

# Work-Related Musculoskeletal Disorders among Sonologists during the Pre-COVID-19 and Present COVID-19 Era: a Survey and Review of Best Practices

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## DOI:

10.32098/mltj.02.2022.17

## LEVEL OF EVIDENCE: 3

## SUMMARY

**Background.** Work-related musculoskeletal disorders (WRMSDs) have become an increasing cause of concern among sonologists. In this study, we evaluate the incidence and risk factors for WRMSDs among sonologists in the pre-COVID-19 and present COVID-19 era while identifying high-risk zones for WRMSDs and providing a brief review of optimal working conditions to avoid WRMSDs.

**Methods.** A “Google form” questionnaire with close-ended questions regarding musculoskeletal discomfort was sent to 350 radiologists during the period of February-March 2021. Data was collected by time-based sampling over a period of 15 days. Statistical analysis was performed using SPSS version 26.

**Results.** 77% (n = 100) of the respondents reported suffering from musculoskeletal discomfort, and 70% (n = 100) attributed such discomfort to their profession as a sonologist (p ≤ 0.001). Among sonologists who attributed their musculoskeletal discomfort to their profession, shoulder pain (p ≤ 0.001), neck pain (p = 0.001), lower back pain (p = 0.001), and wrist pain (p = 0.017) were the most common symptoms. When musculoskeletal discomfort was attributed to the profession, a statistically significant association was found with stress level during the COVID-19 pandemic (p ≤ 0.001) and musculoskeletal discomfort attributed to using extra barrier precautions such as transparent screens during ultrasound (US) scans (p = 0.009).

**Conclusions.** Adapting to new safety and ergonomics is the need of the hour. A regular review of the work practices adopted by sonologists, especially in the current context of COVID-19, enforced protective strategies may greatly help in risk identification and minimizing the precipitation of WRMSDs.

## KEY WORDS

COVID-19; ergonomics; musculoskeletal; ultrasound; work-related musculoskeletal disorder; WRMSD.

## INTRODUCTION

Regardless of which department a patient is admitted to, majority of the times they invariably become a patient of Radiology too. Thus, it comes as no surprise that radiology receives a tremendous amount of workload, contrary to the popular belief that it is a less demanding field. Due to remarkable and exponential growth in the field of ultrasonography, ultrasound (US) has become the diagnostic tool of choice for a vast spectrum of medical conditions. Due to this, sonologists in the modern era are placed under an increased amount of workload attending to many more patients per day. This has become a boon for many radiologists and radiology residents. Unfortunately, due to the increased amount of time spent scanning a higher number of patients with little time spent in between patients has led to a significantly reduced amount of time for repair of damaged muscle fibers (1). Research has suggested that around 90% of sonologists perform scans while in pain (2, 3). This has led to Work-Related Musculoskeletal Disorders (WRMSD) becoming an increasing cause of concern among sonologists. Poor workplace ergonomics is an obvious factor to consider when talking about the etiology of WRMSDs, however, the development of WRMSDs is multifactorial with various other factors playing a role such as poor/static posture, transducer gripping pressure and use of force, repetitive motions, increasing workload, psychological and psychosocial factors (1-5). A rather new physical and psychosocial stress factor among sonologists is the recent and infamous worldwide COVID-19 pandemic. The work environment of sonologists in the era of COVID-19 has been affected greatly due to a concerning disability to minimize patient contact, as performing an US scan certainly requires contact with the patient and surrounding environment, with little or no scope for tele or video consultation that has become widely available to other medical branches.

In this study, we aim to evaluate the incidence and risk factors for WRMSDs among sonologists while identifying high-risk zones for WRMSDs and providing a brief review of optimal working conditions to best avoid WRMSDs. We also aim to evaluate changes that have emerged in the field of US in the present COVID-19 era and whether such changes have impacted the incidence of WRMSDs. This study was conducted to address the often-overlooked concept of WRMSDs in sonologists, especially in the high-octane era of the COVID-19 pandemic where clinical sonologists are swamped with work.

## METHODS

This descriptive cross-sectional study was conducted using a 35-item structured proforma (questionnaire) that was built on "Google Forms" based on the review of literature and

inputs from experts in clinical radiology, physiotherapy, anatomy, and medical education. The Google forms questionnaire was pilot tested by an independent council and modified accordingly, as needed. The 35-item questionnaire contained closed-ended questions and a feedback column. After obtaining approval from the Institutional Ethics Committee, Kasturba Medical College, Mangalore (Ethics approval no. – IECKMC-MLR-11/2020/350 - Date of approval: 26/11/2020), the questionnaire was sent to study participants via social media, specialty groups, personal contacts, or email. The study participants included consultant radiologists, residents, and post-graduates working in clinics, diagnostic centers, and hospitals involved in performing US examinations, reporting cross-sectional imaging, and performing vascular and/or non-vascular interventions. Participants were provided information regarding the study and its objectives, and informed consent was obtained before they proceeded to answer the questionnaire. Participants were given the option to refuse participation or leave the survey at any time by exiting the form. Snowballing was seen in our survey as some research participants circulated the survey amongst their colleagues and recruited other participants to take part in our questionnaire. Non-responders were reminded once again to participate in our survey by contacting them via email or other specialty groups. The gap duration between the first and the second reminder email was 15 days. Data was collected by time-based sampling over the period of February-March 2021. Statistical analysis of the data was performed using SPSS version 26 (IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp).

## RESULTS

Over the period of February-March 2021, a total of 350 Radiologists were requested via email, text message, and specialty groups to participate in our 35-item questionnaire, of which 100 completed the full survey (response rate of 28.6%). The survey was broadly divided into five sections including demography, ergonomic and musculoskeletal assessment, intervention/treatment obtained, physical activity profile, and COVID-19 related stress. The data from the survey was entered into SPSS version 26 and Excel spreadsheets designed for the purpose of the study. Categorical variables were summarized using frequencies and percentages, and subgroups were compared using the chi-square test for categorical variables. A P-value of less than 0.05 was considered to be statistically significant

### Demography

The majority of responding sonologists were aged between the third and fourth decades (62%, n = 100). Among the respondents, 66% were males and 34% were females (n =

100). The male to female ratio was 1.9:1. The majority of respondents (70%, n = 100) reported working six days a week, and 55% (n = 100) respondents reported performing

more than 15 US scans per day. **Table I** shows the details regarding demographic characteristics (physical attributes and work-related) of the responding sonologists.

**Table I.** Demographic characteristics of the responding sonologists.

Attribute	Distribution	Number of respondents (n = 100)	Percentage (%)
Age (years)	20 – 29	22	22%
	30 – 39	30	30%
	40 – 49	32	32%
	50 – 59	12	12%
	60 and above	4	4%
Gender	Male	66	66%
	Female	34	34%
Height (cm)	140 – 149	2	2%
	150 - 159	16	16%
	160 – 169	36	36%
	170 – 179	37	37%
	180 and above	9	9%
Weight (kg)	50 – 59	15	15%
	60 – 69	32	32%
	70 – 79	19	19%
	80 – 89	22	22%
	90 – 99	10	10%
	100 and above	2	2%
Limb dominance	Right	90	90%
	Left	10	10%
Work experience (years)	1 to 5	30	30%
	6 to 10	12	12%
	11 to 15	23	23%
	16 to 20	19	19%
	More than 20	16	16%
Number of work hours per day	5 to 8	50	50%
	9 to 12	45	45%
	More than 12	5	5%
Number of workdays in a week	4	2	2%
	5	10	10%
	6	70	70%
	7	18	18%
Number of ultrasound scans performed in a day	1 to 5	12	12%
	6 to 10	15	15%
	11 to 15	18	18%
	More than 15	55	55%

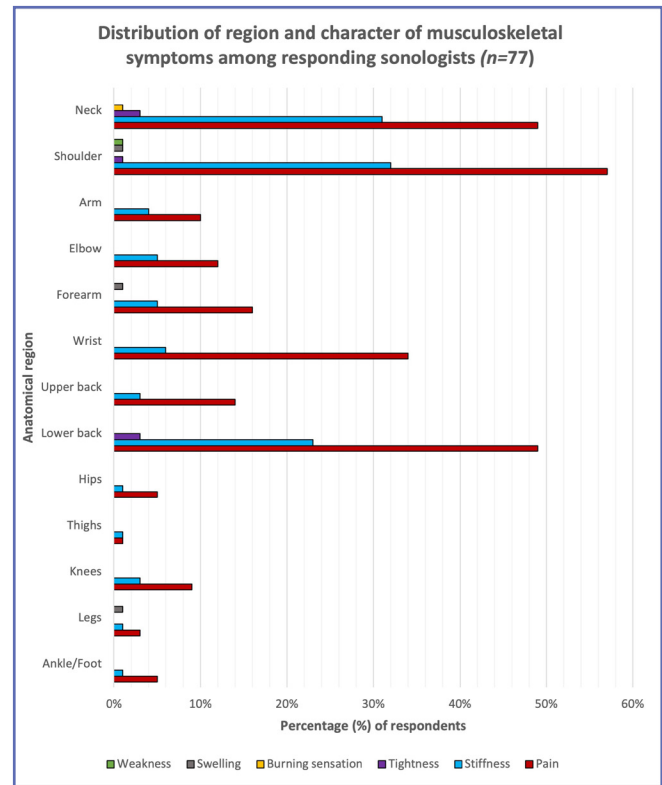
## Ergonomic assessment and musculoskeletal injury profile

77% (n = 100) respondents reported suffering from musculoskeletal discomfort, out of which 70% (n = 100) believed the cause of their musculoskeletal discomfort to be their profession. Considerable discomfort was reported by 42% (n = 100) of the respondents while “looking at the US screen”, by 35% (n = 100) while “squeezing the gel bottle”, by 61% (n = 100) when “maneuvering the shoulder while scanning”, and by 55% (n = 100) while “extending towards the left side of the patient”.

Upon inquiry of any previously diagnosed musculoskeletal ailments, respondents reported various conditions including carpal tunnel syndrome (CTS), chronic neck/shoulder/back pain, fibro-myositis, L5/S1 disc bulge, lumbosacral strain, repetitive stress injury, shoulder ligament swelling, and DeQuervain tenosynovitis.

Respondents were asked to describe and localize their musculoskeletal discomfort/symptom (if present) to the specific region in which they are felt. It was observed that the majority of respondents reported pain in the shoulder (57%, n = 77), neck (49%, n = 77), lower back (49%, n = 77), and wrist (34%, n = 77). Stiffness was reported by participants in the shoulder (32%, n = 77), neck (31%, n = 77), and lower back (23%, n = 77). **Figure 1** shows a bar diagram representing the frequency of musculoskeletal symptoms according to region and character amongst the responding sonologists. **Table II** shows further details regarding characteristics of reported musculoskeletal symptoms amongst the respondents.

24% (n = 88) reported taking leaves due to their musculoskeletal discomfort and 87% (n = 86) reported that their symptom decreases with taking rest or absence from work. 81% (n = 88) of the respondents reported continuing to work even when



**Figure 1.** Distribution of region and character of musculoskeletal symptoms among responding sonologists (n = 77).

they experience symptoms and only 33% (n = 88) reported taking frequent breaks in between performing repetitive examinations. Furthermore, only 58% (n = 88) of the participants believed to have adequate and proper knowledge regarding safe and efficient workplace ergonomics and practices

**Table II.** Musculoskeletal discomfort characteristics among responding sonologists.

Attribute	Distribution	Number of respondents	Percentage (%)
Which side of the body do you experience discomfort in? (n = 83)	Right	38	46%
	Left	9	11%
	Both	36	43%
What is the character of your symptom? (n = 88)	Constant	12	14%
	Intermittent	76	86%
For how long have you experienced these symptoms? (n = 87)	Days	10	11%
	Weeks	11	13%
	Months	32	37%
	Years	34	39%
When are your symptoms most pronounced? (n = 87)	Morning	4	5%
	Night	7	8%
	During work hours	44	51%
	After work hours	32	37%

### Intervention/treatment obtained

Only 32% and 27% (n = 92) of the respondents reported taking medical treatment and physiotherapy for their musculoskeletal discomfort, respectively. However, 90% (n = 92) of the participants believed that a physiotherapist could help them with their discomfort.

### Physical activity profile

Of all the respondents (n = 100), 67% reported partaking in some sort of physical activity daily. Out of these respondents, 84% (n = 64) reported participating in aerobic exercise, whereas 16% (n = 64) reported participating in weight training. Majority of the respondents who reported participating in physical activity reported less than one hour of physical activity daily (71%, n = 76), followed by one to two hours (28%, n = 76), and two to three hours (1%, n = 76).

### Impact of COVID-19 on sonologists' physical and mental stress

40% of the respondents (n = 100) reported that their work hours have not been altered significantly due to the COVID-19 pandemic, 31% (n = 100) reported an increase in work hours, and 29% (n = 100) reported a decrease in work hours. 40% (n = 100) of the respondents believed that their workload has been increased during the COVID-19 pandemic. 34% (n = 100) of the respondents reported reducing their work due to the fear of COVID-19. 82% (n = 100) of the respondents believed that placing a transparent screen at the patient's head end will reduce the transmission of the virus, and 90% (n = 100) of the respondents believed that such extra barrier precautions make performing an US scan more difficult, potentially contributing to increasing the risk of WRMSDs. Only 51% (n = 100) of respondents reported on using extra barrier precautions in their sonography practice such as transparent curtains between the patient and the sonologist. A total of 32% (n = 100) of the respondents attributed their musculoskeletal discomfort/symptoms to using such extra barrier precautions in their practice. 26% (n = 100) of the respondents also believed that adequate measures have not been taken to provide optimal protection to sonologists against possible COVID-19 transmission. 42% and 20% (n = 100) of respondents reported feeling moderately stressed and severely stressed during the pandemic, respectively.

### Statistical analysis

The chi-square test was used to identify any statistical significance between various categorical variables and whether the responding sonologists attributed their muscu-

loskeletal discomfort to their profession. No statistically significant difference was found between demographic characteristics (physical attributes and work-related) and attribution of musculoskeletal discomfort to respondents' profession as a sonologist. The association between the presence of musculoskeletal discomfort and attribution of such discomfort to respondents' profession as a sonologist was found to be highly significant ( $p \leq 0.001$ ). The association between an increase in workload during the COVID-19 pandemic and attribution of musculoskeletal discomfort to profession as a sonologist was statistically significant ( $p = 0.026$ ). Similarly, the association between using extra barrier precautions (*e.g.*, transparent curtain between the sonologist and patient) in US practice and the attribution of musculoskeletal discomfort to profession as a sonologist was statistically significant ( $p = 0.009$ ). A highly significant association ( $p \leq 0.001$ ) was found between the stress level of sonologists during the COVID-19 pandemic and the presence of musculoskeletal discomfort attributed to respondents' profession as a sonologist. **Table III** shows further details regarding the statistical analysis of responses to our survey questions. A statistically significant association was found between attribution of musculoskeletal discomfort to profession as a sonologist and the presence of neck pain ( $p = 0.001$ ), neck stiffness ( $p = 0.008$ ), shoulder pain ( $p \leq 0.001$ ), wrist pain ( $p = 0.017$ ), and lower back pain ( $p = 0.001$ ). **Table IV** shows further details pertaining to the statistical analysis of the localization of musculoskeletal discomfort according to the anatomical region and character of discomfort.

## DISCUSSION

A noteworthy finding of our survey was that majority of the respondents reported having musculoskeletal symptoms that they attributed to their profession. This observed pattern of musculoskeletal injury pertinent to sonologists is in accordance with various other studies conducted on similar subjects (3, 4, 6-8).

There are various factors that contribute to the development of WRMSDs among sonologists (2, 9-14). Several studies and reviews have reported upon the optimal working conditions for sonologists in terms of ideal ergonomics, posture, transducer grip and pressure, repetitive motion/examinations, and irregular break periods in between conducting US scans (1, 4, 5, 9, 11-13). The most frequently identified regions of WRMSDs have been reported to be in the upper body including shoulders, neck, lower back, and wrists (2, 5, 9-11). The results from our survey showed similar findings, wherein, shoulder was the most commonly reported site of musculoskeletal discomfort (54%, n =

**Table III.** Statistical analysis of responses to survey questions.

Survey question	Response	Musculoskeletal discomfort attributed to profession as a sonologist?		P-value
		Yes	No	
Do you suffer from musculoskeletal discomfort? (n = 100)	Yes	67	10	< 0.001*
	No	3	20	
For how long have you suffered from musculoskeletal discomfort? (n = 87)	Days	9	1	0.046*
	Weeks	6	5	
	Months	29	3	
	Years	25	9	
When is your musculoskeletal discomfort most pronounced? (n = 87)	Morning	0	4	< 0.001*
	Night	3	4	
	During work hours	41	3	
	After work hours	25	7	
Have you taken leaves of absence from work due to your musculoskeletal discomfort? (n = 88)	Yes	24	0	0.001*
	No	42	22	
Does your musculoskeletal discomfort decrease with rest of absence from work? (n = 86)	Yes	61	14	0.009*
	No	5	6	
Do you continue to work with musculoskeletal discomfort? (n = 88)	Yes	52	19	0.193
	No	15	2	
Do you take frequent breaks while working? (n = 100)	Yes	24	5	0.183
	No	41	18	
Has your workload increased during the COVID-19 pandemic? (n = 100)	Yes	23	17	0.026*
	No	47	13	
Have you reduced work due to the fear of COVID-19? (n = 100)	Yes	29	5	0.017*
	No	41	25	
Musculoskeletal discomfort attributed to using extra barrier precautions (transparent screens) during ultrasound scans? (n = 88)	Yes	28	4	0.009*
	No	42	26	
How often do you feel stressed during the COVID-19 pandemic? (n = 100)	Never	4	1	< 0.001*
	Sometimes	1	10	
	Often	16	6	
	Very often	34	8	
	Always	15	5	

\*Statistically significant association

**Table IV.** Statistical analysis of localization of musculoskeletal discomfort by respondents.

Anatomical Region	Character of symptom	Musculoskeletal discomfort attributed to profession as a sonologist? (n = 70)		P-value
		Yes	No	
Neck	Pain	34	4	0.001*
	Stiffness	22	2	0.008*
	Burning sensation	1	0	0.511
	Tightness	2	0	0.350

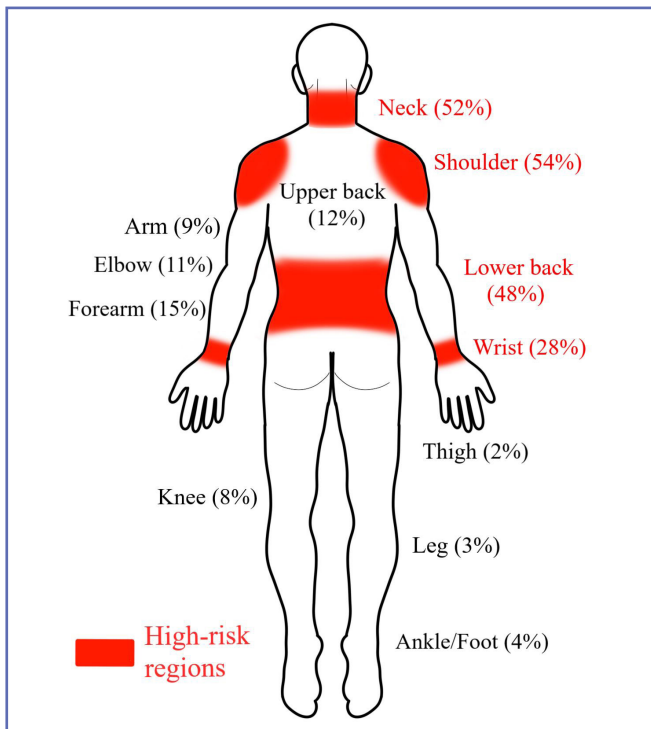
Anatomical Region	Character of symptom	Musculoskeletal discomfort attributed to profession as a sonologist? (n = 70)		P-value
		Yes	No	
<b>Shoulder</b>	Pain	39	5	< 0.001*
	Weakness	1	0	0.511
	Swelling	1	0	0.511
	Stiffness	21	4	0.078
	Tightness	1	0	0.511
<b>Arm</b>	Pain	7	1	0.260
	Stiffness	2	1	0.898
<b>Elbow</b>	Pain	8	1	0.195
	Stiffness	3	1	0.824
<b>Forearm</b>	Pain	10	2	0.283
	Swelling	1	0	0.511
	Stiffness	4	0	0.181
<b>Wrist</b>	Pain	23	3	0.017*
	Stiffness	4	1	0.617
<b>Upper Back</b>	Pain	9	2	0.365
	Stiffness	2	0	0.350
<b>Lower Back</b>	Pain	34	4	0.001*
	Stiffness	16	2	0.053
	Tightness	2	0	0.350
<b>Hips</b>	Pain	4	0	0.181
	Stiffness	1	0	0.511
<b>Thighs</b>	Pain	1	0	0.511
	Stiffness	1	0	0.511
<b>Knee</b>	Pain	5	2	0.932
	Stiffness	1	1	0.533
<b>Legs</b>	Pain	2	0	0.350
	Swelling	1	0	0.511
	Stiffness	1	0	0.511
<b>Ankle/Foot</b>	Pain	3	1	0.824
	Stiffness	1	0	0.511

\*Statistically significant association

100), followed by neck (52%, n = 100), lower back (48%, n = 100), and wrist (28%, n = 100). **Figure 2** shows the anatomical distribution and high-risk zones of musculoskeletal discomfort among responding sonologists in our study. Based on the results of our questionnaire and literature review, a quick review of current concepts on best practices and further suggestions to avoid WRMSDs is presented below.

### Ergonomics and posture

For sonologists, ergonomics involves the assessment of work-related practices and positions that are adopted while performing an US scan and determining various ways in which injuries can be reduced and prevented for each type of examination (9). Evidence has suggested that most departments have adjustable chairs and patient couches (2).



**Figure 2.** Anatomical distribution and high-risk zones of musculoskeletal discomfort among responding sonologists.

As a sonologist, it is essential that a brief period is given to optimizing the position of the equipment and patient at the beginning of the scan to ensure that a good posture can be maintained throughout the examination. When such maneuverable and adjustable equipment is not available to the sonologist, it is the employer's responsibility to provide a safe and efficient work environment for the sonographer. Like previously reported evidence (3, 4, 7), our study also reported the shoulder being one of the most common sites of injury/discomfort amongst sonographers. US scanning requires abduction of the arm, and it has been reported that blood flow to the shoulder reduces when the arm is abducted, raising the potential for subsequent injury (5, 10). To reduce the stress on shoulders while performing an US scan, the arm should be abducted at an angle that is less than 30°, the patient should be positioned as close as possible to the sonologist as possible, the US machine and controls should be placed near the sonographer to reduce strain on the non-scanning arm, and the forearm should be horizontal to the floor (applies to both the scanning and non-scanning arm) in order to maintain a neutral position of the shoulder (1, 9, 11). The results of our survey also observed the neck to be a very common site of discomfort or injury among sonologists. Evans *et al.* (2) reported 65.8% of sonologists who suffered

from neck discomfort. To reduce the stress placed on the neck, it is recommended that the US monitor be adjustable and placed at a level that ensures no neck extension. Slight flexion of the neck at 15-20° is recommended for optimal positioning. Additionally, when performing obstetric US scans, it is a common practice for sonographers to stretch their neck while sharing the monitor with the parents. This should be avoided, and the machine should be placed such that it is directly facing the sonographer performing the scan. The use of a 'slave monitor' is recommended to allow the parents to look at the scan without the need for improper neck posture on the sonologist (9, 11).

Lower back was the third most common site of discomfort reported by respondents in our study. Back pain amongst sonologists has been associated with excessive twisting of the body (5, 9). To avoid such excessive twisting, the patient should be kept as close as possible to the sonographer, the US machine should be kept parallel to the couch, and the couch height should be adjusted to achieve optimal positioning (1, 9, 11).

### Transducer grip and pressure

Wrist was the fourth most reported site of discomfort among sonologists in our survey. Improper transducer grip and pressure is an important factor that often leads to hand and wrist symptoms in sonologists. Nerve entrapment syndromes such as CTS are a common occurrence among sonologists (4). CTS is usually a result of activities that involve flexion and extension of the hand leading to increased pressure on the median nerve in the wrist (4). In US practice, excessive wrist flexion and extension are associated with gripping and manipulation of the transducer. A variety of improper transducer grips and observed such as the pinching grip or grips where fingers are tucked behind the transducer (9, 12). The most appropriate and optimal transducer grip is referred to as a power grip or a palmar grip in which all fingers and palm of the hand are used to manipulate the transducer. In the study conducted by Evans *et al.* (2), one of the factors that contributed to the aggravation of WRMSDs in sonographers was the transducer pressure. To achieve an optimal transducer grip and pressure, the transducer should be gripped lightly with little to no pressure being applied by the transducer (1, 4, 9, 11).

### Repetitive motions and regular break periods

Repetitive motions leading to micro-trauma are one of the more common culprits when it comes to WRMSDs in sonologists (9). Repetitive motions are generally the result of sonologists performing the same type of examination repeatedly throughout the day. This is especially common in sonographers who perform obstetric scans, cardiac scans,



and ergonomically challenging scans such as portable scans, transvaginal scans, venous reflux scans, *etc.* (4, 9, 11, 13). Thus, it is an especially important administrative duty to lay out the work agenda for sonologists such that there are a variety of examinations throughout the day rather than repeated one single type of examination. This will lead to having variation in movement and reduce the risk of injury through repetitive motions.

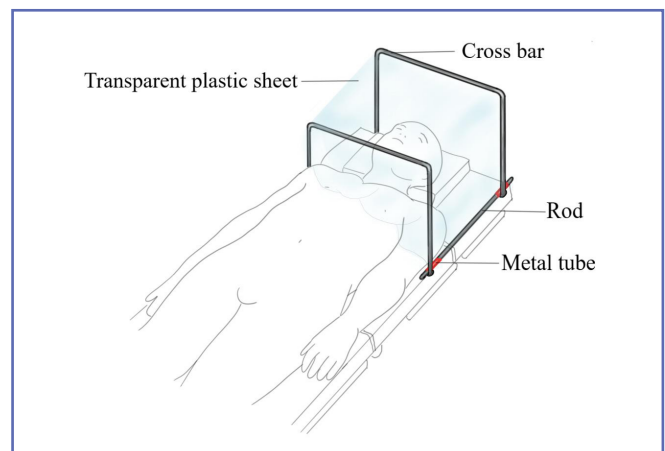
Equally important are rest/break periods assigned to sonologists. In our study, 87% of the respondents reported that their musculoskeletal discomfort decreases with rest from work. However, only 33% reported taking frequent breaks in between work and 81% reported continuing to work even when they experienced musculoskeletal discomfort. Enough time should be provided to sonologists for breaks in between US scans to allow for adequate muscle and tendon recovery. It is also important to use breaks as a time to engage in light activity such as walking or stretching to increase the blood flow and reduce the potential for injury (4, 9)

### Increasing workload and psychosocial stress during the COVID-19 pandemic

Work or personal-related stress and psychosocial factors are often overlooked but are a strong contributor to the development of WRMSDs (4, 5, 9, 14). In a meta-analysis by Faragher *et al.* (15), it was observed that poor job satisfaction was strongly associated with burnout. Burnout can lead to mental and/or physical exhaustion, subsequently resulting in poor performance and illness (9). In the present era, arguably the strongest factor contributing to significantly increased psychosocial stress amongst physicians is the COVID-19 pandemic. Sonologists are particularly at risk due to the patient-physician contact required to perform an US scan. There is no scope for telemedicine or video consultations that have increasingly become popular among other medical branches (16). US examinations are frequently utilized in the diagnosis of COVID-19 related comorbidities (17). Additionally, US is often used for several bedside interventions such as fluid drainage and vascular access (17). 31% of the sonologists in our survey reported an increase in work hours during the COVID-19 pandemic. Furthermore, 62% of the sonologists reported feeling stressed either very often or always due to the pandemic. In the following section, we have presented our recommendations on minimizing patient contact in sonographers while maintaining the best possible ergonomic environment to reduce the psychosocial stress factor and the incidence of WRMSDs.

To minimize patient contact, US examinations should be triaged (18). This includes considerations regarding the necessity of the scan for a patient. For example, considering whether the US scan or guided intervention is essential in provid-

ing a diagnosis or management for the patient (17-20). US scans that would not affect patient management may not be immediately warranted (19). Application of such protocols can potentially reduce the level of psychosocial stress faced by sonologists by reducing patient contact to when it is necessary. Majority of the sonologists in our survey believed that using extra barrier precautions such as placing a transparent screen between the patient and the sonologist can significantly reduce the risk of possible virus transmission. However, they also believed that using such extra barrier precautions make performing an US scan more difficult and some even attributed their musculoskeletal discomfort to using extra barrier precautions. Placing a transparent cover or sheet from head to toe of the patient adds another layer of difficulty in performing the US scan. However, since COVID-19 is believed to be transmitted mainly through droplets and possibly aerosols suspended in the air (20, 21), covering the head end of the patient with a transparent sheet would suffice. In their letter to the editor, Singh *et al.* (21) described an aerosol containment device mainly for use in the anesthesiology department for containment of COVID-19 transmission. This simple device consists of two crossbars that are held in place by two rods passing through small metal tubes fixed at the base of crossbars (21). This allows for the crossbars to be adjustable and move up and down the rods as needed for access. A transparent plastic cover is placed and stretched over the crossbars and can be tucked under the mattress to be secured. This device covers the patient's head end and may be extended up to the lower part of the chest (21). A similar device may be used in the setting of US scans allowing the sonologist to efficiently complete a scan while maintaining proper posture and simultaneously reducing the risk of transmission from the patient. **Figure 3** shows our illustration describing the above-said device. Sonologists should also use



**Figure 3.** Illustration of the device that may be used to cover head end of the patient during an ultrasound scan.

appropriate PPE as warranted to reduce their potential risk of COVID-19 transmission (19, 20). Musculoskeletal symptoms are a constant presence in patients with COVID-19 from the onset of disease to the most severe stages (22). We evaluated the psychosocial stress associated with the COVID-19 pandemic and its effect on WRMSDs among sonologists.

### Role of physiotherapy in WRMSDs

Occupational health physiotherapy is a recognized subspecialty of physiotherapy, the role of which can be primarily categorized into two: 1) health promotion in the workplace, through identification and elimination of physiological, biomechanical, and psychosocial risk factors that cause, precipitate, or aggravate WRMSDs, and 2) to enable an injured worker to be reintegrated into the active workforce safely and efficiently (23, 24).

Although in our survey, of all the respondents that reported experiencing musculoskeletal discomfort owing to their profession, only 32% and 26% reported taking medical treatment and physiotherapy respectively, 90% of the respondents believed that a physiotherapist could help them with their musculoskeletal discomfort. Recent recommendations for eliminating the risk of WRMSDs in sonographers emphasizes on maintenance of overall physical health, adapting and reviewing safe work practice, using ergonomic tools, and exercises directed towards specific regions (23, 25). A well-trained physiotherapist possesses the necessary skillsets to implement these recommendations as they fall under the professional boundaries of physiotherapy practice (23).

### Limitations

This study had two primary limitations. Firstly, the relatively small sample of radiologists that responded to our survey, and secondly, post-correction analysis was not performed.

### CONCLUSIONS

In conclusion, WRMSDs are common among sonologists due to several factors including poor posture, transducer gripping pressure and force, repetitive motions, increas-

ing workload, and psychosocial factors. Key areas identified for redressal are poor and/or static posture, repetitive movements, transducer grip pressure, workload management, and psychosocial factors. In this ominous era of the COVID-19 pandemic, there is a remarkable surge in psychosocial stress, which is further contributing to the incidence of WRMSDs among sonologists. Thus, it is of critical importance for both sonologists and employers that optimal work-related practices be promoted by providing good ergonomic equipment and furniture, providing proper knowledge and training regarding optimal work postures and practices for stress reduction, and getting prompt treatment if any musculoskeletal discomfort is felt by the sonologist. Adapting to new safety and ergonomics is the need of the hour. A regular review of the work practices adopted by sonologists, especially in the current context of COVID 19 enforced, protective strategies may greatly help in risk identification and minimizing the precipitation of WRMSDs

### FUNDINGS

None.

### DATA AVAILABILITY

Data are available under reasonable request to the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

### CONTRIBUTIONS

SR, SS: design, data acquisition, data analysis, statistical analysis, manuscript editing, and manuscript review. SR, SS, SK: literature search, and manuscript preparation. SR, SS, SK, BVM, AH, AJ: conceptualization and definition of intellectual content.

### CONFLICT OF INTERESTS

The authors declare that they have no conflict of interests.

### REFERENCES

1. Jakes C. Sonographers and Occupational Overuse Syndrome: Cause, Effect, and Solutions. *J Diagn Med Sonogr* 2001;17(6):312-20.
2. Evans K, Roll S, Baker J. Work-Related Musculoskeletal Disorders (WRMSD) Among Registered Diagnostic Medical Sonographers and Vascular Technologists. A Representative Sample. *J Diagn Med Sonogr* 2009;25(6):287-99.
3. Feng Q, Liu S, Yang L, Xie M, Zhang Q. The Prevalence of and Risk Factors Associated with Musculoskeletal Disorders among Sonographers in Central China: A Cross-Sectional Study. *PLoS One* 2016;11(10):e0163903.
4. Coffin C. Work-related musculoskeletal disorders in sonographers: a review of causes and types of injury and best practices for reducing injury risk. *Rep Med Imaging* 2014;7:15-26.

5. Baker JP, Coffin CT. The Importance of an Ergonomic Workstation to Practicing Sonographers. *J Ultrasound Med* 2013;32(8):1363-75.
6. Kawathkar AS, Sequeira RA, Arya S, Baheti AD. Non-radiation occupational hazards and health issues faced by radiologists – A cross-sectional study of Indian radiologists. *Indian J Radiol Imaging* 2019;29(1):61-6.
7. Rodrigues JCL, Morgan S, Augustine K, *et al.* Musculoskeletal Symptoms Amongst Clinical Radiologists and the Implications of Reporting Environment Ergonomics – A Multicentre Questionnaire Study. *J Digit Imaging* 2014;27(2):255-61.
8. Kao HW, Yu DS, Wu CJ, *et al.* Work-related Musculoskeletal Disorders among Medical Staff in a Radiology Department. *J Med Sci* 2009;29(3):119-24.
9. Harrison G, Harris A. Work-related musculoskeletal disorders in ultrasound: Can you reduce risk? *Ultrasound* 2015;23(4):224-30.
10. Village J, Trask C. Ergonomic analysis of postural and muscular loads to diagnostic sonographers. *Int J Ind Ergonom.* 2007;37(9-10):781-9.
11. Murphy C, Russo A. An update on ergonomic issues in sonography. *EHS employee health and safety services.* *EHS Employee Health and Safety Services* 2000;1-14
12. Harrison G, Harris A, Flinton D. Can Teaching Ultrasound Ergonomics to Ultrasound Practitioners Reduce White Knuckles and Transducer Grip Force? *J Diagn Med Sonogr* 2018;34(5):321-7.
13. Morton B, Delf P. The prevalence and causes of MSI amongst sonographers. *Radiography* 2008;14(3):195-200.
14. Prevention of work-related musculoskeletal disorders in sonography. *The Society of Radiographers*, 2007.
15. Faragher EB, Cass M, Cooper CL. The relationship between job satisfaction and health: a meta-analysis. *Occup Environ Med* 2005;62(2):105-12.
16. Jumreornvong O, Yang E, Race J, Appel J. Telemedicine and Medical Education in the Age of COVID-19. *Acad Med* 2020;95(12):1838-43.
17. Gogna A, Yogendra P, Lee SHE, *et al.* Diagnostic Ultrasound Services During the Coronavirus Disease (COVID-19) Pandemic. *AJR Am J Roentgenol* 2020;215(5):1130-5.
18. Oliva F, Vittadini F, Frizziero A, *et al.* I.S.Mu.L.T. Recommendations for Intra and Periarticular Injections during COVID-19 Pandemic. *Muscles Ligaments Tendons J* 2020;10(3):343-6.
19. Basseal JM, Westerway SC, McAuley T. COVID-19: Infection prevention and control guidance for all ultrasound practitioners. *Australas J Ultrasound Med* 2020;23(2):90-5.
20. Srivastava S, Rai PV, Jain A, Shenoy S. Perception and practice regarding infection control measures in radiology department during pre-COVID and COVID times – A survey among radiologists and a review of current concepts and literature. *Indian J Radiol Imaging* 2021;31(Suppl 1):S139-S147.
21. Singh B, Singla SL, Gulia P, Kumar A, Bhanwala R. Aerosol containment device for use on suspected COVID-19 patients. *Indian J Anaesth* 2020;64(Suppl 2):S154-S156.
22. Cipollaro L, Giordano L, Padulo J, Oliva F, Maffulli N. Musculoskeletal symptoms in SARS-CoV-2 (COVID-19) patients. *J Orthop Surg Res.* 2020;15(1):178.
23. McMenamin P, Wickstrom R, Blickenstaff C, Bagley J, Johnson C, Jones K, Newquist D, Paddock J. Current concepts in occupational health: Role of Physical Therapists in Occupational Health. *Orthop Phys Ther Practice* 2021;33(1):43-8, with permission from the Academy of Orthopaedic Physical Therapy.
24. Chetty L. Experiences of occupational health doctors and nurses about the role of physiotherapists in occupational health rehabilitation: A qualitative study. *Hong Kong Physiother J* 2020;40(1):1– 9.
25. Fisher TF. Radiologic and Sonography Professionals' Ergonomics: An Occupational Therapy Intervention for Preventing Work Injuries. *J Diagn Med Sonogr* 2015;31(3):137-47.