract: Biopsychosocial Factors and Musculoskeletal Symptoms of the Lower Extremities of Saleswomen in Department Stores in Thailand: Praneet PENSRI, et al. Department of Physical Therapy, Faculty of Allied Health Sciences, Chulalongkorn University, Thailand—Objectives: To identify individual, work-related physical and psychosocial factors associated with the self-reported prevalence of musculoskeletal symptoms in the hip, knee and ankle/foot of saleswomen in department stores in Thailand. Methods: A cross-sectional survey was conducted in which 1,310 saleswomen in 18 department stores received a self-administered questionnaire. Returns were 1,200 (92%) questionnaires, and after screening for exclusion criteria, 1,189 saleswomen were found to be eligible for the study. Results: Having a child, number of working hours per day, frequency of body twisting during work and self-rated perception of light intensity in the workplace were each significantly associated with the prevalence of experiencing hip symptoms. Significant associations were found between age, number of hours per day required to stand or walk and self-rated perception of temperature in the workplace, and the prevalence of experiencing knee symptoms. The number of working hours per day and working days per week as well as frequency of working in static postures and rest breaks during work were each significantly related to the prevalence of experiencing ankle/foot symptoms. Conclusions: Among saleswomen, various individual and work-related physical factors were identified as risks and preventive factors for musculoskeletal symptoms in the lower extremities. Further research should focus on these modifiable factors in order to develop effective strategies for reducing the occurrence of such symptoms in saleswomen. (J Occup Health 2010; 52: 132–141)

Key words: Ankle, Foot, Hip, Knee, Occupational diseases, Pain

In Thailand, a large number of salespersons are employed by department stores, of which there are many in large cities, especially in Bangkok. The main responsibility of a salesperson is to service clients by providing information and recommendations about goods, finding items requested by clients and proceeding with the purchase. Their job also involves ensuring that there is no shortage of goods on display and that the display of goods is well organized at any given time. They are often designated to oversee a small and particular shopping area in a department store. Because working as a salesperson in a department store requires no specific skill, most salespersons graduate below the Bachelor degree level. Salespersons usually receive low to moderate incomes, depending on the number of working hours and their sales performance. A significantly greater number of saleswomen work in department stores compared to their male counterparts, and similar statistics have been reported for department stores in other countries1, 2). Salespersons’ work conditions usually receive minimal attention with there being no specific measures or policies for preventing work-related injuries in place in Thailand.

A recent survey revealed that musculoskeletal symptoms are common among salespersons in department stores with a 12-mo prevalence of 77%3). Ankle/foot symptoms (35%) were the most frequently affected body region followed by low back (34%), knees (33%), hips (28%), shoulders (28%), head/neck (26%), upper back (21%), wrists/hands (14%) and elbows (3%).

Salespersons in department stores are at risk of developing musculoskeletal symptoms because they are exposed to various physical and psychosocial factors...
which are generally attributable to the development of musculoskeletal symptoms\(^4\)–\(^7\). For example, their jobs involve prolonged standing and they are frequently exposed to manual handling tasks, such as lifting, carrying, pushing and pulling. These activities have been previously identified as risk factors for musculoskeletal symptoms\(^8\)–\(^9\). In addition, the role of psychosocial factors in the development and persistence of musculoskeletal symptoms in workers is well recognized\(^4\), \(^5\), \(^10\)–\(^12\). Salespersons inevitably encounter various psychosocial problems involving aspects of the work content, organization and interpersonal relationships. However, it is most likely that a complex array of individual, physical and psychosocial factors is responsible for the development and persistence of musculoskeletal symptoms in workers.

There is a dearth of evidence regarding risk factors relating to the development and persistence of musculoskeletal symptoms in salespersons. Only one previous study was identified demonstrating that high job demands, lack of job variation, low control over time, high competition, tendency to feel overworked, lack of social support from colleagues, sedentary work, driving long distances and time spent in the car were associated with neck, shoulder and low back symptoms in salespersons\(^13\). To date, despite high prevalence of lower extremity symptoms in salespersons, there is no study regarding risk factors for musculoskeletal symptoms in the lower extremities.

The purpose of this study was to examine the relationships between the self-reported prevalence of musculoskeletal symptoms in the hip, knee and ankle/foot, and particular individual, work-related physical and psychosocial factors of salespersons in department stores in Thailand. It was hypothesised that various biopsychosocial factors would be associated with the prevalence of lower extremity symptoms in salespersons. Recognition of modifiable factors associated with musculoskeletal symptoms in salespersons is necessary for rational decisions concerning the development of effective preventive measures.

**Materials and Methods**

**Study population**

A cross-sectional survey using a self-administered questionnaire was conducted in convenience samples of 1,310 saleswomen who worked in 18 department stores located in Bangkok. The stores ranged from mid-scale to up-scale department stores which sell general light goods. A questionnaire, together with an invitation letter and information about the study, was distributed to each saleswoman by hand. The researcher returned to collect the completed questionnaire after a few hours. A total of 1,200 saleswomen completed the questionnaire, giving a response rate of 92%. Of these, 11 were excluded because they did not meet the inclusion criteria of having at least 1 year’s work experience and working in the standing posture for an average of 5 h per day or more, leaving a study population of 1,189. The study was approved by the Chulalongkorn University Human Ethics Committee.

**Questionnaire**

The self-administered questionnaire (Appendix) consisted of four sections gathering data on individual, work-related physical and psychosocial data as well as musculoskeletal symptoms in the lower extremity. Individual and work-related physical sections in the questionnaire were developed based on a literature review. The 12-item Short Form Health Survey (SF-12)\(^14\) and modified Work APGAR (WAPGAR)\(^15\) were used to collect psychological data. The standardized Nordic questionnaire was used to collect data regarding musculoskeletal symptoms in the lower limb region\(^16\).

Individual factors included age, height, body weight, educational level, marital status, number of children and frequency of weekly exercise sessions.

Work-related physical factors included the average number of working hours per day and working days per week as well as years of working experience. Respondents were asked about the average number of hours per day required to stand or walk with and without rest breaks, as well as the frequency of performing various physical activities during the work day (including sitting, bending, lifting, body twisting, climbing stairs and sustaining static postures) and the frequency of rest breaks during work. The questionnaire also asked respondents to self-rate the work environment (including light intensity, noise level, temperature, size of work space and air circulation).

The SF-12 is a generic health status instrument, and the scores from the SF-12 yield two summarized measures of health status: a physical component summary (PCS) and a mental component summary (MCS). The PCS and MCS scores have a range of 0 to 100, and higher scores indicate better physical and mental functioning\(^17\). The average score of each component for the general population is approximately 50\(^18\).

The modified WAPGAR is an instrument for measuring social support and job satisfaction\(^19\). The WAPGAR scores have a range of 0 to 10. A score of 7 or higher indicates low social support and job satisfaction in the workplace\(^20\).

Before data collection, the questionnaire underwent validity and reliability studies. The individual and work-related physical sections of the questionnaire were examined for the face validity by three experts and 211 saleswomen. The SF-12 and modified WAPGAR were tested for reliability using 30 subjects. The Intraclass Correlation Coefficients (ICC [1,1]) for the SF-12 ranged from 0.76–0.82, while the ICC [1,1] for the modified WAPGAR was 0.81.
Statistical analyses

According to age, subjects were divided into groups based on quartile calculation and arranged into five-year intervals. Subject groupings for BMI and frequency of weekly exercise sessions were based on the World Health Organisation’s recommendations\(^{21, 22}\). Average values of the study population were employed as the cut-off points for subject groupings according to daily working time, weekly working days and daily working time spent standing.

Chi-square analysis was carried out first to determine the significant differences in the prevalence of self-reported musculoskeletal symptoms in each body part (i.e. hip, knee and ankle/foot) with various individual, work-related physical and psychosocial characteristics. Chi-square analysis was performed using \(2 \times 2\) contingency tables.

Separated multivariable logistic regression models were used to assess the associations between the prevalence of musculoskeletal symptoms in each body region and biopsychosocial factors. Any factors with a \(p\) value < 0.05 in the Chi-square analysis were eligible for addition into the modeling procedures. Backward selection procedures were used in the statistical modeling. The odds ratios (OR) associated with particular factors were adjusted for the effect of all other factors that were in the model. Adjusted ORs and 95% CI for the final models are presented in the results section. To demonstrate the correlation between age and years of working experience of saleswomen, the Pearson Product-Moment Correlation Coefficient was calculated. All statistical analyses were performed using SPSS statistical software, version 17.0 (SPSS Inc, Chicago, IL, USA).

Results

Background demographic characteristics for the study population are shown in Table 1. Most saleswomen reported occasionally or almost never sitting (87%), prolonged forward leaning (89%), pushing or pulling heavy objects (87%), twisting the body in a narrow space (86%), climbing stairs (83%) and lifting moderately heavy to heavy objects from the floor (90%) during the work day. Nearly one-half of saleswomen reported occasionally or almost never working in a static posture (47%) during the work day.

Hip region

When multivariate logistic regression was used, having a child, average number of working hours per day, frequency of body twisting during work and self-rated condition of light intensity in the workplace were significantly correlated with the complaint of hip symptoms. Workers who had a child (or children) experienced significantly less hip pain than those without a child (adjusted OR=0.73, 95% CI=0.56–0.97) (Table 2).

The average work hours per day was scaled into two classes (1=>10 h per day, 2=≤10 h per day). Working for >10 h per day showed an elevated risk for hip symptoms in saleswomen (adjusted OR=1.42, 95% CI=1.10–1.83). In the questionnaire, the frequency of body twisting in a narrow space during work was rated by the subject according to three categories (1=almost never, 2=occasionally, 3=often). In data analysis, the first two categories (almost never - occasionally) were combined. Workers who reported frequently twisting their body during work were at greater risk of experiencing hip symptoms compared to those who almost never or occasionally twisted their body (adjusted OR=1.46, 95% CI=1.03–2.07). Sixty-six percent of saleswomen reported either having or not having symptoms in both the low back and hip regions.

<table>
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<th>Characteristics</th>
<th>Mean</th>
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<th>Range</th>
<th>N</th>
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<td>5.6</td>
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<td>Body mass index (kg/m(^2))</td>
<td>20.2</td>
<td>2.6</td>
<td>11.6 –36.9</td>
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<td>12</td>
<td>1.0</td>
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<td>Secondary school</td>
<td>591</td>
<td>49.7</td>
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<td>College</td>
<td>314</td>
<td>26.4</td>
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<td>221</td>
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<tr>
<td>Others</td>
<td>51</td>
<td>4.3</td>
<td></td>
<td></td>
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<tr>
<td>Years of work experience (yr)</td>
<td>5.4</td>
<td>4.4</td>
<td>1 –33</td>
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<tr>
<td>Working days per week (days per week)</td>
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<td>0.5</td>
<td>2 –7</td>
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</tr>
<tr>
<td>Working hours per day (hours per day)</td>
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<td>1.7</td>
<td>5 –14</td>
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<tr>
<td>Number of hours per day required to stand or walk with rest break (hours per day)</td>
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<td>2.0</td>
<td>5 –14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of hours per day required to stand or walk without rest break (hours per day)</td>
<td>5.4</td>
<td>3.3</td>
<td>0.6 –13</td>
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</table>

Table 1. Characteristics of participants in the study (N=1,189)
Regarding work environment, the subjects were asked whether they agreed with the sentence ‘Light intensity in the workplace is good’ (1=agree, 2=disagree). Workers who disagreed with the statement that light intensity in the workplace was good were at less risk of experiencing hip symptoms than those who agreed (adjusted OR=0.75, 95% CI=0.57–0.99). In this study, saleswomen who were dissatisfied with at least one work environment condition (i.e. light intensity, noise level, temperature, air circulation or size of work space) had an average working experience of 5.4 yr, whereas saleswomen who were satisfied with work environment had an average working experience of 9.5 yr.

Knee region

Multivariate logistic regression showed that age, average number of working hours per day and working days per week, frequency of working in static postures, and frequency of rest break during work were significantly correlated with the complaint of knee symptoms. Working for >10 h per day showed an elevated risk for knee symptoms in saleswomen (adjusted OR=1.42, 95% CI=1.10–1.83) (Table 3). Also, saleswomen who worked 7 days per week were more likely to experience knee symptoms than those who worked ≤6 days per week (adjusted OR=1.74, 95% CI=1.19–2.53).

The frequency of working in static postures was rated by the subject in the same way as the frequency of body twisting in a narrow space during work. Workers who reported frequently working in static postures had greater likelihood of experiencing knee symptoms than those reporting infrequently working in such postures (adjusted OR=1.37, 95% CI=1.07–1.75).

The subjects were asked whether they agreed with the sentence ‘Temperature in the workplace is not too cold nor too warm’ (1=agree, 2=disagree). Workers who disagreed with the statement that temperature in the workplace was not too cold nor too warm were at less risk of experiencing knee symptoms than those who agreed (adjusted OR=0.72, 95% CI=0.55–0.93).

Ankle/foot region

Multivariate logistic regression revealed that the average number of working hours per day and working days per week, frequency of working in static postures, and frequency of rest break during work were significantly correlated with the complaint of ankle/foot symptoms. Working for >10 h per day showed an elevated risk for ankle/foot symptoms in saleswomen (adjusted OR=1.39, 95% CI=1.09–1.78) (Table 4). Also, saleswomen who worked 7 days per week were more likely to experience ankle/foot symptoms than those who worked ≤6 days per week (adjusted OR=1.74, 95% CI=1.19–2.53).

The frequency of working in static postures was rated by the subject in the same way as the frequency of body twisting in a narrow space during work. Workers who reported frequently working in static postures had greater likelihood of experiencing ankle/foot pains than those reporting infrequently working in such postures (adjusted OR=1.37, 95% CI=1.07–1.75).

In the study, the subjects were asked about rest breaks during work, and the answer was scaled into two classes (1=almost never - occasionally, 2=often). The risk of experiencing ankle/foot symptoms was less for those who

<table>
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<th>Factors</th>
<th>N</th>
<th>Prevalence N (%)</th>
<th>OR adj</th>
<th>95% CI</th>
<th>p</th>
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<td>Having a child (or children)</td>
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<td>Yes</td>
<td>398</td>
<td>98 (25)</td>
<td>0.73</td>
<td>0.56–0.97</td>
<td>0.027*</td>
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<tr>
<td>No</td>
<td>791</td>
<td>241 (30)</td>
<td>1.00</td>
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<td>Average number of working hours per day</td>
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<td></td>
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<tr>
<td>&gt;10 h per day</td>
<td>501</td>
<td>163 (33)</td>
<td>1.42</td>
<td>1.10–1.83</td>
<td>0.008*</td>
</tr>
<tr>
<td>≤10 h per day</td>
<td>688</td>
<td>176 (26)</td>
<td>1.00</td>
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<td>Frequency of body twisting in a narrow space during the work day</td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Often</td>
<td>169</td>
<td>61 (36)</td>
<td>1.46</td>
<td>1.03–2.07</td>
<td>0.034*</td>
</tr>
<tr>
<td>Occasionally–almost never</td>
<td>1020</td>
<td>278 (27)</td>
<td>1.00</td>
<td></td>
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<tr>
<td>Frequency of stair climbing during the work day</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Often</td>
<td>203</td>
<td>70 (34)</td>
<td>1.33</td>
<td>0.96–1.85</td>
<td>0.085</td>
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<tr>
<td>Occasionally–almost never</td>
<td>986</td>
<td>269 (27)</td>
<td>1.00</td>
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<tr>
<td>Light intensity in the workplace is good</td>
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<td></td>
<td></td>
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<tr>
<td>Agree</td>
<td>808</td>
<td>245 (30)</td>
<td>1.00</td>
<td></td>
<td></td>
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<tr>
<td>Disagree</td>
<td>381</td>
<td>94 (25)</td>
<td>0.75</td>
<td>0.57–0.99</td>
<td>0.046*</td>
</tr>
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|*: Significant difference at p<0.05.
often had a rest break during work (adjusted OR=0.67, 95% CI=0.49–0.92).

**Discussion**

To our knowledge, this is the first study investigating the associations between the prevalence of musculoskeletal symptoms in the lower extremities and biopsychosocial factors of saleswomen in department stores. Certain individual and work-related physical factors were significantly correlated with lower extremity complaints, including age, having a child, average number of working hours per day, average number of working
days per week, average number of hours per day required to stand or walk, frequency of body twisting and working in static postures during work, frequency of rest breaks during work, and self-rated perception of light intensity and temperature in the workplace. Different individual and work-related physical factors were significantly related to musculoskeletal symptoms in different parts of the body.

Saleswomen in this study appear to work longer hours during the week compared to their counterparts in other countries. Saleswomen in Thailand worked on average 60 h per week while salespersons in the U.K. reportedly worked an average of 38–40 h per week. Because their income is partly dependent on the number of working hours, salespersons were willing to work longer hours to earn more. In this study, 58% and 10% of saleswomen reportedly worked more than 10 h per day and worked 7 days per week, respectively. Prolonged work duration may place saleswomen in department stores at high risk of musculoskeletal symptoms, which was evidenced by a high prevalence rate. The findings of the present study point out an urgent need from stakeholders to pay more attention to the health and safety of salespersons in department stores in Thailand.

**Individual factors**

In the present study, we found a very strong relationship between age and prevalence of knee symptoms. Saleswomen older than 20 yr were at 7- to 14-fold greater risk of experiencing knee symptoms than those aged less than 20 yr. Our data indicate that saleswomen in the study were mainly required to stand and walk during work. One might conceive that the accumulation of prolonged standing and walking over the years would eventually lead to pathologic lesions in the knees. However, in this study, we found no association between the years of working experience and the prevalence of knee symptoms among saleswomen. In addition, there was only a moderate correlation between the years of working experience and the age of participants meaning that older saleswomen did not always have a greater number of years of working experience compared to their younger counterparts. In other words, salespersons may change jobs often. It has been well-established that the meniscus of the knee joint degenerates with increasing age. Degenerative changes of the meniscus reduce its ability to distribute weight-bearing forces. Prolonged standing leads to continuous concentrated compression on small, load-bearing regions of the knee cartilage, which may result in local disruptions to the blood supply as well as wear and tear on the cartilage. Thus, one interpretation of the present findings could be that the adverse effect of standing or walking on the knee cartilage is more pronounced with the degeneration of the meniscus.

Workers who had a child (or children) were at less risk of experiencing hip pain than those without a child. Malchaire *et al.*, in their review of biopsychosocial factors associated with musculoskeletal problems, stated that females were susceptible to musculoskeletal symptoms in the neck and upper extremity partly because they were intensely involved with home activities. Females, especially among Thais, traditionally play a major role in taking care of children. In the present study, most saleswomen who had a child (or children) (88%) reportedly worked 6 days per week or less and one-half of them (56%) worked 10 h per day or less. Thus, one hypothesis explaining the preventive effect of having a child on musculoskeletal complaints in the lower extremity is that female saleswomen with children were unable to work as a salesperson for long hours, a risk factor for hip symptoms (see the discussion regarding the association between work duration and the prevalence of lower extremity symptoms under the heading Work-related physical factor).

**Work-related physical factors**

The results of this study revealed that a range of work-related physical factors were significantly related to the prevalence of hip, knee and ankle/foot complaints among saleswomen. Because their job characteristics are physical and, in a developing country like Thailand, due to limited resources, the workplace environment is likely to be less than ideal. For example, no consideration regarding health and safety is given to the appropriate number of rest breaks during the work day. As a result, saleswomen are required to stand or walk most of the time during work (Table 1). Additionally, salespersons are required to transfer objects without any protective or assistive devices. Moreover, employers do not provide workstations that suit each individual ergonomically. Therefore, work-related physical factors potentially play a predominant role in the development and persistence of musculoskeletal symptoms. In our previous study of Thai office workers, whose job characteristics usually are less physically demanding than those of saleswomen, several work-related physical factors were associated with musculoskeletal symptoms in the spinal and lower extremity regions.

The average working hours per day and working days per week, as well as the average number of hours per day required to stand or walk were significantly related to the prevalence of lower extremity symptoms. A long working day (average >10 h per day) increased the risk of experiencing hip and ankle/foot symptoms in comparison with a shorter working day (average ≤10 h per day) while a long period of time required to stand or walk during the working day (average >10 h per day) increased the risk of experiencing knee pain. Working 7 days per week also elevated the risk of experiencing ankle/
foot symptoms in comparison with having at least one day off during the week. Standing and walking were presumed to be the main activities during work for saleswomen in this study. Several previous studies have reported a positive relationship between prolonged standing and lower extremity symptoms. Prolonged standing and walking requires the continuous contraction of a number of muscles in the legs, pelvis and spine to maintain posture and balance as well as to generate movements. Sustained muscle activity has been previously reported as a risk factor for developing musculoskeletal symptoms. Also, standing and walking for long periods of time leads to continuous load-bearing of the joints of the lower extremity, which may result in joint injury. Thus, it is plausible that a long work-day or continuously working without a day-off may lead to an accumulation of musculoskeletal overload and/or insufficient time for the natural healing process of an injured structure, resulting in the development of musculoskeletal disorders. Alternatively, prolonged standing may alter loading of the passive (capsulo-ligamentous) structures, which may result in musculoskeletal symptoms.

In the present study, the risk of experiencing ankle/foot symptoms was elevated for those who reported a high frequency of working in static postures. The term 'working in static postures' can be interpreted in many different ways. One possible interpretation of working in static postures may relate to prolonged standing because the main activity of saleswomen in this study presumably was standing, and standing is static in nature. Irving et al. conducted a systematic review to examine the association between chronic plantar heel pain and various factors. They found some evidence of association between prolonged standing and the occurrence of chronic plantar heel pain. Prolonged standing on hard surfaces for 2 h was found to increase the intensity of unpleasantness, swelling of the calf muscle and electromyographic activities of the lower leg muscles. Thus, frequent working in static postures (i.e. prolonged standing) may lead to injuries to the lower extremities. This notion is substantiated by the fact that we found a reduced risk of experiencing ankle/foot symptoms in those who frequently had a rest break during work.

Apart from the frequency of working in static postures, a high frequency of body twisting in a narrow space during work also increased the risk of experiencing hip symptoms. From a mechanical point of view, body twisting in a narrow space would likely result in trunk rotation with the feet fixed on the ground. Previous studies have shown a strong association between trunk rotation during work and low back symptoms. Mechanical low back pain often radiates down to the upper thigh and buttocks. In our study, two thirds of saleswomen reported either having or not having symptoms in both the low back and hip regions. Therefore, the cause of hip symptoms in many saleswomen possibly originates from the low back disorders. On the other hand, trunk rotation with feet fixed on the ground would also cause ipsilateral hip internal rotation and contralateral hip external rotation at the same time. Frequent body twisting may consequently lead to muscle strain or joint sprain at the hip joint.

Interestingly, self-rated perception of the work environment (i.e. light intensity and temperature) appears to be a significant preventive factor for developing hip and knee pain among saleswomen. Poor self-rated perception of light intensity and temperature in the workplace decreased the risk of experiencing hip and knee symptoms by 25–28%. Our results are inconsistent with previous studies of office workers, which showed a positive correlation between work environment and neck and lower extremity symptoms. The data indicated that saleswomen who are reportedly satisfied with their work environment had a greater number of years of working experience than those who were reportedly dissatisfied with their work environment. It is hypothesized that saleswomen who are dissatisfied with their work environment are likely to leave the job sooner than their satisfied counterparts. As a result, satisfied saleswomen may be exposed to risk factors, particularly prolonged standing, longer than dissatisfied saleswomen. Therefore, satisfied workers may be more susceptible to developing musculoskeletal injuries.

**Psychosocial factors**

We found no significant relationship between psychosocial aspects and the prevalence of lower extremity symptoms in saleswomen. This finding is in contrast with the results of a previous study by Skov et al. who reported significant associations between neck, shoulder and low back symptoms in salespersons and a range of psychosocial risk factors. However, the discrepancy may be due to the difference in job characteristics of the target populations in the previous and current studies. In the previous study, salespersons worked outside the company in which they were employed and had little contact with colleagues. They had high job demands and competed with other salespersons. They also had a high degree of control over work and variation in the job. On the other hand, salespersons in the present study worked inside department stores with their colleagues. They were not expected to compete with other salespersons and they would not likely have a high degree of work control or job variation. As a result, the comparison between the studies should be made with caution.

Most previous studies demonstrating the link between psychosocial factors and musculoskeletal symptoms originated in Western countries. The role of
psychosocial factors in the development and persistence of musculoskeletal symptoms in Asians, particularly in Thais, may not be comparable to that of Westerners because work and social culture among Thais is different from those of Westerners. For example, the work schedule for Thai workers is quite flexible. There are no formal coffee/tea breaks during work day. However, chatting with colleagues during work is very common and considered acceptable. Also, in the cultural context, Thais keep very close relationships with their parents and siblings. As a result, various psychosocial factors that are identified as risk factors for musculoskeletal symptoms in Westerners may not be risk factors for Thais or may even have an opposite effect on Thais. Recent studies investigating the relationship between psychosocial factors and the prevalence of musculoskeletal symptoms in Thai office workers support this notion. A different contributing model of musculoskeletal symptoms in Thais may not be risk factors or may even have an opposite effect on Thais. Recent studies investigating the relationship between psychosocial factors and the prevalence of musculoskeletal symptoms in Thai office workers support this notion.

The major strength of this study is the high number of participants and response rate (92%) which is likely to be representative of the larger population of female department store workers. A weakness of the current study includes its cross-sectional nature which only allows the association between exposure and outcome to be examined. It is not possible to establish a causal relationship between exposure and outcome. Therefore, a prospective study design would be necessary to validate the findings of this study. Another limitation is that this study included participants in the studies without due consideration of the cause of musculoskeletal symptoms. Consequently, a number of reported musculoskeletal symptoms may be non-work-related. Future studies should attempt to identify those who have work-related musculoskeletal symptoms and examine their association with biopsychosocial variables. Lastly, this study may be susceptible to the “healthy worker effect”, i.e., saleswomen suffering from musculoskeletal injury due to work may move on to other jobs and, therefore, would have been missed during the sampling process in the present study.

In conclusion, certain individual factors (older age and having no children) as well as some work-related physical factors (long working duration, prolonged standing or walking, frequent body twisting, frequently working in static postures, infrequent rest breaks and good perception of the work environment) are significantly related to high self-reported musculoskeletal symptoms in the lower extremities among saleswomen in department stores in Thailand. The results support the notion that work-related physical factors are a predominant factor in the development and persistence of musculoskeletal symptoms among Thai workers. Within the limitations of this study, it is recommended that specific measures or policies to prevent musculoskeletal symptoms in salespersons in department stores are urgently implemented. These include appropriate rest breaks during the work day and/or a compulsory day off each week. Also, an education program on how to avoid some modifiable risk factors for musculoskeletal symptoms should be introduced. Further research on the effectiveness of measures to reduce the occurrence of musculoskeletal symptoms in the lower extremities of salespersons in department stores should be conducted.

Acknowledgements: This study was funded by the Social Security Office of Thailand (#015/2550).

References
Appendix: Questionnaire

Work-related information

1. How long have you worked as a salesperson? ...years
2. How many days per week and hours per day do you work? ...days per week/...hours per day
3. How many hours do you need to stand or walk during the work day? ...hours per day (with rest break) ...hours per day (without rest break)
4. How often do you perform sitting / prolonged forward leaning / pushing or pulling heavy objects / twisting body in a narrow space / climbing stairs / lifting moderate to heavy objects from the floor / working in a static posture during the work day ? ☐ almost never ☐ occasionally ☐ often
5. How often do you rest from standing or walking during the work day? ☐ almost never ☐ occasionally / only at lunchtime ☐ often
6. Which of the following statements correlate to your workplace environment? (Can select more than one answer)
   ☐ the light intensity is good ☐ the noise level is not too loud ☐ the temperature is not too cold nor too warm ☐ the air circulation is good ☐ the size of the work space is good

Psychosocial information

1. Modified work APGAR
2. The 12-item Short Form Health Survey
   (From Yeomans SG. The clinical application of outcomes assessment. Stamford; USA: Appleton & Lange; 2000.)

Musculoskeletal symptoms in the lower extremities

Have you at any time during the last 12 mo had trouble (ache, pain, discomfort, numbness, weakness) in the following areas?

- Neck ☐yes ☐no
- Shoulders ☐yes ☐no
- Elbows ☐yes ☐no
- Wrist/hands ☐yes ☐no
- Upper back ☐yes ☐no
- Low back ☐yes ☐no
- Hips/thighs ☐yes ☐no
- Knees ☐yes ☐no
- Ankles/feet ☐yes ☐no