

## Work - Related Musculoskeletal Disorders: A Case Study of Sawmill Workers in Bangladesh

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### Abstract

Sawmill workers in Bangladesh are increasingly at risk of emerging work-related musculoskeletal disorders (WRMSDs). Their jobs involve awkward manual handling tasks such as lifting, carrying, pushing and pulling. These are identified as risk factors for musculoskeletal disorders. The aims of this study are to find out the prevalence of musculoskeletal disorders and assessing the postural risk level among sawmills workers. This cross-sectional study was conducted with 254 workers from 60 sawmills at the southern part of Bangladesh. The overall 70.1% of sawmills workers were suffering musculoskeletal disorders in at least one body part for the last one year. The average Rapid Entire Body Assessment (REBA) score of four main tasks (Pushing, Pulling, Lifting, and Carrying the timber) was 9.25, which is high risk for MSDs symptoms. The main reasons behind these MSDs are lack of knowledge about workplace safety, working postures and the settings of the workplace. We have recommended to the management to apply the NIOSH (National Institute for Occupational Safety and Health) lifting and Manual Material handling techniques; arrange OSHA (Occupational Safety and Health Administration) ergonomic training to the workers. Also, suggested designing the working table and workplaces in ergonomically to mitigate the musculoskeletal disorders.



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### Keywords

Musculoskeletal Disorders;  
Risk Factors;  
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### Introduction


Musculoskeletal Disorders (MSDs) are known as injuries and disorders that affect the human body's movement or musculoskeletal system. It includes some body parts such as muscles, tendons, ligaments, nerves, discs, blood vessels, etc. On the

other hand, Work Related-Musculoskeletal Disorder (WRMSDs) have been caused by the continuous and long-term high repetitive task, sudden exposure to lifting or carrying of heavy loads, excessive force, working in an awkward body posture and vibration.<sup>1</sup> Work-related musculoskeletal disorders affect both

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employers and workers. It increases absenteeism, employee turnover, recruitment and training cost, etc. and decreases productivity for the employer. WRMSDs also reduce the workers' quality of life by the job, economic and family stresses. It may also increase the direct and indirect cost as diagnosis and treatment for the workers.<sup>2</sup>

Musculoskeletal Disorders (MSDs) is one of the greatest occupational health problems among manual sawmill workers.<sup>3</sup>The most activities of the sawmills in Bangladesh are controlled manually. These activities include lifting, carrying, pulling, pushing, etc. All of these activities belong to high-risk groups for Musculoskeletal Disorders (MSD) or injuries in different body parts of the sawmill workers.<sup>4</sup> Some of the studies have been conducted to understand the prevalence of WRMSD among workers are as follows.

An observation was conducted with 110 male workers from a sawmill factory in Nimtala at Kolkata, India. Researchers were found that musculoskeletal discomfort was a major problem among the sawmill workers, primarily involving the lower back (100%), neck (95.96%), wrist (87.78%), and shoulder (84.44%) pain.<sup>3</sup> They also identify the causative factors behind the improvement of such discomfort. A structured discussion using a modified-Standardized Nordic Questionnaire was conducted on 116

pre-cast construction workers (male) in sipitang, sabah, Malaysia to determine the prevalence of Musculoskeletal Disorders (MSDs).<sup>5</sup> Researchers showed that 80.17% of workers complained of experiencing ache, pain or body discomfort during and after work. They also found that, the high percentage of MSDs prevalence affecting the wrist (78.5%), shoulder (73.1%), and lower leg (71.0%) pain regions of the body.

Researchers<sup>6</sup> used REBA to analysis the posture of sawmills workers in Karnataka state, India. REBA is postural analysis method used for assessing the risks level of work-related musculoskeletal disorders. To assign a score, following body parts such as wrists, forearms, elbows, shoulders, neck, trunk, back, legs and knees have used in the REBA score assessment sheet (Figure-1). Then the data have collected for each area and scored. Every single score signifies the level of MSD risk (Table-1).

Researchers<sup>6</sup>observed the average REBA score was 7.5. This indicates that the workers were working above the safe limit. They also found the various conditions such as, hard environmental conditions (low temperatures, slippery and uneven ground); heavy works (manual handling of loads back flexed and twisted) dangerous tools and machinery such as chainsaws that expose workers to MSD risks.

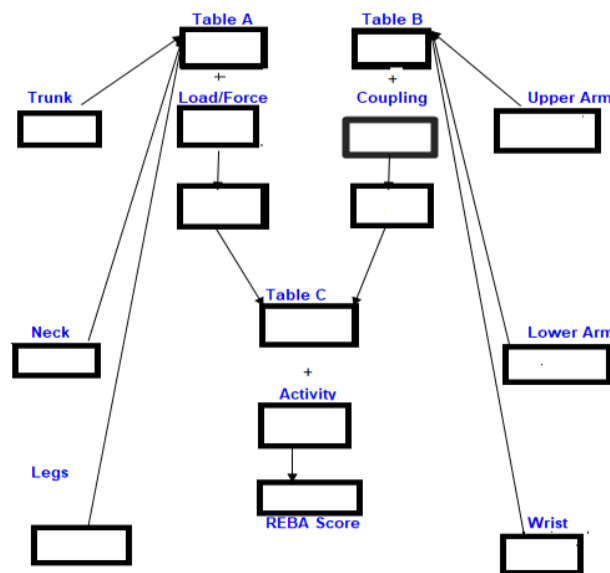


Fig.1: REBA score assessment sheet

A large number of sawmill workers are suffered from Work-Related Musculoskeletal Disorders (WRMSDs).<sup>3</sup> They also spend a huge amount of money for medication purpose. However, we are not aware of any research work, which related to work-related musculoskeletal disorder among the sawmill workers in Bangladesh.

Therefore, the aims of this study are twofold. Firstly, to find the prevalence of musculoskeletal disorders and the risk level among the sawmill workers. Secondly, to identify the associated risk factors with musculoskeletal disorders symptoms among the sawmill workers in Bangladesh.

**Methodology**

**Sample Collection**

To conduct this cross-sectional study, 254 male sawmill workers were randomly selected from 60 sawmills in Jashore, Bangladesh. The selected respondent's workers divided into four main type's e.g; job activities. That includes lifting, carrying, pulling and pushing the timber.

**Data Retriever Through Structures Questionnaire**

In this study, face-to-face interview on wood sawmills workers (male) was taken using a Modified-Standardized Nordic Questionnaire (MNDQ)<sup>7</sup> and a structured questionnaire. The questionnaire had three sections including socio-demographic information, criticisms of musculoskeletal disorders and physical risk factors. The questionnaires were two categories as an open-end and yes/no. A photo of body map delivered for easy identification of the affected body part. The photo of the body map is a sketch of the human body which indicating the nine body parts. A standard height-weight measurement scale (Electronic Body Scale TCS-200RT) used to measure the height and weight of the workers. Questioned were asked to participants if they had any musculoskeletal problems in the last 12 months. If the participant answered positively then further asked to identify the affected area or areas of the body. The participant also asked to identify the physical factors (postural, environmental and ergonomic) that affected the musculoskeletal systems. It took about 15-20 minutes to complete the questionnaire. We collected the data during day work hour (8 am to 6 pm).

**Analysis of Posture**

Work in natural posture is one of the main ergonomics principles. Obstinate working postures have considered as risk factors for work-related musculoskeletal disorders. It leads to fatigue, injuries, and stress on musculoskeletal systems. A video was taken to analysis the body movement and different working posture of sawmill workers. Snapshots of critical body posture have taken from the video that used in analyzing. The Rapid Entire Body Assessment (REBA)<sup>8</sup> is an ergonomic tool. This tool used to assess the risk level of various body postures. The REBA scores with risk level have shown in Table-1.

**Table 1: REBA score and associated risk level**

REBA Score	Risk Level	Action
1	Negligible	None necessary
2 - 3	Low	Maybe necessary
4 - 7	Medium	Necessary
8 - 10	High	Necessary soon
11 - 15	Very High	Necessary now

**Statistical Analysis**

Descriptive analysis of socio-demographic information has performed as maximum, minimum, mean and standard deviation for continuous variables. Frequencies and percentages were derived as categorical variables. To find out the various risk factors and musculoskeletal discomforts, chi-square ( $\chi^2$ ) test has performed. All analyses have performed through SPSS (Statistical Package for the Social Sciences) version 21. The level of significance was considered as 5%.

**Results and Discussions**

The general physical information of 254 workers (sawmills) has shown in Table-2. The mean age of the workers is 37.37 years (SD = 13.71). There are no workers less than 18 years.

The mean working time is 11 hours which very high from standard working hours. As said by the International Labour Organization (ILO), the standard working hours are 8 hours per day.<sup>9</sup> High working hour's leads to numerous problems among the workers include stress, health risks, lack of

attentiveness, etc.<sup>10</sup> The mean body mass index is 21.93 kg/m<sup>2</sup> (SD=2.70) which indicates maximum workers are in normal ranges. A BMI of 18.5-24.9 indicates a healthy weight with respect to height.<sup>11</sup> The healthy weight aids to lessen the risk of serious

health-related problems and it pointers the persons close to his fitness goals.<sup>12</sup> From these aspects, we found that maximum workers in this study are close to the fitness goal.

**Table 2: General physical information of the workers (N=254)**

Factors	Minimum	Maximum	Mean	SD
Age (Years)	18	72	37.35	±13.71
Working time (Hours)	8	15	11.00	±1.94
Work Experience (Years)	1	50	13.98	±11.36
Weight (kg)	41	90	57.86	±8.60
Height (meters)	1.5	1.8	1.62	±0.05
Body Mass Index (kg/m2)	16	33	21.93	±2.70

The socio-demographic information of the respondents has shown in Table-3. From the results, it can be found that about half (42.5%) are illiterate.

Only 13% are received education up to secondary education. Almost (78.3%) workers are the smoker

**Table 3: Socio-demographic information of the workers (N=254)**

Back ground Factors	Frequency	Percent	
Age range (Years)	18-28	80	31.5%
	29-38	68	26.8%
	39-48	55	21.7%
	49-58	26	10.2%
	59-72	25	9.8%
Education Level	No education	108	42.5%
	=<Primary	113	44.5%
	=>Secondary	33	13.0%
	Non-smoker	55	21.7%
Smoker or Non-smoker	Smoker	199	78.3%
	<18.5	22	8.6%
	18.5-24.9	198	78.0%
BMI Range	25-29.9	32	12.6%
	>=30	2	.8%
	Married	218	85.8%
Marital Status	Unmarried	36	14.2%
	=>8	31	12.2%
Working time (hours)	9-11	117	46.1%
	=>12	106	41.7%
Work experiences (Years)	1-10	123	48.4%
	11-20	68	26.8%
	21-30	42	16.6%
	31-40	13	5.1%
	41-50	8	3.1%

The results of musculoskeletal symptoms from respondents have shown in Figure-2. Figure-2 indicates that 70.1% of sawmills workers had been suffered from musculoskeletal disorders in at least one region in the body over the previous 12 months. Researchers have found similar results in several studies.<sup>13, 14, 3</sup> Among of all body parts, 70.1% suffered shoulder pain. Baba *et al.*,<sup>15</sup> reported that 28.3% of construction workers suffering at shoulder pain in Malaysia. Results show that 62.2% of sawmill workers in Bangladesh are suffering from upper

back pain. Researchers<sup>16</sup> found 33% of automobile workers are suffering upper back pain in Bangladesh. In this study, the lowest musculoskeletal symptom of sawmill workers in Bangladesh is 45.7% for the wrist. Anas *et al.*,<sup>17</sup> showed that 77% of worker of the Indian sawmill are facing wrist pain. Therefore, the average musculoskeletal symptoms among sawmill workers in Bangladesh are 55.41% which is very high. Therefore, we need to take the necessary steps to overcome these problems.

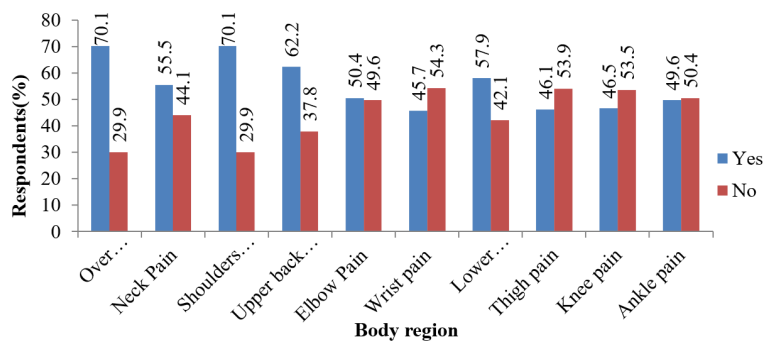


Fig. 2: Musculoskeletal disorders in various body regions

The table-4 shows the relations between socio-demographic factors and reported musculoskeletal disorders of the sawmill workers in Bangladesh. Here, the work experience is statistically significant ( $P=0.034^*$ ) with musculoskeletal disorders. A report<sup>18</sup> showed that, high work experiences

( $P= 0.001^*$ ) that distress the musculoskeletal systems among male construction workers in Nigeria. On the other hand, other factors (age, weight, working time, smoking habit, marital status, education level) are statistically insignificant with musculoskeletal disorders.

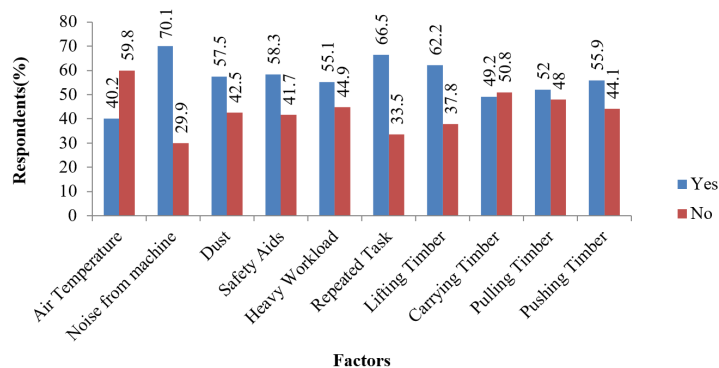
Table 4: Relationship between socio-demographic factors and reported musculoskeletal disorders of the workers (N=254)

Socio-demographic factors(N=254)		Respondent Musculoskeletal Disorders (%)		Chi-Square value	P-value*
		Yes	No		
Age (Years)	18-28	49(27.7%)	31(40.3%)	6.161	.187
	29-38	47(26.6%)	21(27.3%)		
	39-48	40(22.6%)	15(19.5%)		
	49-58	22(12.4%)	4(5.2%)		
	59-72	19(10.7%)	6(7.8%)		
Work experience (Years)	1-10	75(42.4%)	48(62.3%)	10.430	0.034*
	11-20	50(28.2%)	18(23.4%)		
	21-30	36(20.3%)	6(7.8%)		
	31-40	10(5.6%)	3(3.9%)		
	41-50	6(3.4%)	2(2.6%)		
Weight (kg)	<=50	38(21.5%)	12(15.6%)	9.071	0.059
	51-60	78(44.1%)	47(61.0%)		

	61-70	50(28.2%)	11(14.3%)		
	71-80	8(4.5%)	5(6.5%)		
	>=90	3(1.7%)	2(2.6%)		
Working time (hours)	>8	20(11.3%)	11(14.3%)	1.034	0.596
	9-11	85(48.0%)	32(41.6%)		
	>12	72(40.7%)	34(44.2%)		
Smoking habit	Non-smoker	35(19.8%)	20(26.0%)	1.216	0.270
	Smoker	142(80.2%)	57(74.0%)		
Marital status	Married	156(88.1%)	62(80.5%)	2.559	0.110
	Unmarried	21(11.9%)	15(19.5%)		
Education level	No education	79(44.6%)	29(37.7%)	2.907	0.234
	<=Primary	79(44.6%)	34(44.2%)		
	>=Secondary	19(10.8%)	14(18.1%)		

Figure-3 shows the various risk factors that affect musculoskeletal disorders among workers. Here, air temperature, noise from the machine, dust, and safety aids, heavy workload, as well as repeated task have considered as environmental factors. On the other hand, lifting, carrying, pulling and pushing to timber have considered as task factors. Although there is various task exist in a sawmill but in this study, we considered the only four-mentioned task. Figure-3 shows 70.1% of workers blamed that noise from the sawmill is so high. This high-levelled noise is responsible to damage the auditory nerve of the ears. As a result, most of the workers suffer a hearing problem. According to the definition of

MSDs, noise allied problem is related to MSDs. Other factors associated with the sawmill environment included air temperature (40.2%), dust (57.5%), safety aides (58.3%), heavy workload (55.1%) and repeated task (66.5%). Researchers<sup>19</sup> observed similar results among Nigerian sawmill workers. Include as temperature (41.5%), noise (81.9%), dust (95.7%) and safety aides (59.6%). Indonesian farmers (48.6%) responded heavy workload lead to musculoskeletal disorders.<sup>20</sup>The prevalence of musculoskeletal symptoms was reported (56.1% of men and 50% of women), for the repeated task conducted by Anamai *et al.*,<sup>21</sup>



**Fig. 3: Factors affecting the musculoskeletal disorders**

In this study, workers also respond about task factors those are responsible for musculoskeletal disorders. Include as lifting timber (62.2%), carrying timber (49.2%), pulling timber (52%) and pushing timber (55.9%). Researchers (22) carried out a study among workers of Iranian casting workshops and found similar outcomes. They showed that handling

material in lifting (86%), carrying (66%), pulling task (48%), pushing (43%) occurred in the high rate of work-related musculoskeletal disorders among the workers. They concluded the ergonomics inventions and redesigning manual material handling task could reduce work-related musculoskeletal disorders. The Rapid Entire Body Assessment (REBA) score,

risk level and relative action for four tasks such as pushing, pulling, lifting and carrying have shown in Table 5.





Table-5 represents the average REBA score is 9.25. This is in a high-risk zone and we need to take necessary action soon. Among four tasks, the maximum REBA score obtains for lifting task.

It risks level is very high and should take action as now. The lowest score is 7 for pulling task. Others are pushing(9) and carrying(10) as in the high-risk zone. Researchers<sup>23</sup> also revealed that the high-risk level among sawmill workers is in India. They found that the REBA scores for lifting, carrying, pulling and pushing the timber were 11, 9, 10 and 11 respectively.

**Table 5: Rapid Entire Body Assessment (REBA) score**

Task	REBA Score	Risk Level	Action
Pushing	9	High	Necessary soon
Pulling	7	Medium	Necessary
Lifting	11	Very High	Necessary now
Carrying	10	High	Necessary soon
Average	9.25	High	Necessary soon

**Table 6: Work-related musculoskeletal disorders by tasks**

Tasks	Problematic work-related activities	Risk Factors	MSDs for body regions	Figure
Pushing the timber into saw table.	Bending of the body and trending the body parts	Awkward posture, Repetition and Force	Lower back, Elbow and Wrist disorders	
Pulling the timber from saw table.	Bending of the body, hand and legs	Force, Awkward posture and disorders Repetition	Lower back, Upper back, Elbow and Wrist	
Carry out the timber to saw table.	Bending the hand, legs and twisting the body	Awkward posture	Upper back, neck, shoulder and leg region disorders	
Lifting the timber from ground.	Back bending and twisting the body	Awkward Posture, Force	Upper back, lower back, arm, wrist and leg region disorders	

Based on Table 6, the activities of sawmill mainly involve lifting, carrying, pulling and pushing the timber to get the raw wood for furniture. Ergonomics risk factors mainly correlated to the musculoskeletal disorders can be realized from each activity or task of sawmill. These tasks involve a stubborn posture, excessive force and repetitive works to the sawmill workers. Prolong continuing these activities cause damage to the muscular systems of the body. These systems involve the neck, shoulders, upper back, lower back, elbow, wrist, knee, etc. Researchers<sup>24</sup> revealed the wrong working posture that is generally associated with the development of musculoskeletal discomfort. Thus, when workers work in uncomfortable posture for a long time, they suffer from musculoskeletal discomfort. Researchers<sup>25</sup> also presented that the obdurate working posture can cause strains in the low back of the workers and fall negative impact on their health. They work according to job demands and work more time to earn more. This recommended for their long working hours, with uniformity of the work.

### Conclusions

This study concludes that most of the sawmill workers in Bangladesh are affected by the musculoskeletal disorders. The prevalence of overall musculoskeletal disorders is 70.1%. We revealed the main reason behind these MSDs is lack of ergonomics related knowledge. Besides, they are working in such an environment, which is not at all good for health. Another reason is incorrect working positions. The average REBA is 9.25 that show the tasks are performing in high-risk level. Therefore, it is early needed to redesign the workstation in ergonomically. In this study, we also found some risk factors that lead to musculoskeletal injuries. Among these, noise (70.1% reported) from the saw machine is very high. Therefore, both management and workers should

work together to eliminate or reduce these problems. The worker should use safety aids in a regular manner. Technical training must be needed of the workers on the knowledge of ergonomic safety, risk factors, and working positions. The workplace should be well ordered and clean. Mechanical handling aids are required as much as possible. Management should provide a sliding table for easy movement of the timber on the working table.

### Limitations and Future Scope

There are some potential limitations behind this cross-sectional study. These include as the study have been conducted only in the Jashore region of Bangladesh. The intensity of MSDs, duration and medical history were not considered. The study will expand in the future considering the variables to find the more precision outcomes.

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### Conflicts of Interest

The authors declare no conflict of interest.

### Ethical Review

The study has not reviewed and approved by an Institutional Ethics Committee or Institutional Review Board. However, other ethical issues as plagiarism, data duplications, double publications, etc. have been strongly observed by the authors.

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