

## **Patterns of Work-related Musculoskeletal Disorders among Sonographers in selected Health Facilities in Nigeria**

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### **Abstract**

Work-related Musculoskeletal Disorders (WMSDs) are the most common work-related health problems in the World, affecting millions of workers. Health professionals are also vulnerable to WMSDs during the course of routine work especially those who are in direct contact with patients. The literature on WMSDs is scarce in Nigeria, especially with regards to sonographers. This study therefore set out to determine the prevalence and patterns of WMSDs among sonographers in Nigeria.

A total of 55 self-administered structured questionnaires were distributed to sonographers. Items covered included types of examination performed, time spent daily/ weekly, duration of examination, average number of examination done daily, etc as related to the types of symptoms experienced by the sonographers and the measures taken to alleviate the symptoms. Descriptive statistics of means, standard deviations and percentages were obtained and strengths of correlations of measured parameters were tested using the Pearson's Product moment correlation coefficient statistics. Alpha level was set at 0.05 significant level. The total of fifty-one respondents which included thirty-five (69.6%) males and sixteen (31.4%) females ultrasonographers were studied. The ages ranged between 25- 60 years. The mean weight and height of all the respondents were  $74.3 \pm 11.7$ kg and  $1.66 \pm 0.25$ m respectively. All 51 respondents reported varying degrees of WMSDs which they associated with tasks of scanning. There was a high preponderance of back pain [upper and lower] (41%) and wrist joint (27%) respectively among other areas of the body. Symptoms manifested ranged from weakness, movement restriction (stiffness) to tingling sensation.

The study recorded high prevalence of WMSDs among Nigerian sonographers with back region and the wrist joints respectively worse affected by symptoms. Age of sonographers was found to be an internal risk factor associated with affected anatomical sites. Physical

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risk factors like lack of rest breaks, heavy work-loads, and use of facilities that are not ergonomic were identified as mainly contributing to WMSDs.

**Keywords:** Musculoskeletal Disorders; Prevalence; Nigeria; Sonographers

## 1 Introduction

“Musculoskeletal disorders” (MSDs) include a wide range of inflammatory and degenerative conditions affecting the muscles, tendons, ligaments, joints, peripheral nerves, and supporting blood vessels [1]. They are impairments of the bodily structures, which are caused or aggravated primarily by the performance of work and by the effects of the immediate environment in which work is carried out [2]. These include clinical syndromes such as tendon inflammation and related conditions (tenosynovitis, epicondyles, bursitis), nerve compression disorders (carpal tunnel syndrome, sciatica), and osteoarthritis, as well as less well standardized conditions such as myalgia, low back pain and other regional pain syndromes not attributable to known pathology [1]. Most work-related MSDs are cumulative disorders, resulting from repeated exposure to high- or low-intensity loads over a long period of time. The symptoms may vary from discomfort and pain to decreased body function and invalidity [2].

MSDs have become increasingly common worldwide during the past decades [3]. It is a common cause of work-related disability among workers with substantial financial consequences due to workers’ compensation and medical expenses [3]. MSDs can interfere with activities at work and can cause reduction in productivity, increase in sickness absence, and chronic occupational disability. The consequences may include decreased productivity, financial burden for the worker, the company concerned, the society, among other disadvantages [2].

MSDs have been described as one of the main occupational problems among health workers [2]. Several epidemiological studies have shown that physical factors, such as manual handling, frequent bending and twisting, forceful movements and awkward postures, are important determinations of musculoskeletal disorders [2, 3, 4].

While there are reports of MSDs among workers in Europe and America, such reports are rare in Africa, especially Nigeria. The occurrence of MSDs in health care workers is currently being investigated in many countries. In Italy, high prevalence rates of musculoskeletal complaints have been described in various health care professional groups. Among physical therapists, MSDs were shown to be a common problem [4].

However, Lorusso et al., [4] reported a high prevalence of musculoskeletal complaints in radiation technologists in Italy. A Nigerian study has also reported prevalence of MSDs among health workers which included nurses, doctors, support staff, physical therapists, laboratory scientists, management staff, radiologists, dentists and occupational therapists [5].

Ultrasonography is a branch of diagnostic medicine which involves the technique using echoes from ultrasound pulses to delineate objects or areas of different densities in the body. It also involves the formation of a two-dimensional (2D) image (3D/ 4D now in use in addition to 2D), used for the examination and measurement of internal body structures and detection of bodily abnormalities. It is a repeatable non-invasive examination that permits accurate visualization of tendons and ligaments [6].

This study therefore aimed at investigating the prevalence of musculoskeletal complaints among ultrasonographers in Nigeria health facilities within the Edo and Delta states. It also aimed at studying specific or peculiar occupational disorders of the ultrasonographers and factors that can aggravate or relieve the disorders.

## **2 Methodology**

A 32-item, structured questionnaire was used for this study. Items covered included possible symptoms (including aggravating and relieving factors) that may be experienced by sonologists or sonographers in the course of their job performance. Inclusion criterion was at least a year experience in scanning and performance of at least scanning examinations per day. Information sought also included socio-demographic data, work setting, duration of involvement in sonography, type of examination usually performed, time spent daily/ weekly, average number of examination carried out per day or week, type of scanning technique, number of scanning machine(s) and personnel available for scanning. Respondents were also asked to identify the symptoms like pain and site of pain, duration pain lasted if felt, aggravating or relieving factors, persistency or intermittency of pain, treatment administered, and possible presence of other associated symptoms like weakness, movement restriction, loss concentration, joint swelling and tingling sensation. The respondents were requested to identify the effects of the above symptoms on work output and preventive measures undertaken, and state if they considered ultrasonography occupationally rewarding or hazardous. Questionnaires were administered to sonographers working in teaching hospitals, federal medical centres, general hospitals and private ultrasonography clinics. Inclusion criteria were sonographers who have for at least one year experience in scanning, undertake at least ten (10) scans per day and for at least three days a week.

All the data obtained were fed into SPSS software (version 16.0; SPSS Inc., USA) package for statistical analyses. Descriptive statistics of mean, standard deviation and percentages were obtained and the Pearson's Product Moment Correlation co-efficient was used to test the strength of association of the measured parameters with work-related musculoskeletal disorders. Alpha level was set at 0.05 significant level.

## **3 Results**

### *Biographic data*

A total of 55 questionnaires were administered within the Edo and Delta states of Nigeria. 51 of these were found valid and were therefore analyzed, giving a 93% response rate. The respondents included 35 (69%) males and 16 (31%) females sonographers whose ages ranged between 25 and 60 years. 9(18%) were aged between 25 – 30 years, 29(57%) were 35 – 35years and 11(21%) were aged between 45 – 60 years. (13)25.5% were single while the rest 38(74.4%) were married. The mean weight and height of all the respondents were  $74.3 \pm 11.7$ kg and  $1.66 \pm 0.25$ m respectively (table 1). 40(78%) were employed by hospitals (federal medical centers, teaching and general hospitals), while 11(21%) worked with private diagnostic centers.

### *Symptoms Experienced*

Forty-five (88%) reported varying degrees of pain which ranged between mild, moderate and severe and lasted between few minutes to 2hours. Forty-one (80%) reported mild pain, 1(2%) reported moderate pain, 3 (5.9%) reported severe pain arising from work, while the rest of the respondent did not specify the severity of their pain. The site of pain included wrist, elbow and shoulder joints, neck, low back and general body pain. Of the 45.1% who reported pain over the upper limb joints, 14(27.5%) reported wrist joint pain, 2 (3.9%) had elbow joint pain while 7 (13.7%) had pain in the shoulder joint. Pain was most prevalent at the back (upper and low back) with a figure of 41.1% prevalence while 5.7% reported general body pain. The pain was reported to last between 20minutes and two weeks post ultrasonographic procedures. Of the 48 who classified their pain, seventy-nine percent (38) reported their pain to be intermittent while the remaining twenty-one (10) percent reported constant pain. Other symptoms prevalent among these health care providers were feeling of weakness and loss of concentration.

#### *Duration of Symptoms*

The average duration of involvement in ultrasound scanning examinations was  $6.8 \pm 4.1$  years. Forty-one percent of the respondents were involved in examination procedures like obstetric, cranial, gynaecological, ophthalmic, abdominal, vascular, skeletal and prostate scanning. Thyroid and pelvic procedures were infrequently performed. The mean time spent daily in scanning is 5.9hours while an average duration spent per scanning was 10minutes. The sonographers performed a mean of 14 examinations per day. The mean number of sonographers per practice centre was 2.

#### *Aggravating/ Relieving factors.*

Twenty one respondents (41%) reported that the use of low height chair and scanning chair both precipitated and aggravated their symptoms (pain). 15(29%) reported rest as their relieving factor while about 9 (18%) used pain killers for pain relief. 10 (21%) had physiotherapy in form of heat therapy and massage to have relief. 18 (35%) reported weakness while 12 (24%) reported movement restriction; joint swelling was reported by 8(16%) and tingling sensation was reported by 5 (10%) as associated symptoms experienced after sonography.

Two (4%) of the total respondents have had to miss work because of the symptoms for between 1and 2 days. Rest in form of breaks in-between sessions was recommended by 11 (21%), use of chairs and scanning tables of ideal heights was recommended by 18 (35%), while 1 (2%) suggested reduced work load as factors that can reduce risks to musculoskeletal disorders associated with ultrasonography. Sonography was considered rewarding by 29 (59%) of the respondents, 19 (35%) considered unrewarding while the rest 3 (6%) were indifferent. 37 (73%) considered sonography occupationally hazardous, 12 (24%) considered it not hazardous while the rest 2 (4%) were not specific.

#### *Associations of complaints with risk factors*

There was significant association between times spent carrying out sonography and pain severity ( $r=0.824$ ,  $p=0.005$ ) implying that those who spent longer time scanning had worse pain. There was also a significant association between pain severity and average number of examination performed per day and week ( $r= 0.782$ ,  $p= 0.04$ ). There was however no significant association between sex of the respondents and pain severity, duration of pain, site of pain, weakness, movement restriction, joint swelling and tingling and sensation ( $r=0.021$ ,  $p=0.21$ ). Marital status was found to have a significant association

with pain severity ( $r= 0.079$ ,  $p= 0.052$ ) and aggravating/ relieving measures ( $r=0.540$ ,  $p=0.050$ ), but had no significant association with other symptoms like tingling sensation, joint swelling, movement restriction (feeling of stiffness), weakness, duration of pain. Marital status did not also have a significant association with the constancy or intermittency of pain ( $r= 0.179$ ,  $p=0.193$ ). When age of the respondents as an internal risk factor was associated with the complaints, age was found to have a significant association with the anatomical area (sites) affected ( $r=0.903$ ,  $p=0.712$ ), relieving/ aggravating measures ( $r=0.503$ ,  $p=0.475$ ), joint swelling ( $r=0.986$ ,  $p=0.985$ ), loss of concentration ( $r=0.098$ ,  $p=0.041$ ) and constancy of pain ( $r=0.631$ ,  $p=0.583$ ), but shared no significant association with duration of pain ( $r=0.475$ ,  $p=0.481$ ), severity of pain ( $r=0.477$ ,  $p=0.487$ ), tingling sensation ( $r=0.464$ ,  $p=0.541$ ), movement restriction (stiffness) ( $r=0.451$ ,  $p=0.551$ ) and weakness ( $r=0.321$ ,  $p=0.395$ ).

When relating weight as a possible risk factor to work-related musculoskeletal symptoms among sonographers, body weight of the respondents had significant association with pain severity ( $r=0.646$ ,  $p=0.253$ ), duration of pain ( $r=0.945$ ,  $p=0.400$ ), feeling of weakness ( $r=0.557$ ,  $p=0.053$ ) and need to take treatment ( $r=0.658$ ,  $p=0.150$ ). However, body weight did not share significant association with parameters like site of pain ( $r=0.398$ ,  $p=1.000$ ), constancy/ intermittency of pain ( $r=0.379$ ,  $p=0.535$ ), movement restriction [stiffness] ( $r=0.158$ ,  $p=0.515$ ), tingling sensation ( $r= 0.046$ ,  $p=0.872$ ) and joint swelling ( $r=0.418$ ,  $p=0.701$ ).

Pearson's moment correlation showed significant association between height of the respondents and severity of pain ( $r=0.770$ ,  $p=0.03$ ) and duration of pain ( $r=0.961$ ,  $p=0.469$ ) but showed no significant association between intermittency/ constancy of pain ( $r=0.376$ ,  $p=0.663$ ) and site of pain ( $r=0.181$ ,  $p=1.00$ ).

## **4 Discussion**

Musculoskeletal Disorders (MSDs) have been described as one of the main occupational problems among healthcare workers [2]. The response rate of this study, (93%) is higher than those obtained from similar studies in Italy [7] (76.4%), and United States of America [8], which had 80% response rate. A Nigerian study investigating the impact of sonography on occupational stress among radiographers reported a 96% response rate [9]. This study showed that 88% of sonographers experienced musculoskeletal pain during scanning. Previous studies conducted in the United States had also reported that 90% and 84% of their respondents respectively experienced musculoskeletal pain during scanning [10]. There was however an 87% incidence rate in a UK study [11].

The present study revealed that the back region had the highest prevalence of pain (45%) followed by the wrist joint with 27.5% and the elbow joint with 3.9% prevalence among the subjects. The predominant involvement of the back, as observed in this study, is in agreement with reports of studies carried out in British Columbia, Roma and United States [8, 9, 12, 13]. A 13.7% prevalence of pain in the shoulder joints found in the present study is also similar with the reports of works of Ugwu et al [9] on sonographers symptoms. However, other studies [10, 12] have recorded higher prevalence of shoulder pain than that was found in the present study. Pain was intermittent in 79% of our respondents. This finding is similar to the result of a previous study on sonologist in Italy [7]

Use of facilities that were not ergonomically designed was perceived to aggravate musculoskeletal symptoms by 41% of our respondents. This observation agrees with that of a previous European study on this topic [13]. More than half of the respondents sought different means of alleviating their symptoms, which included intermittent rest in between work for 15 (29%) respondents, use of analgesics for 9 (18%) respondents and 10 (20%) physiotherapy. Previous studies [7, 8, 11, 14, 15] reported similar observations, which also included the use of chiropractic intervention[8] and orthopaedic treatment[15] (medication and physiotherapy) in alleviating the symptoms of the participants. Other symptoms like weakness, movement restriction, swelling and tingling sensation were reported by 45 (89%) of the respondents. This observation is in conformity with findings from previous studies [7,8,13]. Insufficient rest has been identified among other external (physical) risk factors for the development of work-related musculoskeletal disorders [17, 18]. Long-time static work, with inability to relax muscles, resulting in reduced microcirculation has also been reported to lead to musculoskeletal symptoms [19]. These symptoms resulted in absence from work by 4% of the sonographers in this study. Previous studies [7, 8, 12, 13, 15, 17] have reported varying degrees of absenteeism as a result of work-related musculoskeletal symptoms.

The use of ergonomically designed facilities, reduced work load and observance of regular breaks in-between procedures were recommended as relieving measures by the participants in the present study. Studies on sonographers' have also linked reduced workload and regular breaks to reduced musculoskeletal symptoms [7, 8, 13, 14]. However, the work of Schoenfeld [19] did not find reduced frequency of scanning to be associated with reduced symptoms among sonographers.

The present study also revealed that sonography is considered occupationally hazardous by 37 (73%) of the respondents. Schoenfeld et al [19] reported that obstetric ultrasound scanning may pose an occupational risk for doctors and technicians. The report of the study by Engen et al [14] had reported that (20%) of cardiac sonographers deemed sonography resulting in a career-threatening injury.

Gender did not have any significant relationship with number of symptoms. This finding is in agreement with the study of Magnavita et al [7] but at variance with that of Schoenfeld [19] who reported that women had combination of symptoms than their male counterpart presumably because of the differences that exist between men and women in terms of muscle mass and performance.

Age was found in this study to have a significant association with affected anatomical sites but not with duration and severity of pain. Other authors [7, 15] have found positive significant association between age, years of practice and symptoms. Smith et al [16] however found no positive relationship between age and musculoskeletal symptoms among cardiac sonographers.

The present study found an association between body mass index (BMI) and severity and duration of symptoms. A previous study had linked body weight and body mass index with work stress and possible development of chronic diseases [20]. Only a few epidemiological studies have explicitly studied the combined effects of work and obesity on musculoskeletal disorders. Musculoskeletal disorders such as carpal tunnel syndrome and osteoarthritis have been associated with increased BMI or obesity in studies that control for work and non-work risk factors [20]. Morke et al [21] reported that weight correlated with musculoskeletal symptoms in the head, shoulders, elbows, hands, lower backs, knees and feet in their similar study among aluminium workers. Also, ultrasonographers height less than 63inches (1.6m) was found to have positive

relationship to musculoskeletal symptoms [17]. Meanwhile, a related study on aluminum workers found height to correlate negatively with musculoskeletal symptoms in the head, shoulders, hands and feet [21].

## **5 Conclusion**

Work-related musculoskeletal disorders are common among sonographers in Nigeria. There is need for health education (specifically on work place ergonomics) aimed at reducing the factors that predispose to those disorders for this group.

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**Appendix**

Table 1: Descriptive statistics of the physical characteristics, pain severity classification and biographic data of the participants.

	Frequency	Percent	Variables	N	Mean ±SD	Range
Age (yrs): 25-35	9	17.6	Weight (Kg)	51	74.3±11.7	9- 100
	29	56.9				
36- 45	11	21.6				
46- 60						
Sex:			Height (m)	51	1.66±0.25	2- 685
Female	16	31.4				
Male	31	68.6				
Marital Status:						
Single	13	25.5				
Married	38	74.5				
Pain Severity:						
Mild	41	80.4				
Moderate	1	2.0				
Severe	3	5.9				

N≈ number; SD≈ Standard Deviation; Kg= kilogram; m= meter

Table 2: Correlation of risk-factors with musculoskeletal disorders symptoms and work-related factors.

Symptoms & grades	Sex	Marital Status	Age	Weight	Height
Severity of Pain	0.021	0.079		0.646	0.770
Duration of Pain				0.945	0.961
Number of Examination					
Duration of scanning		0.179			
Site of Pain	0.021		0.903	0.398	0.181
Feeling of weakness	0.021	0.179	0.321	0.557	
Joint swelling	0.021	0.179	0.986	0.418	
Tingling Sensation	0.021	0.464		0.046	
Movement Restriction (Stiffness)	0.021		0.464	0.046	
Constancy/Intermittency of Pain		0.179	0.631	0.379	0.376
Aggravating/Relieving factors		0.054	0.903		
Loss of Concentration			0.098		
Treatment for symptoms				0.658	

\*Significant at p ≤ 0.05

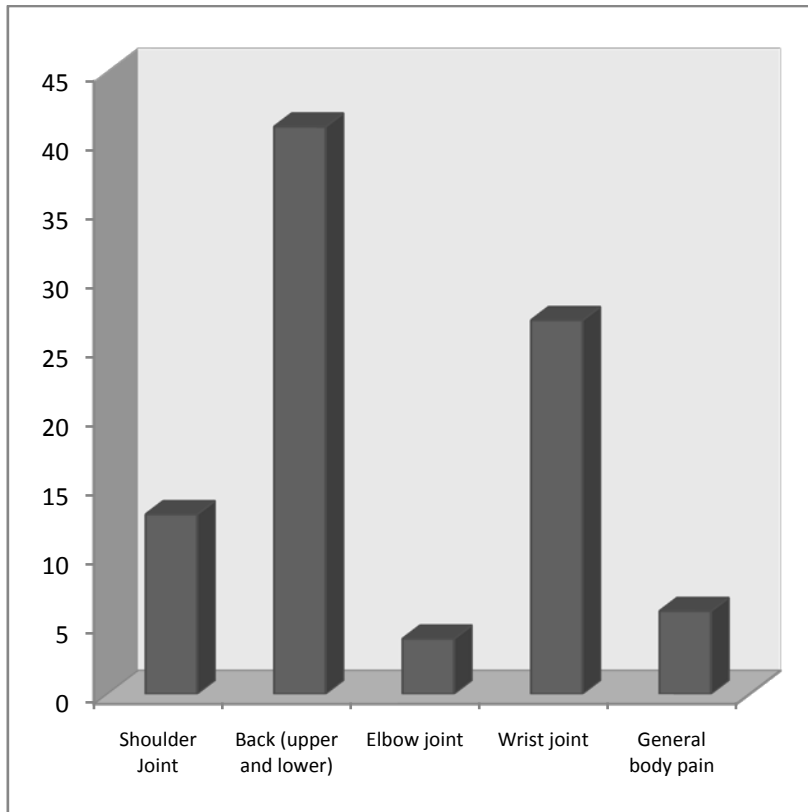


Figure 1: Bar chart showing percentage of affliction of different body anatomical regions.