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Submission date: 02-May-2023 08:55AM (UTC+0700)

Submission ID: 2081548443

File name: Personal_characteristic_occupational_work_enviroinm.pdf (511.29K)

Word count: 3440

Character count: 18688

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To cite this article: M A Zulkarnain *et al* 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **623** 012013View the [article online](#) for updates and enhancements.

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Personal characteristic, occupational, work environment and psychosocial stressor factors of musculoskeletal disorders (MSDs) complaints on bus driver: literature review

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Abstract. Musculoskeletal disorders (MSDs) complaints is an accumulation of injuries and pain in the musculoskeletal system. It is characterized by injuries on muscles, tendons, cartilages, ligaments, and vascular and nervous structures. Bus drivers are high-risk workers that experience MSDs complaints. MSDs on bus drivers can disrupt drivers' performance, endanger drivers, passengers, and public road users. This study aims to review the literature on factors of MSDs complaints among bus drivers. The literature review method is used by compilation, tabulation, comparing the research results, and then summarizing it. The research was obtained from an accredited journal site (PubMed, Research Gate, Science Direct, Scopus) and the google scholar journal search page. After searching for keywords and screening with the research inclusion criteria, 15 studies were obtained. It was found that smoking habits, age, years of work, driving duration, work posture, vibration, work stress, and job dissatisfaction were the main factor of MSDs complaints on the bus driver. Several studies also show that bus drivers with a low level of physical activity, long driving duration, high driving frequency, unergonomic seats, feelings of anxiety and confusion during driving had a higher risk for experiencing MSDs complaints.

1. Introduction

Musculoskeletal disorders (MSDs) complaints are an experience of accumulations of injuries in the musculoskeletal system, characterized by injuries to muscles, tendons, cartilages, ligaments skeletons, vascular and nervous systems [1]. MSDs complaints can be caused or worsened by work activities. MSDs complaints are the work-related disease caused by many factors that interact and produced mixed results in various sectors. Disability-Adjusted Life Years (DALYs). Data reported that musculoskeletal disease globally reaches 61.6% from 1990 to 2016 [2]. In the United States alone, the MSDs caused 213 billion US dollars loss or equal to 1.4% of US gross domestic products [3]. A study of 482 workers in 12 cities in Indonesia showed 16% of workers suffered from MSDs [4]. Several studies by Setyaningsih found that workers in the formal sector, but many formal sector workers such as brass, batik, pan craftsmen, and others also experience MSDs [5-8]. Bus drivers are one of the groups of workers who mostly experience MSDs. Research in Iran shows that MSDs complaints on bus drivers mainly occur on the shoulder, neck, and back area. These complaints cause the driver to experience fatigue and discomfort that affect the driver's performance and concentration, endanger the bus driver's safety, passengers, and other public road users. There have been many researches with

different variations and measurement methodologies related to MSDs complaints in the academic field. Many factors were involved in MSDs complaints on bus drivers, which vary in each finding. On the other hand, based on preliminary research, no updated article specifically reviewed personal characteristics, occupational, work environment, and psychosocial factors of MSDs complaints on bus drivers within the past ten years. This encourages the researcher to review literature related to personal characteristics, occupational, work environment, and psychosocial stressor factors of MSDs complaints on bus drivers.

2. Methodology

This research is a literature review that aims to compile, tabulate, and compare research results, then summarize the entire studies. Studies search are conducted through accredited journal sites (PubMed, Research Gate, Science Direct, Scopus) and the google scholar journal searches page using a combination of search term including "MSDs complaints", "bus driver", and other keywords such as "lower back pain", "neck pain" and "public transportation". Journal inclusion criteria in this study include (i) open access, (ii) full-text journal (iii) Publication date in the past ten years (May 2010 - May 2020), (iv) Indexed journal, and (v) Relevant to research topic.

Table 1. Synthesis matrix of the studies reviewed.

Author, Year	Main Results
Akinpelu A O, 2011 [9]	89.3% of bus drivers experience MSDs complaints before 12 months. The bus driver who had MSDs complaints more apparent on bus drivers who already work for years. Most bus drivers used self-prescribed drugs, herbal and massage to reduce MSDs complaints.
Shamsul B T, 2011 [10]	LBP was the highest complaint among drivers (58.5%). The magnitude of WBV exposure more than 0.5 m/s ² r.m.s, lack of seat adjustability, uncomfortable seat, the hardness of the seat's material, the seat contour, and design were found to be associated with MSDs. Smoking, frequencies of trips daily, duration of driving daily, prolonged sitting, working part-time, and psychological stressor factor were MSDs complaints risk factors on bus drivers
Lestari W L, 2013 [11]	76.7% of the bus driver was known to work with high risk sitting position
Abledu J K, 2014 [12]	Of the 148 drivers, 116 (78.4%) reported having MSDs complaints during the previous 12 months. The prevalence of MSDs complaints was mainly in the back (58.8%) and neck (25%). Multiple logistic regression analysis adjusted for possible confounders showed that less physical activity, driving more than 12 hours per day, driving at least five days per week was significantly associated with MSDs complaints on the bus driver
Fahmi R, 2015 [13]	41.67% of long-distance night bus drivers experience severe fatigue, and 75% experience MSDs complaints around the back, neck, and leg area. MSDs complaints caused by the prolonged and monotonous sitting position
Yasobant S, 2015 [14]	QEC: back and shoulder had very high exposure, REBA: Nearly half (46%) of the bus drivers were at high risk of experiencing MSDs complaints. NBM: Bus driver experience MSDs complaints mainly in the neck (26%) and in the back (24%). Exposure to unsafe ergonomic practices or conditions and health risks were evident.
Wahyuni, 2016 [15]	REBA: 63.6% of bus drivers experience a mild level of LBP on the Solo-Semarang route. ODI: 75.8% of bus drivers experience a mild level of LBP on the Solo-Semarang route. There was a significant association between hours driving daily with LBP.
Anugraheni,	59.5% of bus drivers experienced MSDs complaints. Cigarette consumption more

Author, Year	Main Results
M, 2016 [16]	than ten a day, age factors, and vehicle vibration were proven to had a significant relationship with MSDs complaints
Marthin E J, 2016 [17]	66.7% bus driver in the medium-risk category. 61.3% of bus drivers were exposed to 1.6-2 m/s ² vibration, which exceed the recommended guidelines. There was a significant association between age and vibration to MSDs complaints
Pambudi B, 2016 [18]	Most bus drivers had medium risk hazardous driving positions. Some of the bus drivers experience moderate shoulder pain. There was a significant association between work duration (years) with MSDs complaints
Permana A I, 2017 [19]	Based on the NDI assessment, 22.2% of bus drivers were in the mild category. Sitting duration when driving had a significant association with neck pain.
Octaviani D, 2017 [20]	REBA: 66.2% of bus drivers in the medium-risk category. Driving posture had a significant association with MSDs complaints. The bus driver in the high-risk category had 6.27 times higher risk of experiencing MSDs complaints than the bus driver in a low-risk category.
Sekaaram V, 2017 [21]	76.7% of bus drivers experience MSDs complaints and mainly occur around the back area. 66.7% of bus drivers had frequent tobacco consumption
Cambodiana D W, 2018 [22]	80.4% of bus drivers were exposed to high vibration, and 84% had LBP complaints in the mild category. There was a significant relationship between vibration and LBP complaints
Robo W, 2019 [23]	80% of bus drivers experience LBP. There was a significant association between sitting duration with LBP

3. Results and discussion

After initial findings followed by screening with the inclusion criteria, 15 studies were obtained. Many of the studies were not selected because they did not meet the research inclusion criteria. Mostly because published papers were not indexed and more than ten years old. All of the studies reviewed used a cross-sectional study approach, and it's apparent that Nordic Body Map (NBM) was the most frequently used ergonomic risk assessment method. Several other methods that were used, such as Quick Exposure Checklist (QEC), Rapid Entire Body Assessment (REBA), Rapid Upper Limb Assessment (RULA), and others. Many of the research analyze personal and occupational factors with MSDs on the bus driver. On the other hand, there has been limited research about psychosocial stressor factors with MSDs on the bus driver. Most of the studies reviewed show a high prevalence of MSDs complaints on bus drivers.

3.1. Personal characteristic factor

Research by Anugraheni (2016) found that most bus drivers experienced MSDs complaints in their neck, shoulders, and back bodies area [16]. Statistical test results showed a significant association between the smoking habits of bus drivers with MSDs complaints. The bus driver who smokes more than ten cigarettes per day had a higher risk of MSDs complaints compared to bus drivers who smoke less than ten cigarettes per day. It's also found that there is a significant relationship between age and MSDs complaints on bus drivers. This research is further confirmed by Enricho's study, which showed that bus drivers in Tanongko Bitung Station had a significant association between age and MSDs complaints.

Research by J.K. Abledu (2014) on 148 bus drivers found that most of them had MSDs complaints in the past one year on the low back area [12]. It is showed that there were 4.9 times higher risk to experience MSDs complaints on bus drivers who rarely do physical activities. In addition, the length of work also contributed to MSDs complaints. One study showed that 80% of the bus driver in Mengwi, Indonesia, who worked for more than 18 years, experienced MSDs complaints. Research by Pambudi (2016) points out; there was a significant association between length of work with MSDs

complaints [18]. Despite research including the Body Mass Index (BMI) association with MSDs complaints on the bus driver, none of them had significant results. According to Suma'mur (2014), a person's age will affect the condition of the body [24]. The older a person is, the greater the level of fatigue [24]. Based on all the studies studied, it is known that BMI does not have a significant association with MSDs complaints on bus drivers. According to Setyawati, smoking can cause changes in the respiratory tract and lung tissue structure and function. The majority of people who have smoking habits and high frequency of smoking tend to experience work fatigue. This is closely related to physical fitness and the content of harmful substances in cigarette smoke, which can trigger high muscle complaints at work [25].

3.2. Occupational factor

The occupational factor is job characteristics that can increase the risk of MSDs complaints in workers. It's explained that occupational factors include awkward back postures, static work posture, and repetitive movements [26]. Research between 40 respondents showed that 4-9 hours of driving duration had a significant association with MSDs complaints. Similarly, another study highlighted that long driving duration had a significant association with MSDs complaints. The human body is designed to move, so it can't tolerate being in the same position for a long time. Sitting in a chair for a long time like a bus driver could make the bus driver's musculoskeletal system susceptible to many injuries. It's also found that bus drivers who drive five trips daily or more had a significant association with MSDs complaints and had a higher risk of experiencing MSDs complaints than bus drivers who drive less than five trips daily. According to Octaviani, through the REBA assessment method, more than half of bus drivers were in the medium-risk category and strongly associated with MSDs complaints. It's apparent that long-distance night bus drivers also suffered from MSDs complaints because of awkward and monotonous driving posture. There are two aspects of body positions that can contribute to injuries for workers. First, when the body in extreme positions from their motion range stretch and compress tendons and nerves, the longer duration of awkward and monotonous driving posture, the bus driver is more likely to experience MSDs complaints. The second is when the neck and shoulder in a fixed or static position. Neck/shoulder muscle becomes more tired because the suppression of the blood flow and accelerating fatigue in arms and other areas make drivers have a higher risk of experiencing MSDs complaints [27]. It's supported by a study conducted in Malaysia where the bus driver that sits with an awkward posture for more than 40% of the time increases the risk of developing MSDs.

3.3. Work environment factor

The work environment can have a negative or positive impact on workers. Over the past decade, workers' environmental factors have changed, such as social environment, technology, and regulation. In the research about bus machine condition, it was found that the existing bus was already operated about 10 – 15 years, which had an old engine and unergonomic seats. It's indicated that the mechanical vibration total value of 8 hours frequency-weighted r.m.s exceeded the action value of EU Directive 2002/44/EC. When the daily vibration exposure was expressed as $A_v(8)$ r.m.s, 69.3% of the drivers that complained of having MSDs exceeded the daily exposure action value established by the Directive (0.5 m/s^2). From the logistic regression analysis proven that WBV and MSDs complaint on bus driver had a strong association. Anugraheni further supports this fact, there were MSDs complaints on bus driver whose vehicle had vibration $>4.0 \text{ Hz}$. Another study through NBM assessment concluded that most bus drivers were at medium risk levels and showed a significant association between vibration and MSDs complaints. The condition of the chair that is less comfortable has 3.4 times greater risk of experiencing MSDs than bus driver who has a comfortable seat.

3.4. Psychosocial stressor factor

Psychosocial stressors are all forms of phenomena in the work environment, which can disrupt workers' physical and mental health. In this research, only two journals analyzed the psychosocial stressor factors with MSDs complaints on the bus driver. A study in Ghana stated that most bus drivers feel stressed, and almost half of the respondents feel dissatisfied with their work. It was found that the perception of work stress and the perception of job dissatisfaction have a significant association with MSDs complaints on bus drivers. The majority of respondents with MSDs complaints in Shamsul's study felt emotionally exhausted while working, and many bus drivers felt stressed and worried. Furthermore, it highlighted that stress perception, anxiety perception, fatigue perception, and the perception of confusion were risk factors for MSDs complaints. The mechanism underlying the association between psychosocial stressors and MSDs complaints remains unclear. However, previous studies hypothesized that psychosocial stressors interact through neurogenic and neuroendocrine complexes. It affects muscle tension, spinal cord tension, and fatigue, causing drivers to experience traumatic injuries. Such findings and hypotheses need further corroboration, such as the lack of standardization in quantifying psychological variables, and better epidemiologic research of the role of psychosocial stressor factor with MSDs complaints on bus drivers is needed [28].

4. Conclusion

Based on the studies that have been reviewed, personal characteristic (smoking habits, age, and years of work), occupational (driving duration and work posture), work environment (vibration), and psychosocial stressors factor (work stress and job dissatisfaction) were the main factors of MSDs complaints on the bus driver. Furthermore, several studies also found that bus drivers with a low level of physical activity, long driving duration, high driving frequency, unergonomic seats, feelings of anxiety, and confusion during driving had a higher risk for experiencing MSDs complaints. The studies reviewed indicate that bus operators need to give more severe attention regarding the bus driver's health as their worker. Bus operators must provide health promotion about a healthy lifestyle such as regular physical exercise, reduce tobacco use, etc. Bus operators also need to create operational and understandable occupational health guidelines for the bus driver that adjust the work area. Some of the important substances in that guidelines include calculation or standardization for proportional and fixed work schedules. The operational bus which being used needs to be in excellent condition to ensure minimum vibration exposure and ergonomic workspace. Providing entertainment media equipment (radio or mp3 player) to reduce the bus driver's risk of stress is also an option. It's highly recommended that bus operators provide regular health check-ups from bus operators to monitor and evaluate their physical and mental health. The bus driver needs to have proper driving posture while driving (upper body not hunching or leaning back too far, setting seat height and seat distance), a regular stretch break between driving schedule, and adopt a healthy lifestyle. It is envisaged that by implementing these measures could benefit both bus operator management as a company and bus driver's health as workers.

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