Supermarket workers: Their work and their health, particularly their self-reported musculoskeletal problems and compensable injuries

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Abstract. A literature review revealed that cashiers are the most studied of all supermarket workers, while little is known about other types of employees. However, cashiers are far from being the only supermarket workers affected by musculoskeletal disorders. The musculoskeletal health of supermarket employees other than cashiers was therefore examined for one company. Two sources of data were used: compensation statistics (from the company’s 57 corporate supermarkets) and self-reported questionnaires (administered in 4 selected stores). These sources provided very different descriptive statistics, both in terms of the size of problems (depending on which aspects were compared, compensation statistics depicted 2 to 18 times fewer disorders than self-reports), and in terms of which body regions were most affected. There were also discrepancies with regard to identifying those departments which were most at risk (wrappers according to self-reports, delicatessen according to compensation reports). According to self-reports, 83% of workers (excluding cashiers) reported at least one musculoskeletal disorder over a 12-month period, and 32% had problems severe enough to impede regular activities. Different approaches to calculating rates were also used within each data source. Calculations using the number of hours worked annually by all workers were deemed to be the best. The significance of these results for supermarket employees and in terms of intervention and prevention in other sectors is examined.

Keywords: Supermarket, musculoskeletal disorders, repetitive strain injuries, low back pain, compensable injuries, self-administered questionnaire data, Nordic Questionnaire, surveillance

1. Introduction

Supermarket workers are known to be an at-risk population for musculoskeletal disorders (MSDs); both compensation statistics and research studies conducted in the supermarket environment have shown this [42, 46,65]). However an in-depth analysis of the information that is currently available reveals a pressing need for data on supermarket workers other than cashiers.

In 2000, in the province of Quebec, the incidence rate for compensated back disorders in the grocery industry (CAFO 6017 [8]) was 19.6 per 1000 full-time equiv.
tent (FTE) workers, compared with 14.6 per 1000 FTE workers for all industries combined [16,68]. For compensated musculoskeletal disorders of the limbs, for the same year in the same industry, the incidence rate was 4.9 per 1000 FTE workers, compared with 4.5 per 1000 FTE workers for all industries. However, within these statistics for the grocery industry (for 1998 to 2000), cashiers accounted for only 16% of the compensated back disorders (409 cases out of 2,507) and only 24% (174 out of 713) of the compensated limb disorders [16,68]. Statistics for 1995 to 1997 and for 1992 to 1994 revealed the same pattern [15,67].

Cashiers do not account for the majority of compensation cases, yet most research conducted in supermarkets focuses on cashiers and leaves other types of workers in the shadows. In a literature review carried out in March 2006, most documents (96 of the 133 that were found) dealt exclusively with cashiers. The majority (85) focused on MSDs resulting from work station design and, more recently, the use of the scanner (only references from 1998 onwards are listed here) [10–13,18–20,22,31–34,36–39,41,43,45,49,51–56,59–62,69]. Only 37 references dealt with other supermarket workers, and only 13 of these were on MSDs [5–7,17,28–30,47,50,57,58,70]. Most of these 13 articles either focused on only one other group of supermarket workers, or clumped many different types of workers into the all-encompassing “clerk” category, or studied specific MSDs (lower back problems, or upper extremity MSDs, or carpel tunnel syndrome).

Considering, firstly, that compensation statistics reveal a need to carry out research on workers other than cashiers; that, secondly, there is little information on these workers in existing literature; and that, thirdly, the work of supermarket employees has changed little in recent years, this article will present combined, revised study of supermarket employees. This review also allowed us to determine the degree to which the situation had or had not changed since the publication of the results of our study, which took place between 1995 and 1999. The literature review focusing on the health of supermarket employees, which was mentioned in the introduction, was carried out in March 2006. Its objective was to evaluate the state of current scientific knowledge with regard to the work and health situations of supermarket employees. This review also allowed us to discuss any discrepancies with regard to the body regions in which problems were most prevalent. We will also examine the implications for future research on musculoskeletal disorders.

2. Methodology

2.1. Terminology and definitions

The term “musculoskeletal disorder” is used here to refer to back problems and upper and lower limb problems. Terminology in the area of musculoskeletal disorders can be confusing, particularly in a study such as this one, in which two sources of data have been used. The term “musculoskeletal disorder” (MSD) is used here as a general, all-encompassing term. MSDs can be examined using compensable injuries (compensation statistics). In this case they are called musculoskeletal injuries (MSIs). They can also be examined using self-reported questionnaires. In this case, they are referred to as musculoskeletal problems (MSPs).

2.2. Literature review carried out in March 2006

The literature review focusing on the health of supermarket employees, which was mentioned in the introduction, was carried out in March 2006. Its objective was to evaluate the state of current scientific knowledge with regard to the work and health situations of supermarket employees. This review also allowed us to determine the degree to which the situation had or had not changed since the publication of the results of our study, which took place between 1995 and 1999. The most relevant reference databases were consulted for this review: Ergonomics Abstracts Online, Medline (PubMed), FRANCIS, SocialSciSearch, Hseline, and INRS_CISDOC. Our goal was to locate texts in English and French, published between the date of the oldest reference found and March 2006. (We placed no limitation on the earliest publication date that we would consider.) We used two types of key words for the search: The purpose of the first set of words was to locate texts focusing on workers’ health prob-
lems (“health problem”, “health”, “injuries”, “occupational disease”, “work task”, “task”, “work condition”, etc.), and the second was to identify studies dealing specifically with the supermarket context (“supermarket worker”, “cashier”, “supermarket”, “grocery”, etc.).

2.3. Data collection, and supermarkets involved in this study

The supermarket company used in this study was located in the province of Quebec, and belonged to the food distribution sector. It employed more than 20,000 employees in total, 13,000 of whom worked in corporate and affiliated supermarkets (155 supermarkets in all), with the remaining employees working mainly in the warehouse division. As is the case for most of today’s large corporations, both the number of supermarkets and the company’s worker population change over time. We therefore focused on a specific date: January 27, 1996, which corresponded to the end of the company’s fiscal year. At this point in time, there were 57 corporate supermarkets and 3,910 employees. On this same date, the company also had 98 affiliated and franchisee supermarkets. However, these have been excluded for the purposes of this article, since they did not have the same relationship with the company in many aspects, including with regard to OHS.

2.3.1. Selecting 4 corporate supermarkets

Since the objective of the research project was to assess both the jobs and the health of supermarket workers almost store-wide, it was not feasible to study all 57 corporate supermarkets. Selecting only a few of these supermarkets (4, to be precise) meant that we had to extensively examine all 57 corporate supermarkets [27]. A list of variables for this examination was therefore drawn up in collaboration with a specialist in organisational variables (Table 1). We then verified the pertinence and availability of information on these characteristics with company and union representatives. These same individuals also helped us to locate various data sources for the variables. Data collection involved several departments in the company, namely: operations, human resources, finance, and occupational health and safety. Most of the data were supplied to us in the form of company databases. Finally, we reviewed the descriptive data that we had obtained. Two specific aspects of this review need to be reported in this section (2.3.1). First, since the main purpose of this work was to provide some basis for correctly selecting 4 supermarkets for an in-depth study, the results of this examination helped define the important criteria which should be used: 1) supermarkets with unionised employees belonging to the company’s main union, 2) large size supermarkets (at least 69 employees), 3) supermarkets with an OHS performance corresponding to the average, 4) supermarkets located in the vicinity of Montreal, 5) supermarkets with no unique architectural characteristics, 6) supermarkets at least corporates for the major part of the year, and 7) supermarkets with no recent or current renovations, and with none planned for the period of the study. The similarity between the 4 selected supermarkets and the remaining 53 corporate supermarkets was then investigated. Overall, after examining the 19 characteristics listed in Table 1, the 4 selected supermarkets generally resembled the others [27].

Secondly, it is important to mention one piece of information that we discovered while conducting the examination of the 57 corporate supermarkets, since this information determined the way in which some of the data would be approached and analyzed. We learned that we could not use job titles (e.g. grocery clerk, pastry clerk, fruit and vegetable clerk) in the analyses, because these titles did not describe the same set of tasks from one supermarket to another. For example, some “grocery clerks” were assigned strictly to dairy products while others worked with a variety of products, and some were night clerks, while others worked days only and carried out different tasks. However, we could use the variable “department”, since the set of tasks to be accomplished within each department was the same from one supermarket to another.

2.3.2. Self-reported musculoskeletal data in 4 selected supermarkets

The 4 selected supermarkets combined had 226 employees, excluding cashiers and managers. Data on the musculoskeletal health of these workers were collected by means of a self-administered questionnaire known as the Nordic Questionnaire [35]. We used the French version of this questionnaire [23], which was published in 1994, and we made some minor adjustments to this version of it [26]. The decision to use this questionnaire was based on a review of the literature about existing questionnaires, followed by consultations with the authors of those that were the most pertinent to our study. The Nordic Questionnaire is, to date, the only questionnaire in French which allows for documentation of all musculoskeletal disorders (back, upper and lower limbs), and which was developed for...
Table 1: Characteristics Studied for the Description of the 57 Corporate Supermarkets

<table>
<thead>
<tr>
<th>Characteristics Studied</th>
</tr>
</thead>
<tbody>
<tr>
<td>General information on the supermarket</td>
</tr>
<tr>
<td>1) Physical environment: Total surface area</td>
</tr>
<tr>
<td>2) Physical environment: Change in layout (e.g. extension, relocation, renovation, etc.)</td>
</tr>
<tr>
<td>3) Physical environment: Characteristics – several aspects (e.g. number of floors)</td>
</tr>
<tr>
<td>4) Performance: Total number of hours worked by the employees during the year</td>
</tr>
<tr>
<td>5) Performance: Total number of hours open to the public per week</td>
</tr>
<tr>
<td>6) Unionisation: (unionised: yes or no)</td>
</tr>
<tr>
<td>7) Unionisation: (name of union)</td>
</tr>
<tr>
<td>Supermarket history</td>
</tr>
<tr>
<td>8) Data on changes in supermarket’s status (corporate, affiliate or franchise)</td>
</tr>
<tr>
<td>9) Changes or not to the management team (e.g. manager transferred, etc.)</td>
</tr>
<tr>
<td>10) Occurrence or not of key events (e.g. strike, lock-out, etc.)</td>
</tr>
<tr>
<td>Information on supermarket employees</td>
</tr>
<tr>
<td>11) Number of employees per supermarket</td>
</tr>
<tr>
<td>12) Gender distribution of employees by supermarket</td>
</tr>
<tr>
<td>13) Number Of regular or part-time employees</td>
</tr>
<tr>
<td>14) Number of management and non-management employees</td>
</tr>
<tr>
<td>15) Number of unionised and non-unionised employees</td>
</tr>
<tr>
<td>16) Age of current employees</td>
</tr>
<tr>
<td>17) Seniority of employees in the company and in the actual supermarket</td>
</tr>
<tr>
<td>18) Personnel turnover</td>
</tr>
<tr>
<td>19) Employees’ department</td>
</tr>
<tr>
<td>OHS</td>
</tr>
<tr>
<td>20) Data on the supermarket’s OHS committee</td>
</tr>
<tr>
<td>21) Data on occupational injuries</td>
</tr>
</tbody>
</table>

Of the 226 workers in the 4 selected supermarkets, 202 completed the questionnaire (89% response rate). The 24 people who did not respond were randomly distributed amongst the 4 supermarkets.

We also applied a “consistency” filter to the data from the self-administered questionnaire, in order to determine which data would be included in the analysis. That is, employees showing an inconsistent pattern in their answers were considered as non-respondents in the analysis, meaning that they were not counted for the question or the section (region of the body) for which they had been inconsistent. For example, if a respondent indicated that he had not had any lower back problems over the course of the preceding 12-month period, but indicated in a separate question that he had had a lower back problem in the preceding 7 days, we excluded that person’s answers regarding the lower back. However, if this same respondent consistently answered the questions relating to the neck, the respondent was still included in the analysis for that particular region of the body.

2.3.3. Workers’ compensation data in the 57 corporate supermarkets

Occupational injuries were one of the important variables studied in the examination of the 57 corporate supermarkets. We studied all of the occupational injuries reported by the company to the Quebec Workers’ Compensation Board (QWCB) for the 57 supermarkets, during the period from January 29, 1995 to January 27, 1996 (the period corresponding to one fiscal year for that company). We considered all injuries (i.e. occupational accidents and occupational diseases) that occurred during this period, and considered all types of workers, including cashiers.

The data were collected from physical files on occupational injuries held at the company’s head office, by means of a standardized form that we had devised in order to prompt data collection on 69 variables (diagnosis, injury type, body part, causal agent, department, seniority, age, etc.). All details regarding data collection and results can be obtained from the research report [25].
2.3.4. Data quality overall

Numerous quality checks were performed on all data collected: supermarket variables, compensation data, and self-reported data. In all cases, the quality was high. For example, data entered in the computer files were randomly checked against the original source; for those data to which this test could be applied, all were more than 90% accurate. More details on the data quality of each variable are available in the research reports for supermarket characteristics [27], compensation data [25], and self-reported data [26].

2.4. Data analysis

Since the objective of this article is to describe the health of supermarket workers, the statistics presented here are mainly descriptive. As already mentioned, they come from two sources of data. Furthermore, the data are reported in one of three ways: in absolute numbers, by the rate of disorders on the basis of the number of workers (workforce), or by the rate of disorders on the basis of the annual number of hours worked by workers (using full-time worker equivalents or FTEs). Discrepancies between results from the two sources, and differences identified between the three ways of presenting the data, will be discussed.

In a few cases, statistical differences were tested using a chi-square (e.g. testing a difference in gender or part-time versus regular status for the risk of suffering a compensable musculoskeletal injury).

Some descriptive data on the supermarket as a workplace are also reported.

3. Results

3.1. Description of the 57 corporate supermarkets

Using some of the characteristics listed in Table 1, and employing descriptive statistics, a profile of the company’s 57 corporate supermarkets can be obtained. This description will enable readers to make comparisons between familiar supermarket situations and those described in the study. Although some characteristics may be particular to this company, we expect that there are probably many similarities with other supermarkets elsewhere in the world.

On average, each supermarket measured approximately 2,044 square meters (including shop surface and stocking areas). Most (73%) consisted of a single floor. In the 57 stores, there were 3,910 employees. Annually, for all workers combined, there were 85,264 hours worked in an average supermarket (1,640 hours per week). On average, each store was open to the public for business 92 hours a week (i.e. approximately 13 hours a day). Almost all (95%) of the supermarkets were unionised. Of these, half were affiliated with the same union, while the remaining supermarkets were affiliated with 4 different unions.

Of the 57 supermarkets, only one had had a major event (fire, strike, lockout, etc.) in the two years preceding the study. In the year of our study (1995–1996), close to 25% of the supermarkets were renovated (including additions to the structure). In that same year, 50% of the 57 supermarkets also underwent changes to their management teams. Management represented 9% \( (n = 333) \) of the employee population \( (n = 3910) \).

Internally, the supermarkets were usually divided into the following 6 departments: 1) bakery, 2) grocery goods, 3) fruits and vegetables, 4) delicatessen, 5) meat, and 6) service (checkout). Employees were the main processing force within each department. Other than employees, there were two other basic hierarchical levels: directors and department managers (who usually had assistant-managers working with them). To a certain extent, managers were like the directors of their own small firms – each manager’s “firm” being his or her department. For example, managers were responsible for planning orders, managing stocking areas, arranging employees’ schedules, hiring new employees, and so on. The supermarket director was the administrator who oversaw the entire supermarket. He/she was responsible for defining the number of hours that could be worked in each department, and for ensuring that standards were correctly applied.

The characteristics of supermarket employees were also reviewed (including cashiers and managers, unless otherwise stated). An average of 69 employees worked in each supermarket (45% of whom were women and 55% of whom were men). Most employees worked part-time (64% of employees) and held non-management jobs (91% of employees). It should be noted that the term “part-time”, as used by the company, can be misleading, as it includes employees who regularly work close to 40 hours per week. We have therefore rarely used this categorisation in our analyses. The great majority of employees (85%) were unionised, and this percentage includes managers.

In the average supermarket, the mean age of employees was 32 years. However, the mean age did not properly reflect employees’ ages, since there was a high proportion of young workers (40% being between
5 and 24 years of age). The young employees were concentrated in the part-time group, with the mean age of these employees being 27 years, while the average age of regular employees was 40 years. In the average supermarket, the mean seniority for employees was 7 years. However, 62% of employees had less than 6 years of seniority, and 39% had less than 2 years. This is consistent with the large proportion of young workers in this company.

The employee turnover rate was calculated based on a snapshot of the employee population at two different moments. The annual turnover rate for employees (those who left) was 26%. Management had a turnover rate due to departures of 13%. However, management also had a turnover rate of 25% due to transfers between supermarkets, with a total of 38% annual turnover for management at the supermarket level.

Among the 57 corporate supermarkets, 40 had an OHS committee: of those, 37 answered the question about frequency of meetings. In 20 of these 37 supermarkets, OHS committees met regularly, i.e. at least every two months. Therefore, of the 57 supermarkets, approximately 35% had what would be considered as an active OHS committee.

A more detailed description of the supermarket environment, and of the work involved, can be found in Beaugrand et al. [3] and Forcier et al. [27].

3.2. Compensable occupational injuries in the 57 supermarkets

In total, 224 occupational injuries (accidents and diseases) were reported between January 1995 and January 1996 in the 57 corporate supermarkets. Of the 57 supermarkets, 12 had become corporate over the course of the year, and therefore had not contributed a full year’s worth of reported injuries. The 224 injuries that were reported were sustained by 210 employees from all categories, including managers and cashiers (n = 3910). A summary description of the 224 injuries is provided here, and more details can be obtained in the report [25].

Using the diagnoses written on medical forms, the 224 reported injuries were re-categorised by a physician into one of three types of injury: musculoskeletal disorders, lacerations, or other types of injury (referred to as “other”). A total of 131 employees reported 140 musculoskeletal injuries (MSIs) in the year studied (with 9 employees reporting two each). This makes musculoskeletal injuries the most common type of health problem, as they accounted for 63% of all problems and 73% of all days during which employees were absent from their formal duties due to injury (Table 2). Employees other than cashiers and managers reported 94 MSIs (managers reported only 1 MSI among them). Therefore, as a group, employees other than cashiers and managers accounted for 67% of all MSIs reported. Considering these observations, the results presented here will focus on MSIs.

The similarity between the population of employees with MSIs and the population of employees without compensable injuries was tested for some characteristics: gender and part-time status will be reported here. These data were made available at a later date, by which time some 11 employees with MSIs had already left. The remaining 120 employees with MSIs were then compared with the rest of the population (n = 3,725 employees without compensable injuries). There was no difference in gender distribution, nor in the part-time/full-time status distribution of the two populations (injured and uninjured).

If only absolute numbers are considered, the service department would appear to have the most MSIs (Table 3). However, examining injury rates reveals a different picture. Since this industry deals with a large percentage of part-time workers, it is best to evaluate injury rates using Full Time Equivalents (FTE). Using the company’s statistics on the total number of hours worked between January 1995 and January 1996 in each supermarket and each department, the annual MSI rate per 1000 employees FTE could be calculated. As can be seen in Table 3, based on annual FTE rates, the departments with the most MSIs are: delicatessen, grocery, fruits and vegetables, and meat. Overall there is a rate of 61 MSIs per 1000 FTE workers. It is important to note that the prevalence rates calculated per 1000 workers (i.e. not adjusted in relation to the number of hours worked in the year) are lower than the FTE rates, thus underestimating by 40% the size of the problem. The rate for all departments was 36 MSIs per 1000 employees, versus 61 MSIs per 1000 FTE.

Body regions affected by the 140 MSIs were examined. (Although there were 140 MSIs, 7 injuries affected 2 regions for a total of 147). The back was the most frequent region, accounting for 46% of all cases, followed by the upper limbs (38%), and, to a much lesser degree, the lower limbs (7%) and neck (5%). When the body region is defined more precisely, the lower back prevails with 37%, followed by the shoulders (16%), wrists (9%), elbows (8%) and upper back (7%).
Table 2

<table>
<thead>
<tr>
<th>Type of injury</th>
<th>Number of injuries in a 12-month period (%)</th>
<th>Number of days of absence from regular work for 183 injuries, Maximum Total days (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Musculoskeletal</td>
<td>140 (63%)</td>
<td>36 372 3917 (73%)</td>
</tr>
<tr>
<td>Cut</td>
<td>51 (23%)</td>
<td>15 72 624 (12%)</td>
</tr>
<tr>
<td>Other</td>
<td>31 (13%)</td>
<td>48 360 795 (15%)</td>
</tr>
</tbody>
</table>

1. Number of injuries that could not be classified = 2 of 224 (1\%).
2. Since supermarkets were open 7 days per week, the lengths of absences were calculated on the basis of 7 days per week (calendar days).
3. This is the difference between the date the injury was recorded and the date of return to normal work; this length of absence includes the length of the temporary assignment (modified work).
4. Of the 222 classified injuries, data on the number of days of leave were available for 183 injuries.
5. The “musculoskeletal” category consists of chronic injuries and those that could be chronic; those that were definitely traumatic (e.g. contusions) were categorised as “other”.
6. Employees other than cashiers had 94 musculoskeletal injuries, managers had 1.
7. “Other” includes broken bones, burns, bruises and contusions, lacerations or multiple contusions, non-viral conjunctivitis, nervous shock or post-traumatic stress disorder (after a robbery) and unspecified injury or traumatic disorder.

Table 3

<table>
<thead>
<tr>
<th>Department</th>
<th>Number of reported injuries (%)</th>
<th>Number of employees</th>
<th>Rate of injuries per 1000 employees</th>
<th>Yearly number of hours worked</th>
<th>Rate of injuries per 1000 FTE employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service (cash)</td>
<td>48 (36%)</td>
<td>1944</td>
<td>25</td>
<td>1948 823</td>
<td>49</td>
</tr>
<tr>
<td>Groceries</td>
<td>31 (23%)</td>
<td>492</td>
<td>63</td>
<td>716 320</td>
<td>87</td>
</tr>
<tr>
<td>Meat</td>
<td>24 (18%)</td>
<td>444</td>
<td>54</td>
<td>634 048</td>
<td>76</td>
</tr>
<tr>
<td>Delicatessen</td>
<td>12 (9%)</td>
<td>218</td>
<td>55</td>
<td>262 388</td>
<td>91</td>
</tr>
<tr>
<td>Fruits and vegetables</td>
<td>10 (7%)</td>
<td>188</td>
<td>53</td>
<td>262 371</td>
<td>76</td>
</tr>
<tr>
<td>Bakery</td>
<td>8 (6%)</td>
<td>262</td>
<td>31</td>
<td>326 371</td>
<td>49</td>
</tr>
<tr>
<td>Administration</td>
<td>1 (1%)</td>
<td>330</td>
<td>3</td>
<td>462 503</td>
<td>4</td>
</tr>
<tr>
<td>Overall</td>
<td>140</td>
<td>3 878</td>
<td>36</td>
<td>4 612 824</td>
<td>61</td>
</tr>
</tbody>
</table>

1. The department in which the employee was working when the injury occurred. In 4 cases, this department was not the employee’s regular department. Number of musculoskeletal injuries that could not be categorised by department: 6 out of 140 (5\%).
2. Since supermarkets are notorious for part-time work, the number of hours worked is more indicative of the work force. The number of people-hours worked in a department for the year is defined as the sum of all the hours worked by all the employees in the 57 supermarkets for the year in this department.
3. In order to make the numbers comparable to the rate per 1000 employees, we used the equivalent in hours worked. We then postulated that 1 full-time employee has a 40-hour week for 50 weeks of the year so 2000 hours worked per year (2,000,000 hours worked = 2000 hours worked by an employee per year X 1000 employees).
4. For the occupational injury analysis, cashiers and managers were included.
5. There were 3,910 employees in total, including cashiers and managers, but 32 employees did not belong to a department (e.g. security guards).

3.3. Self-reported musculoskeletal problems

This part of the study was conducted in 4 selected supermarkets, and included all employees except cashiers and managers.

3.3.1. Overall picture

Most employees (83\%) reported having had some sort of musculoskeletal problem (MSP) in the 12-month period that preceded the study. (In other words, they reported having had pain, aches or discomfort of some sort.) (Table 4). The lower back was by far the region with the most problems, as two out of three workers (66\%) indicated that they had had a problem in that region. However other parts of the body, such as the upper back, knees, neck, and shoulders, were also frequently noted for MSPs.

Of the 83\% of employees with MSPs, close to one...
Table 4
Frequency and seriousness of self-reported musculoskeletal problems in the last 12 months: By body region

<table>
<thead>
<tr>
<th>Body region</th>
<th>Number of workers who reported problems</th>
<th>Number of workers who reported problems that prevented them from carrying out their regular work (at work or at home)</th>
<th>Number of problems reported (N = 416)</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least one body region</td>
<td>165/200 (83%)</td>
<td>53/165 (32%)</td>
<td>122 29%</td>
</tr>
<tr>
<td>Lower back</td>
<td>122/185 (66%)</td>
<td>32/122 (26%)</td>
<td>83 12%</td>
</tr>
<tr>
<td>Upper back</td>
<td>58/192 (30%)</td>
<td>11/58 (19%)</td>
<td>58 14%</td>
</tr>
<tr>
<td>Knees</td>
<td>48/192 (25%)</td>
<td>8/48 (17%)</td>
<td>48 12%</td>
</tr>
<tr>
<td>Neck</td>
<td>46/184 (25%)</td>
<td>5/46 (11%)</td>
<td>46 11%</td>
</tr>
<tr>
<td>Shoulders</td>
<td>44/185 (24%)</td>
<td>9/43 (21%)</td>
<td>44 11%</td>
</tr>
<tr>
<td>Wrists/hands</td>
<td>32/181 (18%)</td>
<td>6/32 (19%)</td>
<td>32 8%</td>
</tr>
<tr>
<td>Ankles/feet</td>
<td>27/191 (14%)</td>
<td>6/27 (22%)</td>
<td>27 7%</td>
</tr>
<tr>
<td>Hips/thighs</td>
<td>21/189 (11%)</td>
<td>2/21 (10%)</td>
<td>21 5%</td>
</tr>
<tr>
<td>Elbows</td>
<td>18/195 (9%)</td>
<td>5/18 (28%)</td>
<td>18 4%</td>
</tr>
</tbody>
</table>

1. There were 226 workers in the 4 selected supermarkets, excluding cashiers and managers; 202 responded to the Nordic Questionnaire. A few workers out of the 202 respondents did not answer this question for any region of the body, or answered the question inconsistently for all regions of the body.

2. 202 workers answered the questionnaire but some respondents did not answer all the questions. Also, some respondents were inconsistent in their answers (see methodology). This number indicates the number of respondents who answered consistently, for this part of the body.

3. This number is not always equal to the number of workers who answered that they had had a problem with this part of the body in the last 12 months, because some workers did not answer this subsequent question.

Table 5
Origin and severity of musculoskeletal problems

<table>
<thead>
<tr>
<th>Body region</th>
<th>For whom this problem was not related to an accident</th>
<th>Who had this problem for 30 days or more during the year</th>
<th>Who consulted a professional about their problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower back</td>
<td>NA</td>
<td>39/117 (33%)</td>
<td>30/115 (26%)</td>
</tr>
<tr>
<td>Neck</td>
<td>39/46 (85%)</td>
<td>11/45 (24%)</td>
<td>15/45 (33%)</td>
</tr>
<tr>
<td>Shoulders</td>
<td>35/47 (75%)</td>
<td>13/44 (30%)</td>
<td>16/43 (37%)</td>
</tr>
<tr>
<td>Wrists/hands</td>
<td>24/34 (71%)</td>
<td>8/31 (26%)</td>
<td>3/31 (10%)</td>
</tr>
<tr>
<td>Elbows</td>
<td>13/17 (77%)</td>
<td>6/16 (38%)</td>
<td>7/15 (47%)</td>
</tr>
</tbody>
</table>

1. This question does not appear for the lower back in the Nordic Questionnaire.

2. Not all respondents who had a problem in this body region during the last 12 months answered this additional question.

In three (32%) had a problem that was severe enough to impede their regular activities at work or at home. This represents 27% of all workers who answered consistently (53 out of 200 with IC95% from 20.5% to 33.2%). For the company in our study, considering that there were 2,457 workers in all corporate supermarkets combined (excluding cashiers and managers), the expectation was that 663 workers (IC95% from 504 to 815) would be affected in their normal activities over the course of the year. This is not a negligible number. It should also be mentioned that these data do not tell us how often workers’ activities were impeded over the course of the year, nor for what length of time; all we know is that they were impeded at least once. It is also noteworthy that the regions of the body for which the greatest number of employees reported MSPs (lower back, upper back, knees, neck, and shoulders) were not necessarily the same as those for which the more severe problems were reported. Indeed, elbows and ankles, for which fewer employees had problems, seemed to be the regions of the body that were most often associated with a restriction in workers’ activities.

3.3.2. More information on some body regions
To clarify the nature of the problem, and further elucidate its importance in terms of workers’ health, the Nordic Questionnaire included extra questions for five body regions (Table 5). The most striking result arising from the use of this table was the fact that most workers could not link their problem to any kind of traumatic event. (Between 71 and 85% of all workers did not think that their problem was associated with an accident.) This supports the theory that these types of problems may develop over time. Furthermore, for those
Table 6
By department, self-reported musculoskeletal problems and compensable musculoskeletal injuries in a 12-month period

<table>
<thead>
<tr>
<th>Department</th>
<th>Number of employees who reported MSPs</th>
<th>Number of employees who reported MSPs (that prevented them from carrying out their normal work at home or at work)</th>
<th>Number of hours worked per year</th>
<th>Annual rate of MSPs per 1000 FTE employees</th>
<th>Annual rate of MSPs per 1000 FTE employees that prevented workers from carrying out normal work at home or at work</th>
<th>Annual rate of MSIs per 1000 FTE employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service (cash)</td>
<td>47</td>
<td>15</td>
<td>63 908</td>
<td>1471</td>
<td>469</td>
<td>49</td>
</tr>
<tr>
<td>Groceries</td>
<td>38</td>
<td>16</td>
<td>76 908</td>
<td>988</td>
<td>416</td>
<td>87</td>
</tr>
<tr>
<td>Meat</td>
<td>24</td>
<td>6</td>
<td>57 928</td>
<td>829</td>
<td>207</td>
<td>76</td>
</tr>
<tr>
<td>Bakery</td>
<td>22</td>
<td>8</td>
<td>38 116</td>
<td>1154</td>
<td>420</td>
<td>49</td>
</tr>
<tr>
<td>Delicatessen</td>
<td>19</td>
<td>5</td>
<td>41 756</td>
<td>910</td>
<td>240</td>
<td>91</td>
</tr>
<tr>
<td>Fruits and vegetables</td>
<td>14</td>
<td>2</td>
<td>29 328</td>
<td>955</td>
<td>136</td>
<td>76</td>
</tr>
<tr>
<td>Administration</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>164</td>
<td>52</td>
<td>307 944</td>
<td>1065</td>
<td>338</td>
<td>61</td>
</tr>
</tbody>
</table>

1. These are self-reported musculoskeletal problems, irrespective of body region of employees who answered the Nordic Questionnaire (N = 202).
2. Musculoskeletal injuries reported over a 12-month period, irrespective of body region.
3. Number of hours worked per week reported by employees who answered the Nordic Questionnaire (X 52 weeks).
4. Number of workers in that department who had a problem ÷ number of hours worked yearly by all workers in that department who answered our questionnaire × 2,000,000 hours worked.
5. 2,000,000 hours worked = 2,000 hours worked yearly by an employee × 1,000 employees.
6. For the service department, problems exclude cashiers’ problems and their hours worked; injuries include cashiers’ injuries and their hours worked.
7. Since the injury analysis included management, the total here includes them as well.
8. 3 respondents out of 202 did not indicate their department.

Body regions covered by the extra questions, at least one employee in four who reported having an MSP had had the problem for a long period of time (30 days or more in the year preceding the study). Again, this indicates that a large number of workers experience severe musculoskeletal problems. It is interesting to note that among the body regions in question here, elbow problems (38%) emerged as particularly incapacitating, surpassing lower back problems (33%). Finally, another indication of the severity of the MSP is the number of workers who consulted a professional to seek treatment. In these five body regions, with the exception of the hands-wrists body region, at least one in four employees who reported an MSP had actually consulted a health professional for the problem. For the elbow, this statistic is close to half of those reporting a problem, indicating that problems occurring in the elbow tend to be rather severe.

3.3.3. Which supermarket department seems at higher risk of musculoskeletal problems?

When all body regions are combined (Table 6), it appears that the employees from the service department (excluding cashiers, which leaves only wrappers) and employees from the grocery department reported more MSPs in the 12 months preceding the study. However, when the rate of MSP is calculated on a full-time equivalent basis (FTE), it is the bakery department, not the grocery department, which is the second most affected by MSPs (Table 6). Other departments all seem to have relatively similar rates of MSPs. When the rate of only the more severe MSPs is considered, three departments top the list, with the service department (wrappers) still first, followed closely by the bakery and grocery departments.

3.3.4. Data by body region in each department

The data showed that the body region most often cited by employees reporting MSPs in the 12-month period preceding the study was the lower back. This was consistent across all departments. Indeed, it was always the first body region cited (varying from 52% of workers in the meat department to 73% for both the bakery and grocery departments). However, other than the lower back, each department was unique in terms of the pattern by which other body regions were most often reported by workers. For example, the second most important body region mentioned by 41% of grocery department workers was the knees, whereas 57% of workers in the bakery department mentioned the upper back. For the meat department, it was the shoulder area (41% of workers). The delicatessen had 30% of...
Its workers reporting MSPs in the upper back, as did the service department (29% of workers), while 27% in the fruit and vegetable department had ankle or foot problems. The relative importance of body regions, in terms of the reporting of MSPs in the 12-month period preceding the study, therefore varied based on the department in which the employees worked [26]. These patterns are all consistent across the 4 supermarkets and within each supermarket. For example, the knee was always the second most important body region mentioned by workers in the grocery department, both when each grocery department was studied individually and when all 4 were studied together.

The patterns of MSPs that were observed for different body regions were logical, considering that supermarket tasks are department-specific; these patterns were indeed consistent with our analyses of these various tasks. For example, knees were the second most common body region reported as being problematic in the grocery department. An analysis of the work carried out by night-time grocery clerks revealed that they either crouched or kneeled for an average of 10.6 hours each week (with a maximum of 13.1 hours for any individual worker); day-time grocery clerks carried out the same activities for an average of 4.5 hours each week [24]. No other department came anywhere close to these figures. (The department with the next highest rate in terms of crouching and kneeling was the meat department, with an average of 0.6 hours per week.) The results at the department level therefore indicate a possible link between reported MSPs and the types of tasks that employees perform.

3.3.5. Credibility of worker reports

It should be mentioned that although results are shown here for the 4 supermarkets combined, the results obtained for each individual supermarket (e.g. the relative size of the problem and the importance of various body regions) followed a similar pattern for each one. Even at the departmental level, the results were similar for each of the 4 supermarkets (e.g. the importance of the knee region in each grocery department). Since the 4 supermarkets were geographically distant from each other, and employees from the different supermarkets did not communicate amongst themselves, the possibility that employees would have colluded to provide similar answers about their problems seems highly unlikely. Consequently, the similarity in results for the four supermarkets lends credibility to the worker reports on MSPs.

3.4. Compensable musculoskeletal injuries compared with self-reported musculoskeletal problems: Do both provide the same picture of musculoskeletal disorders?

3.4.1. Size of the problem

An annual rate of 61 MSIs per 1000 FTE employees was calculated (Table 3); this included both the injuries sustained and the hours worked by cashiers and managers. The employees who answered the questionnaire in the 4 supermarkets, excluding cashiers and managers, worked 307,944 hours yearly and, among these workers, 165 employees reported an MSI in at least one body region during the 12-month period preceding the study (Table 4). This is equal to an annual rate of 1,065 MSPs per 1000 FTE employees (Table 6), which is 18 times higher than the rate of MSIs. It could be argued that a problem may not be as severe as a compensable injury. For this reason, perhaps it would be best to examine those employees for whom the problem was severe enough that it prevented them from carrying out their regular work (53 employees, Table 4). The rate would then be 338 problems per 1000 FTE employees (Table 6). This rate is 6 times greater than that of declared injuries. It does appear that to base oneself on compensation data would be to greatly underestimate the full scope of musculoskeletal disorders.

Department by department, it is interesting to note how the perceived size of each problem can vary depending on whether one looks at MSIs or MSPs (Table 6). Even when the comparison is made between "injuries" and more severe "problems" (i.e. those which have prevented workers from carrying out their normal activities at home or at work), there are between 2 and 9 times fewer injuries reported than problems reported, depending on the department. The departments with the highest prevalence rates do not correspond either.

3.4.2. Body region affected

MSI data were adjusted to enable comparison with MSP data. Excluding cashiers and managers, there were 94 MSIs reported, corresponding to 100 body regions affected. Table 7 presents the distribution of reported MSI regions after the data was reclassified according to which body region was injured, and using the same groupings as those found in the questionnaire. The lower back was by far the most frequently injured region, with 43%, followed by the shoulders and the wrists or hands, with 13% each, and then the elbows (10%). There was a very small proportion of injuries to the knees (3%) and to the ankles or feet (3%).
| Body region affected: Compensable injuries versus self-reported problems |
|---------------------------------------------------|-------------------|
| Injuries 1, 2 | Problems (from Table 4) |
| Lower back 42/97 (43%) | Lower back 122/185 (66%) |
| Shoulders 13/97 (13%) | Upper back 58/192 (30%) |
| Wrists/hands 13/97 (13%) | Knees 48/192 (25%) |
| Elbows 10/97 (10%) | Neck 46/184 (25%) |
| Upper back 6/97 (6%) | Shoulders 44/185 (24%) |
| Neck 4/97 (4%) | Wrists/hands 32/181 (18%) |
| Knees 3/97 (3%) | Ankles/feet 27/191 (14%) |
| Ankles/feet 3/97 (3%) | Hips/thighs 21/189 (11%) |
| Hips/thighs 3/97 (3%) | Elbows 18/195 (9%) |

1. To limit the number of body sites, and establish their correspondence to the category for body region found in the questionnaire, we reviewed all musculoskeletal injuries and the body sites listed in the records. Of the 100 sites, there were 13 injuries whose site did not correspond. We were able to establish a correspondence for 10 of them (see below). The 3 sites that we could not reclassify were located in the thorax. Thus only 97 body regions are reported in this table.

2. We eliminated managers and cashiers from this population to make it correspond to that of the questionnaire respondents. (Ninety-four musculoskeletal injuries then remained with 100 sites; therefore, 6 of these injuries had 2 sites.)

3. We reclassified 3 injuries (1 sacral region and 2 unspecified back regions) to the lower back.

4. We reclassified 1 injury (arm) to the shoulder.

5. We reclassified 4 injuries (fingers) to the wrists/hands.

6. We reclassified 2 injuries (abdomen except internal site of diseases or problems, and pelvic area) to the hips/thighs.

When these results are compared to those obtained for MSPs (Table 7), we note that, with the exception of the lower back, which was the most important MSD in both sources of data, injuries and problems occurring in the other most frequently mentioned body regions do not correspond. Several regions (wrists/hands, elbows, neck and knees) are in reverse order. One should also note the major difference between the 2 sources with respect to the extent of the MSDs occurring in the lower limbs (knees and ankles/feet). These correspond to only 6% of the MSIs, while they account for 39% of the MSPs (including 25% in the knees). Thus, the most common MSDs vary, depending on the source of data that is used.

4. Discussion

Some of the findings of this study are specific to supermarket workers, but others extend beyond the supermarket environment and provide us with a clearer understanding of work-related MSDs in general. For this reason, the findings are discussed in two separate sections.

4.1. What have we learned about the health of supermarket workers?

4.1.1. Musculoskeletal disorders constitute the biggest OHS problem in the supermarket setting

Based on compensable injuries, the results of our study show that MSDs are a considerable problem in supermarkets, both in terms of their scope and their severity. MSDs make up close to two thirds of compensable injuries, far exceeding lacerations and other types of injuries. The annual prevalence rate, based on the number of hours worked in the company, is 61 MSIs per 1000 FTE workers. MSIs are also the most incapacitating of all injuries, producing the longest absences from work; they are responsible for 73% of all days during which employees are absent from work. These results are similar to those obtained in two studies [9,14] that examined compensation data for the supermarket sector in 1992 and 2003.

Another source of data which was used to examine MSDs was self-reporting, using the Nordic Questionnaire. MSDs are equally important from the standpoint of MSPs reported by employees other than cashiers – who were excluded from this part of the study. Eighty-
three percent of the workers answered that they had had a problem in the 12 months preceding the study, and of these, 32% had experienced MSPs that had prevented them from carrying out their normal activities at work or at home. Calculated as an annual prevalence rate, this 32% represents 338 MSPs per 1000 workers FTE. In other words, a significant number of workers have to deal with disabling MSPs. This rate is much higher than that obtained using MSIs.

In our review of existing literature, we identified only 7 documents describing studies that determined the actual extent of MSDs. However, 2 documents [7,48] covered studies that, due to the methods used, couldn’t be compared to the current study. Buckle et al. [5,6] calculated the prevalence of regular pain (i.e. pain occurring more than once a week) by body region; their results (the sample consists exclusively of female employees, namely female workers in a supermarket chain and a department store chain) showed that 65% of the employees reported having regular pain in at least one body region. Ohlsson et al. [47] reported a pain prevalence rate (muscle discomfort or ache over a period of 7 days) of 57%. (In this case, the sample consisted exclusively of women from 4 different industries, including a small group of female supermarket workers, and excluding cashiers). During a survey on discomfort, Porter et al. [50] calculated a prevalence of musculoskeletal discomfort due to work (up to 3 episodes in the working day) of more than 50%. (The sample consisted of all the employees in a supermarket). Finally, a survey of all employees, including managers and cashiers, in a sample of 7 supermarkets [58], revealed that almost one-third of the workers reported having regular symptoms (i.e. work-related symptoms occurring at least once a week for a period of at least 2 months). It is difficult to compare our results directly to any of these studies, since different criteria were used to define MSIs, and since the study population differed in some cases. However, it seems that our results do not contradict what these other researchers have reported.

4.1.2. Cashiers are far from being the only supermarket workers with MSDs

It seems that cashiers are not the only workers to suffer from MSDs in the supermarket setting. Our study revealed that, with respect to compensable injuries, the majority of MSIs (i.e. 67%, or 94 out of 140) affected employees other than cashiers. Among the MSIs compensated in supermarkets in Quebec between 1998 and 2000, only 16% of the back injuries and 24% of the MSDs occurring in lower and upper limbs involved cashiers [16,68].

4.1.3. Which supermarket department seems to be at the highest risk in terms of MSDs?

It was decided that job categories (e.g. grocery clerk, pastry clerk, fruits and vegetables clerk, or often just “clerk” in this company’s database) were not useful for the purposes of this study, since these categories did not describe any particular sets of tasks that were consistent from one supermarket to the next. However, department categories were useful, since each department had a specific set of tasks to be accomplished, and these remained constant from one supermarket to another.

The results obtained were different depending on the basis of the calculations. Employees from the grocery and service departments (wrappers only, since cashiers were excluded) reported more MSPs in the 12-month period preceding the study when using absolute numbers of MSPs (Table 6). When the number of hours worked was considered in the calculations (FTE), wrappers still headed the list. However, the bakery department was the second most affected by MSPs, not the grocery department (Table 6), and all other departments seemed to have relatively similar rates of problems. Finally, when using the rate of more severe problems, as defined as normal activities being affected, three departments topped the list: The service department (wrappers) was still first, with the grocery and bakery departments following closely. Interestingly, when the MSI rate per 1000 FTE was examined, the delicatessen and grocery departments topped the list.

In terms of where to intervene first, one source (the self-questionnaires) would indicate that wrappers should be given priority, while the other source (compensation statistics) would indicate that the delicatessen department should be the priority. These findings could not be compared with other research, since, for the few articles in which information on jobs other than cashiers is available, the rates are examined in relation to very broad categories of employment, and these categories include workers with extremely varied tasks [9,14].

Within each department, the lower back was the most prevalent MSP. With the exception of the lower back, however, there is no observable pattern from one department to the next, in terms of the body regions mentioned in reported MSPs. Each department’s pattern made sense when work analyses were conducted. Again, there is nothing available in the literature as a comparison base for these results.
4.2. What have we learned about musculoskeletal disorders in general?

4.2.1. Credibility of self-reported musculoskeletal disorders

Self-reported problems have often been discredited as being “imagined” problems or even written off as “malingering”. The findings of this study lend credibility to data collected with the self-administered Nordic Questionnaire. First, it is important to remember that this questionnaire includes more than one question per body region, and that the coherence of responses for any given body region can be checked from one question to another. The answers of employees who were inconsistent with regard to any particular body region were excluded from this analysis. Second, the results were similar for each of the 4 supermarkets, indicating that the questionnaire truly measured what it set out to measure. Indeed, there was consistency among departments in terms of problematic body regions, and among the 4 supermarkets, which were geographically distant from one another and whose respective employees did not communicate with one another. Third, adding to the credibility, the patterns of self-reported musculoskeletal problems in each department were consistent with analyses of the types of tasks performed in these departments [3,24].

These results add to other studies which examine the validity of the Nordic Questionnaire. For example, a recent study compared four MSD case definitions, among which two were based on different questions in the Nordic questionnaire [2]. Using the data point “musculoskeletal problem which prevented the performance of usual activities at work and at home”, it was found that this case definition is more rigorous than other definitions, and when applied to the same population of workers, it targets more cases with incapacities.

4.2.2. Compensation data greatly underestimates the importance of musculoskeletal disorders

The prevalence rates for MSDs obtained from the 2 sources (compensable injuries and self-reported problems) are not comparable, since the MSP rate was much higher than the MSI rate. Even when considering the more severe MSPs, namely those that limit the worker’s usual activities, the difference remained significant. The underestimation of MSDs based on injuries is a well-known phenomenon; what is surprising here is the extent of this difference between our 2 sources of data, and particularly what it means in terms of prevention. Although it is clear that a problem is not a compensable injury, surely those problems which hinder the employee’s activities (at home or at work) are important enough. At the very least these should be considered by anyone (company, medical team or researcher) wishing to focus on prevention.

An underestimate means that we have less to work with, statistics wise, and most importantly, that we may not have the full picture. The latter is borne out in our other results. It could be argued that this underestimate in the compensable injuries is an artefact of comparing with a source which excludes cashiers (in the case of self-reported problems). If such was the case, this underestimate should only be noticed in the service department (where the cashiers are); however, data from all other departments also reveals that focusing on injuries leads to an underestimation of the size of the problem (Table 6). It could also be that the difference between the two sources is due to the fact that the 12-month period started a bit earlier for one source than for the other, although they do overlap; however this is very unlikely to explain such great differences.

It is well documented in the scientific literature that a reported occupational injury is a recognized or compensable injury under the law or regulations of the country, province or state involved. The underestimation of the number of injuries may therefore be directly related to a mechanism by which we count only those injuries which have been recognized as occupational injuries. Even within “acceptable” injuries, other mechanisms can also lead to an underestimation: acceptance criteria being interpreted in relation to compensable types of injuries, jurisprudence, and the knowledge used in determining the relationship with the work [1,21]. This underestimation is more likely to be significant in the case of MSDs than in other OHS compensable problems, insofar as the injury data do not allow reliable discrimination of MSDs of chronic origin among the MSDs [64,71].

Finally, even considering recognized and compensable occupational injuries, the actual number of occupational injuries may be underestimated due to an underreporting of cases. Chronic MSDs could be considered more difficult to “recognize” by workers and health professionals alike, and when they are reported, they are also more severe. This phenomenon is documented in the scientific literature, and information has recently become available on the importance of this underreporting, mainly in the case of MSDs or WMSDs. Studies, although they use varied definitions of MSDs and very different methods, all converge towards the same observation: A large number of allowable or ac-
ceptable MSDs are not reported by workers, and are therefore not counted among the injuries. Indeed, Biddle et al. [4] estimated that out of all the workers for whom a recognized or suspected occupational injury was reported, only between 9% and 45% claimed income replacement indemnity. Morse et al. [44], who were interested specifically in upper limb WMSDs, reported a ratio of unreported cases versus reported cases of 11 to 1.

4.2.3. Compensation data provides a different portrait of MSDs

Not only is there an underestimation but it also seems that MSDs reported in MSIs are not the same as those reported in MSPs, despite the treatment that was done on the MSI data to make them comparable. Except for lower back MSDs, which emerged as the most common in both sources, the most prevalent body regions affected by MSDs were often in inverse order. Also of importance is the great divergence observed regarding lower limb MSDs, namely those involving the knees, which represent only 3% of the MSIs, while they correspond to 25% of the MSPs. Lusted et al. [40] obtained equally divergent results with the same 2 sources in their study on nurses. They noted that even though neck and upper limb MSDs are just as common but more incapacitating at work than lower back MSPs, they do not emerge in such a significant way in MSIs.

4.2.4. Full-time worker equivalent rates

The picture of MSDs that was obtained differed depending on the method used for qualifying the “at-risk” population. The results of this study confirm that FTE is essential for calculating MSD rates when conducting studies in workplaces with a sizeable percentage of part-time employees—therefore certainly in this industry, and probably in most retail industries. To remind the reader of only some of the findings here, absolute numbers provided a very different portrait of which supermarket departments were more at risk, and using the number of workers provided an overall rate of 36 MSIs per 1000 employees, compared with using FTE, which provided a rate of 61 MSIs per 1000 FTE (a 40% underestimation). With MSPs, an important underestimate also emerged when the “at-risk” population was the number of workers versus FTE.

How many part-time workers constitute a “sizeable” proportion? The answer of course depends on how many hours each worker contributes, compared to the number of hours put in by a “full-time” worker (the dilution factor). Thus the risk of one MSD in a population of 100 workers, each of whom works 40 hours, is equivalent to one MSD in a population of 175 workers where 75 workers put in a 40-hour week and 100 put in a 10-hour week (57% part-time employees). It is also equivalent to one MSD in a population of 120 workers where 75 workers put in a 40-hour week, 25 work a 20-hour week, and 20 work a 25-hour week (thus 38% are part-time). As can be seen, if the number of workers is the denominator used in calculating the rate, it would appear that the rate of one MSD per 175 workers depicts a workplace with a much lower risk than the other two workplaces (one in 100 and one in 120). Yet the risk of experiencing an MSD is the same for all of these workplaces; the number of hours that employees work, and are thus exposed to work risk factors, remains constant.

Other studies have also discussed the importance of using the correct denominator [71,72]. In a growing trend, some analyses of compensation statistics do tend to use FTE in their rate calculations [63,64,66], but this trend has yet to trickle through to most studies conducted in the workplace, particularly in the grocery industry.

4.2.5. Musculoskeletal problems reported by workers were not the result of traumatic injuries

It is known that musculoskeletal injury claims are more often rejected when the claim states a “gradual onset of injury” (as opposed to a “sudden onset”) [71]. Indeed, it is sometimes thought that claims are purposefully categorised as “sudden onset”, in order to facilitate the process and ensure a better chance of approval. Indirectly, Silverstein [64] discussed CTS misclassification between sudden and gradual onset. In our study, for musculoskeletal problems of 5 body regions (lower back, neck, shoulders, wrists/hands, elbows), the Nordic Questionnaire included a supplementary section. Workers were asked if they thought their problem was related to an accident. The majority of workers did not think so. (Depending on the body region, between 71 and 85% of workers with a problem responded in this way.) This finding adds to the body of information which supports the idea that these disorders tend to be of a chronic nature.

4.2.6. For prevention of musculoskeletal disorders, should prevalence or disability be used as the guiding light?

Given the various data available on MSDs, or in some cases, the lack of data available, it is difficult to determine the most appropriate source to use in order to fa-
5. Conclusion

Our study shows that MSDs are more common in supermarket employees other than cashiers, and that they are specific to the work carried out; the most prevalent MSDs differ according to department.

Comparison of the MSD data originating from the 2 sources for these employees reveals a significant underestimation of MSDs using compensable occupational injuries as the data, despite the use of company recorded data, which were of good quality, and despite the care taken in processing them. The types of MSDs and the body regions in which they were most prevalent also differed, depending on the source that was used.

In the context of any study whose objective is the prevention of MSDs in the workplace, and given both the extent to which MSDs are underestimated when based on occupational injury statistics and the discrepancies in the information that emerges from the two different data sources used in this study, it seems preferable to use the Nordic Questionnaire or a similar questionnaire/instrument to document MSDs. Furthermore, this type of questionnaire allows various case definitions to be targeted according to the prevention objectives being pursued.

Finally, MSDs were viewed using various numbers and various methods for calculating rates. Our experience in supermarkets, which are often places of part-time employment, supports the use of total hours worked (FTE), rather than number of workers, as the denominator in calculating the rates of MSDs. Thus, compared with musculoskeletal injuries, a musculoskeletal problem rate - calculated using the total number of hours worked – would appear to provide a clearer view of the musculoskeletal health of workers.

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