

# Work-related musculoskeletal disorders and predisposing factors among commercial motorcyclists in Ibadan North Local Government Area, Nigeria

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## ABSTRACT

**Background:** Studies on the prevalence of work-related musculoskeletal disorders (WRMSDs) among motorcyclists in sub-Saharan Africa are scarce.

**Objective:** This study aimed to investigate the prevalence of WRMSDs and the predisposing factors among commercial motorcyclists operating in Ibadan North Local Government Area, Oyo State, Nigeria.

**Methods:** Information was obtained from 122 (of 200) motorcyclists using a structured questionnaire which elicited information on the respondents' demographic characteristics, work experience, and predisposing factors to, and possible causes of, WRMSDs.

**Results:** The response rate was 61.0%. The age range of the 122 participants was 15-55 years. One hundred and thirteen (92.6%) of the motorcyclists reported WRMSDs and 66.4% of all respondents worked for 6-10 hours daily. Lower back complaints were most commonly reported. WRMSDs were significantly associated ( $p < 0.05$ ) with age, marital status, education, years of experience, hours spent at work daily, and days spent working per week.

**Conclusion:** The prevalence of WRMSDs was high among these workers. Age, marital status, educational qualification and work behaviour were risk factors.

**Keywords:** motorcyclists, work-related MSD, lower back pain

## INTRODUCTION

Musculoskeletal disorders have been reported as major and the most common cause of severe long-term pain and physical disability that affects hundreds of millions of people across the world.<sup>1</sup> The term 'musculoskeletal disorder' covers a very heterogeneous group of symptoms and illness. In some cases, the illnesses are specific, that is, they have a known anatomical or physiological cause or are due to a known pathologic mechanism and can be clearly distinguished from each other.<sup>2</sup> Work-related musculoskeletal disorders (WRMSDs) are defined as musculoskeletal disorders that result from a work-related event.<sup>3</sup> They are a complete range of inflammatory and degenerative disorders initiated or aggravated largely by the performance of work or in associated work settings.<sup>4,5</sup>

Most occupations are related to a high risk of developing injury<sup>4</sup> and WRMSDs are among the most frequently reported work-related injuries.<sup>6</sup> Generally, driving as a profession entails routine muscular effort, awkward sitting postures, and exposure to whole-body vibration.<sup>7</sup> This suggests that the work tasks and environment put drivers at risk for WRMSDs.<sup>7</sup> High prevalences of WRMSDs, which vary from 53% to 91%, have been reported among drivers in different parts of the world.<sup>8</sup> This is reportedly linked to risk factors that include seat discomfort, exposure to whole-body vibration, long driving time, non-neutral postures,

heavy lifting, manual materials handling, and psychosocial factors.<sup>7,9</sup>

The increasing growth of Nigerian towns and cities encourages commercial motorcycling (locally called 'okada') as it is an easier means of navigating through traffic jams.<sup>9,10</sup> It is cheaper than taxi cabs and operates in areas where taxis are not readily available due to the poor state of the roads.<sup>9,10</sup> In addition, motorcycles are compact and agile, consume less fuel, are cheaper to buy, and require less maintenance compared to cars.<sup>11</sup> However, according to Karmegam et al.<sup>12</sup> motorcycle riding involves complex and risky manoeuvres and processes in spite of the advantages.

In addition to the biomechanical and ergonomic risk factors associated with driving, motorcyclists are exposed to a variety of other hazards<sup>12</sup> including fatigue, pollution from other vehicles, and physical harm due to noise, motion and vibration.<sup>9</sup> The workspace of a motorcycle operator is open to direct and indirect risks, resulting in discomfort, restriction to a fixed position, and prolonged stresses from long-distance driving on poor and bumpy roads, all of which can lead to accident, injury or death.<sup>9,12</sup> Evidence in the literature shows that motorcyclists are more vulnerable to personal injury than drivers of cars.<sup>13,14</sup>

In Nigeria, commercial motorcycle riding often involves prolonged sitting on motorcycles that are usually not ergonomically compatible with their riders.<sup>9</sup> Humans are mechanically designed for walking and

not for sitting, which is related to the biomechanical effects of reaction to load and stresses in the body.<sup>16</sup> In a static sitting position, there is increased pressure in the posterior aspect of the spine's disc, as well as strain in the posterior passive elements of the spine. Some authors have attributed this to posterior rotation of the pelvis and flattening out of the lumbar lordosis.<sup>17,18</sup>

Studies among occupational/commercial drivers conducted in south west Nigeria have reported high prevalence of WRMSDs<sup>19,20</sup> (89.3% and 77%, respectively), with the lower back being the body part most commonly affected. Rufai et al. reported a high prevalence of lower back pain among transport workers in northern Nigeria.<sup>21</sup> However, these studies involved only car, bus and lorry drivers. A similar study in Ghana reported a 78.4% prevalence of WRMSDs among drivers but considered minibus drivers only.<sup>7</sup> Onawumi and Oyawale<sup>9</sup> reported WRMSDs among 300 commercial motorcyclists in south west Nigeria but did not calculate the prevalence of WRMSDs or investigate associated risk factors. Their research was focused on problems associated with the ergonomic design of the different makes of motorcycles.

Little is known about the prevalence of WRMSDs among motorcyclists in Nigeria and sub-Saharan Africa. Most previous studies focused on car, bus and truck drivers. Due to the high level of unemployment, commercial motorcycling is becoming a popular occupation among both educated and uneducated Nigerian youths.<sup>9</sup> There is, therefore, a need for more research in this area. This study was designed to investigate the prevalence of WRMSDs and predisposing factors among commercial motorcyclists in Ibadan. This city is the hub of commercial activity in Nigeria, covers the largest geographical area and has the third largest population in the country.<sup>22</sup>

## MATERIALS AND METHODS

This cross-sectional survey involved commercial motorcyclists operating within Ibadan North-East Local Government Area of Oyo State, Nigeria. Participants were registered by the National Union of Road Transport Workers (NURTW) in Ibadan North Local Government Area who had no history of traumatic injuries in the six months prior to the commencement of study. Convenience sampling was used to select study participants because the motorcycle park in Ibadan North Local Government Area was the most accessible, in terms of both obtaining the regulating authority's permission and obtaining participants' consent.

Officials of NURTW invited the researchers to the monthly meeting of the union at their headquarter park. The researchers briefed the motorcyclists on the purpose and procedure of the study, and those who were literate and agreed to participate were given the questionnaires to complete after signing the informed consent form. One of the researchers who is a native of Ibadan and fluent in Yoruba (the predominant local language in Ibadan) administered the questionnaires to those participants who had difficulty reading and understanding the questions. Questionnaires were distributed to 200 commercial motorcyclists. Some participants left the park with their questionnaires and promised to return them to the union's office. Motorcyclists who reported having musculoskeletal complaints from sources unrelated to motorcycling (such as domestic activities, farming, gardening etc.) within six months prior to the time of data

**Table 1. Socio-demographic characteristics of participants (N = 122)**

Variable	n	%	p-value
<b>Age (years)</b>			
15-20	6	4.9	
21-25	15	12.3	
26-30	18	14.8	
31-35	28	23.0	
36-40	27	22.1	
41-45	13	10.7	
46-50	9	7.4	
51-55	6	4.9	0.000
<b>Marital status</b>			
Married	96	78.7	
Single	26	21.3	0.000
<b>Education</b>			
PLC	47	38.5	
Modern School	2	1.6	
SSC	66	54.1	
OND	5	4.1	
NCE	2	1.6	0.000

PLC: Primary School-leaving Certificate

SSC: Senior School Certificate

OND: Ordinary National Diploma

NCE: National Certificate in Education

collection (June 2005), were not included in the study.

A 19-item self-administered questionnaire was used for data collection. The questionnaire was derived from standardised questionnaires developed for investigating WRMSDs.<sup>23,24</sup> The questionnaire has three sections: section A, consisting of three questions relating to participants' demographic information; section B, consisting of 11 questions designed to identify factors that predisposed participants to WRMSDs; and section C, consisting of five questions regarding work-related musculoskeletal pain and injury.

The data were analysed using SPSS 25.0 version software (SPSS Inc., Chicago, Illinois, USA). The data were presented as frequencies and percentiles. For the purposes of this study, a WRMSD was defined as pain/discomfort or a motorcycling-related injury to any part of the body. Six-month prevalence of WRMSDs was calculated as the proportion of participants who experienced WRMSDs six months prior to the time of data collection. The chi-square test was used to explore the association between the prevalence of musculoskeletal disorders and demographic variables and work histories. Level of significance was set at  $p \leq 0.05$ .

The University of Ibadan/University College Hospital Health Research Ethics Committee approved the study. Permission to conduct the study was obtained from NURTW officials. Informed consent was also obtained from study participants.

## RESULTS

Seventy-eight questionnaires were not returned; the response rate was 61.0%. The socio-demographic characteristics of the respondents are presented in Table 1. Most respondents were younger than 36 years (55.0%). The highest educational qualification of the

**Table 2. Work-related characteristics of participants (N = 122)**

Variable	n	%	p-value
<b>Years of experience</b>			
<1	25	20.5	
1-5	63	51.6	
6-10	34	27.9	0.000
<b>Hours spent working per day</b>			
1-5	7	5.7	
6-10	81	66.4	
>10	34	27.9	0.000
<b>Days spent working per week*</b>			
3	2	1.6	
5	22	18	
6	61	50	
7	37	30.3	0.000
<b>Observed break</b>			
Yes	120	98.4	
No	2	1.6	0.000
<b>Length of break (hours)</b>			
<0.5	6	4.9	
0.5-1	28	23.0	
1-2	34	27.9	
>2	54	44.3	0.000
<b>Easily tired</b>			
Yes	74	60.7	
No	48	39.3	0.000
<b>Frequency of tiredness</b>			
Often	32	26.2	
Sometimes	61	50.0	
Rarely	24	19.7	
Never	5	4.1	0.000
<b>Action taken when tired</b>			
Rest	89	73.0	
Continue working	18	14.8	
Other	15	12.3	0.000

\*No motorcyclist worked for 1, 2 or 4 days

majority of respondents was a secondary school leaving certificate (54.1%); most were married (78.7%).

Table 2 shows the distribution of work-related characteristics of the respondents. Most (51.6%) of the respondents had 1-6 years of experience of driving motorcycles. Approximately one third worked more than 10 hours a day, and seven days a week (27.9% and 30.3%, respectively). Most (98.4%) reported taking breaks of varying lengths within working hours; 60.7% were easily tired, but 14.8% of the respondents continued working even when tired.

The prevalence of, and characteristics of those with, WRMSDs are shown in Table 3. A high percentage (92.6%) of the respondents reported WRMSDs, and many had sustained an injury (61.5%). The most common site of pain in the last six months was the lower back (80.3%), followed by the neck (67.2%). The least common site was the elbow (29.5%). Pain was also commonly reported in

**Table 3. Prevalence and characteristics of WRMSDs (N = 122)**

Variable	n	%	p-value
<b>WRMSDs</b>			
Yes	113	92.6	
No	6	4.9	
No response	3	2.5	0.000
<b>Occurrence of injury</b>			
Sustained Injury	75	61.5	
No injury	47	38.5	0.000
<b>Presence of disability</b>			
Yes	60	49.2	
No	62	50.8	0.000
<b>Type of WRMSD</b>			
Back pain	29	23.8	
Fracture	4	3.3	
Pulled muscle	2	1.6	
Crush injury	6	4.9	
Burns injury	10	8.2	
Other	71	58.2	0.000
<b>Body part affected</b>			
Lower back	98	80.3	
Neck	82	67.2	
Upper back	73	59.8	
Wrist/hand	73	59.8	
Shoulder	71	58.2	
Ankle/foot	64	52.5	
Hip/thigh	55	45.1	
Knee	42	34.4	
Elbow	36	29.5	0.000
<b>Absence from work due to WRMSD</b>			
Yes	69	56.6	
No	53	43.4	0.001

Note: Proportions of responses for 'body part affected' were not compared because participants reported WRMSDs of multiple body parts

the ankle or foot (52.5%), and the hip or thigh (45.1%). More than half of the motorcyclists (56.6%) had been absent from work due to pain at least once in the past six months.

Table 4 shows the associations between demographic and work-related characteristics, and WRMSDs as defined in this study. All drivers in each age group reported pain, other than the youngest and oldest age group (in which 50% and 0% reported pain, respectively). The majority with WRMSDs were younger than 41 years, married, had a secondary school education, had been driving motorcycles for 1-5 years, worked long hours and many days per week, took breaks of an hour or more, were easily tired, and rested when tired. All of these factors, other than observing a break, were statistically significantly associated with musculoskeletal pain. All respondents who worked 6-10 hours daily reported having WRMSDs, while 82.4% of those who worked for more than 10 hours reported WRMSDs. Of the 74 respondents who reported becoming easily tired, 71 (95.9%) had experienced WRMSDs, while 42 of the 48 who were not easily tired (87.5%) had experienced WRMSDs.

**Table 4. Associations between demographic and work-related characteristics, and WRMSDs (N = 119\*)**

Variable	n	%	p-value
<b>Age (years)</b>			
15-20	3/6	50.0	
21-25	15/15	100	
26-30	18/18	100	
31-35	28/28	100	
36-40	27/27	100	
41-45	13/13	100	
46-50	9/9	100	
51-55	0/6	0	0.000
<b>Marital status</b>			
Married	93/96	96.9	
Single	20/26	76.9	0.000
<b>Education</b>			
PLC	44/47	93.6	
Modern school	2/2	100	
SSC	66/66	100	
OND	0/5	0	
NCE	1/2	50.0	0.000
<b>Years of experience</b>			
<1 year	22/25	88.0	
1-5 years	63/63	100	
6-10 years	28/34	82.4	0.000
<b>Time spent working per day</b>			
1-5 hours	4/7	57.1	
6-10 hours	81/81	100	
>10 hours	28/34	82.4	0.000
<b>Days spent working per week</b>			
3 days	0/2	0	
5 days	19/22	86.4	
6 days	53/61	86.9	
7 days	31/37	83.8	0.001
<b>Observed break</b>			
Yes	111/120	92.5	
No	2/2	100	0.742
<b>Length of break (hours)</b>			
<0.5	3/6	50.0	
0.5-1	28/28	100	
1-2	34/34	100	
>2	48/54	88.9	0.055
<b>Easily tired</b>			
Yes	71/74	96.0	
No	42/48	87.5	0.002
<b>Action taken when tired</b>			
Rest	86/89	96.6	
Continue working	18/18	100	
Other	9/15	60.0	0.000

\*Three participants did not respond regarding presence of WRMSDs

## DISCUSSION

More than 90% of the motorcyclists reported WRMSDs as defined in this study. This is about 30% higher than the 60% back pain prevalence rate reported by Akinbo et al.<sup>25</sup> among commercial motorcyclists in Lagos, Nigeria in 2008. However, our study included WRMSDs involving all body parts, while the study by Akinbo et al., who looked only at back pain which might explain the difference in prevalence rates. Our findings are, however, comparable to those of Akinpelu et al.,<sup>19</sup> who found an 89.3% prevalence rate of musculoskeletal pain among occupational car/bus drivers in the same city of Ibadan where the present study was conducted. Karmegam et al.<sup>26</sup> found an overall prevalence of discomfort (during the riding process) of 52.9% (50.3% for males and 55.5% for females) among motorcyclists in Malaysia. Akinpelu et al.<sup>19</sup> attributed their findings to the bad state of the roads, use of poorly managed vehicles and non-enforcement of roadworthiness tests. Apart from racial and cultural variations, these factors might have accounted for the observed difference between the results in the different studies. Furthermore, prevalence of WRMSDs in this study was assessed as motorcyclists' reported experience of pain/discomfort in the previous six months, and not during the riding process itself; and only male commercial motorcyclists were included.

There was high prevalence of injuries (61.5%) among the participants. This may be attributed to the high rate of road traffic accidents on Nigerian roads with 337 301 accidents and 608 277 injuries or fatalities reported in the country from 1990 to 2012.<sup>27,28</sup> This has been linked to human factors such as impatience, speeding, lack of proper training, drink driving, and noncompliance with road safety laws.<sup>27</sup> Mechanical causes (brake failure, burst tyres, use of fake spare parts, defective or dazzling lights, etc.) and environmental causes (poorly maintained roads, dangerous bends, weather conditions, road obstructions, etc.) of accidents have also been reported in Nigeria.<sup>27</sup>

Body parts most affected by WRMSDs were the lower back, neck, upper back and wrist/hand. Other Nigerian studies have found the lower back to be the most affected body part among drivers of cars, buses and lorries.<sup>19,20</sup> Mohd Hafzi et al.<sup>29</sup> also found lower back pain to be the most commonly reported symptom with a 12-month prevalence of 82.3% and 62.8%, respectively, among occupational and non-occupational motorcyclists in Malaysia. Activities such as prolonged sitting, whole-body vibration and awkward postures that have been associated with the risk of developing lower back pain,<sup>30</sup> are all consistent with day-to-day life of commercial motorcyclists. In a recent review by Diyana et al.,<sup>31</sup> a high incidence of WRMSDs among police riders was linked to a combination of exposure to vibrations with prolonged sitting and static posture. Onawumi and Oyawale<sup>9</sup> observed that most of the motorcycles used by commercial drivers lacked back support and were not compatible with the anthropometric characteristics of Nigerian drivers. Karmegam et al.<sup>12</sup> found that the level of discomfort (in all body parts) decreases over time during a testing period with lumbar support. They concluded that the use of lumbar support provided postural stability and integrity for the motorcyclist's musculoskeletal system, particularly the spinal column, during riding.

Onawumi and Oyawale<sup>9</sup> reported that the majority of surveyed motorcyclists complained about shoulder-related, rather than lower back, issues. The motorcyclists seemed to maintain a static neck

posture and were exposed to hand-arm vibration during riding which might have accounted for the high prevalence of observed upper back and neck WRMSDs.<sup>31</sup> Bridger<sup>32</sup> earlier reported that static neck postures, repeated flexion and/or extension of the neck, forceful movements of the upper body, shoulder elevation, and arm abduction, were all possible risk factors for neck pain.

Almost 57% of commercial motorcyclists had taken leave from work because of WRMSDs. This suggests that WRMSDs can have adverse effects on productivity. This is a major characteristic of WRMSDs highlighted by the Centre for Disease Control and Prevention (CDC)<sup>33</sup> which reported that "musculoskeletal disorders are associated with high costs to employers such as absenteeism, lost productivity, and increased healthcare, disability, and worker's compensation costs".<sup>33</sup> However, the extent of the losses associated with WRMSDs is reportedly dependent on the severity of the condition, the nature and quality of healthcare received, and on the characteristics of the patient, such as age and general health status.<sup>34</sup>

Factors that were associated with WRMSDs as defined in this study were demographic characteristics (age, marital status, education and years of experience), time spent working daily, and days spent at work weekly. Age has been reported as a significant correlate of WRMSDs among Ghanaian commercial drivers,<sup>7</sup> and young age as a predictor of traumatic injuries among Ugandan motorcyclists.<sup>35</sup> All participants, other than those aged 15-20 and 51-55 years, reported having WRMSDs. Although the study by Olumide and Owoaje<sup>36</sup> found age to be a predictor of road safety practices among commercial motorcyclists in Oyo State, Nigeria, with younger drivers displaying poorer road safety practices, the findings of this study suggest that all commercial motorcyclists, irrespective of age, are predisposed to having WRMSDs. The prevalence of WRMSDs was high among motorcyclists of lower educational status. This category of motorcyclists is likely to be younger and less compliant with road safety practices compared to their more learned counterparts. The official age for obtaining a driver's licence is 18 years<sup>36</sup>, however, the inclusion of younger motorcyclists in a previous Nigerian survey<sup>36</sup> and in the present study, suggests that national traffic laws are not fully implemented.

A higher prevalence of WRMSDs among workers who did not easily get tired suggests that they continued working for long periods, which might have predisposed them to musculoskeletal disorders. Of all respondents that rested when tired, 96.6% had experienced a WRMSD. This suggests that taking rest was not deliberate and/or calculated, because observations about Nigerian commercial motorcyclists is that they rest when there are no commuters. Stress/fatigue and state of the road (27% each) were jointly ranked by the majority of Nigerian motorcyclists, in the study by Onawumi and Oyawale,<sup>9</sup> as risk factors for WRMSDs.

Significant associations were found between WRMSDs and work experience, hours spent at work per day and number of days spent at work in a week. Abledu et al.<sup>7</sup> found significant associations between WRMSDs, and driving more than 12 hours per day and driving at least five days per week, among a cohort of minibus drivers in Accra, Ghana. In a review, Diyana et al.<sup>31</sup> also found that prolonged exposure to

segmented or whole-body vibration was significantly linked to incidence of WRMSDs among police riders. It was suggested that the aforementioned risk factors should be targeted for preventive strategies to reduce the incidence of WRMSDs among minibus drivers, since they are modifiable. Prolonged static work posture<sup>37</sup> and sitting for eight hours a day<sup>38</sup> have been reported to be major occupational risk factors for WRMSDs.

Although the data analysed for this study are around 12 years old, the results are relevant as commercial motorcycle riding in Nigeria is still prominent. Neither the conditions of the roads<sup>39,40</sup> nor the level of unemployment<sup>40</sup> has improved. Recent national statistics show that the unemployment rate increased by 13.6% between the last quarters of 2010 and 2017.<sup>40,41</sup> Young school leavers still embrace motorcycle riding as a livelihood.

## LIMITATIONS

The non-probability sampling employed in our study limits the extent to which our results can be generalised. We could not select participants randomly because the number of motorcyclists accessible to us was small, and they were a group of workers who are always in haste; hence, we included the few who were available for business at their parks within the local government, and who agreed to participate.

## CONCLUSION AND RECOMMENDATIONS

The prevalence of WRMSDs was high among the participating motorcyclists operating in Ibadan North Local Government Area, Nigeria. Age, marital status and educational qualification were identified as demographic risk factors, while years of experience, time spent working daily, days spent at work weekly, and length of breaks observed daily while working were work-related risk factors.

Reducing time spent in the process of commercial riding and observing breaks during working hours are recommended for these workers to reduce the incidence of WRMSDs. Postural education and exercise, stretching, ergonomic instructions and work behaviour modifications will also be of benefit to commercial motorcyclists.

## LESSONS LEARNED

1. The lower back is the most affected body part in commercial motorcyclists in Ibadan.
2. Younger and lowly educated commercial motorcyclists appear to be more predisposed to work-related musculoskeletal disorders.
3. Prolonged driving of motorcycles might cause commercial motorcyclists to experience work-related musculoskeletal disorders.

## Authors' contributions

AOJ and OJA were involved in the conceptualisation of the study, the acquisition of data, initial statistical analyses, and drafting of the manuscript; OMO re-analysed the data, and carried out final preparation of the manuscript; SOB and EMU reviewed the data analysis results, and critically revised the manuscript. All authors read and approved the final version of the manuscript.

17. De Carvalho DE. Time varying gender and passive tissue responses

## DECLARATION

The authors declare no conflicts of interest.

## Funding/support

This project was fully funded by the authors.

## ACKNOWLEDGEMENT

The authors acknowledge the technical support received from the academic staff of the Department of Physiotherapy, College of Medicine, University of Ibadan, Nigeria.

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