

Work Related Musculoskeletal Discomforts (WRMD) in Ultrasonologists: Prevalence and Risk Factors

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Abstract: Musculoskeletal discomforts/pain are common occupational problems in healthcare workers whose job tasks involve repetitive motion and assumption of awkward positions. They are major causes of disability worldwide often resulting in job modification and outright resignation by many healthcare practitioners. This work aimed to assess the prevalence and risk factors for musculoskeletal discomfort/pain. A total of 110 Radiologists involved in the use of ultrasound were participated in this survey. Participants were required to complete structured closed-ended questionnaires, the questionnaire collected information of participants biodata, prevalence of Work Related Musculoskeletal Discomforts (WRMD), risk factors to WRMD amongst sonologists. Results revealed that the mean age of the respondents was 38.36 ± 7.96 years. Results showed that 90.6% of sonologists suffered symptoms of work related musculoskeletal complaints. Weight of the sonologists and the duration of work session were reported as the possible risk factors for the development of musculoskeletal discomfort/pain. In conclusion musculoskeletal discomfort and pain are common in Ultrasonologists practicing in Nigeria. Weight and long duration of work were the risk factors involved in the development of musculoskeletal discomfort/pain amongst the participants.

Key words: Ultrasonologists • Work-related • Musculoskeletal Discomfort • Pain • Prevalence

INTRODUCTION

Work Related Musculoskeletal Disorders (WMSDs)/pain are injuries or disorders to the muscles, nerves, tendons, joints, cartilages and spinal discs associated with exposure to risk factors in the work place [1]. They are known to be the most common causes of severe long term disability and pain affecting hundreds of millions of people world over [2], causing impairment of working capacity [3]. Musculoskeletal pain constitutes serious health concern amongst health care workers especially sonologists; in this category of health workers, WRMD often manifest as arthralgia and myalgia. Several studies have reported occurrence of WRMDs

in sonologists, these include eye strain, muscle strain, back injuries, neck and shoulder pain; while musculoskeletal disorders among ultra-sonographers have been reported in 82-88% of population in some previous studies [5-7] Female gender, longer duration of practice, increased work hours, number of scan per session and various equipment features have been associated with higher prevalence of musculoskeletal pains. Patient handling activities have also been implicated as a possible source for musculoskeletal symptoms. The occurrence has also been related to repetitive isometric maneuvers or misalignment of the body position which may cause pain, loss of function or permanent disability [8]. This has caused some sonologists to seek alternative

employment as they can no longer perform ultrasound procedures [4]. Others have had to reduce their hours of work or modify their work patterns in order to continue work.

Few epidemiological studies have investigated musculoskeletal complaints in radiologists in Nigeria. Therefore, the study set out to determine the prevalence and risk factors of work related musculoskeletal pain in ultrasonologists in Nigeria.

MATERIALS AND METHOD

A total of 110 Radiologists involved in the use of ultrasound were participated in this survey. They were recruited from Teaching, General and Private Hospitals as well as diagnostic centers in Nigeria and were required to complete structured closed-ended questionnaires, which collected socio-demographic and employment related information, prevalence of Work Related Musculoskeletal Discomforts (WRMD), risk factors to WRMD, Scanning technique, workload and intensity (including the number of years worked, average days per week worked, average hours per day worked and the average number of ultrasound procedures performed). The assessment of physical exertion was obtained by asking the respondents how physically strenuous their daily work tasks were. Collated responses were divided into a five-point Likert scale, ranging from 'not at all' to 'extremely' [8, 9] Respondents were divided into two groups (pain and no pain) depending on the answers to the question. The presence of musculoskeletal pain was defined by a 'yes' and 'no' response whereas a visual analogue scale was used to determine the severity of pain.

The questionnaire was developed in a three-man focused group, thereafter it was piloted by sending 10 copies to 10 Radiologists involved in sonography. This was to ensure that the questions were not ambiguous. Corrections were made on the final draft of the questionnaire based on the results of the pilot study. Copies of the questionnaire were distributed during a conference of radiologists in Lagos, Nigeria to Radiologists only who consented to participate in the study. The distribution was done on one-on-one basis.

Statistical Analysis: Data were analysed using the Statistical Package for Social Sciences-SPSS®, version 17 (USA, Chicago). Numerical data was presented as mean±SD while categorical data was expressed as frequencies and percentages. Non-parametric variables were compared by using inferential of Chi-Squared

analysis while parametric variables were compared using t-test statistic. The level of significant was set at $P < 0.05$. For the variable that contributed significantly in the definitive models, the odds ratio and their appropriate confidence interval were calculated [9].

RESULTS

A total of 150 copies of the questionnaire were distributed from which 110 validly completed responses were received; resulting in 73.33% response rate (Table 1). The mean age of the respondents was 38.36 ± 7.96 years, mean weight was 70.64 ± 23.46 kg, mean height 1.83 ± 1.28 m and the mean body mass index was 24.11 ± 8.09 kg/m². Male sonologists constituted 75 (68.2%) and females were 35 (31.8%). The respondents worked for an average of 8.26 ± 2.47 hours per day while the mean duration of career was 4.85 ± 3.68 years. The respondents had 23.22 ± 18.49 scan sessions per month, (Table 2). Results showed that 90.6% of the respondents suffered symptoms of work related musculoskeletal injuries. The weight of the sonologists and the duration of work session were implicated in the development of musculoskeletal pain.

Musculoskeletal pain was reported in 100 (90.91%) of the respondents. The most commonly reported painful body site was the lower back 41 (37.27%) followed by the neck 22 (20%), upper back 12 (10.91%), shoulder 8 (7.27%) while multiple body parts were affected in 17 (15.47%) let us have pictorial representation of the distribution of body parts affected by WRMDs. Whereas musculoskeletal pain affected the performance of work in 34 (30.91%) of respondents, physical therapy or medical treatment was sought by 92 (92%). Of this number, treatment was beneficial in 75 (81.5%) and not beneficial in 17 (18.5%).

Table 1: Socio-demographic information for the respondents

Characteristics	Frequency (n)	Percentage (%)
<i>Gender</i>		
Female	35	31.8
Male	75	68.2
<i>Age</i>		
20-29	0.9	
30-39	30	
>40	69.1	
<i>Years of clinical practice</i>		
0-4 yrs	76	69.1
5-9 yrs	15	13.6
>10 years	19	17.3
<i>Clinical setting</i>		
Tertiary hospital	94	85.4
General hospital	8	7.3
Private hospital	8	7.3
<i>Position</i>		
Sitting	110	100

Table 2: Analysis of the physical characteristics of respondents by the report of pain

Variables	MSP (n = 100)	No pain (n = 10)	p value
Age	38.3±7.66	39±11.01	0.082
Height (cm)	1.88±1.25	1.34±1.53	0.792
Weight	72.42±20.67	52.9±39.75	0.011
Year of practice	4.91±3.73	4.2±3.29	0.008
Frequency	2.82±2.09	3.95±2.3	0.74
Time spent daily at work	8.54±2.11	5.5±3.97	<0.0001
No of scan sessions per month	23.68±18.76	17.63±14.01	0.38

Data represents mean±SD and p value of demographic and clinical data. A p<0.05 was considered significant.

Table 3: Risk factors associated with pain in Ultrasonologists

Variables	No. of ultrasonologists in pain			p value
	Yes	No	df	
Break during work	48	52	2	0.778
Position during scanning session	48	1		<0.001*
Pain due to nature of work	38	48	3	<0.001*
Job required repetitive work	87	11	3	<0.001*
Symptoms related to posture	70	30	2	<0.001*
Easy access to equipment	55	45	2	0.878
Ergonomic intervention that alleviate pain	26	74	2	<0.0001*

*Significant at P<0.05

Table 4: Prevalence and the frequency distribution of musculoskeletal pain and WRMDs by cadre of specialist and gender

Characteristics	Yes n (%)	No n (%)	Total
Prevalence of WRMDs			
Point	100 (90.91)	10 (9.09)	110 (100)
12-month			
Cadre of specialist:			
Residents	81(73.64%)	7(6.36%)	88(100%)
Consultants	19(17.27%)	3(2.73%)	22(20%)
Gender:			
Male	68(61.82%)	7(6.36%)	75(%)
Female	32(29.09%)	3(2.73%)	35(%)

There was significant association between musculoskeletal pain and the respondents' weight, years of service and the duration of time spent on scanning. The mean weight for the respondents with pain was 72.42±20.67 kg compared with 52.9±39.75 kg for those with no pain (p=0.001), as shown in Table 1. The respondents with increased weight reported a proportionally higher incidence or prevalence of pain or WRMDs 49.09% versus 37.27% (p=0.015). The respondents that worked for more hours (8.54±2.11) hours had more pain or WRMDs than their counterpart with lower duration of session (5.5±3.9) hours, p<0.0001. The respondents involved with repetitive use of joint 91(82.73%) had more pain than those not involved p <0.0001. Other factors such as age, weight and sex did not influence the occurrence of MSP. The mean visual analogue score was 4.01±1.85 in patients that had MSP. The respondents who had pain were helped by treatment. The majority 91(82.73%) found non-steroidal anti-inflammatory drugs, physiotherapy, ergonomics and rest to be beneficial.

There was no association between gender and pain or WRMDs, Male (68) versus female (32), p = 0.897, height, frequency of scan, number of scan session per month and years on the job as shown in Table 3.

DISCUSSION

The response rate in this study was higher than some previous reports [4, 7]. This response rate was considered to be an adequate sample of sonologists in Nigeria. The result of this survey showed that musculoskeletal pain (MSP) is prevalent amongst ultrasonologists, with a prevalence of 90.9 percent. This finding agrees with the common trend in the literature; Smith *et al.* [8] and Vahdatpour *et al.* [4] in their separate studies reported the prevalence of MSP to be 80 and 100 respectively. The higher prevalence of MSD reported Vahdatpour *et al.* [4] and Kao [6] respectively in their studies, may be due to the recruitment of other medical specialists such as radiographers and technicians in that study. Previous studies had also reported a high prevalence of MSP in other

professionals such as the dentists and drivers whose task involved sitting. Smith *et al.* [8] and amongst physiotherapists. Tella *et al.* [9] In a cohort study involving drivers and non-drivers, the incidence of back or neck pain among drivers was significantly higher than in non-drivers. The back pain in drivers was attributed to years on the job, body habits and poor equipment design. Anderson [10]. Musculoskeletal pain (MSP) has been reported in jobs which require repetitive motion or isometric contraction. Ultrasonography involves an activity of operating ultrasound equipment which is applied on a body part or specific region over time while making repetitive and constant movement. This movement involves specific parts of the musculoskeletal system especially the wrist, the meta-carpophalangeal and the interphalangeal joints thereby subjecting them to constant wearing and tearing and early degenerative changes. Several factors have been implicated in the development of musculoskeletal pain such as duration of job, number of work sessions per week and the duration of scanning. Schoenfeld *et al.* [14] also reported that prolonged and repetitive manipulation of ultrasound transducers might be hazardous to sonographers.

In this study, a greater proportion of the sonologists had low back pain, followed by shoulder and wrist pain. This observed distribution of MSP is similar to that reported by Vahdapour in their study involving a group of Radiologists. Vahdatpour *et al.* [4]. The finding that the low-back (Low Back Pain-LBP) was the most reported MSP in the respondents may be related to the prolonged sitting position, forward bending, twisting or side bending of the trunk which are characteristics of the task of Ultrasonologists. It is not surprising then that LBP was the commonest presentation in our study as a majority of the sonologists operate more in the sitting position. The effect of prolonged sitting position on low-back has been illustrated by Jin *et al.* [11]. The prevalence of LBP in sedentary workers was higher than for workers with free posture. Pushing and/or pulling on the back and shoulder was also implicated in the development of back pain and wrist pain [4].

This finding of this study has demonstrated that there is a significant relationship between MSP and weight, repetitive motions, year of training, time spent at work and duration of work session. The age, height and sex, however, were not implicated. In contrast, Vahdatpour *et al.* [4] reported significant relationship between pain and sex, total working hours and age group. In their study, the older patients had more pain than their

younger counterparts. The mean age of the respondents in the present study was lower than that documented in the study by Vahdatpour who reported a high incidence or prevalence of MSP in the younger age group; and related his finding to the fact that ultrasonography is a relatively new speciality which may have a lower proportion of practitioners in the middle age group. This finding was corroborated by the present study with mean age of less than 40 years.

The finding of this study also showed that there was no association between MSP and height suggesting that the occurrence of MSP in Ultrasonologists may not be influenced by the height of the Radiologists. This finding disagrees with the finding of Wihlidal *et al.* [7] who reported a significant association between MSP, weight and height. The results of the study by Wihlidal *et al.* [7] reported that Ultrasonographers with decreased weight, short stature and younger age had pain when compared with their counterpart. The finding of this study that there was no association between MSP and height, may probably be because the mean height was higher than that reported by Wihlidal *et al.* [7] Smith *et al.* [8] in their study also implicated short stature, long duration of scan time per patient and the use of manually propelling machine. They reported that height had an indirect effect on the development of MSP which is related to the sonographer's posture. In agreement on the effect of posture, abduction of the arm for more than 450 markedly increased the static load on muscle and predisposed it to MSP. Working position involved with constant turning and bending of the cervical spine increased the load on the neck and back and significantly contribute to the development of MSP [4, 7] Smith *et al.* [8] reported that sonographers with shorter stature have relatively short arm and may be vulnerable to the effect of posture on musculoskeletal pain. It is therefore not surprising that height had no association with MSP in our study, as the mean height was greater than that reported in the study by Vahdatpour and Smith [4, 8].

No association was reported between sex and MSP in this study. This is in contrast with the findings by Necas *et al.* [12] who observed that female sonographers appeared to have suffered MSP more than their male colleagues. They also reported more pain in more anatomical positions. In their study, however, there was no significant association between MSP and weight or height. The differences in the findings of the present study and the study by Necas *et al.* [12] may be attributed to the small sample size used in their study. Similarly in this study, there was no significant

association between the number of scan per month and reported MSP. This may be due to the relative low volume of work load done by the sonologists, as an association had been reported earlier in a similar study with four to five times the work load reported in our centres [13].

No case of carpal tunnel syndrome was reported in our study. In contrast, Schoenfeld *et al.* [11] who in their study on a group of obstetrics and gynaecological sonographers reported the occurrence of carpal tunnel syndrome. One possible reason for this observation may be the small sample size of the study by Schoenfeld *et al.* [14]. In a similar study conducted at St Pters University Hospital in obstetric and gynaecological sonographers using video tape analysis, it was reported that trans-abdominal ultrasound required awkward shoulder posture, sustained application of static force and various pinch grip while scanning. The size of the patients determined wrist posture. These factors predispose the sonographer to MSP. Other factors included position and configuration of the equipment, the shape of the transducer and the type of patient bed. In their study symptoms were located in the neck, right shoulder, elbow, hand and wrist regions. Therefore, they recommended the use of a height adjustable examination table and chair, support for the elbow when long reach is required and considering standing while performing scanning on late term pregnant patients. They stated that older transducers that are longer and wider are more conducive for proper ergonomic handgrip. In addition sonographers should request assistance from the patients to aid their positioning, rather than put the burden of positioning on themselves. They also noted that the ultrasound equipment was often located at the head of the patient's examination table which contributes to the awkward postures seen during trans-vaginal examinations. The authors concluded that an examination room should be arranged specifically for the trans-vaginal ultrasonographic procedures to facilitate use of neutral posture.

Highly repetitive tasks such as ultrasonography may result in muscle fatigue as the task does not allow sufficient recovery time of muscle, which may result in muscle fatigue. Necas Martin [12]. No single factor is implicated in the development of MSP, however there appears to be an interplay of different confounding factors and mechanism. Work related musculoskeletal disorders pose a significant threat to career path and longevity of health care professionals and to maintenance of a viable workforce for health organisations. There is a need for prevention of MSP as it may result in disability. Although

complete elimination of risk factors may not be possible, emphasis should be placed on improving working condition and equipment that allows the sonologists to maintain joints in optimum positions, maintain balanced postures and allow frequent breaks to give soft tissues a chance to recuperate from awkward positions and repetitive movement. Preventive health education and training is important in helping sonologists to maintain their health [13].

CONCLUSION

This study has demonstrated a high prevalence of MSP amongst Radiologists involved in ultrasonography practices in Nigeria. The commonest site of MSP was the low-back region and the risk factors which contribute to the development of MSP included weight, duration of work as a sonologists, posture and rhythmic movement of the body.

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