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METHOD OF PREVENTING WORK-RELATED MUSCULOSKELETAL DISORDERS AMONG WORKERS IN SOME NIGERIAN CONSTRUCTION INDUSTRY (SOKOTO, NIGER, KEBBI AND KOGI STATES)

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ABSTRACT
The aim of this paper was to contribute to understanding a healthy construction site brought about by the best practices implemented by large construction sites to prevent WMSDs. A triangulation method made of interviews, site observations and studies on company's documents was used to identify the best practices in 13 several construction firms from Sokoto, Niger, Kebbi and Kogi States. A survey and structured interviews are conducted. It is found that construction workers are unfamiliar with WMSD and prevention methods. About half of the respondents did not even understand the meaning of WMSD. It is also found that the construction workers are more concernedon their occupational health than the managers. Ergonomics training and lifting technique training are also found limitedly provided to the employees. Therefore, it is recommended that the government should educate workers on these occupational illnesses to uphold healthy working bodies and lives for the construction workers.

***Keywords**: Work-related musculoskeletal symptoms, injuries, occupational health*

INTRODUCTION

In most of the developing nations such as Nigeria and Ghana, occupational health is said to be neglected under the influence of social and economic challenges according to Nuwayhid (2004) cited in (Gourab, Arkajit and Bhattacharya, 2017).

Musculoskeletal disorders mean that a part of musculoskeletal systems, such as muscles, nerves, tendons, ligaments, joints, cartilage and blood vessels, are affected by chronic overuse and misuse. The physical ergonomic features of work frequently cited as risk factors for musculoskeletal disorders include rapid work pace and repetitive motion, forceful exertions, non-neutral body postures and vibration (Punnett and Wegman, 2004).

WMSDs occur when mechanical workload is higher than the physical capacity of the human body. This is a chronic occupational illness occurring as a result of repeated trauma, rather than through a single accident or injury (Washington State Department of Labor and Industries, 2007). Millions of workers across construction industry are affected by WMSDs (European Agency for Safety and Health at Work, 2012). In America, about 1.8 million workers experience these disorders every year (Occupational Safety and Health Administration, 2010).

WMSDs are not just one of the major occupational health problems worldwide; they are also recognized as an economic burden on society (Amell and Kumar, 2001). A variety of costs, including direct and indirect costs, arise from this occupational illness. The direct costs are associated with workers compensation, medical care and rehabilitation; while the indirect costs include work disability, sick leave, reduced productivity, decreased work quality, retraining costs, and diminished morale (Deborah, 2003). The direct and indirect costs resulting from musculoskeletal conditions have been evaluated at about US$254 billion in America (Kassi, 2004; Silverstein and Adams, 2005), about US$16 billion in Canada (The Canadian Institutes of Health Research, 2005), about US$40 billion in the United Kingdom (Health and Safety Commission, 2006) and about US$100 million in Taiwan (Wei, 2000). Further, about 40% of the world's total workers compensation claims are from WMSDs (Takala, 2002).

Generally, these disorders occur in many parts of the human body including neck, upper limbs (hands, wrists, elbows and shoulders), lower limbs (legs, hips, ankles and feet) and back. Discomfort, fatigue and pain are the most common early symptoms of WMSDs (Hagberg et al., 1995). These disorders will not kill workers, but they generate a destructive impact on workers' lives, such as persistence of pain in work or leisure, and even permanent disability. Construction workers are at greater risk of developing WMSDs compared with workers in other occupations (Guo et al., 2004; Chen et al., 2005; Bureau of Labor Statistics, 2006).

There was evidence that near-infrared spectroscopy-derived signals can be used to evaluate oxidative metabolism in working muscles (Perry et al., 2010). Muscle oxygenation status during upper extremity work could help provide insight into the pathophysiological mechanisms behind work-related muscle fatigue. Best practice for preventing musculoskeletal disorders in masonry activities from stakeholders. It was suggested that: (1) grouting, climbing scaffolding, and laying block in foundation trenches are appropriate targets for further hazard assessment and solution development; and (2) a wide range of voluntary ergonomic controls currently available and utilized in the masonry trades (Entzel et al., 2007).

There is a lack of study in investigating knowledge, attitude and prevention methods ofWMSDs in the construction industry. Therefore, this study aims to assess knowledge, attitude and prevention methods for WMSDs among construction workers and construction managers. Prevention methods to minimize WMSD cases in the construction industry are also given.

RISK FACTORS ASSOCIATED WITH MUSCULOSKELETAL DISORDERS

Any factors present in the workplace which directly lead to the development of MSDs are considered as risk factors for WMSDs. The WMSD risk factors can either directly or indirectly influence onset of WMSDs (Hagberg et al., 1995). In general, occupational risk factors which associate with WMSDs can be broadly categorized into physical, psychosocial, organizational and thermal factors (Hagberg et al., 1995; Punnett and Paquet, 1996; Devereux et al., 2002; National Research Council Canada, 2006).

The physical risk factors includes the applications of force, repetition, vibration, awkward working postures, static working posture, lifting/forceful movement, and heavy physical work(Devereux et al., 2002; National Research Council Canada, 2006). It is found that elbow, hand or wrist and tendonitis are the most common disorders resulted from physical risks in the industry (Devereux et al., 2002).

The psychosocial risk factors describe subjective aspects of work organization and howthey are perceived by workers and managers (Hagberg et al., 1995). These disorders can be divided into two main categories (National Research Council Canada, 2006): i) those that are truly specific to the workplace, i.e., job satisfaction, poor social support and work pace; and ii) those that are individual psychosocial factors, i.e., depression. High job demands and high perceived stress are the most common psychosocial risk factors leading to subsequent episode of disorders in the upper extremities (National Research Council Canada, 2006).

The organizational risk factors describe objective aspects of how the work is structured, supervised and processed (Hagberg et al., 1995), which influences both physical load patterns such as work pace, repetitiveness, rest breaks and psychosocial features such as job demands and low decision latitude or skill utilization (Punnett and Paquet, 1996). It is found that stressful work organization such as inadequate break, increase time pressure, increase work schedule and wage incentives are the major causes for the development of WMSDs (Bernard et al., 1994; Bergpvist et al., 1995; Ferreira et al., 1997; Annalee, 2000; Birch et al., 2000; Warren et al., 2000).

The thermal risk factors are mainly affected by cold exposure. It is found that musculoskeletal symptoms are more frequently happened in cold store working environment (Pienimaki, 2002). Furthermore, pain on lower back and knee are frequently occurred on workers with a cold working environment. Cold exposure has a specific role either as a causative or a contributing factor in etiology of tenosynovitis and associated with degenerative discopathies of lower back. Moreover, cold exposure in association with repetitive wrist movements can also increase risks for carpal tunnel disease.

RESEARCH METHODOLOGY

To investigate knowledge, attitude and prevention methods for WMSD at the selected construction workplace in the north-western part of Nigeria, a questionnaire survey was conducted. Two sets of questionnaires were separately used for construction workers and management staff. The questionnaire for construction workers contained questions relating to: a) background information; b) knowledge and attitude on occupational health; and c)

knowledge on employees' compensation ordinance. Six compensable occupational diseases related to WMSDs abstracted from the Nigerian compensation ordinance (see Table 1) were selected to test the understanding of construction workers in the survey. The questionnaire for the management staff contained the same three sectors as did the questionnaires for the construction workers, with an additional section on prevention and improvement methods for WMSDs. Four hundred questionnaires were sent out to a list of target respondents which were collected from a final report on the review of trade classification in the construction industry (Environment Transport and Works Bureau, 2013). Three hundred and twenty three responses were received, 136 of these were from construction workers and 187 from management staff, with a response rate of about 80.8%. However, four of the questionnaires are not properly completed and therefore only 319 questionnaires were used for analysis.

Table 1. Compensable occupational diseases related to WMSDs in Employees'

Compensation Ordinance (Labours Department, 2010)

Item	Disease	Occupation	Prescribed period
A4	Cramp of hand or forearm due to repetitive movements	Any occupation involving prolonged periods of handwriting, typing or other repetitive movements of fingers, hand or arm	1 year
A5	Subcutaneous cellulitis of hand	Any occupation involving manual labour causing severe or prolonged friction or pressure on hand	1 year
A6	Bursitis or subcutaneous cellulitis arising at or about knee due to severe or prolonged external friction or pressure at or about knee	Any occupation involving manual labour causing severe or prolonged external friction or pressure at or about knee	1 year
A7	Bursitis or subcutaneous cellulitis arising at or about elbow due to severe or prolonged external friction or pressure at orabout elbow	Any occupation involving manual labour causing severe or prolonged external friction or pressure at or about elbow	1 year
A8	Traumatic inflammation of tendons of hand or forearm (including elbow), or of associated tendon sheaths	Any occupation involving manual labour, or frequent or repeated movements of hand or wrist	1 year
A9	Carpal tunnel syndrome	Any occupation involving repetitive use of hand-held powered tools whose internal parts vibrate so as to transmit that vibration to the hand, but excluding those which are solely powered by hand	1 year

To determine the relative ranking of factors, the scores are transformed to indices based on Equation (1) (Tam et al., 2000):

$$RII = \frac{\sum w}{AN}, \quad (1)$$

where w is the weighting given to each factor by the respondent, ranging from 1 to 5 in which '1' is the least important and '5' the most important; A is the highest weight, in this study A=5; N the total number of samples; and RII the relative importance index, $0 \leq RII \leq$

After receiving the questionnaires, individual structured interviews were arranged with 20 respondents; 10 of whom were construction workers and 10 were management staff. The intention of the interviews was to gather further comments, elaboration and interpretation on the results from the questionnaire survey. Consistent responses were also collected from different companies via survey and interviews which validate the results.

Before the data could be analysed and used for discussion, it was important to prove the reliability of the data. The data will be useless if their reliability is low, which indicates the questions and data may be wrongly collected. One of the most popular reliability statistics in use today is Cronbach's alpha (Cronbach, 1951). Cronbach's alpha determines the internal consistency or average correlation of items in a survey instrument for gauging its reliability (Santos and Reynaldo, 1999). Alpha ranges from 0 to 1, in which 0 means complete unreliability and 1 means perfect reliability (Judd et al., 1991). The larger score will reflect a higher reliability. A score of more than 0.5 is considered an acceptable reliable value.

RESULT AND DISCUSSION

Respondents' Background

The reliability of the data which aimed to investigate the knowledge and attitude on occupational health is high. All the reliability of factors were acceptable in samples where the alpha value exceeded 0.5 (see Table 2). This forms a strong evidence to show that there is a high reliability on the data, which can show the validity and support the below discussions.

Table 2. Reliability of the survey to the respondents: Coefficient alpha of the factors under knowledge and attitude on occupational health

Knowledge and attitude on occupational health	**Coefficient Alpha ( )**
Level of concern on your occupational health	0.69
Level of concern from your employer / to your employees on occupational health	0.66
Cognition of the WMSDs	0.75
Ergonomics training	0.63
Lifting technique training	0.71

Table 3 summarizes respondents' background. As construction is a male-dominant industry, it is not surprising that about 99% of respondents from construction workers and about 77% of respondents from the management staff were male. Regarding age distribution, most respondents were aged from 40 to 49 years old or about 53% of the construction workers and from 31 to 39 years old or about 42% of the management staff. The majority of the respondents had an education level of primary or secondary school for the construction worker group and bachelor degree for the management staff group. All respondents had atleast one year's working experience, and the majority of them had 6 to 10-year's working

experience. For their job positions, most of the construction workers were carpenters (about 22%), bar benders and fixers (about 21%) and plasterers (about 18%); while most of the management staff were engineers (about 32%).

Table 3. Survey on respondents' background

Background	Construction worker	Management staff
	Percentage (in %)	
Gender		
Male	103	66
Female	1	27
Age		
Below 30	8	13
31 to 39	13	42
40 to 49	53	39
50 to 59	29	0
Above 60	1	0
Education level		
Uneducated	11	0
Primary school level	56	0
Secondary school level	36	13
Associate degree	1	19
Bachelor degree	0	42
Higher than Bachelor degree	0	26
Working experience		
1 to 5 years	16	13
6 to 10 years	47	61
Over 11 years	37	23
16 to 20 years	0	0
Above 20 years	0	3
Position		
Plant and equipment operator	6	–
Labourer	7	–
Concreter	7	–
Carpenter	22	–
Plasterer	18	–
Welder	9	–
Bar bender and fixer	21	–
Electrician	10	–
Project manager	–	1
Engineer	–	32
Foreman	–	19
Safety manager	–	6
Safety supervisor	–	16
Safety officer	–	15
Others	–	10

KNOWLEDGE AND ATTITUDE ON OCCUPATIONAL HEALTH

Table 4 summarizes the survey results on knowledge and attitude on occupational health.

Most of the respondents indicated that they and their employers / employees were concerned with occupational health. However, about half of the respondents did not understand the meaning of WMSDs, which reflects the lack of understanding of WMSDs in the industry.

Table 4. Survey on respondents' knowledge and attitude on occupational health

Knowledge and attitude on occupational health	Construction worker	Management staff
	Percentage (in %)	
Level of concern on your occupational health		
Very unconcerned	0	–
Unconcerned	1	–
Neither concerned or unconcerned	4	–
Concerned	33	–
Very concerned	62	–
Level of concern from your employer / to your employees on occupational health		
Very unconcerned	1	10
Unconcerned	6	61
Neither concerned or unconcerned	32	0
Concerned	52	16
Very concerned	9	13
Cognition of the WMSDs		
Yes	35	55
No	65	45
Provide ergonomics training		
Yes	28	45
No	72	55
Provide lifting technique training		
Yes	-	-
No	56	74

Table 5 summarizes the correlations between the respondents' knowledge and attitude on occupational health on two groups: construction workers and management staff. There are some discrepancies on some issues. The construction worker group is significantly higher than the management staff group for the concern on their own occupational health (with the correlation coefficients of about 0.814 and 0.493 for the construction workers and the management staff respectively), and concern from the employer / employees' occupational health (with correlation coefficients of about 0.641 and 0.325 for the construction workers and the management staff respectively). It can highlight that the construction workers who are mostly in the construction environment are concerned with their own occupational health, which can ensure that the construction workers are willing to receive knowledge and ensuretheir safety on site. From the interview discussions, it is unveiled that the most common methods in getting information of WMSDs are from safety related courses, information from books and newspapers. Interviewees also suggested that seminars could convey the required knowledge of WMSDs.

Table 5. Correlations between the respondents' knowledge and attitude on occupational health on two groups: Construction workers and management staff

Knowledge and attitude onoccupational health	Pearson correlation coefficients for construction workers group	Pearson correlation coefficients for management staff group
Level of concern on your occupational health	0.814**	0.493**
Level of concern from your employer / to your employees on occupational health	0.641**	0.325**
Cognition of the WMSDs	0.730**	0.624**
Ergonomics training	0.433**	0.764**
Lifting technique training	0.609**	0.388**

Note: ** correlation is significant at the 0.01 level.

From the survey results, one of the major reasons for the lack of knowledge onoccupational health is lack of training provided by their organizations. About 72% and 56% of the construction worker group and about 55% and 74% of the management staff group opined that they had not received any ergonomics training and lifting technique training respectively from their employers / to their employees. It is also found that ergonomics training (with correlation coefficients of about 0.433 and 0.764 for the construction workers and the management staff respectively) and lifting technique training (with correlation coefficients of about 0.609 and 0.388 for the construction workers and the management staff respectively) receive different opinions between the two groups. The construction workers were more concerned about lifting technique training, while the management teams were more concerned about ergonomics training. From the interview discussions, it is unveiled that the most common methods in getting information of WMSDs are from safety related courses, and information from books and newspapers. Interviewees also suggest that seminars could convey the required knowledge of WMSDs.

Employees' Compensation Ordinance

Employees' compensation ordinance has been launched to protect workers' health and safety. However, about 67% of the respondents reported that they were not familiar with the laws and procedures for employees' compensation (see Table 6). The majority of the respondents reported that they did not know whether the mentioned occupational diseases were compensable under the compensation ordinance. This revealed that workers do not effectively use the compensation ordinance to protect their health while at their workplace.

Furthermore, about 61% of the respondents experienced difficulty in claiming compensation of WMSDs. The main problems included the lack of knowledge on occupational diseases (about 37%), the lack of knowledge on claiming procedures (about 26%) and difficulty tofulfil the prescribed period of at least one year set in the ordinance (about 35%).

Table 6. Survey on the employees' compensation ordinance

Employees' compensation ordinance	**Percentage (%)**
Familiar with laws and procedures on employees' compensation ordinance	
Yes	33
No	67
Is "Item A4: Cramp of the hand or forearm due to repetitive movement" compensable?	
Yes	4
No	24
Not sure	72
Is "Item A5: Subcutaneous cellulites of the hand" compensable?	
Yes	5
No	20
Not sure	75
Is "Item A6: Bursitis or subcutaneous cellulites arising at or about the knee due to severe or prolonged external friction or pressure at or about the knee" compensable?	
Yes	4
No	13
Not sure	83
Is "Item A7: Bursitis or subcutaneous cellulites arising at or about elbow due to severe or prolonged external friction or pressure at or about the elbow" compensable?	
Yes	4
No	13
Not sure	83
Is "Item A8: Traumatic inflammation of tendons of hand or forearm, or of the association tendons sheaths" compensable?	
Yes	20
No	18
Not sure	62
Difficult to claim for the WMSDs	
Yes	61
No	39
Problems on claiming the WMSDs	
Lack of knowledge on occupational diseases	37
Lack of knowledge on claiming procedures	26
Difficult to fulfill prescribed period of at least 1 year set in the ordinance	35
Others	2

Prevention and Improvement Methods for WMSDs

Table 7 shows that the majority of the respondents did not know the prevention methods for WMSDs. They opined that the government should enhance publicity and education on WMSDs.

Table 7. Survey on prevention methods for WMSDs

Prevention methods for the WMSDs Percentage (%)	**Percentage (%)**
Cognition of prevention methods of WMSDs	
Yes	35
No	65
Government should enhance publicity and education on WMSDs	
Yes	84
No	16

The results found that the construction workers and management staff basically have similar opinions on the prevention and improvement methods for WMSDs. It is highlighted that training and education on WMSDs and ergonomics should be provided. As discussed earlier, inclusion of the knowledge on WMSDs in a mandatory safety course can significantly improve the understanding of these disorders and make people aware of the seriousness of the diseases. Development of occupational health related policies is also recommended from various construction stakeholders.

However, the management teams did not consider improving knowledge on economic consequences of the WMSDs and advantages gained from work breaks to be useful, and ranked these as the last two improvement methods from the survey results. The management teams explained that improving knowledge is very difficult. They preferred to provide training instead, which they considered to be a more effective way of ensuring worker safety.

The construction workers also provided similar opinions from the survey results, in which they did not consider doing stretching exercises, providing regular and continuous breaks and using ergonomically designed tools as useful as providing training for the improvement methods.

CONCLUSION

This paper investigated musculoskeletal problems between construction workers and management staff. A questionnaire and structured interviews were conducted. It was found that the construction workers and management staff are concerned with occupational health; however, they lack of understanding on WMSDs in the industry. The industry lacks knowledge on occupational health because of a lack of training provided by their organizations. The workers are not familiar with the laws and procedures for employees' compensation, which is not enough to protect workers' health and safety. It was suggested that government should enhance publicity and education on WMSDs. Training and education on WMSDs and ergonomics should also be provided to construction workers and management teams. It was recommended that inclusion of the knowledge on WMSDs in a mandatory safety course can significantly improve the understanding of WMSDs and make people more aware of the seriousness of the diseases. Development of occupational health related policies was also recommended from various construction stakeholders. The results of this paper can assist the construction industry and practitioners should aware of the musculoskeletal disorders that may affect workers as a result of their activities at work.

Proper actions have to be taken immediately by the government and employers to avoid unnecessary injuries and accidents in the construction industry. Further research directions on investigating the most suitable prevention methods for WMSDs for the short-term and long-termin the construction industry should be conducted.

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