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MUSCULOSKELETAL DISORDERS AMONG BUS DRIVERS AT "ALSOUQ ALMARKAZI AND ISLAMIC CENTER KHARTOUM" 2018

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Abstract:
Musculoskeletal disorders (MSDs) are a common occupational health problem among professional drivers. This descriptive cross-sectional community-based study assessed the prevalence and risk factors of MSDs among 131 bus drivers working at Alsouq Almarkazi and the Islamic Center in Khartoum in 2018. Data were collected using structured interviews and the standardized Nordic Musculoskeletal Questionnaire. Drivers were predominantly male, with most working long hours (up to 12 hours daily) and more than half driving seven days a week. Nearly one-third had over 30 years of driving experience. The most frequently reported musculoskeletal complaints involved the wrists/hands (20.6%), shoulders (19.8%), neck (13.8%), and lower back (16%). Many drivers experienced chronic or recurrent symptoms, with some persisting for over 20 months. Findings indicate that prolonged driving hours, limited rest periods, and extended years of exposure are major contributors to MSD risk. In conclusion, bus drivers in Khartoum face multiple occupational risk factors that predispose them to MSDs, highlighting the need for preventive ergonomic interventions, increased awareness, and targeted health policies.
Keywords: bus drivers, Khartoum, musculoskeletal disorders, occupational health, risk factors.

I. INTRODUCTION:

A. Background

Work-related musculoskeletal disorders (WMSD) are the class of musculoskeletal disorders that include damage to tendons, tendon sheaths, and synovial lubrication of tendon sheaths, and related to bones, muscles, and nerves of hands, wrists, elbows, shoulders, neck and back.(1)

These musculoskeletal disorders belong to a collection of health problems that are more prevalent among the working class than the general population.

They encompass the everyday aches and pains that are part of life as well as the consequence of specific injuries. MSDs can and do affect capability for work, both short and long term. They vary inconsistently by occupation.(2)

Work related MSDs are very common among many professions specifically bus drivers, they have been found to have high prevalence rates of various MSDs. The prevalence of MSDs has been shown to vary between (35% - 81.8%). (3-5)

A study in Ghana, where 148 bus drivers were asked MSD related question. The result indicate that a total of 148, 78 has MSD. (5)

B. Problem statement:

In different parts of the world bus drivers are exposed to a combination of risk factors and occupational hazards that may lead to an increased risk of developing MSDs that leads to various disabilities which affects their lifestyles.

A study showed that city bus drivers spend about 60% of their daily work time actually driving, often with the torso straight or unsupported. They may experience a few or a lot of discomforting shock/jerking vibration whilst driving.(6)

The lower back region is one of the most affected areas in the body, studies has shown that it was the major complaint among bus drivers with a percentage ranging from (45.4% - 60%). (4,5,7-9)

Therefore, the economical and psychosocial burden should be highlighted in our region and the effects of work related MSDs on bus drivers in their daily life.

C. Rationale:

Bus drivers play a major role in transportation in Khartoum. A large amount of people living in the city use the bus as their form of transportation due to its availability and convenience as it less expensive than other forms of transportation.

Their job requires them to be seated behind the wheel in the same position for a long period of time. They are required to work long shifts in order to be able to provide for themselves and their family.

Therefore, this puts them at risk and makes them more prone to develop MSDs. Among the African countries, the study in Ghana was the only study conducted (5). This study has not been done previously in Sudan, Khartoum.

D. Objectives:

1- Estimate the prevalence and pattern of MSDs among bus drivers in Khartoum.
2- Identify physical, and psychosocial risk factors.
3- Assess drivers' awareness, preventive measures, and safety practices.
4- Compare findings with previous international studies.

II. LITERATURE REVIEW:

Work-related musculoskeletal disorders (WMSD) are the class of musculoskeletal disorders that include damage to tendons, tendon sheaths, and synovial lubrication of tendon sheaths, and related to bones, muscles, and nerves of hands, wrists, elbows, shoulders, neck and back.(1)

Work related MSDs are very common among many professions specifically bus drivers, they have been found to have high prevalence rates of various MSDs. The prevalence of MSDs has been shown to vary between (35% - 81.8%). (3-5)

Urban bus drivers have been found to have high prevalence rates of back problems in overseas studies and it affects their daily lifestyles gravely.

According to a study in Hong Kong Work-related Musculoskeletal Disorders in Urban Bus Drivers.The study was conducted on 481 bus drivers (404 males, 77 females) aimed at investigating the prevalence and characteristics of WMSD in male and female bus driver but in our country this occupation is restricted to males only. The study assessed physical aspects of measurement of lumbar spine mobility, hand grip strength, sit-and-reach test, and observation of standing and sitting postures, although in our study we only used questionnaire as a way of measurement. The results of this study showed that male drivers had longer years of work experience but their daily workloads were similar to the females. On the average drivers worked 9–10 h per day, with 5 days on and 1 day off. Neck, back, shoulder and knee/thigh areas had the highest 12-month prevalence rates ranging from 35% to 60%, and about 90% of the discomfort was related to bus-driving. (3)

Also, a cross-sectional study conducted to associate risk Factors with Musculoskeletal Disorders among Male Commercial Bus Drivers in Malaysia.

The study included 1,181 male commercial bus drivers in Malaysia. the main objective being to determine the prevalence of musculoskeletal disorders (MSDs) and the association between risk factors and MSDs among Malaysian bus drivers, using questionnaires to determine demographic, working characteristics and a translated Nordic questionnaire to determine MSD complaints. A Human Vibration Meter was used to measure whole body vibration (WBV) exposure, and postural analysis was used to evaluate awkward working posture.

To assess psychological factors, the validated Profile of Mood States (POMS) was used.

While our study focused only on the physical aspects of bus drivers.

The overall prevalence of MSD was 81.8% and, by body parts, low back pain was reported to be the highest complaint of lifetime MSD (58.5%) compared to other body parts, and only 1.2% of the bus drivers adopt more than 40% of awkward postures while driving. Logistic regression analysis, controlling for age, income, education level, and work activities, revealed that factors such as lack of seat adjustability, uncomfortable seat, seat's material, seat contour and design, smoking, frequency of daily trips, duration of daily driving, prolonged sitting, working part time, and psychological factors (namely, feeling stress, feeling worried, feeling fatigued) were important risk factors of MSDs among Malaysian bus drivers. (4)

Also, an ergonomic study under the title Are Occupational Drivers at an Increased Risk for Developing Musculoskeletal Disorders? The study analyzed the role of exposure to driving and other covariates in reports of back, neck, and shoulder pain and resultant disability. Cohorts in Sweden and the United States were compared. The aim of this study was to establish the effect of mechanical and psychosocial factors in reporting back, neck, and shoulder pain and work loss.

Vibration exposure was obtained by directly measuring the vibration imposed on the driver during a typical work day, Lifting exposure was attained by questionnaire, Cumulative exposure was computed based on work history. Musculoskeletal health information was based on a modified Nordic questionnaire, and other questionnaires recorded the physical and psychosocial aspects of the work environment. Our study have limited resources so computed tests were not available. The results of the sample, 50% reported low back pain, with no difference between countries. The highest risk factors (odds ratios) for back and neck pain were long-term vibration exposure, heavy lifting, and frequent lifting. A combination of long-term vibration exposure and frequent lifting carried the highest risk of low back pain. Work loss from low back pain was influenced by perceived job stress. (7)

According to another cross sectional study assessing the risk factors of lower back pain. A total of 384 male full-time urban bus drivers were consecutively enrolled to this cross-sectional study, the objectives were to assess the prevalence of LBP among Israeli professional urban bus drivers, and evaluate the association between LBP in drivers and work-related psychosocial and ergonomic risk factors. Information on regular physical activity and work-related ergonomic and psychosocial stressing factors was collected during face-to-face interviews. The prevalence of LBP was assessed using the Standardized Nordic Questionnaire. The study concluded that From the total cohort, 164 bus drivers (45.4%) reported experiencing LBP in the previous 12 months. Ergonomic factors associated with LBP were uncomfortable seat (odds ratio 2.6, 95% confidence interval 1.4–5.0) and an uncomfortable back support (OR[2] 2.5, 95% CI[3] 1.4–4.5). In the group of drivers with LBP, 48.5% reported participation in regular physical activities vs. 67.3% in the group without LBP ($P < 0.01$). The following psychosocial stressing factors showed significant association with LBP: “limited rest period during a working day” (1.6, 1.0–2.6), “traffic congestion on the bus route” (1.8, 1.2–2.7), “lack of accessibility to the bus stop for the descending and ascending of passengers” (1.5, 1.0–1.5), and “passengers' hostility” regarding our study the participants complained of the long working periods as well and the lack of resting spots and comfort. (8)

An applied Ergonomics study on City bus driving and low back pain to study of the exposures to posture demands, manual materials handling and whole-body vibration Using validated questionnaire, information about driving experience, driving (sitting) posture, manual materials handling (MMH), and health history was obtained from 80 city bus drivers. Twelve drivers were observed during their service route driving (at least one complete round trip) and vibration measurements were obtained the study aimed to investigate worker exposure to posture demands, manual materials handling (MMH) and whole body vibration as risks for low back pain (LBP).The results showed that city bus drivers spend about 60% of the daily work time actually driving, often with the torso straight or unsupported, perform occasional and light MMH, and experience discomforting shock/jerking vibration events. Transient and mild LBP (not likely to interfere with work or customary levels of activity. (6)

In a study to predict the effect of Work-Related Musculoskeletal Disorders among Commercial Minibus Drivers in Accra Metropolis, Ghana The objective of the study was to determine the prevalence and predictors of work-related musculoskeletal disorders (WMSDs) among a sample of commercial minibus drivers in the Accra Metropolis of Ghana. The participating drivers (148) were recruited from various lorry terminals and assessed by using a semi structured questionnaire that included the Nordic Musculoskeletal Questionnaire (NMQ). The results of this study is that of the 148 drivers, 116 (78.4%) reported having WMSDs during the previous 12 months. The prevalence of the various WMSD domains was low back pain (58.8%), neck pain (25%), upper back pain (22.3%), shoulder pain (18.2%), knee pain (14.9%), ankle pain (9.5%), wrist pain (7.4%), elbow pain (4.7%), and hip/thigh pain (2.7%).(5)

Also a study in India assessed ergonomic exposure on the developmental risk of WMSDs among bus drivers. A total of 280 male drivers with acute body pain in any region were randomly selected for the study, and ergonomic information on driver’s seat was collected using a validated questionnaire. Then the exposure and risks of developing WMSDS were assessed using Quick Exposure Check (QEC), Rapid Entire Body Assessment (REBA), Rapid Upper Limb Assessment (RULA) and Nordic Musculoskeletal Questionnaire (NMQ), but in our research we have used only Nordic questionnaire. The results of QEC showed that back and shoulder had very high exposure followed by neck and wrist. REBA revealed that nearly half (46%) of the drivers were at high risk of developing WMSDs, whereas14% were at very high risk and 29% were at medium risk. As per RULA, 46% of bus drivers needed further ergonomic investigation and modification of workstation/work style, indicating that the risk for WMSDs is potentially high. Among others, 29% were at moderate risk and 14% were at low risk, whereas 11% were at very high risk, requiring immediate change. From NMQ, it was found that 26% of drivers had musculoskeletal problems in the neck, 24% in the back, 20% in the upper limbs (shoulder and wrists were equally affected), 6% in the knees and 4% in the ankles. (10)

Also, a study in Zanjan aimed to determine the prevalence of musculoskeletal pains in suburban bus drivers. This cross-sectional study has been verified by Ethics Committee of Zanjan University of Medical Sciences. Nordic questionnaire of musculoskeletal disorders and demographic questionnaire in relation to the individual characteristics were filled for all of suburban bus drivers in Zanjan (89 individuals) in the passenger terminals of this city. Data analysis was conducted using SPSS version 11. Results: The highest prevalence of musculoskeletal disorders in the participants for the last 12 months was observed in the low back (47.2%), neck (38.2%) , shoulders and knees (27%) hip and thigh(16.9%), upper back (15.7%), foot and ankle (12.4%), wrist and hand (9.1%) and elbow (7.9%), respectively. Variables such as daily exercise, smoking, age and work experience

showed a significant relationship with pain in various parts of the body within the last 12 months and 7 days (p_{value}<0.05). However, the variables have no significant relationship between the variables and preventing normal work during the last 12 months .(11)
Also a study in India 2015 was undertaken among 100 randomly selected bus conductors from 2 routes. A questionnaire study based on the modified Nordic musculoskeletal questionnaire, assessment of physical and physiological parameters, analysis of working postures and a detailed work study were performed. Results: The analysis revealed that conductors had a work schedule of 16–18 h each day; the duration of work could vary from 15 to 20 days at a stretch. Discomfort leading to musculoskeletal disorders mainly affecting the leg (93.3%), knee (83.3%), shoulder (80%) and back areas (56.7%) had the highest 12-month prevalence rates and increased day by day. The conductors also suffered from extreme physiological stress due to prolonged working hours in hazardous standing posture conditions, excessive work pressure and minimum rest between trips. Consequently, all those factors affected their health and work performance. (12)

III.METHODOLOGY:

A. Study Design:
Descriptive analytical cross-sectional community-based study.
B. Study Area:
The study is conducted in Alsouq Almarkazi, and Islamic center. The bus station is located at the end of Africa Street near the Sport City.
C. Study Population:
The study will be conducted among bus drivers in bus stop In Alsouq Almarkazi, Khartoum 2018.

D. Sample Size:
n=sample size
z=confidence level
p=prevalence
q=1-prevalance
d= error

$$n=\frac{z^2(p\times q)}{d^2}$$

$$n=\frac{(1.96)^2\ (0.784\times 0.216)}{0.05^2}$$

n= 260
260 was not feasible in regards to our research group. Therefore, we minimized our sample size by reducing the confidence level from 96% to 83% (1.96 to 1.39)

$$n=\frac{z^2(p\times q)}{d^2}$$

$$n=\frac{(1.39)^2\ (0.784\times 0.216)}{0.05^2}$$

n= 130.8 ≈ 131
E. Sampling technique:
Non-probability sampling (Convenience sampling)
F. Data collection:
Tool: interview questionnaires and checklist
Using NORDIC MSK questionnaire (13,14)
The reliability of the NMQ, using a test–retest methodology, found the number of different answers ranged from 0 to 23%. Validity tested against clinical history and the NMQ found a range of 0 to 20% disagreement. The authors concluded this was acceptable in a screening tool (15) Further trials identified that the number of different answers between questionnaires ranged from 7 to 26% for annual prevalence and 6 to 19% for weekly prevalence (16). This research also led to a number of improvements within the questionnaire including changing wording, layout and administration for use in the UK.
Comparing pain in the last 7 days and clinical examination found sensitivity ranged between 66 and 92% and specificity between 71 and 88% (17) . In a further study of outpatients with a range of upper limb disorders, participants completed a Nordic style questionnaire on two occasions 1 week apart. The study identified that symptoms reporting for pain were highly repeatable and in terms of sensitivity, 0.90 for cervical spondylosis, 1.00 for shoulder capsulitis, 0.90 for lateral epicondylitis, 1.00 for carpal tunnel syndrome and 0.78 for Raynaud's phenomenon (18). Both papers conclude that the NMQ is repeatable, sensitive and useful as a screening and surveillance tool. However, medical examination is essential to establish a clinical diagnosis.(19)
G. Variables:
Independent variable:
Age.
Marital status.

have kids.
Driving days per week.
Driving hours per day.
Number of years driving.
Shifts (day, night, both).
Number of breaks taken.
Duration of breaks.
Type of vehicle (big bus, bus, mini bus).
Gear of vehicle.
Ownership of vehicle.
Exposure to trauma.
History of surgery.
History of MSDs.
Awareness of the effects of MSDs while driving.
Applying the proper instructions while driving.
Working more than one job.
Dependent variable:
Work related MSDs among the bus drivers.
Tool: interview questionnaires and checklist.

H. Data management and analysis plan:

Data management :

Entries questionnaires and records were refined and managed carefully, the data were cross checked for duplication and inaccuracy. Questionnaires and records were checked before data entry. Statistical package for statistic version 20 was used for data entry and analysis.

I. Ethical consideration:

Letter of ethical approval from the National University of Sudan.
Verbal consent will be obtained from each participant.

IV.RESULTS

Demographic Characteristics

A total of 131 bus drivers participated in this study. The majority were aged 31–40 years (33%), followed by those aged 20–30 years (32%), 41–50 years (18%), 51–60 years (11%), and only 6% aged 61 years or above. Most drivers were married (70%), while 29% were single and 1% divorced. Regarding parental status, 33.5% had children whereas 66.5% did not.

Work Pattern and Experience

More than half of the drivers (55.8%) reported driving seven days a week, 31.3% drove six days, and smaller proportions reported driving fewer than five days weekly. In terms of daily driving hours, the majority reported extended hours, with some driving up to 12–16 hours per day. Over a quarter (28.8%) had been driving for more than 30 years, 26.4% for 6–10 years, 18.4% for 2–5 years, and smaller percentages for shorter durations.

Nearly half (47.3%) worked only during the day, 0.8% at night, and 51.9% during both day and night. Concerning rest periods, 8% took no breaks, 40% took one, and 27.2% took two breaks per shift. The most common break duration was two hours (32.8%), followed by one hour (30.4%).

Most drivers (53.4%) operated minibuses, 40% buses, and 5.6% large buses. Manual transmission vehicles were overwhelmingly predominant (96.2%), while only 3.8% used automatic vehicles. Slightly more than half (52.7%) did not own the buses they drove, while 47.3% were owners.

Health and Lifestyle Factors

About one in five drivers (19.9%) reported previous exposure to trauma, and 8% had undergone surgery. Musculoskeletal disorders (MSDs) were reported by 32.1% of participants, while 67.9% did not experience any. Awareness of MSD effects was limited, with 52.7% unaware of potential impacts.

In terms of occupational safety, 58.8% reported following driving instructions, while 41.2% did not. Additionally, 17.6% held secondary employment alongside their driving duties.

Musculoskeletal Symptoms (Nordic Data)

During the previous 12 months, neck pain was reported by 13.8% of drivers, shoulder pain by 19.8%, and elbow pain by 3.8%. Shoulder discomfort was most frequently bilateral (12.2%), with 3.8% affecting either side individually. Elbow pain was reported in both elbows by 2.3% and in the left elbow by 1.5%.

In the preceding seven days, 6.9% experienced neck pain, 10.7% shoulder pain, and 2.3% elbow pain, again predominantly bilateral. Over the past 12 months, 14.5% had neck pain that limited daily activities, 6.1% shoulder pain, and 2.3% elbow pain.

Ankle and foot pain restricted activity in 6.8% of drivers (3 both sides, 5 right, 1 left), while 27.5% reported wrist or hand pain, 13.8% upper back pain, 13% lower back pain, and 13% hip or thigh pain. Knee pain affected 10.6%, mostly bilateral (8.4%), and eye discomfort interfered with activities in 3.9% of participants.

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Musculoskeletal Symptoms in the Past Seven Days

Within the last week, 4.6% of participants experienced ankle or foot pain (mostly bilateral), 27.5% wrist or hand pain, 12.2% upper back pain, 16% lower back pain, and 13% hip or thigh pain. Knee pain was reported by 7.7% (5.3% both knees, 2.3% one knee), and 3.1% noted eye discomfort.

Musculoskeletal Symptoms in the Past 20 Months

During the last 20 months, 4.6% of the drivers experienced ankle or foot pain, 20.6% wrist or hand pain, 9.9% upper back pain, 9.2% lower back pain, and 10.6% hip or thigh pain. Knee pain was reported by 6.1% (4.6% bilateral and 1.5% unilateral), and eye problems were reported by 7.7% of participants.

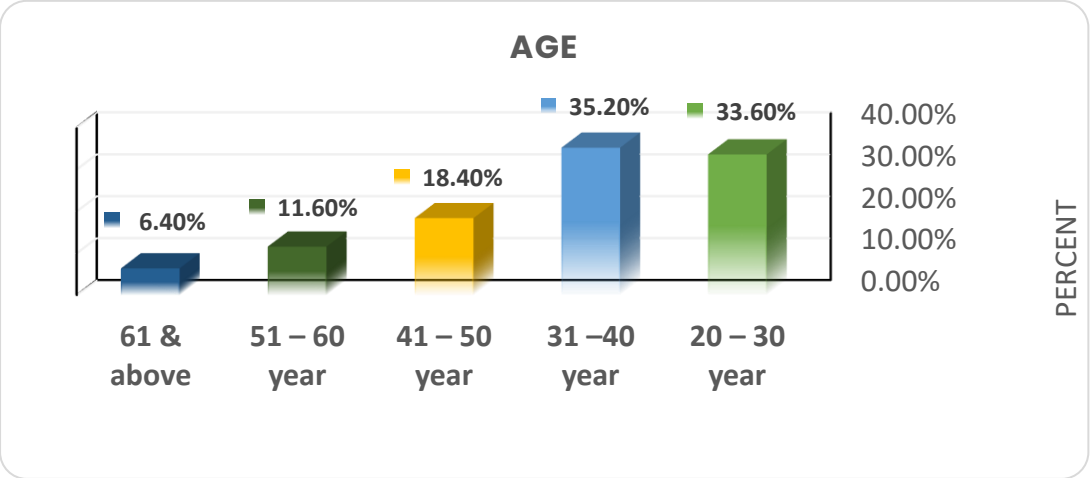

Fig. 1 Age Distribution

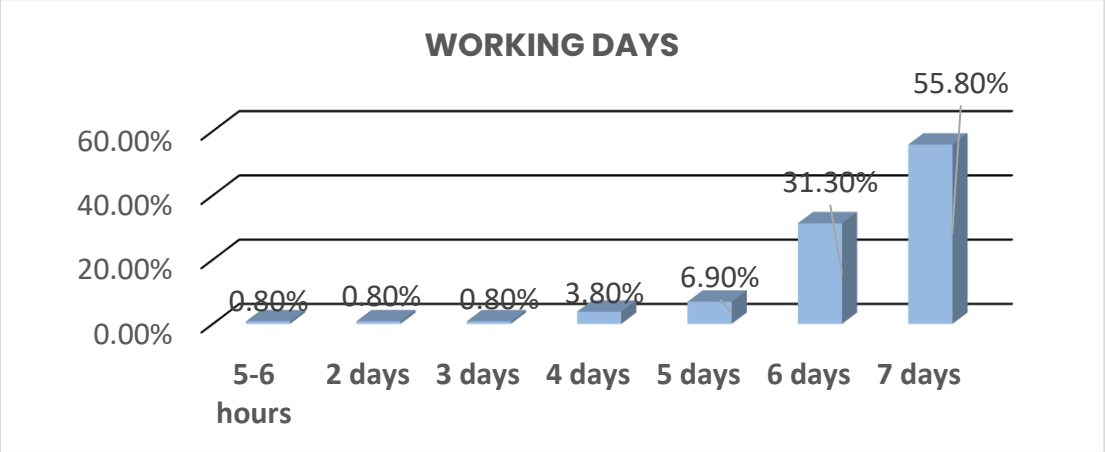

Fig. 2 Working Days Per Week

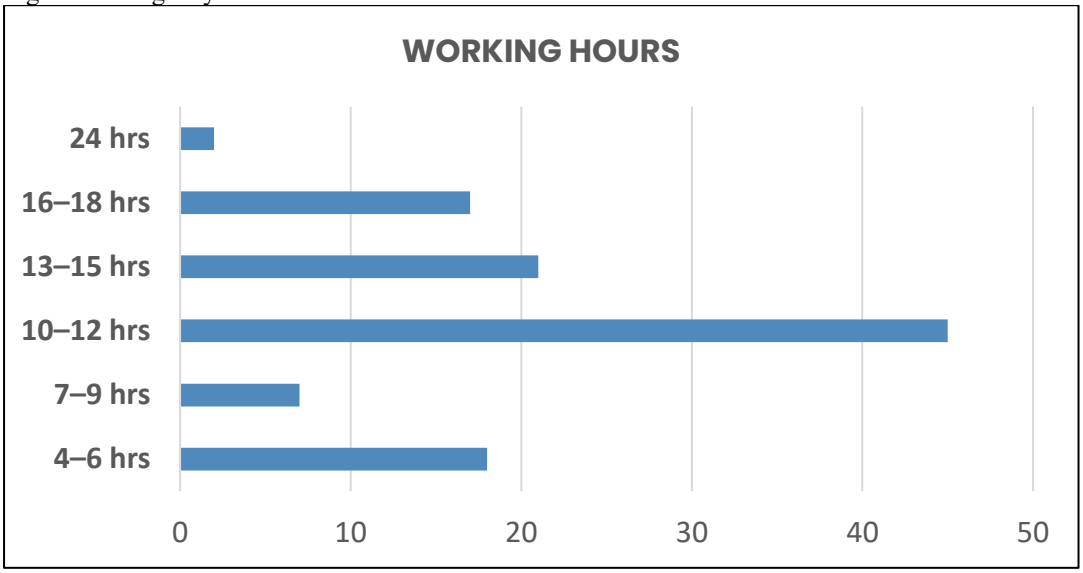

Fig.3 Working Hours Per Day

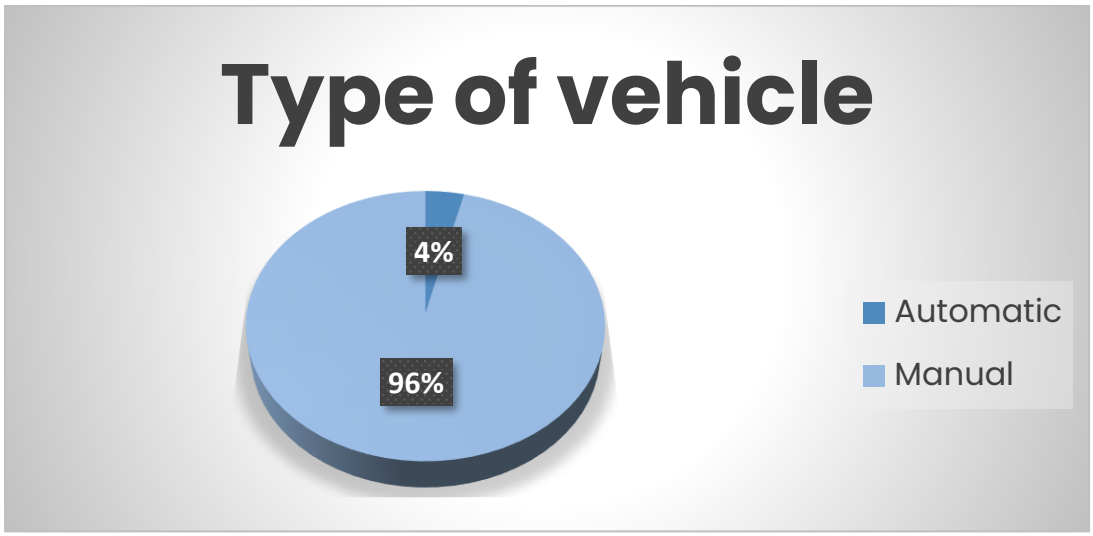

Fig.4 Type Of Vehicle

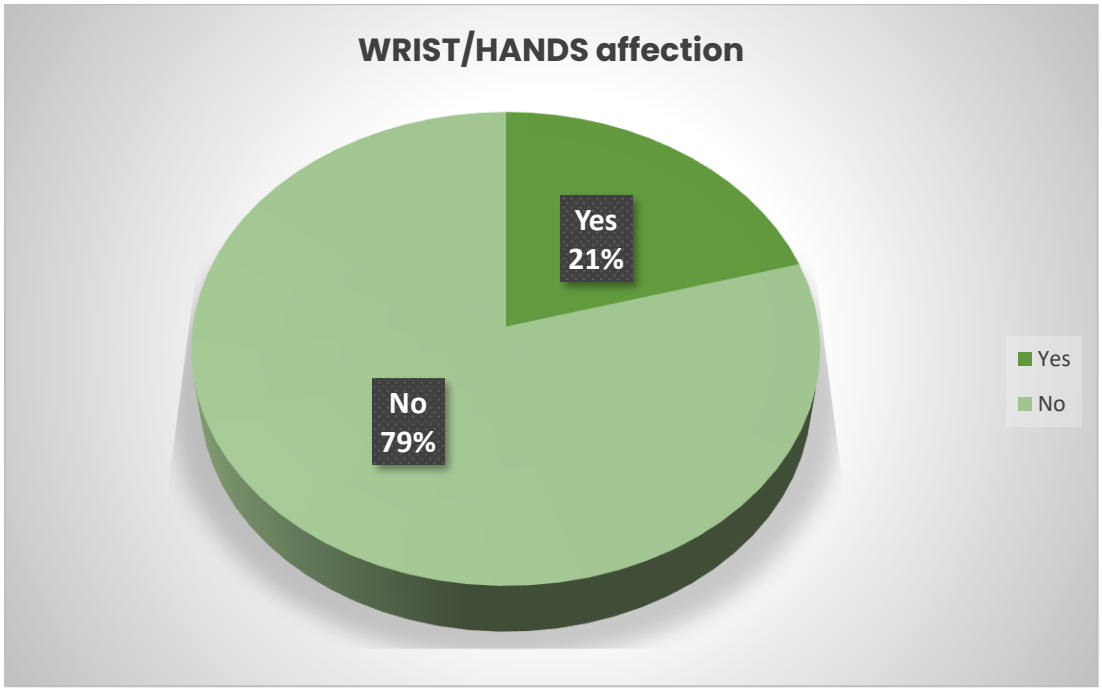

Fig.5 Most Affected Area Wrists and Hands

V. DISCUSSION, CONCLUSION AND RECOMMENDATIONS:

A. Discussion

The study has aimed to assess the MSD's among bus drivers in AL Khartoum and that was achieved by using two types of questionnaires including the international NORDIC questionnaire.

The data suggests that the age group (31-40) represents the largest percentage of the study subjects consisting of 131 male drivers of which 55.8% work all week with no days off, while 17.6% work for long hours that can extend up to 12 hours, the working hours of 50.9% mostly include having to drive during daytime as well as night.

A considerable 28.8% of the drivers have been in this line of work for 30 years or more exposing them to higher risk of developing MSDs and psychological factors (stress, fatigue, and anxiety) according to other studies (4), the ownership of the vehicles is an important psychosocial factor with up to 52.7% not owning their vehicles, although 82.4% depends solely on this job without having to work a second job.

The most prevalent complain among the drivers was in wrists/hands (20.6%) affecting them in a chronic way up to 20 months and also in a daily continuous manner (27.5%), followed by long standing shoulders pain (19.8%) and neck pain (13.8%), upper back pain (13.8%) and hip/thigh/buttock aches(13%), although the commonest discomforts in the lower back (16%) and hips/thigh/buttock (10.6%) were more often noted on a weekly bases but subsides during the same week.

The results suggest that MSDs is a major entity affecting the bus drivers life on the short and long run, the studies from all over the world supports this statements with some studies highlighting more aspects than others.
Most of the studies conducted in this topic stated that lower and upper back pain plus neck pain is the most common, however based on our results the wrists and hands are the highest complaint most probably due to the use of manual vehicles in 96.2% of the sample. (3,5,7,8,10)
The data also shows that drivers spend almost half of their day driving and in other studies up to 60% of the day which increases the risk of MSDs because of the awkward positions such as with the torso straight or unsupported, and experiencing discomforting shock/jerking vibration events, with all of these hours spent without any prompt physical activities, although a number of the bus drivers showed awareness about the importance of it and even had regular exercise weekly in a form of football matches. (6)
The data also shows that 40% of the participants have one break during the day ranging mostly between (1hr-2hrs), regarding the long working hours a study showed the relation of limited resting hours during the day has a significant association for lower back pain, and another study stated that it causes extreme physiological stress and all these factors affected health and work performance. (8, 12)
Another aspect to assess is that 19.9% of the drivers have been expose to trauma in their line of work which is a significant percentage to be considered, 8% of them have had a surgery related to that trauma which implies that many of these drivers have difficulties in this line of work, although many are experienced and up to 58.8% admitted that they follow the instructions while driving.
The majority of the drivers were aware of the effects of MSDs 47.30% and many of them stated that they take precautions to keep their postures and body comfortable while driving by adjusting and maintaining their seats in a good condition, the use of cushions for back support as well.
This study has potential limitations regarding the method of collection of data, we have used questionnaires to obtain this data, but in many studies conducted on the same topic the assessment of physical aspects of measurement such as lumbar spine mobility, hand grip strength, sit-and-reach test, and observation of standing and sitting postures, the use of Human Vibration Meter to measure whole body vibration (WBV) exposure, and postural analysis was used to evaluate awkward working posture.
Plus the use of other MSDs international questionnaires e.g.: Quick Exposure Check (QEC), Rapid Entire Body Assessment (REBA), Rapid Upper Limb Assessment (RULA).
To assess psychological factors, the validated Profile of Mood States (POMS) was used in other studies while we have only included some questions in our questionnaire that focused on the psychosocial risk factors.
The limitation of this study falls upon our limited time and resources, the use of international slandered questionnaires is preferred in studies to be conducted.

B. Conclusion

1- The estimation of MSDs among bus drivers was obtained.
2-the relevance and spread of MSDs in bus drivers in AL Khartoum was established.
3- The physical and psychosocial risk factors have been considered and compared with other studies.
4-The difficult work environment effects on drivers.
5-The awareness of the drivers about MSDs was high and they used precautions.
6- The drivers were safe and followed road regulations.

C. Recommendations

1- Further studies with larger sample size should be conducted, to have a broader understanding of this topic in AL Khartoum.
2- Spreading the awareness of the importance of physical exercise among bus drivers.
3-Establishing rest stations for the drivers in certain areas to provide them with a comfortable area during their breaks.
4- The use of devices to have more accurate results for vibration exposure and postural analysis.
5-Regular physical checkups for drivers to manage any MSDs early on.
6-Provide health insurance for drivers that cover any occupational related injuries.

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REFERENCES

[1] ErgoPlus, “The definition and causes of musculoskeletal disorders,” ErgoPlus, Jul. 23, 2018. [Online]. Available: https://ergo-plus.com/musculoskeletal-disorders-msd/
[2] K. Burton and N. Kendall, “Musculoskeletal disorders,” BMJ, vol. 348, p. g1076, Feb. 21, 2014. [Online]. Available: http://www.ncbi.nlm.nih.gov/pubmed/24561301
[3] G. P. Y. Szeto and P. Lam, “Work-related musculoskeletal disorders in urban bus drivers of Hong Kong,” J. Occup. Rehabil., vol. 17, no. 2, pp. 181–198, Jun. 2007. [Online]. Available: http://link.springer.com/10.1007/s10926-007-9070-7

[4] S. B. M. Tamrin, K. Yokoyama, N. Aziz, and S. Maeda, "Association of risk factors with musculoskeletal disorders among male commercial bus drivers in Malaysia," Hum. Factors Ergon. Manuf. Serv. Ind., vol. 24, no. 4, pp. 369–385, Jul. 2014. [Online]. Available: http://doi.wiley.com/10.1002/hfm.20387
[5] J. K. Abledu, E. B. Offei, and G. K. Abledu, "Predictors of work-related musculoskeletal disorders among commercial minibus drivers in Accra Metropolis, Ghana," Adv. Epidemiol., vol. 2014, Article ID 384279, pp. 1–5, Aug. 21, 2014. [Online]. Available: http://www.hindawi.com/archive/2014/384279/
[6] O. O. Okunribido, S. J. Shimbles, M. Magnusson, and M. Pope, "City bus driving and low back pain: a study of the exposures to posture demands, manual materials handling and whole-body vibration," Appl. Ergon., vol. 38, no. 1, pp. 29–38, Jan. 2007. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0003687006000172
[7] M. Bovenzi and A. Zadini, "Are occupational drivers at an increased risk for developing low back pain?," Spine, vol. 21, no. 6, pp. 710–717, Mar. 15, 1996. [Online]. Available: https://journals.lww.com/spinejournal/Abstract/1996/03150/Are_Occupational_Drivers_at_an_Increased_Risk_for.10.aspx
[8] F. Tüchsen, H. Hannerz, H. Burr, and N. Krause, "Low back pain among professional bus drivers: ergonomic and occupational-psychosocial risk factors," Isr. Med. Assoc. J., vol. 12, no. 1, pp. 26–31, Jan. 2010. [Online]. Available: https://www.ima.org.il/MedicineIMAJ/viewarticle.aspx?aid=40
[9] M. J. M. Robb and N. J. Mansfield, "Self-reported musculoskeletal problems amongst professional truck drivers," Ergonomics, vol. 50, no. 6, pp. 814–827, Jun. 2007. [Online]. Available: http://www.tandfonline.com/doi/abs/10.1080/00140130701220341
[10] S. Yasobant and P. Rajkumar, "Are bus drivers at an increased risk for developing musculoskeletal disorders? An ergonomic risk assessment study," ResearchGate, 2015. [Online]. Available: https://www.researchgate.net/publication/277559268
[11] S. Arghami, K. Kamali, and M. Nasab-Alhosseini, "A survey on musculoskeletal pain in suburban bus drivers," J. Occup. Hyg. Eng., vol. 2, no. 2, pp. 72–81, Sep. 10, 2015.
[12] S. Gangopadhyay, S. Dev, T. Das, G. Ghoshal, and T. Ara, "An ergonomics study on the prevalence of musculoskeletal disorders among Indian bus conductors," Int. J. Occup. Saf. Ergon., vol. 18, no. 4, pp. 521–530, Jan. 2012.
[13] O. Erdinç, K. Hot, and M. Ozkaya, "Turkish version of the Cornell Musculoskeletal Discomfort Questionnaire: cross-cultural adaptation and validation," ResearchGate, 2008. [Online]. Available: https://www.researchgate.net/figure/Male-version-of-the-CMDQ-for-standing-workers_fig1_51253827
[14] J. O. Crawford, "The Nordic musculoskeletal questionnaire," Occup. Med. (Lond)., vol. 57, no. 4, pp. 300–301, Apr. 16, 2007. [Online]. Available: https://academic.oup.com/occmed/article-lookup/doi/10.1093/occmed/kqm036
[15] I. Kuorinka et al., "Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms," Appl. Ergon., vol. 18, no. 3, pp. 233–237, Sep. 1987. [Online]. Available: https://www.sciencedirect.com/science/article/pii/000368708790010X
[16] C. E. Dickinson, K. Campion, A. F. Foster, S. J. Newman, A. M. T. O'Rourke, and P. G. Thomas, "Questionnaire development: an examination of the Nordic musculoskeletal questionnaire," Appl. Ergon., vol. 23, no. 3, pp. 197–201, Jun. 1992. [Online]. Available: https://www.sciencedirect.com/science/article/pii/000368709290225K
[17] K. Ohlsson, R. G. Attewell, B. Johnsson, A. Ahlm, and S. Skerfving, "An assessment of neck and upper extremity disorders by questionnaire and clinical examination," Ergonomics, vol. 37, no. 5, pp. 891–897, May 1994. [Online]. Available: http://www.tandfonline.com/doi/abs/10.1080/00140139408963698
[18] K. Palmer, G. Smith, S. Kellingray, and C. Cooper, "Repeatability and validity of an upper limb and neck discomfort questionnaire: the utility of the standardized Nordic questionnaire," Occup. Med. (Lond)., vol. 49, no. 3, pp. 171–175, Apr. 1999. [Online]. Available: https://academic.oup.com/occmed/article-lookup/doi/10.1093/occmed/49.3.171
[19] J. O. Crawford, "The Nordic musculoskeletal questionnaire," Occup. Med. (Lond)., vol. 57, no. 4, pp. 300–301, Apr. 16, 2007. [Online]. Available: https://academic.oup.com/occmed/article-lookup/doi/10.1093/occmed/kqm036

Annexes

A. Questionnaire

Age?	Marital status?	Do you have kids?
☐	Married ☐ ngle I ☐ cee	Yes ☐ No ☐

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How many days do you drive per week?	How many hours do you drive per day?	How many years have you been driving?
☐ days	☐ hours	☐ year
Do you work by?	How many breaks do you take?	How long are your breaks?
Day ☐ Night ☐ Both ☐	☐	☐ hours
What type of vehicle?	Is the vehicle?	Do you own your bus?
Big bus ☐ Bus ☐ Mini bus ☐	Manual ☐ Automatic ☐	Yes. ☐ No. ☐
Have you been exposed to trauma?	Have you had any surgery?	Do you have any MSDs?
Yes. ☐ No. ☐	Yes. ☐ No. ☐	Yes. ☐ No. ☐
Are you aware of the effects of MSDs?	Do you follow the instruction while driving?	Do you work another job?
Yes. ☐ No. ☐	Yes. ☐ No. ☐	Yes. ☐ No. ☐ Specify it? ☐

B. NORDIC Musculoskeletal Questionnaire

Have you any time during the last 12 months had trouble (such as ache , pain discomfort numbness ,) in	Have you had trouble during the last 7 days :	During the last 12 months have been prevented from carrying normal activities (e g. job house , hobbies) because of this trouble
1.neck No yes 1☐ ☐ 2	2.neck No yes 1 ☐ 2☐	3.neck No yes 1 ☐ ☐
4.shoulders No yes ☐ 1 ☐ 2 in the right shoulder ☐ 2 in the left shoulder ☐ 2 in the both shoulder	5.shoulders No yes ☐1 ☐ 2 in the right shoulder ☐ 2 in the left shoulder ☐2 in the both shoulder	6.shoulders No yes 1☐ ☐ 2 in the right shoulder ☐ 2 in the left shoulder ☐ 2 in the both shoulder

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7.elbows No yes ☐ 2 in the right elbows 2 ☐ the left elbows 2 ☐ the both elbows	8.elbows No yes ☐1 ☐ in the right elbows ☐ 2 in the left elbows ☐ 2 in the both elbows	9.elbows No yes ☐ 1 ☐2 in the right elbows ☐2 in the left elbows ☐ 2 in the both elbows
During the last 12 months have been prevented from carrying normal activities (eg .job house, hobbies)because of this trouble	Have you at any time during the last 7days :	Have you at any time during the last 20 months had trouble (such as ache pain discomfort ,numbness)in:
10. WRIST/HANDS No yes ☐ ☐2 in the right wrist hand ☐2 in the left wrist hand ☐2 in the both wrist hand	11. WRIST/HANDS No yes ☐ ☐in the right wrist hand ☐2 in the left wrist hand ☐2 in the both wrist hand	12. WRIST/HANDS No yes 1 ☐ ☐in the right wrist hand ☐2 in the left wrist hand ☐2 in the both wrist hand
13. upper back No yes 1 ☐ 2 ☐	14. upper back No yes 1 ☐ 2 ☐	15.upper back No yes 1 ☐ 2 ☐
16. lower back No yes 1☐ 2 ☐	17. lower back No yes 1 ☐ 2 ☐	18.lower back (small of back) No yes 1 ☐ 2 ☐
19. on both Hips/thight/buttocks No yes 1 ☐ 2 ☐	20. on both Hips/thight/buttocks No yes 1 ☐ 2 ☐	21. on both Hips/thight/buttocks No yes 1 ☐ 2 ☐
22. knees No yes 1 ☐ 2 ☐	23.knees No yes 1 ☐ 2 ☐	24.one or both knees No yes 1 ☐ 2 ☐
During the last 12 months have been prevented from carrying normal activities (eg .job house, hobbies)because of this trouble	Have you at any time during the last 7days :	Have you at any time during the last 20 months had trouble (such as ache pain discomfort numbness)in:
25. ankle /feet No yes 1☐ 2 ☐	26. ankle /feet No yes 1☐ 2 ☐	27.one or both ankles /feet No yes 1 ☐ 2 ☐

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During the last 12 months have been prevented from carrying normal activities (eg .job house, hobbies)because of this trouble	Have you had trouble during the last 7 days:	Have you at any time during the last 20 months had trouble (such as ache pain discomfort redness strain)in:
28. Eyes No yes 1 ☐ ☐2in the right eye ☐2 in the left eye ☐2 in the both eye	29. Eyes No yes 1 ☐ ☐2in the right eye ☐2 in the left eye ☐2 in the both eye	30. Eyes No yes 1 ☐ ☐2in the right eye ☐2 in the left eye ☐2 in the both eye