HOSPITAL CONTACTS DUE TO INJURIES AMONG MALE DRIVERS WORKING FOR ROAD GOODS-TRANSPORT CONTRACTORS IN DENMARK

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Abstract
Objectives: To establish a detailed picture of injury pattern among professional goods-transport drivers in Denmark.
Methods: For each calendar year over the period of 1995–2003, the age-standardized hospital contact ratios (SHRs) for injury were calculated for male drivers working for road goods-transport contractors in Denmark. The reference population was the male skilled/semiskilled subpopulation of the general workforce in Denmark. Results: No differences in the rate of injury-related hospital contact could be found between male goods-transport drivers and the reference population between 1995 and 1999. However, in the following period of 2000–2003, elevated rates of injury-related hospital contact were noted among goods-transport drivers, compared with the reference population. Furthermore, the injury-related SHR of goods-transport drivers showed a significant increase throughout the period of 1995–2003. Injuries to ankles/feet/toes were prominent among goods-transport drivers. Compared with the reference population, male goods-transport drivers had elevated rates of superficial injuries, dislocations/sprains/strains, fractures, and concussion. The superficial injuries were sustained most frequently in the ankles/feet/toes, open wounds in head/neck, dislocations/sprains/strains in ankles/feet/toes, and fractures in wrists/hands/fingers and ankles/feet/toes. Conclusion: There is a clear need for efforts to prevent work injuries among goods-transport drivers. Special attention should be paid to preventing fractures in wrists/hands/fingers and ankles/feet/toes, dislocations/sprains/strains in ankles/feet/toes, open wounds in head/neck, and concussion.

Key words:
Professional drivers, Road transport contractors, Hospital contacts, Work injury

INTRODUCTION
Considerable attention has been paid to fatigue among goods-transport drivers as a risk factor for traffic accidents [1–9], yet little consideration has been given to their work injuries. An earlier study [10] showed that in the period of 1991–1993, male professional goods-transport drivers had an elevated rate of injury-related hospital contact, compared with the male workforce in general. Goods-transport drivers stood in sharp contrast to passenger-transport drivers for whom the rate of injury-related hospital contact did not differ from that for the male workforce in general. A recent study [11] also revealed that the job group ‘plant and machinery operators and assemblers’, including goods-transport drivers, was characterized by a particularly high risk of disability retirement related to injury. In this group, not only the rate of injury, but also the risk of injury leading to retirement was higher, compared with the general workforce. There is, therefore, a clear need for efforts to prevent work injuries among goods-transport drivers in Denmark. To this end, it is essential to establish a detailed picture of the injury pattern in this population. Accordingly, in
the present study, we have analyzed the Danish Occupational Hospitalization Register (OHR) by describing the distribution of various injury types over various body parts among goods-transport drivers, and comparing the rates of hospital contact for various injury categories in this population with those in the male skilled/semiskilled workforce and the general male workforce in Denmark.

MATERIAL AND METHOD

Databases

The present study employed information from the Danish Occupational Hospitalization Register (OHR), a database obtained through a record linkage between three national registers: the central person register (CPR), the employment classification module (ECM), and the national hospital register (HR). Currently, OHR includes every person who has been economically active and an inhabitant of Denmark at some point after 1980. CPR contains information on gender, dates of birth, death, and migration for every person who has been an inhabitant of Denmark at some point between 1968 and the present day. ECM contains data regarding the employment status, occupation, and branch of industry of each person for each year since 1975 [12]. The occupational code is a national version of the international standard classification of occupations (ISCO), 1988 version [13]. The industries are coded according to DB93, the Danish Industrial Classification of All Economic Activities 1993, which is a national version of the European Industrial Classification of All Economic Activities [14]. HR has existed since 1977 and contains data from all the public hospitals in Denmark. Since 1994, each record in HR includes diagnosis coded according to the international classification of diseases, version 10 (ICD-10). For the period of 1977–1994, HR included only the data for the inpatients, but from 1995 it has also covered outpatients and emergency ward visits [12]. (It should be noted that all the emergency wards in Denmark are run by the public hospitals). As HR does not contain information as to the cause of the injury, it is not possible to distinguish between the work injuries and other injuries. One may, however, assume that the differences in the injury rate between the different job groups will be associated with the differences in occupational risk between the groups.

Study Population and Reference Populations

The study concerned the period of 1995–2003. For each calendar year, the study population comprised those male drivers (ISCO-88 = 832) who were aged 20–59 years and working for road goods-transport contractors in Denmark at the beginning of the year considered. (We have focused on male drivers when analyzing the major occupational risk factors for goods-transport drivers, as they constitute the vast majority, over 97%). Table 1 shows annual data on the number and mean age of the study population, as well as the number of injury-related hospital contacts (the registered number and the number per 10,000 workers). The size of the study population was stable from 1995 to 2000, but started to decrease from 2001. However, no apparent systematic changes either in the demographic statistics or the number of injury-related hospital contacts per 10,000 workers could be found during this period.

We employed the following two populations as the reference populations: (a) the male workforce in general in Denmark and (b) the male skilled/semiskilled subpopulation of the general workforce in Denmark. (The study population is a subpopulation of each of the reference populations).

Table 1. The study population: male drivers working for road goods-transport contractors in Denmark in 1995–2003

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
<th>Age</th>
<th>Number of injury-related hospital contacts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean</td>
<td>SD</td>
<td>registered number</td>
</tr>
<tr>
<td>1995</td>
<td>15,165</td>
<td>40.9</td>
<td>9.31</td>
</tr>
<tr>
<td>1996</td>
<td>14,913</td>
<td>41.2</td>
<td>9.39</td>
</tr>
<tr>
<td>1997</td>
<td>15,360</td>
<td>41.3</td>
<td>9.51</td>
</tr>
<tr>
<td>1998</td>
<td>15,496</td>
<td>41.4</td>
<td>9.53</td>
</tr>
<tr>
<td>1999</td>
<td>15,117</td>
<td>41.9</td>
<td>9.53</td>
</tr>
<tr>
<td>2000</td>
<td>15,339</td>
<td>42.1</td>
<td>9.64</td>
</tr>
<tr>
<td>2001</td>
<td>11,269</td>
<td>40.7</td>
<td>10.07</td>
</tr>
<tr>
<td>2002</td>
<td>10,618</td>
<td>40.9</td>
<td>10.21</td>
</tr>
<tr>
<td>2003</td>
<td>9,190</td>
<td>41.4</td>
<td>10.27</td>
</tr>
</tbody>
</table>
Statistical Analyses
For each calendar year over the period of 1995–2003, each member of the study and reference population was followed up for his first hospital contact registered under "injuries and other external causes" (ICD-10 = S00-T98) as the principal diagnosis. The injuries were categorized by the type of injury and the body part injured (see Table 2). We calculated the age-standardized hospital contact ratio (SHR) for the study population with each of the two reference populations. SHR represents the ratio of the hospital contact rate in the study population to that in the reference population. For each injury category, the expected number of hospital contacts was calculated for the study population, under the null hypothesis that the rate of hospital contacts in the study population did not differ from that in the reference population. The calculation of the expected number of hospital contacts was based on the rate determined for the age-matched subpopulation of the reference population in each calendar year of the study period. It should be noted that in the analysis, the members of the study and reference population were removed from respective groups for the rest of the year since the date of the first injury-related hospital contact, death, or emigration. Therefore, when calculating the person-years for each population, the dates of hospitalizations, death, and emigration of each member were taken into account. SHR was obtained by dividing the registered number of hospital contacts by the expected number and then multiplying this ratio by 100. We also calculated the large sample 95% confidence intervals (95% CIs) with the estimated standard errors. When the lower boundary of 95% CI is greater than 100, it is a common practice to conclude that the study population has an elevated rate compared with the reference population. Further, we calculated the mean annual rates of change in SHR for injury, employing either of the two reference populations. As the number of hospital contacts in a population is very small compared with the person-years of the population considered, an appropriate way to model the time trends for SHR is by a log linear Poisson regression, with the expected number of contacts as an offset. We estimated the parameters by using the “Proc Genmod” program developed by the SAS Institute.

RESULTS
All Injuries
Figure 1 (a) presents annual SHRs for injury (any type of injury in any body part) and the 95% CIs for male goods-transport drivers as the study population, during the period of 1995–2003, with the male workforce in general as the reference population. As can be seen in Figure 1 (a), in each year of the study period, the lower boundary of 95% CI of SHR for injury was higher than 100. This

Table 2. Categorization of injuries by injury type and body part

<table>
<thead>
<tr>
<th>Body part</th>
<th>ICD-10 code for body part</th>
<th>superficial injuries</th>
<th>open wounds</th>
<th>fractures</th>
<th>dislocations sprains strains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head / neck</td>
<td>S00-S19, S00, S10</td>
<td>S01, S11, S02, S12</td>
<td>S03, S13, S16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thorax</td>
<td>S20-S29, S20</td>
<td>S21, S22</td>
<td>S23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdomen / lower back / lumbar spine / pelvis</td>
<td>S30-S39, S30</td>
<td>S31, S32</td>
<td>S33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shoulders / arms</td>
<td>S40-S59, S40, S50</td>
<td>S41, S51, S42, S52</td>
<td>S43, S46, S53, S56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wrists / hands / fingers</td>
<td>S60-S69, S60</td>
<td>S61, S62</td>
<td>S63, S66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hip / legs</td>
<td>S70-S89, S70, S80</td>
<td>S71, S81, S72, S82</td>
<td>S73, S76, S83, S86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ankles / feet / toes</td>
<td>S90-S99, S90</td>
<td>S91, S92</td>
<td>S93, S96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>T00-T98, T00, T15, T16, T18, T19</td>
<td>T01, T02, T10, T12</td>
<td>T06.4, T09.5, T11.2, T11.5, T13.2, T13.5, T14.3, T14.6, T14.7, T14.8, T14.9, T14.10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

...
This trend was also highly significant (p < 0.0001). With regard to the rate of SHR increase, no significant interactions could be found with respect to either injury type or body part (P > 0.05).

These results indicate that the higher level of physical workload among male goods-transport drivers alone may not be the cause of their elevated rate of injury-related hospital contact, when this population is compared with the male workforce in general. It is also suggested that there is something particular about male goods-transport drivers that has been causing the increase in SHR for injury, not only when the male workforce in general but also the male skilled/semiskilled workforce was employed as the reference population.

We have conducted analyses of the SHR of male goods-transport drivers for injuries to various body parts and for various injury types, by using aggregated data for the period of 1995–2003, with each of the two reference populations: (a) the male workforce in general and (b) the male skilled/semiskilled workforce. The findings were similar for the two sets of analyses. For the sake of simplicity, we present only the results of analyses with the male skilled/semiskilled workforce as the reference population.

**Injuries to Various Body Parts**

Figure 2 shows aggregated data on the actual number of injury-related hospital contacts among male goods-transport drivers, for injuries to various body parts over the study period of 1995–2003. It also shows the expected number of injury-related hospital contacts in this study population, under the null hypothesis that the rates of injury-related hospital contact in the study population did not differ from those in the reference population of male skilled/semiskilled workforce. As can be seen in Figure 2, the difference between the actual and expected number of injury-related hospital contacts in the study population was greatest with respect to the injuries to ankles/feet/toes (SHR = 134; 95% CI: 129–139). If the rate of injury to these body parts in the study population had been as low as in the reference population, the total number of injuries would have been 4.6% smaller than actually registered.
In this study population, the rate of open wounds in these body parts in the study population had been as low as that in the reference population, the total number of cases of open wounds in the study population would have been 4.8% smaller than actually registered, which means that the total number of injuries in the study population would have been 1.1% smaller than actually registered.

Dislocations, sprains, and strains
Dislocations/sprains/strains accounted for 21.8% of all injuries among male goods-transport drivers. This study population had an elevated rate of hospital contact due to this injury type, compared with the reference population of the male skilled/semiskilled workforce (SHR = 105; 95% CI: 101–108). If the rate of this type of injury in the study population had been as low as that in the reference population, the total number of injuries in the study population would have been 1.0% smaller than actually registered.

In the study population, dislocations/sprains/strains were sustained most frequently (42%) in ankles/feet/toes, accounting for 50.7% of all injury cases within these body parts. Further, the study population had an elevated rate of hospital contact for dislocations/sprains/strains in these body parts, compared with the reference population (SHR = 128; 95% CI: 122–135). If the rate of this injury type in these body parts in the study population had been as low as that in the reference population, the total number of dislocations/sprains/strains in the study population would have been 9.3% smaller than actually registered, which means that the total number of injuries in the study population would have been 2.0% smaller than actually registered.
Fractures
Fractures, which are considered to be serious injuries, accounted for 13.1% of all registered injury cases among male goods-transport drivers. This study population had an elevated rate of hospital contact for fractures, compared with the reference population of the male skilled/semiskilled workforce (SHR = 121; 95% CI: 116–127). If the rate of fractures in the study population had been as low as that in the reference population, the total number of injuries in the study population would have been 1.9% smaller than actually registered. In the study population, the fractures were most frequently (32.2%) sustained in wrists/hands/fingers, accounting for 17.7% of all registered cases of injury within these body parts. Further, the study population had an elevated rate of hospital contact for fracture in these body parts, compared with that in the reference population (SHR = 111; 95% CI: 103–120). If the rate of fractures in these body parts in the study population had been as low as that in the reference population, the total number of fractures in the study population would have been 3.2% smaller than actually registered, which means that the total number of injuries in the study population would have been 0.4% smaller than actually registered. Fractures were also frequently (20.6%) sustained in ankles/feet/toes in the study population, accounting for 14.9% of all registered cases of injury within these body parts. The study population had an elevated rate of hospital contacts due to fracture in these body parts, compared with the reference population (SHR = 143; 95% CI: 130–158). If the rate of fractures in these body parts in the study population had been as low as that in the reference population, the total number of fractures in the study population would have been 6.2% smaller than actually registered, which means that the total number of injuries in the study population would have been 0.8% smaller than actually registered.

Concussion
Concussion (ICD-10 = S06.0), which in the present analysis is included in the category ‘other injuries’ (see Table 2), accounted for 1.4% of all the cases of injury and 8.5% of all cases of injury in the head/neck area among male goods-transport drivers. This study population had an elevated rate of hospital contact for concussion compared with the reference population of male skilled/semiskilled workforce (SHR = 121; 95% CI: 106–139). If the rate of concussion in the study population had been as low as that in the reference population, the total number of injuries within the head/neck area in the study population would have been 1.5% smaller than actually registered, which means that the total number of injuries in the study population would have been 0.2% smaller than actually registered.

DISCUSSION
As evidenced by the results of our analyses, the rate of injury-related hospital contact among male goods-transport drivers in Denmark (the study population) did not differ from that among the male skilled/semiskilled workforce in Denmark (the reference population) over the period of 1995–1999. However, starting from 2000 through 2003, the study population had elevated rates of injury-related hospital contact, compared with the reference population. Further, the SHR, which represents the ratio of the hospital contact rate in the study population to that in the reference population, was increasing throughout the period of 1995–2003. The injuries to ankles/feet/toes were prominent in the study population, compared with the reference population. The study population had elevated rates of superficial injuries, dislocations/sprains/strains, fractures, and concussion, compared with the reference population. Superficial injuries were prominent in ankles/feet/toes, open wounds in head/neck, dislocations/sprains/strains in ankles/feet/toes, and fractures in wrists/hands/fingers and ankles/feet/toes. The rates of these injuries in the study population were elevated compared with those in the reference population.

As the Danish Occupational Hospitalization Register (OHR), which was analyzed in the present study, does not contain information as to the cause of the injury, it was not possible to elucidate what events could have caused these injuries among male goods-transport drivers. To establish the events leading to work injuries in this population, we analyzed in a parallel study [15] the Danish National Work Accident Register (WAR), a national register of events...
resulting in work injuries. The analysis showed that traffic accidents accounted for only 7.4% of the registered work injuries. Although the job title ‘driver’ is strongly associated with driving vehicles on the roads, the tasks of goods-transport drivers do not necessarily consist only in driving. The goods to be transported on the vehicle, which can amount to many tons, have to be collected, loaded, unloaded, and delivered. In many cases, it is the drivers who have to carry out these tasks. A variety of health hazards and risk factors pertain to these activities: descending from/ascending to an elevated area (e.g. the truck’s cabin, the truck’s back hatch lift, and platform); handling heavy goods; and moving in an elevated area, on an uneven surface, in an environment with poor housekeeping, or in an area with heavy moving objects (e.g. forklifts and other pallet carriers, and manual internal transport wagons). It was further shown that an event type “fall from height” accounted for 22.3% of the registered injuries, “overexertion” 14.2%, “caught between/under objects” 12.6%, “collision with objects” 12.0%, “slip/trip” 10.6%, and “struck by falling object” 9.0%. As for the fractures, 35.3% resulted from a “fall from height”, 20.0% from being “caught between/under objects”, 12.7% from being “struck by falling objects,” and 10.9% from “collision with objects”. As for the dislocations/sprains/strains, 29.3% were due to the event type “overexertion”, 21.1% “slip/trip”, and 19.6% “fall from height”.

There were some discrepancies between OHR and WAR in the rate of injuries by injury type. Although the present analysis showed that in OHR, the dislocations/sprains/strains accounted for only 21.8% of injuries among male goods-transport drivers, these types of injury were the most frequent (41.4%) work injuries in this job category according to WAR. This discrepancy is probably due to the fact that it is not required to have a hospital registration in order to register events to WAR. In some cases, the injured worker might seek medical attention at his family doctor, who might find it unnecessary to refer the patient further to a hospital. In other cases, the injured worker might judge himself that no medical examination is needed and that the recovery is a matter of time, and thus might choose to stay home. One may assume that in many cases of work-related dislocations/sprains/strains, the injured workers do not receive medical attention at hospitals. It should be stressed, therefore, that the prevalence of a certain type of injury can be underestimated in an analysis of the pattern of work injuries, if the analysis is based solely on OHR.

Specific investigations are necessary to elucidate why the age-standardized hospital contact ratio (SHR) for injury of male goods-transport drivers was increasing significantly throughout the period of 1995–2003, when each of the two reference populations was employed in our analyses: the male workforce in general and the male skilled/semiskilled workforce. Some possible explanations can be pointed out. It has been shown that around 60% of companies in the goods-transport branch in Denmark were either inactive or only passively engaged in efforts to prevent work injuries. This finding stands in sharp contrast with the observations in other industries, e.g. food production, in which only 25% of companies are passive or inactive with respect to such preventive activities [16]. The workers in industries with a lower level of engagement in the prevention of work injuries had higher rates of work injury [16]. Further, even if the road goods-transport contractors were actively involved in efforts to prevent work injuries among their drivers, there are some intrinsic factors that make this task particularly difficult. Unlike factory workers, the goods-transport drivers for the most part work alone and away from the company employing them. Thus, the employer has limited possibilities to exert control over the drivers’ job during collecting/loading/unloading/delivering goods and over the environment in which these activities are performed. Under these circumstances, it is difficult for road goods-transport contractors to improve the drivers’ safety, either through reinforcing occupational safety procedures or via improvements in the physical work environment, which is often under control of their customers. It is, therefore, suggested that the lack of engagement in preventing work injury on the part of the employers, allied with the intrinsic difficulties pertaining to the prevention of work injury in goods-transport branch, have resulted in the situation where the branch lags increasingly behind the other branches. This condition may have contributed...
to the observed increase in SHR for injury of the male-goods transport drivers, with either of the reference populations.

While rigorous attention has been paid to regulations on driving hours for goods-transport drivers to limit their fatigue and thus prevent traffic accidents, little consideration has been given to the prevention of work injuries in this population. The results of the present study indicate that there is a clear need for efforts in this respect. For these efforts to be successful, it is necessary to involve not only the road goods-transport contractors, but also their customers who are responsible for the physical environment in which the drivers collect/load/unload/deliver the goods.

REFERENCES