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Risk factors associated with self-reported musculoskeletal pain among short and long distance industrial gas delivery truck drivers

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ABSTRACT

Aim: This study investigated and compared the associations between self-reported exposures to individual as well as work-related physical and psychosocial risk factors for musculoskeletal (MS) disorders and the prevalence of MS symptoms in different body areas among short- (P&D) and long-distance (Bulk delivery) truck drivers working for the same large gas delivery company in Canada.
Methods: 123 truck drivers nationwide participated in this questionnaire-based cross-sectional study. Univariate and multivariate logistic regression analyses were performed.
Results: 43.1% of drivers reported MS pain in at least one body area over the past 12 months and 26.8% over the past 7 days. Bulk drivers had a significantly higher prevalence of MS pain than P&D drivers for both periods. When P&D and Bulk drivers were pooled together, belonging to the Bulk subgroup emerged as the strongest factor for low back pain (OR = 8.45, p = 0.002), for shoulder pain (OR = 3.70, p = 0.027) and for MS pain in any body area (OR = 4.05, p = 0.006). In Bulk drivers "High effort-reward imbalance" was strongly associated with MS pain in any body area (OR = 6.47, p = 0.01), with shoulder pain (OR = 4.95, p = 0.016), and with low back pain (OR = 4.51, p = 0.02). In P&D drivers MS pain in any body area was strongly associated with "Working with hands above shoulders" (OR = 6.58, p = 0.009) and "Whole-body vibration" (OR = 5.48, p = 0.018), while shoulder pain was strongly associated with "Hand-arm vibration" (OR = 7.27, p = 0.041).
Conclusions: Prevalence of MS pain was higher among industrial gas delivery truck drivers than in the general Quebec male worker population, and higher for Bulk drivers compared to P&D drivers. MS pain in Bulk drivers was mainly associated with psychosocial risk factors and lifestyle; MS pain in P&D drivers was mainly associated with physical risk factors.

1. Introduction

The US private industry as a whole experienced a decline in non-fatal injury incidence rate over the years, with a rate of 2.9 non-fatal injuries per 100 full-time workers in 2016. In comparison with the US trucking industry, non-fatal injury incidence rate remained fairly constant over the years and well above the national figure, showing a rate of 4.3 in 2016 (BLS, 2017). Figures were similar in Canada with a disabling injury incidence rate for the inter-provincial road transportation sector under federal jurisdiction of 3.77 fatal or non-fatal injuries per 100 full-time workers in 2015, compared with the national rate of 1.85 (Government of Canada, 2017). The Canadian transportation and storage industry ranked 5th among all industries for the highest number of accepted time-loss occupational injury or disease, which amounted to 15,527 lost time claims in 2016, or some 7% of all lost time claims across the nation, and costed an estimated 400 million$ (CAD) in benefit compensation payments (AWCBC, 2018). Several studies have shown a majority of work-related injuries in trucking industries to be associated with non-traffic-related incidents (Lin and Cohen, 1997; Shibuya et al., 2010; Smith and Williams, 2014; Spielholz et al., 2008). Work tasks performed by truck drivers are highly diverse in nature (e.g., driving, loading/unloading the truck, getting into, on, off or out of the vehicle, working from heights on trailers, performing inspections), and their repetition increases the risk of injury. Depending on the type of trucking industry, some of these tasks can be fairly complex (e.g., hazardous material goods). Lin and Cohen (1997) analysed data from worker injury/illness reporting systems implemented for the US motor trucking industry and showed that “slips and falls” followed by “struck by” and “overexertion” were the most commonly reported accident types. A Washington State survey of trucking companies reported that

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musculoskeletal disorders (MSDs) and injuries resulting from slip/trip or falls among truck drivers were ranked as the top two types of injuries by both employers and drivers (Spielholz et al., 2008). In a recent Washington State study, Smith and Williams (2014) found that work-related MSDs (WMSD) were the most common injuries among truck drivers from different sectors.

WMSDs are disorders of the tendons, muscles, joints, nerves and circulatory system that develop over time through overuse and are caused or aggravated by work or by the work environment (Nunes and Bush, 2012). They are associated with discomfort, pain, and loss of functional capacity of the affected area, and their occurrence results from a complex interaction between physical, mental, biomechanical and physiological workloads, behavior, and cognitive aspects (Bongers et al., 2002; NRC/IM, 2001). Epidemiological studies generally define three groups of WMSD risk factors: 1) Physical risk factors that include repetitive work, awkward postures, static postures, physical workload, manual materials handling, and exposure to whole-body vibration; 2) Psychosocial risk factors that relate to the organizational aspects of work such as low decisional latitude and high psychological demands; 3) Individual risk factors pertaining to worker sociodemographic profile (e.g., age, gender) or lifestyle (e.g., obesity, level of physical activity) known to have an incidence on MS pain (NIOSH, 1997; NRC/IM, 2001).

Table 1 summarizes the results of studies on self-reported MS outcomes among varied samples of truck drivers and other professional drivers. In terms of MS pain, truck drivers tended to report higher prevalence than other groups such as office workers (78.6% *vs* 55.5%; Mozafari et al., 2015). Low back pain (LBP) was the most frequent type of MS pain reported by truck drivers with prevalence ranging from 45% to 79% over the previous 12-month period, with long-haul drivers showing higher prevalence than short-haul drivers (Chih-Long Lin and Chen, 2010; Goon et al., 2010; Okunribido et al., 2006) and other professional drivers of vans or cars (Kresal et al., 2017). MS pain among truck drivers was also reported to other body areas, with prevalence ranging from 24% to 35% for pain in the knees, 26%–33% for pain in the shoulders, and 34% for the neck (Robb and Mansfield, 2007; Van der Beek et al., 1993). Prevalence of MS pain was shown to increase significantly with age (Van der Beek et al., 1993; Goon et al., 2010). Prevalence of LBP has been associated with a number of work-related risk factors such as irregular work schedule, insufficient rest, and long driving hours in long-haul (inter-city) truck drivers (Andrusaitis et al., 2006; Miyamoto et al., 2000), manual materials handling (MMH) (Awang Lukman et al., 2017; Bovenzi et al., 2006; Okunribido et al., 2008), degraded driver seat quality (Bhaumik and Anjenaya, 2017; Robb and Mansfield, 2007), exposure to whole body vibration (WBV) (Kim et al., 2016; Tiemessen et al., 2008), and WBV combined with awkward postures (Hoy et al., 2005; Raffler et al., 2017). Besides driving distance, short- and long-haul truck drivers have very different work profiles (Hanowski et al., 2000; Olson et al., 2009). Short-haul truck drivers make multiple pickups and deliveries per shift involving frequent manual load handling, load and unload the truck, and coordinate tasks with customers. In contrast, long-haul truck drivers work profile is characterized mainly by driving longer distances in a specific region or cross-country, making fewer deliveries, and having more of irregular shifts. Such different exposures to work-related risk factors likely explain the different MS pain prevalence between these groups.

Interestingly, while most studies show significant associations between MS pain among professional truck drivers and individual as well as work-related physical risk factors, association with psychosocial factors is less clear. These factors are usually assessed through the Effort-reward imbalance (ERI) model from Siegrist (1996) and the Demand-Control-Support Model (DCS) from Karasek and Theorell (1990). The ERI model states that a mismatch between high efforts and low rewards leads to adverse stress-related health problems, while the DCM model states that a combination of high psychological demands and low decision latitude yields job strain situations that increase the risk for developing diseases. Social support is a third dimension of the DCS model buffering the negative effect of job strain situations. High ERI has been associated with a higher probability of reporting MS symptoms in bus and subway drivers (Peter et al., 1998). This result was corroborated in a 7.5-year prospective study of San Francisco transit operators, where a high ERI ratio and job strain situations increased the likelihood of neck injuries (Rugulies and Krause, 2008). Recent studies specific to the trucking industries also showed that low decision latitude, low social support and job dissatisfaction to be significant predictors of neck pain (Bovenzi, 2015), and of hand, wrist and upper limb disorders when combined with high physical exposure (Devereux et al., 2002). Goon et al. (2010) found a weak association between low back pain and psychological stress in long-haul drivers. A cross-sectional study from Bovenzi et al. (2006) and longitudinal studies from Bovenzi (2009, 2010) and Bovenzi et al. (2015) among professional drivers failed to show clear associations between LBP outcomes and psychosocial risk factors derived from the DCS model. Such a result might be due to the heterogeneity in the groups of professional drivers in these studies (e.g., 6 different sectors, and 17 different machines/vehicles in Bovenzi et al., 2006). Given the sample sizes available if an association between MS pain and work-related psychosocial risk factors was actually present in one of the sub-groups, then it may not have been possible to detect it at the group level.

In Canada, the trucking industry is one of the largest industrial sectors with over 200,000 workers in 2010 (Statistics Canada, 2010). In spite of its importance, very few studies have investigated work-related injuries or MS outcomes among Canadian truck drivers and, to our knowledge, none has yet compared short- and long-haul delivery drivers working for a single large employer (or same industrial sector) in terms of exposure to risk factors for MSD.

The aim of this cross-sectional comparative study was to document the prevalence of self-reported MS pain in different body areas and investigate associations with self-reported exposures to risk factors for MS disorders (individual, work-related physical and psychosocial) among two groups of Canadian truck drivers (short- and long-haul) all employed by a same multinational company specializing in industrial gas delivery.

2. Methods

The data were collected through anonymous self-reporting questionnaires between May and October 2016 at company locations in 6 Canadian provinces (Quebec, Ontario, Alberta, New Brunswick, British Columbia, Nova Scotia). The present study was part of a larger project in which field observations were also conducted to assess exposures to work-related physical risk factors for MS outcomes. The study was approved by the Research Ethics Board at Polytechnique Montreal and at the University of Montreal (No. CÉR-1516-27).

2.1. Participants

All 249 delivery truck drivers from the same company were targeted across Canada for this study. They were either P&D drivers responsible for picking-up and delivering gas cylinders of different sizes, or Bulk delivery drivers responsible for delivering gas from large tanker trucks. The work involved in P&D differs from the work in Bulk delivery as P&D involves more manual materials handling (i.e., empty or full gas cylinders), short driving distances, and many deliveries per day. On the other hand, Bulk delivery involves longer driving distances and one or few clients per day since the volume of gas to deliver is large.

Two strategies were used to contact the drivers. At the company locations visited by the research team members, the drivers received an envelope containing a short description of their expected participation and confidentiality aspects of the data collected, an informed consent form, and the questionnaire. The team members who were on site during regular working hours explained the details of the study to participants during a meeting held in a private room, and answered