

Work-related musculoskeletal symptoms among motorcycle mechanics, Lahore (Pakistan): an application of standardized Nordic questionnaire

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Abstract

The current study is a follow up to our previously published “letter to the editor”, whose purpose was to report the relationship of pain prevalence (work-related musculoskeletal symptoms) and trouble prohibiting to normal work (work-related musculoskeletal disorders) with descriptive variables among motorcycle mechanics using standardized Nordic musculoskeletal questionnaire (NMQ) as a tool. Results demonstrates that the pain prevalence was significantly high in shoulders, neck, low-back, wrists, ankles and elbows compared to other body parts. Among variables “age of participants and working hours” were found to be directly associated whereby shoulder and neck pain had significant correlation with lower age groups and more working hours. Regarding trouble prohibited to normal work, a total of 121 (46%) participants reported hindrance in normal work with serious complaints about shoulders for younger age group; wrists and hips for middle age group; and neck, lower back, knees, ankles for old age group. Finally, results of a frequencies and cross-tabulations indicated that prolong work hours were significantly associated with emergence of musculoskeletal symptoms. This high prevalence of WMSS leading to WMSD among the motorcycles mechanics reflects the ignorance of occupational duties. A possible recommendation of this research includes the development and implementation of health and safety guidelines for the mentioned industry.

Keywords: Ergonomics, Motor cycle Mechanics, Nordic Musculoskeletal Questionnaire

Introduction

Ergonomics and identification of work-related musculoskeletal disorders (WMSDs) due to poor working environment has been emerged as a profession after the World War II in the developed countries (Nanthavanij, 2000; Wilson, 2000). With the advancement of people approaches towards industrialization, the technologies were transferred to undeveloped countries previously. However, the ergonomics was not precisely transmitted to these countries (Gurr et al., 1998). Due to these reasons, WMSDs arose as one of the predominant cause of occupational injuries and disabilities in the developing countries (Karimfar et al., 2008; Maul et al., 2003; Menzel, 2004; Shahnavaz, 1987; Smith et al., 2003). The key risk factors at workplace associated with the WMSDs are bending, prolonged sitting-standing, repetitive tasks, manual handling, and heavy lifting (Abou-ElWafa et al., 2012; Hoozemans et al., 2004; IJzelenberg et al., 2004; Keyserling, 2000). WMSDs are perceived to be insignificant relative to other major diseases as they are usually chronic, non-fatal and sometimes assumed to be consequences of aging (Bihari et al., 2011) which reflects poor physical health status. However, the impacts of WMSDs are pervasive; they may

lead to acute to chronic disorders, including osteoarthritis, rheumatoid, arthritis, osteoporosis, low back pain (Woolf and Pfleger, 2003) and physical disability of the individual (Christensen et al., 2011; Verweij et al., 2009). Moreover, they can also significantly affect the psychosocial status of the susceptible people (Woolf and Åkesson, 2001) and decrease the work efficiency resulting in economic burden on the organization and society (Ariëns et al., 2001; Choobineh et al., 2009).

Presently, the prevention of WMSDs has been considered as national priority in many developed countries (Spielholz et al., 2001). However, despite of their vast impacts, the WMSDs do not receive the proper attention from the policy makers, national health priorities, media, and medical practitioners especially in the developing world (Woolf and Åkesson, 2001). This fact has been recognized by United Nations and World Health Organization (WHO) by endorsement of the Bone and Joint decade 2000–2010 (Woolf and Pfleger, 2003).

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The WMSDs are considered as one of the major workplace problems by the ergonomists around the world. According to Standardized Nordic Musculoskeletal Questionnaire conducted studies, musculoskeletal symptoms (MSS) and/or WMSDs are associated with poor working environment (Alrowayeh et al., 2010; Choobineh et al., 2006; Choobineh et al., 2009; Choobineh et al., 2007a; Darwish and Al-Zuhair, 2013; Morken et al., 2000; Torp et al., 1996). This study was conducted to elucidate the ergonomics related MSDs observed among motorcycle mechanics.

In Pakistan, the estimated population for 2013 is 182 Million and number of motorcycles registered in fiscal year 2012-2013 are 6,976,200. On the other hand, no ergonomics study has been conducted to date to assess the work-related musculoskeletal symptoms in Pakistan. The current study is a follow up to our previous report (Baqar et al., 2015) in which earlier results on prevalence of MSS among the motorcycle mechanics in Lahore, Pakistan were reported. However, the current study extends the information in terms of detailed investigation and identification of prevalence extent, responsible factors, and the associated risk contributing to their occurrence.

Materials and Methods

Subjects

The cross-sectional questionnaire study was carried out in July – August, 2013 to assess prevalence of the work-related musculoskeletal symptoms among motorcycle mechanics. The sample size involved 260 workers (all of them male) of motorcycle repairing workshops across the four major workshop markets of Lahore, Pakistan i.e. McLeod Road, Multan Road, Abu Bakar Road (Township), and Shama Road.

Structure of the Questionnaire and the Instrument Development

A self-administered questionnaire comprising of two portions was used to conduct interview based questionnaire survey. The first portion of questionnaire relates to socio-demographic information of the respondent workers and second portion comprised of Standardized Nordic Musculoskeletal Questionnaire (NMQ). Questionnaire study was designed under a project supported by Nordic Council of Ministers and contain binary questions correlating to nine anatomical areas of the body including neck, shoulder, elbow, hand/wrist, upper back, low back, hip/thigh, knee, and ankle/foot, based upon the areas where symptoms accumulates (Wilson, 2000). The present study used general questionnaire of the NMQ to identify the musculoskeletal symptoms among the motorcycle mechanics and covers only the prevalence of MSS among the motorcycle mechanics during past 12 months.

Procedure

At the beginning, the permission of survey was requested from the owner of the each workshop to avoid any ambiguity in data collection process and for better participation of workers at motorcycle repair workshops. Before the interview, each subject was briefly explained about the issue of interest and objectives of the study by

a team of interviewers. After the verbal consent from the workers, the questionnaires were filled by the interviewers interviewing the workers. In order to obtain better results, the whole survey was conducted in the native language of respondents, i.e. Urdu and Punjabi.

Statistical Analysis

Statistical Package for Social Sciences (SPSS) 16.0 was used for the data analyses in which descriptive statistics were main concern to estimate and elucidate the prevalence of WMSS relating to the demographic characteristics. Furthermore, musculoskeletal diseases prevalence between demographics was compared by the frequencies and cross-tabulations (age group, literacy, etc.) and work history (experience in past occupation, etc.). Chi-square tests was employed to assess these relationships with statistical significance, if $\alpha = 0.05$. Moreover, Statistical Package for Social Sciences (SPSS), version 16, was used to perform Correspondence Analysis (CA). The aim was to describe the relationships of age and working hour variables with pain location variables among motorcycle mechanics.

Results

Descriptive Variables

The study presents prevalence of work-related musculoskeletal symptoms and disorders against 260 responses of motorcycle mechanics. All of the participants were male with the mean age of 27.23(± 6.33) years in which 132 (50.7%) motorcycle mechanics ranged between 21-30 years of age. There were 53.46% subjects married, 33.07% single, 10% divorced and 3.46% widowers. The subjects with monthly income 10,001–15,000 (PKR) constitute 54.62% of the sample; and 65.77% of the subjects were illiterate. Majority of the subjects (63%) used to work in their workshops for more than 61 hours per week and most of the subjects (55.38%) have more than 12 year experience in the study occupation. In total 256 (98.5%) motorcycle mechanics were right-handed, with mean BMI 24.12 (± 2.28). Details of demographic, socio-economical, and work-related variables are presented in Table 1.

The Pain Prevalence (WMSS)

The Nordic musculoskeletal disorders questionnaire analysis reflects significant occurrence of WMSS in directly involved body organs such as shoulders, neck, low-back, wrists, ankles and elbows with percentage prevalence of 57%, 54%, 44%, 44%, 41% and 39%, respectively, during last 12-months period. However, pain and discomfort in knees, thighs/hips and upper back was moderate compared to directly involved body organs i.e. 32%, 30%, 28% and 22% respectively. Details of prevalence of musculoskeletal symptoms are shown in Table 2.

In addition to this, the prevalence was significantly associated with the age of participants ($p = .005$) and seems occurred more often in the 21-30 years age group. Furthermore, mechanics working more than 70 hours per week also suffered from serious neck pain ($p = .001$). Similarly, shoulder pain was significantly associated with 0-20 years age group ($p = .01$) working more than 80 hours per week and ankles pain was associated with 31-40 years age group

Table 1: Demographic, socio-economical, and work-related variables

Variable	Mechanics (n = 260)		Variable	Mechanics (n = 260)	
	n	%age		n	%age
Gender			Weight (kg)		
Male	260	100	71 – 80	47	18.08
Age (years)			Greater than 80	9	3.46
10 – 20	29	11.15	Height (cm)		
21 – 30	132	50.77	Less than 150	23	8.85
31 – 40	92	35.38	150 – 180	229	88.08
41 – 50	7	2.70	Greater than 180	8	3.07
Marital status			Right handed/ left handed		
Single	86	33.07	Right handed	256	98.47
Married	139	53.46	Left handed	4	1.53
Divorced	26	10	Average working hours/ week (hrs)		
Widower	9	3.46	less than 40	0	0
Widow	0	0	40 – 50	12	4.61
Literacy*			51 – 60	83	31.92
Illiterate	171	65.77	61 – 70	34	13.07
Literate	89	34.23	71 – 80	32	12.30
Monthly income (PKR)**			more than 80	99	38.07
less than or equals to 5000	23	8.84	Experience in present occupation (year/s)		
5001 – 10000	93	35.77	less than 1	5	1.92
10001 – 15000	142	54.62	1 – 3	9	3.46
More than 15000	2	0.77	3 – 6	24	9.23
Weight (kg)			6 – 9	56	21.53
Less than 50	11	4.23	9 – 12	22	8.46
51 – 60	59	22.69	more than 12 years	144	55.38
61 – 70	134	51.54			

*literate – one who can read a newspaper, write a simple letter in any language and master the basic use of numbers (UNESCO)

** PKR = Pakistani Rupee; 1 PKR = 0.01 US Dollar

working 71-80 hours ($p = .005$). Moreover, wrist pain was significantly associated among mechanics working more than 50 hours per week. However, no significant correlation was found for the group with more than 40 years age (Figure 1a,b). Besides, the prevalence of both neck and shoulder pains were not significantly associated with literacy, marital status, monthly income, body weight (BMI), height, and experience in present occupation.

Lower back pain complaint was the next most prevalent WMSS among motorcycle mechanics (Table 2). The prevalence of lower back WMSS was significantly associated with working hours ($p = .05$), occurring more often with workers who works more than 70 hours per week. However, literacy, marital status, monthly income, body weight (BMI), height, and experience in present occu-

upation were not significantly associated with its prevalence. Similarly, rest of the prevalence results (shoulders, elbows, wrists/hands, upper back, etc.) did not seems to be associated with any socio-demographic factor significantly.

Trouble Prohibiting to Normal Work (WMSD)

The study further revealed that the prevalence of trouble in the body parts of motorcycle mechanics significantly caused limitation in the normal work activities of the mechanics during past 12 months (Table 3). A total of 121 (47%), 119 (46%), 108 (42%), 80 (31%), 76 (29%), 72 (28%), 69 (27%), 68 (26%), and 63 (24%) mechanics reported hindrance in normal work due to trouble in neck, shoulders, low back, elbows, wrists/hands, ankles/ feet, upper back, knees, and hips/thighs, respectively. There were serious

Table 2: Prevalence of trouble, ache, pain, and discomfort with the body parts during last 12 months.

Body Part	Mechanics	
	n	%age
Neck	141	54.23
Shoulders	147	56.53
Elbows	102	39.23
Wrists/hands	114	43.84
Upper back	73	28.08
Low back	115	44.23
One or both hips/ thighs	79	30.38
One or both knees	84	32.31
One or both ankles/ feet	107	41.15

Table 3: Trouble prohibited to normal work (at work or away from work) in last 12 months.

Body Part	Mechanic (n = 260)		Percentage Limitation to the normal work
	n	%	
Neck	121	46.54	85.81
Shoulders	119	45.77	80.95
Elbows	80	30.77	78.43
Wrists/hands	76	29.23	66.66
Upper back	69	26.58	94.52
Low back	108	41.53	93.91
One or both hips/ thighs	63	24.23	79.75
One or both knees	68	26.15	80.95
One or both ankles/ feet	72	27.69	67.29

complaints about significant reduction in working efficiencies of shoulders for 0-20 years age group; wrists and hips for 21-30 years; and neck, lower back, knees, and ankles for 31-40 years age group. However, no significant WMSS association was found for respondents having more than 40 years age. The order of magnitude for limitation in the normal work activities associated with WMSS was low back (94%), neck (86%), shoulders (81%), knees (81%), hips (80%), elbows (78%), wrists/hands (67%), and ankles/feet (67%) respectively.

While studying the trouble with working hours, period of 40-50 hours per week did not show any serious disorder leading to organ malfunctionity. However, for mechanics working 51-60 hours suffered from knees impairment, serious lower back malfunctionity, and severe pain in ankles. The damage was strengthened with further increase in working hours i.e. more than 60 hours per week. This resulted into severe pain with significant reduction in efficiency even in the resistive body parts such as hips/thighs and shoulders. Lastly, no significant relationship was found for elbows and upper back with any age group (Fig. 2a,b).

Discussion

The aim of this study was to develop a baseline data on prevalence of work-related musculoskeletal symptoms among motorcycle mechanics using NMQ, a validated tool. Workplace tasks such as awkward and/or static postures with forceful actions can result into one or more WMSS (Russo et al., 2002). It is a well-known fact that poor working environment is associated with higher vulnerability of WMSS (Joling et al., 2008). In this study, responses collected from 260 motorcycle mechanics reflects that more than one fourth of the subjects were suffering from at least one WMSS during past year. Mostly reported WMSS was shoulder-related, affecting 57% of the mechanics. This might be due to the fact that shoulder pain is highly prevalent among other WMSS (Åkesson et al., 2012). Likewise, MSS of the neck was the second most prevalent disorder among mechanics, affecting over half the subjects (54%). This prevalence of neck pain is seemed to be associated with the shoulder pain as described earlier (Madeleine et al., 2009). The contributing factor behind both dysfunctionality could be the curved-back posture that triggered tension in the muscles of shoulder and neck regions (Andersen et al., 2003; Lötters et al., 2003;

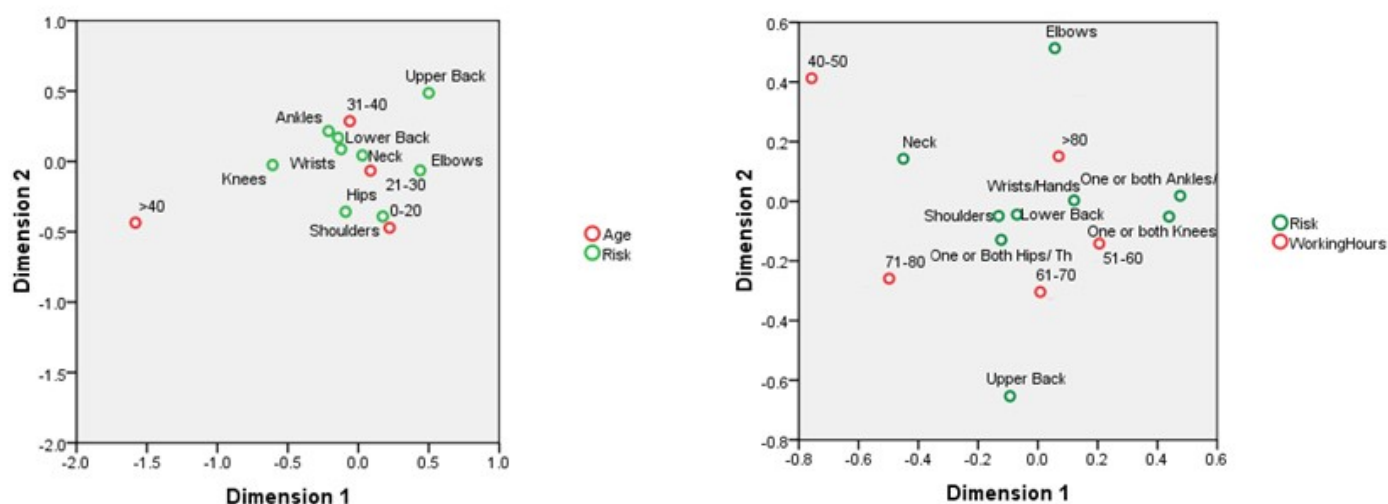


Fig. 1: Correspondence analysis highlighting prevalence of pain while indicating relationship between (a) working hours and pain prevalence (b) age and pain prevalence

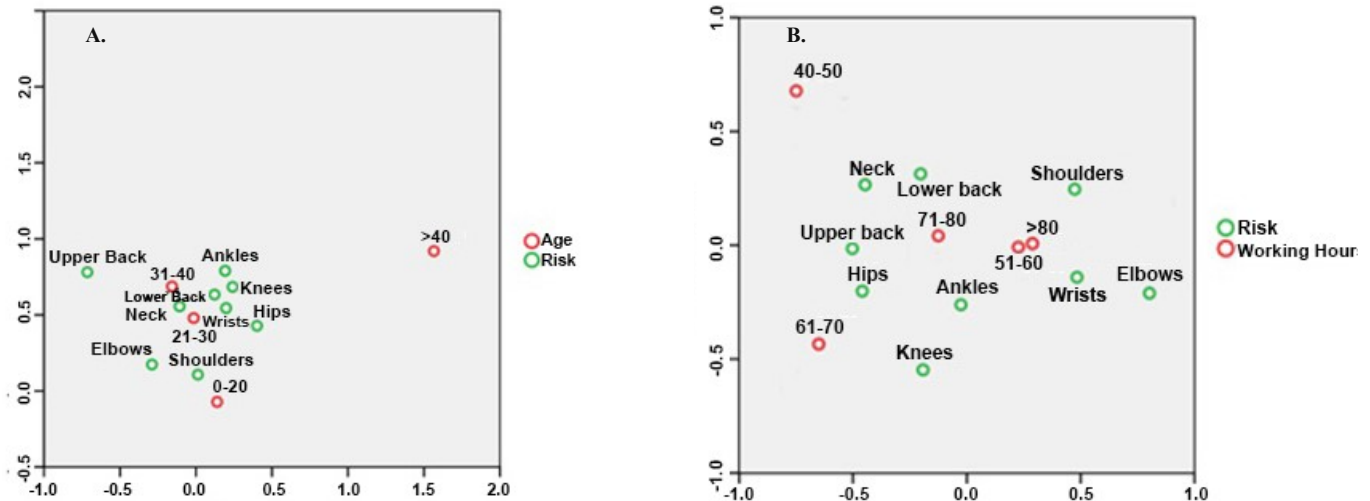


Fig. 2: Correspondence analysis highlighting trouble prohibited to normal work while indicating relationship between (a) working hours and pain prevalence (b) age and pain prevalence.

Widanarko et al., 2011).

The study further reveals that the majority of the workers, approximately 95%, work more than the international standard of forty-eight per week working hours criteria. Furthermore, approximately 63% of the mechanics works more than 61 hours per week that resulted into severe pain in hips and thighs. This prevalence was further intensified among subjects working more than 70 working hours per week in terms of neck pain ($p = .005$). This is because the additional working hours might exert synergistic effects due to increase in musculoskeletal stress and reduction in rest hours. A significant association is reported between different WMSS and long working hours (Russo et al., 2002; Yu et al., 2012). In addition to this, the low-income mechanics working long hours found to have high prevalence of WMSS compared to high income respondents. This prevalence could be due to the psychological stresses as it may induce muscular load, affecting the immune system response and consequently enhances the susceptibility to WMSS built after imbalance in the society (Gallis, 2006).

Similarly, prevalence of neck MSS was significantly associated with the younger age group (21-30 years) as this work group might have a relative higher level physical job demands that increases the risk of WMSS (Heiden, Weigl, Angerer, & Müller, 2013; Widanarko et al., 2011). In contrast to this, the older age group (more than 40 years) do not have significant association with any WMSS (Fig. 2), as older subjects are relatively more experienced and, hence, their high familiarity with the work process makes them less exposed to occupational hazards at workplace (Yu et al., 2012).

The risk of WMSS vulnerability, associated with abnormal body-weight is minimal in our study as the mean BMI of the mechanics (24.12 ± 2.28) are within the normal range, i.e. 18.5–25 of WHO classification for BMI (WHO, 2004). It has been further reported non-significance of weight, and height in WMSS development.

In Pakistan, education level among daily wages workers is quite low as 65.77% of the subjects are illiterate. Despite of this fact, no significance was found between prevalence of WMSS and education in this study. The correlation between education and workplace injuries is founded inconsistent in past studies. A higher occupation injury risk among workers with lower level of education has also reported earlier (Xiang et al., 2000). However, other researchers have reported increased occupational injuries with higher education level (Lewis et al., 1998; Mac Crawford et al., 1998).

The high prevalence rate of WMSS among motorcycle mechanics significantly caused hindrance in the normal work activities of the mechanics during past year (Table 3). This may decrease work productivity because musculoskeletal symptomatic workers relative to healthy workers are usually less productive (Burton, Conti, Chen, Schultz, & Edington, 1999). Furthermore, the high prevalence rate may lead to work absenteeism (Gallis, 2006). However, despite of limitation to perform normal workplace task, non-absenteeism might be observed from work due to necessity to earn a wage (Russo et al., 2002), particularly in less developed countries. The WMSS, hindering the normal work activities not only affects the quality of workers life but also have substantial social consequences which are hard to be quantified (Banerjee, Jadhav, & Bhawalkar, 2013). Therefore, further research is required to identify the extent of effects of prevalence of WMSS among motorcycle mechanics.

Conclusions

The study reveals that the motorcycle mechanics are vulnerable to WMSS at high prevalence rate due to poor working environment, prolonged working hours and lack of training and ergonomically oriented work practices. The high prevalence of WMSS further limitize the motorcycle mechanics from their normal work activi-

ties, leading to economical losses to work. Therefore, a special attention must be paid at international level to protect the health and safety of the mechanics. However, further studies are needed to investigate the effects of general health status of the mechanics on the prevalence of these WMSS, to make logical conclusions and identify the specific risk factors associated with WMSS in order to

introduce effective and appropriate remedial measures.

Compliance with ethical standards

Conflict of Interest

The authors declare that they have no conflict of interests.

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