

IMPACT OF WORK-RELATED MUSCULOSKELETAL DISORDERS AMONG CONSTRUCTION WORKERS IN GHANA

Zakari MUSTAPHA*, Benjamin Boahene AKOMAH, James BAIDEN

Cape Coast Technical University, Cape Coast, Ghana

**Corresponding author's email: mustapha.zakari@cctu.edu.gh*

Abstract. The construction industry is known for its task-related risks and hazards contributing to occupational stress and musculoskeletal disorders (MSDs). The study sought to identify the impact of MSDs among concrete mixer operators and workers in the construction industry in the Central Region of Ghana. The population for the study was made up of 28 concrete mixer operators and 187 workers. Out of the 215 questionnaires administered, 206 questionnaires were returned which represented 95.8 % of the response rate. Descriptive statistics and Relative Importance Index (RII) were used for the data analysis. Findings show that most of the workers were young males and worked for a longer period a day. Force movement, repetition, awkward bending and fixed body postures were the major factors leading to the development of MSDs and contributed to frequent absenteeism and poor performance of workers. Further findings show that back pain, waist pain and shoulder pain were the major self-reported MSD complaints. Risk assessment should be conducted on all site hazards and ergonomic tools/equipment should be introduced to reduce the impact of MSDs on workers.

Keywords: *Ergonomic tools/equipment, Ghana, MSDs health issues, MSDs risk factors, poor performance, risk assessment.*

INTRODUCTION

The construction industry is consistently ranked among the most hazardous occupations which contribute to adverse health effects (Occupational Safety and Health Administration OSHA, 2015; Boschman et al., 2012). Construction workers can be exposed to many risk factors and develop health problems within a macro environment related to their working conditions or their personal habits and lifestyle. Gopalakrishnan & Kumar (2020) posits that risk factors do not occur alone, they often coexist and interact with one another. Extreme temperature, fixed or awkward posture, repetition, vibration, contact stress, and force movement were found to be risk factors associated with musculoskeletal disorders (Choobineh et al., 2007). Work-related musculoskeletal disorders are major problems encountered among construction workers (Boschman et al., 2012) and are among the most frequently reported causes of lost or restricted work time (OSHA, 2015). Musculoskeletal disorders (MSDs) can arise from a sudden exertion (e.g., lifting a heavy object) or they can arise from making the same motions repeatedly, repetitive strain or from repeated exposure to force, vibration, or awkward posture (Boschman

et al., 2012). Boschman et al. (2012) define musculoskeletal disorders as injuries or pains in the human musculoskeletal system, including the joints, ligaments, muscles, nerves, tendons, and structures that support limbs, neck and back. MSDs are a key cause of productivity loss at work, functional damage and persistent disability for construction and further reduce workers' ability and willingness to continue to remain in their job until retirement. The study sought to identify the impact of musculoskeletal disorder factors among concrete mixer operators and workers in the construction industry in the Central Region of Ghana. The proceeding sections discuss the construction industry, factors that contribute to musculoskeletal disorders, effect of musculoskeletal disorders and measures to minimize the effects of musculoskeletal disorders.

1. THE CONSTRUCTION INDUSTRY

The construction industry is the major contributor to gross domestic product (GDP) and contributes to the development of a country's infrastructure (Gopalakrishnan & Kumar, 2020). Sang and Powell (2012) report that the construction industry remains one of the most male dominated sectors worldwide as women were underrepresented. Small number of female workers in the construction sector was reported in most developed countries such as Canada, the United States of America and Australia where the employment rate of women in the construction industry was 3 % (Sang & Powell, 2012). Madikizela Haupt (2010) conducted research in South Africa and confirmed that most construction firms employed a small number of women. Workers in different construction occupations are at risk for distinct work-related musculoskeletal disorders due to different biomechanical risk factors (Boschman et al., 2012). In 2010, the European Agency for Safety and Health at Work (EASHW) reported that musculoskeletal disorders were the most common work-related health problems in Europe, affecting millions of workers. The size of the problem as pointed out was likely to increase as exposure to work-related risk factors for these conditions increased within the European Union (EASHW, 2010). For construction workers, musculoskeletal disorders are the key cause of productivity loss at work, functional damage and persistent disability (OSHA, 2015; Boschman et al., 2012).

1.1. Factors Contributing to MSDs

Construction workers are especially at risk as a result of overexertion caused by heavy labour, along with direct exposure to insufferable heat and humidity (Lop et al., 2019). Many construction workers are exposed to extreme temperature, both extreme cold and hot temperature, which caused force frequent movement among workers (Lop et al., 2019). Ahankoob & Charehzehi (2013) postulated that extreme cold could narrow the blood vessels and decline sensitivity and harmonization of the body. Musculoskeletal problems are considered a major problem of construction workers due to the handling of heavy materials (Gopalakrishnan, 2020). When a worker is in an awkward posture, muscles operate less efficiently and expend more force to complete the task (Ahankoob & Charehzehi, 2013). Maintaining awkward postures over time results in muscle fatigue and discomfort for a worker and, thus,

the prolonged non-neutral (awkward) posture increases the risk of work musculoskeletal disorders (WMSDs). Similarly, back bending forward postures involve larger waist rotations, while neck bending postures have a straight body trunk (Ahankoob & Charehzehi, 2013; Gallagher & Heberger, 2013). Musculoskeletal disorders and excessive occupational stress have been found to be the major reason for the loss of work efficiency (Mukhopadhyay et al., 2015).

1.2. Effect of Musculoskeletal Disorders

Construction work involves a physically demanding activity from its workforce (Albers & Estill, 2007). Construction workers are exposed to different hazardous and accident-prone working environments, which lead to numerous ergonomic related hazards (Ajayi & Thwala, 2014). Some of the hazards are related to whole-body vibration in excavation works (Gopalakrishnan & Kumar, 2020; Manikandan et al., 2014). Tension neck syndrome is associated with unsafe lifting techniques and overload, while loss of control and balance in overhead works are associated with plumbing workers, and compressed spinal cord leading to damage of the disc is associated with bending related works in construction activities (Manikandan et al., 2014). Musculoskeletal symptoms among roofers are strongly associated with work limitation, missed work and reduced physical functioning (Welch, 2009). Thoracic outlet syndrome is associated with abnormal position, involving continuous painting of a building by a painter (Manikandan et al., 2014; Rwamamara & Smallwood, 2009). Rwamamara & Smallwood (2009) posited that waist and back injuries were associated with brick layers.

1.3. Measures Minimising MSD Effects

Best practices, such as job rotation, have been found to reduce the cases of MSDs among production workers in highly repetitive jobs with heavy loads (Mathiassen, 2006). This has been shown to help in cost reduction and promotion of health of workers (Keir et al., 2011). Management of projects must be committed and ergonomic principles must be applied to ensure the success of a project, and workers' views and risks from previous projects should be taken into account during the planning stage (Rwamamara & Smallwood, 2009). There is also the need for a Work Environment Plan (WEP) to be delegated to the principal contractor (Rwamamara & Smallwood, 2009). A high-level master schedule should be maintained throughout a project period to manage a detailed flow of work (Albers & Estill, 2007). Good design has a strong influence on construction workers' health and safety (Mrosczyk, 2007). When a risk of injury cannot be eliminated by engineering design or reduced by incorporating a safety device, warnings, instruction and training are considered to be the last resort (Mrosczyk, 2007). General health promotion at the workplace might be an additional strategy to prevent WMDs (Ajayi & Thwala, 2014). Engineering control measures are used to eliminate risk factors present in specific construction tasks. By changing work schedule, it is possible to decrease the labour intensity and time taken to carry out a task (Albers & Estill, 2007). Another way to reduce some MSDs is the use of ergonomically designed hand tools that enhance the performance of task with less stress on the employees' hands and wrists (Albers & Estill, 2007). Changing the

design of the tool handle can help prevent ergonomic injuries at the workplace (Choi et al., 2007). Hand gloves that meet the International Organisation for Standardisation (ISO) 10819 standard may be used to reduce the vibrations from power tool and low vibration tools (Albers & Estill, 2007). A standard work environment has a low noise level (produces good communication, and eliminates vibration problems (Rwamamara et al., 2009). Risk assessment is critical for the identification of the magnitude of injury and the number of people that are exposed to a specific risk (Ahankooob & Charehzehi, 2013). The preceding section discusses the methods employed during the data collection and the statistical methods used for the presentation of the findings.

2. METHODOLOGY

Questionnaire was the main instrument for data collection (Nayeem, 2017). Structured questionnaires were administered among concrete mixer operators and workers on construction sites in the Central Region of Ghana. A pilot study was conducted in May 2021 to identify the actual sites and respondents (concrete mixer operators and workers) for the study. Respondents were asked about complaints of the musculoskeletal system, such as the perceived work-related symptoms, health problems that occurred during work and the occupational tasks that were perceived as the causes or aggravated factors of the musculoskeletal disorders. The population for the study was made up of all the construction workers within the study area (Central Region). The sample size for the study was made up of the total number of concrete mixer operators and workers from various sites during the period of the pilot study.

Table 1. Sample Size

Site	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CMO	2	1	3	2	2	2	1	2	1	1	1	2	2	2	2
L	14	12	25	12	16	10	9	13	8	7	11	12	15	11	12

Concrete mixer operators (CMO) = 28; Workers (W) = 187

The study covered 215 respondents, comprising 28 concrete mixer operators and 187 workers who participated in the survey between June and July 2021, as shown in Table 1. The questionnaire was divided into two Sections: 'Section A' was related to demographic information of the respondents and 'Section B' covered musculoskeletal disorders. At the end of the fieldwork, 206 questionnaires were returned, which represented 95.8 %. The remaining 9 questionnaires were either incomplete or two answers were shaded in some questions. After the compilation of the data from the fieldwork, the information was exported to MS Excel where the analysis was performed. The data were analysed using the descriptive statistics and Relative Importance Index (RII) with Mean Score and Ranking. The results from MS Excel were presented in the form of tables and charts, and results from MSDs were presented using RII with MS and Ranking. The further section presents the findings from the analysed data from the field.

3. DEMOGRAPHIC DATA

Majority (37 %) of the respondents were between the age range of 18 and 25 years, and few (17 %) of the respondents were between the age range of 36 years and above. Majority (92 %) of the respondents were males and most (71 %) of them were single. Majority (45 %) of the respondents were exposed to risk for 8 hours, and few (7 %) of the respondents were exposed to risk for only two hours (Figs. 1–3).

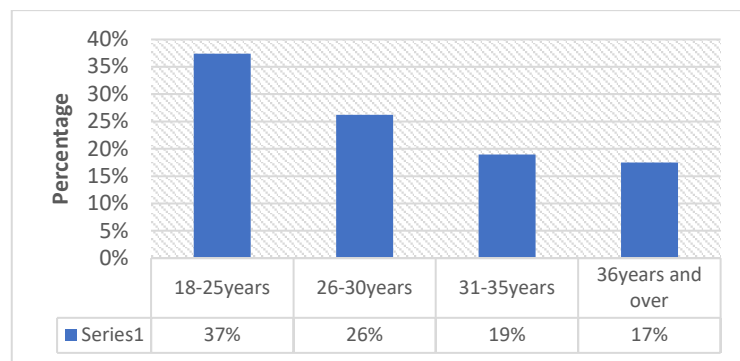


Fig. 1. Age of respondents.

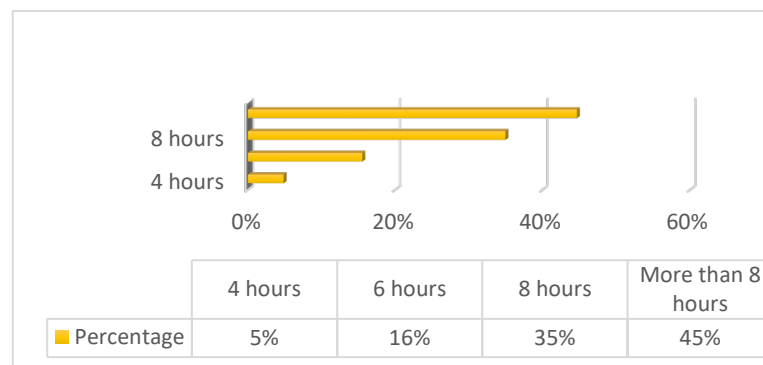


Fig. 2. Number of hours respondents work each day.

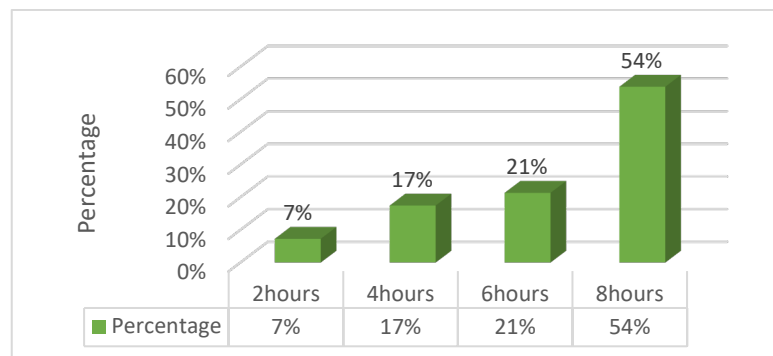


Fig. 3. Number of hours respondents are exposed to risk factors.

3.1. Contributing Activities to MSDs

Majority (96 %) of the workers indicated that standing for a long period of time contributed to musculoskeletal disorders and was ranked first. This was followed by doing repetitive tasks with arms or hands for a long period of time (85 %). Making the same movement for a long period of time (83 %) was ranked third. Bending and twisting the neck often (61 %) was found to have contributed to MSDs. However, (56 %) of the respondents indicated that sitting or moving on their knees contributed to MSDs. This was the least ranked factor among the eleven factors as shown in Table 2.

Table 2. Activities Contributing to Musculoskeletal Disorders

MSD issues	Workers		Concrete Mixer Operators		Rank
	Frequency	Percent, %	Frequency	Percent, %	
Standing for a long period of time	197	96	9	4	1
Kneeling or squatting for a long period of time	162	79	44	21	5
Making the same movement for a long period of time	172	83	34	17	3
Working in a twisted posture for a long period of time	148	72	58	28	7
Bending and twisting the neck often	125	61	81	39	9
Working with the hands above a shoulder level	135	66	71	34	8
Working with the hands below a knee level	124	60	82	40	10
Sitting or moving on the knees	115	56	91	44	11
Moving loads more than 25kg	161	78	45	22	6
Moving heavy loads more than 50kg	164	80	42	20	4
Doing repetitive tasks with arms or hands for a long period of time	175	85	31	15	2

3.2. Contributing Factors to the Development of MSDs

The most crucial factor that contributed to the development of MSDs was fixed body postures with a relative importance index of 0.95. It was followed by force movement with RII of 0.93. The third factor identified to be contributing to the development of MSDs as recorded in Table 3 was repetition with RII of 0.88. The least ranked factor among the nine factors was awkward bending postures.

Table 3. Factors Contributing to the Development of MSDs

MSD issues	RII	R
Awkward bending posture	0.57	9
Improper lifting of material	0.84	6
Vibration	0.67	8
Fixed body postures	0.95	1
Repetition	0.88	3
Force movement	0.93	2
Static loading	0.82	7
Contact stress	0.83	5
Extreme temperature	0.86	4

Relative Importance Index (RII); Ranking (R)

3.3. Effects of MSDs

The major effect of MSDs among workers and concrete mixer operators was identified to be absenteeism with RII of 0.88. It was followed by shoddy work with RII of 0.83 and loss of productivity with RII of 0.82. The least rated factor was increased health care with RII of 0.69 (see Table 4).

Table 4. Effect of MSDs

MSD issues	RII	RANK
Absenteeism	0.88	1
Loss of productivity	0.82	3
Increased health care	0.69	11
Disability	0.81	5
Worker's compensation costs	0.81	5
Working not in the area of specification	0.76	9
Delay of work	0.78	8
Loss of concentration	0.81	4
Shoddy work	0.83	2
Loss of contract	0.71	10
Lateness to work	0.79	7

Relative Importance Index (RII); Ranking (R)

3.4. Self-Reported Musculoskeletal Health Complaints

Table 5 shows self-reported MSD health complaints as indicated by respondents. Back pain was recorded as the most dominant self-reported complaint with RII of 0.98. It was followed by waist pain with RII of 0.96. The third rated complaint was shoulder pain with RII of 0.95. However, respondents deemed elbow pain as the least complaint with RII of 0.63.

Table 5. Self-Reported MSD Health Complaints

MSD health complaints	RII	RANK
Shoulder	0.95	3
Upper arm	0.88	5
Elbow	0.63	13
Lower arm	0.86	7
Waist	0.96	2
Ankle	0.78	10
Knee	0.78	11
Upper leg	0.79	9
Lower leg	0.85	8
Hip	0.87	6
Neck	0.94	4
Back	0.98	1
Foot	0.75	12

Relative Importance Index (RII); Ranking (R)

3.5. Recovery Periods

Majority (49 %) of the respondents indicated that foot and ankle injuries, and upper extremity injuries lasted between 10 and 15 days before recovery. It was followed by 33 % of the respondents who indicated that shoulder, neck and low back problems lasted between 25 and 30 days before recovery. Few (26 %) of the respondents indicated that knee, leg, waist and hip injuries lasted beyond 30 days before recovery.

4. MEASURES MINIMISING THE EFFECT OF MSDS

4.1. Engineering Control

Majority (83 %) of the respondents (171/206) indicated that the introduction of ergonomic programmes would contribute to the reduction in injuries, illness and workers' compensation. Few (17 %) of the respondents (35/206) indicated that the introduction of ergonomic programmes would not contribute to the reduction in injuries, illness and workers' compensation. Majority (34.5 %) of the respondents (71/206) indicated that the use of ergonomic tools/equipment such as hoist would help to minimise the risk on site. It was followed by the use of Automatic Climbing System (ACS) (33.0 %) (68/06) and of trencher (32.5%) (67/206), respectively.

4.2 Risk Assessment

All the respondents (100 %) (206/206) agreed that risk assessment should be conducted on all reported issues to ascertain the level of injury and personnel involved in order to determine an appropriate action to be taken.

5. DISCUSSION OF FINDINGS

Majority of the workers were males and at their youthful stage. These findings agree with findings of Sang & Powell (2012) who reported that the construction industry remained one of the most male dominated sectors worldwide. Similar findings were reported by Madikizela & Haupt (2010) who confirmed that most construction firms employed a small number of women because the task was strenuous and physically demanding. The workers stood on their feet for a long period of time during their activities which contributed to MSDs. Fixed body postures and force movement, repetition and awkward bending posture were found to be the major factors, which contributed to the development of MSDs among workers and concrete mixer operators. The major effect of MSDs among workers and concrete mixer operators was found to be absenteeism and shoddy works, which led to loss of productivity. Back pain, waist pain and shoulder pain were found to be the major self-reported MSD health complaints. Risk assessment should be conducted on reported major body parts, such as knee, leg, waist and hip injuries that lasted beyond 30 days before recovery to determine appropriate measures to be instituted to minimise the effect of MSDs. The findings agree with findings of Ahankoob & Charehzehi (2013). The use of ergonomic tools/equipment such as hoist, Automatic Climbing System (ACS) and trencher would contribute to the reduction of risks on site. The findings concur with findings of Bust et al. (2005).

CONCLUSION AND RECOMMENDATIONS

The study sought to identify the impact of MSDs among concrete mixer operators and workers in the construction industry in the Central Region of Ghana. The construction sector was male dominated; hence, more men were exposed to MSDs in Cape Coast Metropolis. More workers were reported to have suffered from body part pains, which had contributed to MSDs and led to their poor performance, and frequent absenteeism from work. Risk assessment should be conducted on reported major body parts to determine appropriate measures to be instituted to minimise the impact of MSDs among concrete mixer operators and workers. Management of construction companies should encourage and enforce the use of engineering control measures to minimise the impact of MSDs and reduce the high level of injuries, and illness among concrete mixer operators and workers in the construction industry.

FURTHER RESEARCH

Self-reported symptoms may be underestimated or overestimated (NIOSH, 1997) since they were the core of the current study. It is thus suggested that longitudinal studies based on medical examinations be carried out among workers and concrete mixer operators within the Cape Coast Metropolis to verify the prevalence of MSDs.

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AUTHORS' SHORT BIOGRAPHY

Zakari Mustapha received his Doctoral degree in Engineering Management from the University of Johannesburg, South Africa. He received his Master and Bachelor degrees from the Bayero University, Kano, Nigeria and Federal University of Technology, Yola, Nigeria, respectively. He is a Senior Lecturer at the Cape Coast Technical University, Cape Coast, Ghana. He is the author and a co-author of several scientific publications. He is a cooperate member of the Ghana Institution of Construction (MGIOC).

E-mail: mustapha.zakari@cctu.edu.gh

ORCID iD: <https://orcid.org/0000-0002-0653-8739>

Benjamin Boahene Akomah is a Senior Lecturer at the Cape Coast Technical University. B. B. Akomah is currently pursuing his PhD at VIT University in India. He obtained his Master of Philosophy degree in Procurement Management in 2014 from the Kwame Nkrumah University of Science and Technology (KNUST), B. Sc. in Building Technology from the same university in 2008 and his Higher National Diploma in Building Technology from the Cape Coast Technical University in 2005. He is a co-author of several scientific publications. He is a corporate member of the Ghana Institution of Construction and Institution of Engineering and Technology.

E-mail: benjamin.akomah@cctu.edu.gh

ORCID iD: <https://orcid.org/0000-0002-2701-2867>

James Baiden has Higher National Diploma in Building Technology from Cape Coast Technical University, Cape Coast, Ghana. He is currently a graduate member of the Institution of Engineering and Technology.

E-mail: baidensebastine@gmail.com

ORCID iD: <https://orcid.org/0000-0003-1049-4502>