

SELF-REPORTED WORK ORGANIZATION INDICES (FACTORS) ARE ASSOCIATED WITH PREVALENCE OF WORK-RELATED MUSCULOSKELETAL DISORDERS AMONG BOTTLING WORKERS: A CROSS-SECTIONAL STUDY.

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ABSTRACT

Background/Objective: Poorly fitted work organization is high risk factors for developing work related musculoskeletal disorders (WMSDs). Bottling tasks require workers to maintain awkward posture while continually performing a machine paced repetitive motions throughout the work period thereby increasing risk for developing WMSDs. Determination of the association between such exposure to work-organizational factors and WMSDs can be the appropriate base for planning and implementing interventional program. This study was conducted among bottling workers of three bottling companies in Eastern Nigeria to investigate associations between work-organizational risks exposure and prevalence of WMSDs.

Method: In this cross-sectional study, 301 workers were purposefully recruited from bottling task workstations of 3 bottling companies in Enugu state, South East Nigeria. Standard Nordic musculoskeletal questionnaire (NMQ) was applied to study the prevalence of WMSDs while Organizational factor questionnaire (OFQ) was applied to evaluate work organization association with WMSDs.

Result: There was a high prevalence (91.4%) of WMSDs among the bottling workers. Significant association existed between organizational risk scores and the prevalence of WMSDs in all the nine body parts studied ($p=0.000$). Moreover, all the domain of organizational factors was significantly associated with WMSD in at least one body part. **Conclusion:** Bottling task is a high risk occupation for developing WMSDs. These WMSDs are associated with work organization indices of work recovery cycles, task variability, work rate, workers' control and mental stress as well as working posture adopted the workers. Therefore, intervention aimed at reducing risks and/or its effect on workers is essential.

KEYWORDS: Bottling tasks, Work rate, Work recovery cycle, musculoskeletal disorder, mental stress.

INTRODUCTION

Work-related musculoskeletal disorders (WMSDs) constitute significant ergonomic problems encountered in the workplaces (Alireza *et al*, 2007) ranking among the leading causes of occupational disability (Maul *et al*, 2003; Alireza, 2007). Several studies have repeatedly implicated WMSDs as a major cause of work-related disabilities and lost-time illness injuries in both developed and industrially developing countries (Genaidy *et al*, 1993; Bernard, 1997; Maul *et al*, 2003; Choobineh *et al*, 2007; and Pourmahabadian and Azam, 2006). This problem is extremely serious in the developing countries owing to poor working conditions and the absence of effective work injury prevention programs (Shahnavaz, 1987; Jafry, 2000).

Several Scholar have reported high prevalence of musculoskeletal disorders among different groups including physiotherapists (Akinbo, 2006; Adegoke *et al*, 2008), commercial drivers (Akinbo *et al*, 2008; Akinpelu, 2009), computer system users (Adedoyin *et al*, 2004) rural community dweller (Akinpelu *et al*, 2010) dentists, (Udoye *et al*, 2007), rural hospital workers (Omokhodion *et al*, 2000), Timber workers (Ezeukwu *et al*, 2001), and office workers (Omokhodion *et al*, 2003) in Nigeria. Studies have also suggested an association between WMSDs and some multiple physical work task variations specifically repetitive machine paced tasks (Ezeukwu *et al*, 2011), various postural stresses (Akinbo *et al*, 2008; Ajimotokan, 2009; Moriguchiet *et al*, 2009), forceful exertion, sustained static muscle action (National Institute for Occupational Safety Health (NIOSH), 2007; Akinbo *et al*

2008; Choi, 2010)), contact mechanical stress (NIOSH, 2007; Ezeukwu *et al*, 2011) as well as work organizational and demographic cofounders (NIOSH, 2007; Ajimotokan, 2009; Choi, 2010).

In the United States of America, for instance, injury and illness rate for lost workday in the bottling industry ranked sixth highest among corresponding rate reported for some 370 individual manufacturing industries (NIOSH, 1996). Three out every five of these injuries are severe enough to prevent the affected individual from activity either at home or in the workplace (NIOSH, 1996). These obvious risks notwithstanding, data on the prevalence of WMSDs as well as work organization associations among Nigeria workers involved in bottling tasks are lacking in published literatures. Hence this study was designed to investigate the association between work organisation risk factors and occurrence of WMSDs among workers who are directly involved in bottling tasks in selected bottling companies in Eastern Nigeria.

MATERIALS AND METHODS

Subject selection

A total of 301 subjects participated in the study. They were recruited from 3 bottling companies in Eastern Nigeria.

Inclusion criteria:

- a. Workers at the bottling workstations of the selected companies who have worked for up to 1 year in the bottling tasks workstations and consented to participate in the study were recruited for the study.
- b. Workers who can comprehend written English or Igbo language.

Exclusion criteria:

- a. Workers that cannot comprehend written English or Igbo language
- b. Supervisors in these workstations that are not directly involved in bottling tasks.
- c. Workers that have not worked in these workstations for up to 12 months.

Description of instruments

1. Standard Nordic questionnaire: The questionnaire was available in English and Igbo languages. The Standard Nordic Questionnaire (SNQ) was developed for the gathering data on the occurrence of Musculoskeletal Symptoms (Kourinka *et al*, 1987). It is a 9 item questionnaire, each item comprising of three questions. The questions including: WMSDs in the past twelve months; past seven days as well as; prevention from activity by WMSDs are asked for each one of 9 body parts. The Items/body parts include: Neck; Shoulder; Elbow; Wrist/Hand; Upper back; Lower back; One or both hip/thigh; One or both knees; One or both ankles. Responses to any of the question is either a 'Yes' or a 'No', i.e response variables are nominal. If a respondent answers 'NO' to the first question, he may not proceed to answer the other two questions of the same body part. Validity and test-retest reliability of the SNQ has been well demonstrated (Kourinka *et al*, 1987; Dickson *et al*, 1996, Pinheiro *et al*, 2002; de Barros *et al*, 2003). A pretested Igbo version of this questionnaire was available for participants who do not comprehend written English language.
2. Organizational Factors Questionnaire (OFQ). This is a work organizational factors questionnaire developed by the Work Council Bureau of British Columbia for assessing organisational risk factors for WMSDs in the industrial settings. It consists of six factor domains/subscales namely: daily work recovery cycle; action recovery cycle; task variability; work rate; worker's control over the work; mental stress. Responses (Rating level) are recorded on a 3 point scale for each domain, from Low Risk (1) to High Risk (3). Where a risk factor is not applicable to a workstation, a score of zero (0) is given to the factor. The subscale/domain scores (ranging from 0-3) sum up to give the total organization risk factors score for an individual worker. Total score for individuals ranges as low as 0 to as high as 18. If a total score value is greater than 0 and less than 9, risk is regarded as low; between 9 and 14 is taking as medium and total score greater than 14 is regarded as high. The OFQ has previously been validated (Ergonomic working group, 2000; Kay-way *et al*, 2003). A pretested Igbo version of questionnaire was available and were administered to worker do not comprehend written English language.

Ethical issues

The protocol of this study was approved by the Research and Ethics Committee of the Lagos University Teaching Hospital (LUTH) Idi-Araba, Lagos State, Nigeria. Permission to conduct the study was also obtained from the management of the companies where the research was carried out. Lastly, written consent of the participating workers was duly sought and obtained.

Research design

A cross-sectional descriptive survey research design was employed in this study.

Sampling technique

The 3 bottling companies were selected using the convenience sampling method while the purposive sampling technique was used to recruit the participants for this study.

Procedure for data collection

The procedure for data collection began, with meetings were held with the employees of each of the bottling Companies, during which the aims and objectives of the study and procedures were discussed with the hope of getting approval. The voluntary consent form applicable to this study was also discussed to ensure the participants absolute confidentiality of any information provided. Afterwards, the NMQ and OFQ were administered to each worker. Each questionnaire bore a serial number and the Igbo versions were only administered to participants who cannot comprehend English Language. A maximum of 7 days were allowed for collecting the filled questionnaire.

Data analysis

The data collected were presented and analyzed using SPSS version 15.0. Inferential statistics of Chi-square was utilized to find out any significant association existing between WMSDs and OFQ were also tested by Chi-square. The significance level of all inferential statistics was $p < 0.05$.

RESULTS

WMSDs AND ORGANIZATIONAL FACTORS

In this study, all comparison referring to prevalence of musculoskeletal disorders will refers to the 12-months prevalence. About 74.4% of the worker was rated moderate or high. Majority of the tasks were consistent with regular pauses, however, workers were not able to take pauses during the tasks which were either frequently repetitive or monotonous requiring the use of same body part for long period of time. Although some of the tasks were slow, significant others involved rapid steady motion which workers reported difficulty keeping up. Concerning work control, majority of the tasks allowed little flexibility with deadlines.

The overall prevalence of WMSDs was consistently higher among workers with increasing total organizational risk scores (levels) except for the upper back where those with medium risk rating reported the highest prevalence of MSDs (48.7%). The percentage of the sample in each of the three risk levels with reports of WMSDs in the different body regions are shown in Table 1. Shoulder, neck, and lower back were the most affected body parts with 95.4%, 93.6%, and 88.1% respectively in the high risk category. Proportions with low organizational risk scores correspond to low reports of WMSDs for all the body regions examined (neck=14.3%; shoulder 40%; elbow 11%; wrist 3.9%; upper back 7.8%; lower back 18.2%; hip/thigh=1.3%; knee=10.4%; ankle/foot=5.2%). Additionally, the association between increasing organizational risk level and the occurrence of WMSDs was significant for all body regions ($P = 0.000$).

Table 2 presented the association between WMSDs in at least one body part and the different domains of organizational risk factors. Workers whose scores were rated as high organizational risk in any of all the domains had 100% prevalence of WMSDs in at least one body part. Although reports of WMSDs is common among all the risk levels (low, medium, high), those with low domain risk ratings reported lower prevalence of WMSDs compared to those with medium or high domain risk ratings.

Table1: Association between 12 Months prevalence and organizational factors (N=301)

	Prevalence at different Organizational risk rating (Risk levels)						df =2	
	<9		9-14		>14		Pearson Chi-square	
	Low		Medium		High		test	
Body parts	n	%	n	%	n	%	X ²	p-value
Overall	51	66.2	112	97.4	109	100.0	69.644	0.000*
Neck	11	14.3	60	52.2	102	93.6	118.216	0.000*
Shoulder	31	40.3	94	81.7	104	95.4	78.699	0.000*
Elbow	9	11.7	39	33.9	51	46.8	25.275	0.000*
Wrist	3	3.9	45	39.1	61	56.0	53.645	0.000*
Upper back	6	7.8	56	48.7	12	11.0	120.177	0.000*
Lower back	14	18.2	77	67.8	96	88.1	95.524	0.000*
Hip/thigh	1	1.3	17	14.8	26	23.9	22.030	0.000*
Knee	8	10.4	35	30.4	50	45.9	126.626	0.000*
Ankle/foot	4	5.2	32	27.8	83	76.1	105.700	0.000*

Key *= Significant

Table 2: Association between 12 Month prevalence of WMSDs in at least one body part and domains of organizational risk factors (N=301)

		Prevalence of WMSDs at different risk levels							
		Low risk		Medium risk		High risk		Pearson Chi-square	
Domains		n	%	n	%	n	%	X ²	P-value
Daily work recovery cycle		111	79.9	117	99.2	44	100	32.789	0.000*
Action recovery cycle		52	70.3	175	96.2	45	100	46.125	0.000*
Task variability		65	72.2	99	96.1	108	100	49.456	0.000*
Work rate		93	64.8	79	100.0	100	100	47.086	0.000*
Worker's control		28	59.6	156	94.0	88	100	63.049	0.000*
MSMental stress		59	72.8	110	94.0	103	100	41.350	0.000*

DISCUSSION

Organizational risks among the workers were majorly moderate to high (74.4%). While majority of the tasks being carried out at the workstations were consistent with regular pauses, however, workers were not able to take pauses during a work period. Additionally the tasks, which were either frequently repetitive, sustained postures or monotonous, predominantly required the use of same body part for long period of time. Although some of the tasks were of slow pace, significant others involved rapid steady motion which workers reported difficulty meeting up. Concerning work control, the job tasks many workstations were machine paced and workers could not modify the pace at will. Few job tasks have some flexibility over daily deadline.

Conclusively, our study found an association between increasing prevalence of MSDs and high grand work-related organizational risks level among the bottling workers. Particularly, each of the indices of work-recovery cycles, action recovery cycles, task variability, work rate, worker's control and mental stress were significantly associated with reported musculoskeletal disorders. The implication is that the less time allowed for breaks, the longer work duration before break, the less variable tasks are, the more rapid work are carried out, the less control a worker have over task decision or the more mentally stressful a task is or at least if worker consider it so, the more likely the worker would manifest symptoms of MSDs. While Bamptom (1988) and Linton (1990) evidences were clearly supportive of this result, Strand (1987); Biering-Sorensen *et al* (1989); Hopkins (1990); Houtman *et al* (1994) found no association.

The major limitation of our study is the design. Cross-sectional observational study like our at best establishes association and not a cause effect trend. Also responses provided in the musculoskeletal symptoms surveys by the workers were entirely subjective and physical examination case definition was not done. However, our study evidence importantly showed that the prevalence of WMSDs is high in the bottling tasks and that organizational risk factors among these workers were moderate to high and are associated significantly with all cases of reported WMSDs. Specifically, the daily work recovery cycle, action recovery cycle, task variability, work rate, extent of workers' control over task, and mental demand of tasks are conducive for the development of WMSDs among workers in the bottling tasks workstations.

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