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Associations between musculoskeletal conditions risk, sedentary behaviour, sleep and markers of mental health: A cross-sectional observational study in Heavy Goods Vehicle drivers

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ABSTRACT

Objective: To explore the risk of having musculoskeletal conditions (MSKs) associated with sitting and sleeping time during workdays, presenteeism, work engagement anxiety and depression in a sample of UK HGV drivers.

Methods: 88 male drivers participated in this cross-sectional study. Binary logistic regression analyses were performed to explore the associations between two-or-more MSKs and common health risk factors.

Results: Possessing two or more MSKs is associated with prolonged sitting time (OR 4.34) and working hours per day (OR 3.10) and per week (OR 3.12), severe sleep deprivation (OR 33.19), presenteeism (OR 4.22) and borderline or abnormal scores of depression (OR 11.69) and anxiety (OR 4.44), compared with the reference categories.

Conclusion: Workplace policies and health promotion interventions to improve HGV drivers working environment are required to minimise the risk of MSK's across this sector.

Keywords: occupational health, lorry drivers, mental health, musculoskeletal conditions, activity behaviours

Introduction

The transport sector has been defined as a severely under-staffed and under-pressure UK industry.¹ The Department for Transport estimated a shortage between 45,000 and 50,000 HGV drivers in the UK in 2017.² The acceptance of the neoliberal context within the UK society has also helped normalise the long-hours culture, accentuating individual workloads. The working time directive allows HGV drivers to work up to 60 hours with reduced resting times (9 hours) between shifts up to three times a week.³ This framework of high levels of stress^{4,5} coupled with the obesogenic culture,^{6,7} the limited access to medical health care and the long hours working remotely and in isolation result in worse-than-average health and safety records in this occupational group compared to other industries in the UK.⁸

Musculoskeletal conditions are prevalent in the workforce and have been described as a major cause of employee disability, reduced work competence and sickness absence.⁹ It also has been suggested that employees with chronic pain, particularly low back pain (LBP), are at higher risk of losing their job compared to their healthy counterparts.⁹ Musculoskeletal conditions account for 53% of all work-related ill health within the transport and storage sector in the UK;¹⁰ which is proportionately higher in comparison to workers from other industries (Agriculture, 46%; Education, 26%; Human Health and social work activities, 36%; Manufacturing, 43%).¹¹ Prolonged time sitting and long hours at work, combined with poor workplace ergonomics and continuous whole-body vibration have been described as some of the main contributors towards this prevalence.¹² Yet, limited research has objectively measured HGV drivers sitting time^{6,7} and no research has assessed the association between prolonged time sitting and the risk of MSKs in this occupational group.

Other factors such as age, sex, weight, body mass index (BMI) and general health seem to also contribute to the development of MSKs.¹² Psychosocial work factors, including chronic job strain and effort-reward imbalance, anxiety, depression or fatigue have also been described as significant contributors to work-related MSKs.^{4,12,15} Some reports have also indicated that work engagement and sickness presenteeism are linked to chronic MSKs.^{15,16} Based on the Conservation of Resources (COR) theory,¹⁷ having an MSD may lead to an escalating spiral of losses of energetic resources as there is a limit to how much energy and resources are available to workers.¹⁸ Therefore, sustaining levels of engagement with an MSD may be difficult. To date, no research has explored the associations between HGV drivers working patterns, mental health and well-being and MSKs. Therefore, the aim of this study therefore was to explore the associations between MSK risk and sitting and sleeping time during workdays, sickness presenteeism, work engagement and anxiety and depression in a sample of UK HGV drivers.

METHODS

Study design and participants

This novel cross-sectional and observational study is part of a programme of research^{5-7,17} which was undertaken in partnership with a large transport company from the East Midlands, UK. This study involves data from 88 full time long-distance lorry drivers that were screened as part of a larger surveillance study.⁶ This sample of drivers was included in this analysis as they provided objective physical activity and sedentary time data in addition to markers of cardiovascular and mental health.⁶ Participants involved in this study were recruited from across all shift patterns (morning 06:00 to 14:00, afternoon 14:00 to 22:00 and night 22:00 to 06:00). Participant's shifts do not rotate. However, every driver has an allocated "start time

window” of two hours. This means that their start time will vary on a daily basis depending on the allocated route for the day. Drivers were notified of their actual start time one day in advance. Data were collected between May and August 2014. Participants without current diagnosed cardiovascular disease (CVD), haemophilia, and any blood-borne viruses were included in the analysis. Ethical approval was obtained from the local Ethical Advisory Committee and all participants provided written informed consent.

MEASUREMENTS

Self-reported measures

For this study, participants self-reported their age, ethnicity, level of education, years working at the company and shift pattern. Drivers were asked to complete a Health Screen Questionnaire, in which they recorded any medical problems, medication taken and diabetes status (yes or no; type 1 or type 2).

Musculoskeletal conditions (MSKs) were assessed using the Nordic Musculoskeletal Questionnaire (NMQ)¹⁹ which records musculoskeletal troubles (such as aches and pains) experienced in nine areas of the body. Responses are dichotomous; ‘Yes’ received a score of 1 and ‘No’ scored 0. Anxiety and depression were assessed using the Hospital Anxiety and Depression Scale (HADS).¹⁹ Scores below eight were considered normal, scores between 8-10 were considered borderline and those scoring 11 or over were considered as clinical ‘cases’ for anxiety or depression.²⁰ Work engagement (characterized by vigour, dedication and absorption) was measured using the Utrecht Work Engagement Scale (UWES).²² The UWES contains nine items which are rated from “0” (never) to “6” (always). The internal consistency

of each of the scales for this sample of participants was acceptable with Cronbach's alpha scores for vigour (Cronbach's alpha = 0.89), dedication (Cronbach's alpha = 0.87) and absorption (Cronbach's alpha = 0.84). Sickness presenteeism was investigated using the following question: In the past 4 weeks, how many whole days have you gone to work despite feeling that you should have taken sick leave due to your state of health? This item was designed based on Aaronson and colleagues' original item¹⁵ but used a 4-week rather than a 12-month recall period and instead of using a four-point scale a blank space was deemed more appropriate to help improve recall bias due to HGV drivers working patterns. This approach is similar to that use by McGregor and colleagues²² and it is supported by previous research.^{20,23,24}

Physiological measures

Height was measured without shoes using a portable stadiometer (Seca 206, Oxford, UK). Body composition and weight were assessed using a Tanita BC-418 MA Segmental Body Composition Analyzer (Tanita UK Ltd). BMI was calculated as kg/m². Ten-year CVD risk was calculated using the QRISK 2 algorithm (<http://www.qrisk.org/>). Participants were clustered into two categories: 1) less than 10 percent CVD risk and 2) ten percent or more CVD risk. These values were used as covariates in the analyses in this paper, the specific results of these measures have been presented elsewhere.⁷

Sedentary behaviour and sleep time

Participants' sitting time during waking hours and the duration of their sleep time were assessed using an activPAL3 accelerometer. This is a small device worn on the front of the right thigh, containing a tri-axial accelerometer, that is a valid measure of time spent sitting/lying, standing and walking in adults.²⁵ The activPAL3 was waterproofed; which enabled participants to wear it continuously for 24 hours/day over seven days, following their health assessments. Participants were asked to complete a daily-log book where they recorded the time they went to bed and woke up on workdays and non-workdays and the time they started and finished working on workdays. Information about any non-wear time was also recorded. A paper containing further detail on how the data were processed has been published elsewhere.⁷

Data analysis

Mean and standard deviations were explored for a range of sociodemographic variables, musculoskeletal injuries, including the intensity of pain, mental health and well-being parameters and sitting and sleeping time levels. Due to the prevalence of musculoskeletal injuries, participants were clustered into two groups: 1) one or less MSK and 2) two-or-more MSKs.

Binary Logistic regression analyses were performed to estimate the association between two-or-more MSKs and work engagement, sickness presenteeism, anxiety, depression, sleep hours on workdays, work hours per day and sitting time at work, as expressed by odds ratios (OR) and 95% confidence intervals (CI). First, separate constructs of work engagement were categorised into tertiles of low, medium and high.²⁶ For dedication and absorption, there were not enough participant data for the low absorption and dedication category. Therefore, only two categories were used, low to medium and high. Similarly, the three constructs of the

original HADS classification ²⁰ were merged into two categories, normal and borderline to abnormal scores for anxiety and depression. The “sleep hours on workdays” variable was clustered into four groups (1, less than five hours sleep; 2, between five to six hours sleep; 3, between six and seven hours sleep; 4, seven or more hours sleep) based on Itani’s classification.²³ Based on mean values, sitting time on workdays was classified into “eight or less hours sitting at work per day” and “more than eight hours sitting at work per day” and total hours at work was clustered into “less than 10 hours at work per day” and “10 or more hours at work per day” and “less than 50 hours at work per week” and “50 hours or more at work per week”.

Logistic regression models were first constructed to estimate the odds of low to medium dedication and absorption (against high dedication and absorption) due to two-or-more MSKs. One logistic regression model was conducted to estimate the odds of medium and low vigour (against high vigour). The first two models were adjusted for age, the QRISK percentage and BMI; the third model was also adjusted for sleep time on workdays. Two logistic regression models were constructed to explore the odds of borderline to abnormal scores for depression and anxiety (against normal scores) in relation to having two-or-more MSKs. The first model was adjusted for age, BMI, QRISK and sleep time on workdays. The second model to explore the association between two-or-more MSK and depression was also adjusted for shift pattern, alcohol and tobacco consumption, years working at the company and age. A binary logistic regression model was used to explore the likelihood of two-or-more MSKs in relation to presenteeism with depression as a covariate and adjusted for age, BMI, alcohol consumption and sleep time on workdays. Three further binary logistic regression analyses were constructed to assess the odds of shortage of sleep (against seven or more hours of

sleep per night) and total hours at work per day (less than 10 hours used as a reference category) and per week (≤ 50 hours at work per week used as a reference category) and total sitting time at work (eight hours or less used as reference category). The first three models were adjusted for age, BMI, ethnicity, level of education shift pattern. A final binary logistic regression model was used to explore the likelihood of two-or-more MSK in relation to sitting time at work with depression as a covariate and adjusted for shift pattern and working hours.

RESULTS

Table 1 displays participant's sociodemographic information, medical information, levels of work engagement, categories of anxiety and depression, sickness presenteeism, sitting and sleeping time and musculoskeletal conditions for a sample of 88 male lorry drivers. Although drivers participating in this study were classed as medically fit to drive, 80% of them were overweight or obese, 65% presented two-or-more MSKs, 56% reported sickness presenteeism, 36% presented borderline to abnormal levels of depression, 33% were sleep deprived (< 6 hours per night), 22% scored over 10% in the QRISK index and 17% presented with borderline to abnormal levels of anxiety.

Insert table 1 about here

Table 2 presents associations between demographic characteristics, sitting and sleeping time, sickness presenteeism, work engagement and anxiety and depression with MSKs, using two categories of "less-than-two MSKs" and "two-or-more MSKs" (with less than two MSKs used as a reference category against two-or-more MSKs). The results show that the risk of two-or-

more MSKs is associated with elevated sitting time on workdays (≥ 8 hours) and long hours at work per day (≥ 10 hours) and per week (≥ 50 hours). Severe shortage of sleep (< 5 hours sleep), borderline to abnormal scores of depression and sickness presenteeism are positively associated with two-or-more MSKs.

Insert table 2 about here

DISCUSSION

This study is the first to examine the associations between musculoskeletal conditions (MSKs) and sitting and sleeping time during workdays, presenteeism, work engagement, and anxiety and depression in a cross-sectional sample of UK HGV drivers. Overall, this study highlights that the odds of having two-or-more MSKs is significantly associated with long shifts (≥ 10 hours), prolonged time sitting at work (> 8 hours/day), sleep deprivation on workdays (< 5 hours sleep/night), presenteeism and borderline to abnormal levels of anxiety and depression.

Prevalence of musculoskeletal conditions (MSKs) in HGV drivers compared to other occupational groups

Musculoskeletal conditions are one of the major causes of disability in the workforce.⁹⁻¹¹ Indeed, it is estimated that 17.6 workdays are lost per new case of work-related MSKs, with a total cost to society of about £2.3 billion per year in the UK.⁸ Multisite pain is also common among those reporting pain.⁸ Shoulder, lower back and knee are the most prevalent MSKs out of the 9 included within the Nordic Musculoskeletal Questionnaire (NMQ).¹⁹ Although,

LBP is the most common of the three, with 54% of this sample reporting pain in this region of the body. Similar results (60%) were reported by Rob and Masfield ²⁷ across a sample of UK lorry drivers and by Magnusson and colleagues ²⁸ in a sample of American and Swedish bus drivers. However, contrasting findings have been found across the literature, with prevalences ranging from 24% to 70% in different occupational drivers.^{29,30} These differences may be related to the lack of standardised methods to record MSKs in occupational drivers. However, these may also be a result of comparing different types of occupational drivers, where working environments vary greatly (e.g. type of vehicle, road, working hours...). Indeed, several studies have demonstrated that MSKs are more prevalent in ergonomically stressful jobs, particularly with continuous exposure to high levels of whole-body vibrations (WBV).^{30,31} For instance, Bovenzi's prospective cohort study ³¹ showed that the incidence of 12-month LBP was 47% amongst drivers of earth-moving machines, compared to 35% in the driver's group with lower WBV exposure (i.e. public utility vehicles). Data from the US highlights that HGV lorry drivers account for 5% of all cases of work-related MSKs, with an incidence rate of 94 cases per every 10,000 full-time drivers.¹⁰ This prevalence is higher compared to workers from other sectors (i.e. maintenance and repair workers 75.9 cases; construction laborers 62.7 cases; firefighters 24.0 cases).¹⁰ These data suggest that limited health promotion efforts have been developed within this occupational group and preventative health initiatives promoted by the logistics sector are needed.

The risk of two-or-more MSKs in relation to working patterns, sitting time and sleeping time in HGV drivers in comparison to other occupational groups.

Bad ergonomics and prolonged time at work, with the underlying issue of prolonged time sitting, have been highlighted as main contributors to the occurrence of MSKs in occupational drivers.^{4,12} This study shows that 63% of the lorry drivers sampled sat for more than 8 hours on workdays (average of 11 hours/day), which is associated with a three-fold higher risk of having two-or-more MSKs, compared to those drivers sitting for 8 hours or less on workdays. This OR is higher than that found by Gupta et al,³² who suggested that excessive occupational sitting increased the risk of LBP by 1.34 (OR) in Danish blue-collar workers. This risk is also higher than that reported by Lis et al³³ whose systematic review showed that sitting time increased the risk of occupational LBP (OR 1.99) amongst workers from occupations that required sitting for more than half of a working day and had physical co-exposure factors such as whole-body vibration (WBV) and/or awkward postures (e.g. police officers -drivers-, dentists, tractor drivers, bus drivers). Recent research³⁴ suggests that lorry drivers are exposed to moderate-to-high-levels of WBV with exposures above the International Standards Operator and the EU, which can get aggravated by the lorry's seat age or manufacturer; every increase of vibration by m^2/s^4 -hour also results in an increased OR of LBP by 3.7.³⁴ Therefore, it is not clear if the positive association between sitting time and MSKs in this sample of drivers is merely because of the prolonged time sitting or the continuous WBV. Future research should explore this relationship further to help minimise the risk of MSKs in lorry drivers.

Results from the present study also suggest that severe sleep deprivation (<5 hours sleep per night) is strongly associated (OR 33.19) with multi-site MSKs. These results are unique, as to

the authors' knowledge, no similar research has been conducted amongst lorry drivers previously. However, they are supported by previous research conducted amongst a large sample of blue- and white-collar workers in Finland.³⁵ In this Finnish prospective cohort study, sleep disturbance predicted the risk of future LBP (OR 1.6 if mild sleep disturbance; OR 3.2 if severe sleep disturbance), even amongst those who never experienced LBP in the past. A recent meta-analysis suggests that sleep deprivation increases pain perception.³⁶ Biologically plausible explanations might be related to reductions of the morphine analgesia during sleep deprivation, becoming more sensitive to pain.³⁷ It also appears that sleep deprivation is associated with increased markers of systemic inflammation resulting in lower pain thresholds.³⁸ In contrast, it might be the case that chronic musculoskeletal pain may also result in sleep disturbance. Thus, future interventions should be developed to explore whether modifying lorry drivers working and sleep patterns the likelihood of MSKs is improved.

The risk of two-or-more MSKs in relation to sickness presenteeism, anxiety and depression in HGV drivers in comparison to other occupational groups.

Sickness presenteeism and general aspects of mental health have been related to MSKs previously.^{4,12,13} A meta-analysis conducted by Hauke and colleagues³⁹ established that the risk of onset of MSKs is between 15 to 59% higher among employees exposed to adverse psychosocial working conditions; which are main predictors of sickness presenteeism.⁴⁰ Despite the working conditions inherent in the logistics sector, limited research has explored the association between these factors and MSKs in lorry drivers.⁴¹ The present data show that multi-site MSKs are positively associated with borderline to abnormal levels of anxiety (OR

4.44) depression (OR 11.69) and presenteeism (OR 4.22). These results are congruent with others in the literature.^{42,43} For instance, a prospective study by Magni et al⁴⁴ suggested that depressive symptoms might predict the likelihood of future episodes of low back, neck and shoulder pain by an OR of 2.14. Similarly, a Norwegian study involving 19,000 participants predicted that depression, anxiety and sleep disturbances were strongly associated with the onset of chronic pain over a period of 11 years.⁴³ Although it is beyond the scope of this paper, the physiological pathways commonly suggested to explain this link include the continuous muscle tension when under stress, increasing the susceptibility of muscle fibres to injury.⁴⁴ Therefore, further research should explore if the relationship between these factors of mental health and well-being and the risk of MSKs is causal or it is mediated by other aspects of the lorry drivers' day to day living. Future research should explore the physiological pathways between these parameters of health. Prospective research should also explore the association between sickness presenteeism, anxiety and depression and lorry drivers working environment and how this might affect the development of MSKs.

STRENGTHS AND LIMITATIONS

It is important to be aware of inherent limitations of the present study associated with its cross-sectional design that limits the extent to which reverse causation and alternate pathways between two-or-more MSKs and lorry drivers working patterns, work engagement, sickness presenteeism, anxiety and depression could be tested. However, the study findings are consistent with those in the current literature and present strong associations between several parameters of mental health and well-being and MSKs. Second, the number of participants included in this study was relatively small (n=88), limiting the ability to generalise and to draw conclusions about this occupational group relative to others. Nevertheless, this

is the first study to assess the risk of MSKs in association with objective data on lorry drivers' sitting and sleeping time, as well as other parameters of mental health and well-being. Thirdly, work engagement, anxiety, depression and sickness presenteeism data were derived from self-reported measures. Reporting bias might have influenced the results of the associations and confidence intervals. Although, the Utrecht Work Engagement scale and the HADS questionnaire are widely validated tools, future research should explore the option of using standardised clinical interviews to diagnose specific mental health and well-being parameters.

CONCLUSION

Results from this study add new information on the prevalence of musculoskeletal conditions and how these are associated with lorry drivers' working patterns and mental health and well-being. The high prevalence of multi-site MSKs in this occupational group are a result of poor health and safety standards across the logistics sector, which is of public concern due to road safety implications. Workplace policies to improve HGV drivers working environment are required (i.e. new systems to pull the curtains, physiotherapy and postural advice, increased breaks and resting periods within shifts, increased resting time between shifts, reduced driving-time allowances). Health promotion interventions are highly encouraged across this sector (i.e. mental health support; health coaching focused on physical activity, sleep and sitting time; interventions to improve shift patterns and sleep adaptation would be of interest).

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