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Survey of UK Sonographers on the Prevention of Work Related Muscular-Skeletal Disorder (WRMSD)

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Abstract:

Background. To establish whether the current training of student sonographers in both academic and clinical settings is sufficient for educating about the dangers of work-related musculoskeletal disorders (WRMSDs).

Methods. A dual method of data collection was undertaken. Initially, a focus group was set up, involving a small group of practicing sonographers from a hospital in the United Kingdom, with the results of that survey being used to design a postal survey questionnaire. The questionnaire focused on ergonomics, scanning technique, training in physical techniques, personal general health, risk, stress, and task management. It was sent to seven participating universities across the United Kingdom. Approvals were obtained from the local ethics committees, the hospital Trust, and the academic institution.

Results. The focus group highlighted several areas in which improvements could be made in educating sonographers on the reduction of WRMSDs. The questionnaire results indicated that students are being taught about certain aspects of WRMSD prevention by both their university and clinical mentors. Respondents received training on the prevention of WRMSDs: 97% in the university setting and 81% from clinical mentors.

Conclusions. Improvements need to be made in terms of educating students to perform muscle strengthening exercises during the workday; to have a system of reporting injury; to consider personal health, well-being, and stress management in the workplace; and to evaluate the ergonomics of computer workstations.

Keywords: work-related musculoskeletal disorders; ultrasound; sonographer; education; musculoskeletal; occupational diseases

More than 80% of sonographers in the United Kingdom have reported experiencing pain from repeatedly performing sonographic (US) examinations.1 Sonographers are scanning an increasing number of patients per session and are often working without taking protected breaks and rest periods.

Sonography is an expanding modality, with applications in obstetrics and gynecology, general abdominal and small parts, vascular, and musculoskeletal imaging.3 Sonographers are increasingly developing work-related musculoskeletal disorders (WRMSDs), and more than 80% of sonographers in the United Kingdom are reporting pain from US scanning.4,5 WRMSDs are caused by small repetitive stresses to muscles and tendons that occur over time and include conditions such as carpal tunnel syndrome, tendinitis, bursitis, and epicondylitis.6

In addition to scanning, sonographers also must regularly type reports and review images at a computer workstation.5 Carrying out this type of activity for more than 4 hours per day greatly increases a person's risk of acquiring a WRMSD.7 With the incorporation of digital systems into radiology departments,8 there is increased risk of acquiring a WRMSD by unknowingly engaging in unsafe postures. This lack of understanding and awareness needs to be addressed in WRMSD-prevention training programs.7 Until recently, formal training sessions on WRMSD prevention were not part of educational programs for student or practicing sonographers either in the university setting or in the clinical department. This led us to question whether other universities and clinical departments in the United Kingdom are educating students about the risks of WRMSDs and current prevention strategies.

Twenty percent of sonographers in the United Kingdom have had a career-ending injury as the result of a WRMSD.2,9 Poor posture and applying sustained pressure with the US transducer, in addition to poor equipment design and poorly planned scanning sessions, are the main risk factors for WRMSDs in US examinations.5,10 Advances in the field of US imaging have increased demands on the service and hence increased the workload of sonographers, with fewer opportunities to incorporate rest breaks within the workday. This has increased the incidence of conditions such as carpel tunnel syndrome and upper limb, shoulder, and neck problems.2,11

Additionally, sonographers may be waiting too long before reporting symptoms of WRMSDs, perhaps because of concerns over losing their job, colleagues' resentment owing to potential effects on the workload, and negative responses from management.12 Morton and Delf 5 previously suggested that changes are being made for the better in some US departments in the United Kingdom. Educational programs are currently in use to aid in the reduction of WRMSDs for computer users. However, these are often quickly forgotten or ignored completely.13 Group training can encourage colleague support, and this could be adapted and incorporated into the field of sonographer training.5,7 Educational programs are a crucial part of any prevention program in reducing the incidence of WRMSDs.11,14 Programs need to be well-designed and evidence-based and use reflective learning from previous interventions to be successful.15 Any educational program would need to be carefully planned. Giving people the knowledge is not sufficient to bring about a change in behavior,16 as it relies on the employees' willingness to accept the new techniques and skills necessary to reduce the incidence of WRMSDs.15

More recently, it was reported that although attendees found educational sessions to play an important role in raising awareness, after 12 months many sonographers had returned to their old bad habits, suggesting the need for continued regular training to combat WRMSDs.11

Sonographers may be putting themselves at risk of WRMSDs by adopting a poor work style, which may include missing rest breaks, working while in pain, and rushing ahead without considering body postures.17 The issue of WRMSDs is a complex one, which is being researched, and no studies have seemed to establish an exact cause of the condition. The majority of authors agree that poor posture, repetitive movements, and insufficient strength seem to be the main causes.18 Marinus and Van Hilten19 also acknowledged that the absence of a diagnostic gold standard for WRMSDs is a major problem in creating a prevention program for employees experiencing a WRMSD.

To be successful, prevention programs need to consider both biomechanical and psychological causes.20 There needs to be a readiness for change among both managers and staff, and knowledge needs to be openly discussed and shared to bring about positive changes in any WRMSD-prevention program.11,20

Occupational therapists seem to be playing a useful role in developing preventive strategies for WRMSDs by analyzing job tasks in relation to ergonomics, the person's physical fitness and ability, and the general work behavior.21 However, Burton et al14 stressed that many researchers give the impression that successful prevention strategies automatically lead to a complete resolution to the problem, which often is not the case. They also suggested that some ergonomics literature encourages the belief that specific occupations themselves are the sole cause of WRMSDs, which is not accurate, and they suggested that a person's whole lifestyle needs to be considered.14 The discussion of lifestyle is important in the prevention of WRMSDs because research has suggested that those who spend their leisure time taking part in more passive activity, such as relaxing on the sofa, are twice as likely to develop WRMSDs than those who are more active.22

MATERIALS AND METHODS

This project was classified as a "service evaluation" by the United Kingdom National Health Service (NHS) ethics committee and local NHS Trust and therefore did not require full ethics committee approval. Written informed consent was obtained from those participating in the focus group.

A focus group was set up initially to explore

the subject and assist with the questionnaire design. These data, together with the literature examined, were used to compile the postal questionnaire. The questionnaire focused on ergonomics, scanning technique, training in physical techniques, personal general health, and risk, stress, and task management. This particular approach allowed one technique to compensate for the potential weaknesses of the other and strengthened the validity of the research method overall.23

The focus group was facilitated by a group leader, using a semi-structured topic guide.24 It was held in a conference room within a hospital setting and lasted for 30 minutes.

Sample

The focus group comprised 15 sonographers at a hospital Trust in northwest England. The sample for the postal questionnaire was selected by means of purposeful sampling.25 The address of each university that currently offers a postgraduate US program was found on the British Medical Ultrasound Society Web site, along with the names of the US program director at each institution. A letter was sent with a copy of the questionnaire to each program director asking if they would forward the questionnaires to their students in the final module of their postgraduate diploma or their certificate in US.

Data Analysis

The focus group transcript was analyzed by us and an independent third party, who was an experienced allied health professional researcher, to reduce the incidence of any possible bias and enhance the credibility and trustworthiness of the research, using content analysis with a thematic approach.26 Themes were visually selected from the transcript. The transcript was read a minimum of three times, and the right-hand column was used to annotate the recurring themes that were exposed.

These were cross-checked by an independent third party, then checked alongside the information gathered in the literature search, and were then used to create a comprehensive range of potential responses that were to be included in the postal questionnaire. A spreadsheet on Microsoft Excel was designed to record the number, range, frequency, and percentage of responses for each question of the questionnaire.27 These data were cross-checked by an independent third party who was not familiar with the research area but was experienced in creating spreadsheets and in data analysis.

RESULTS

Although the data from the focus group informed the development of the content of the postal questionnaire, a number of issues were raised that warrant further consideration. The focus group data were summarized into four themes: current teaching of student sonographers, overcoming the problem, muscle strengthening exercises, and the future.

The group suggested that a range of people

are involved in teaching student sonographers—lecturers, clinical mentors, colleagues, and equipment manufacturers—and that in university, students are not currently taught about the risks associated with WRMSDs. One focus group participant stated, “I think it boils down to the sonographers that train the students, rather than the college, and it depends on the attitude of the department that you are in and the workload. I mean there’s only so much a person can teach you.. . apart from one lecture, I don’t see what else they can do [at university].. . they can only give you the theory.”

This gives a negative view of universities in terms of how useful their contribution might be in educating sonographers about WRMSDs and associated preventive methods. It also implies that there is little that can actually be done by the universities to help sonographers reduce their risk of acquiring a WRMSD.

However, positive attitudes toward educating sonographers were also highlighted by the focus group: one participant stated, in relation to teaching WRMSD prevention in US, “They did address it, but it wasn’t exactly a dedicated lecture.. .. I think you could allow it as a dedicated lecture, perhaps on the causes [of WRMSDs] and on how you can avoid it; you could have a physiotherapist explaining the long-term effects of posture.. .. I know one university had a[n] Alexander-technique lecturer.. .. [T]here are things we can do, but we don’t seem to be doing them.”

Suggestions were made by the participants to overcome WRMSDs, including prevention lectures and using specific techniques, advice from a physiotherapist, and intervention and education sessions.

In regard to muscle-strengthening exercises, participants suggested using advertisements, education posters, regular demonstrations, and reminder sessions. It emerged that participants are aware of the need to exercise but do not carry out these exercises.

A number of ways to make US safer in the future for sonographers were suggested by the participants, such as risk assessment by hospital occupational health specialists, a regular health questionnaire (that is acted on), introductory and follow-up educational lectures and demonstrations by the university, and accountability in the practice of clinical mentors to ensure that students implement what is taught. Of the 17 universities in the United Kingdom that were invited to take part in this study, 7 (41%) participated. Each university specified how many potential students they had who were currently studying their final module for either their postgraduate diploma or their certificate in medical US; this meant that a total of

80 questionnaires were sent out across the United Kingdom, and 32 completed questionnaires were returned (40% response rate). Data were collected on ergonomics, scanning technique, training in physical techniques, personal general health, and risk, stress, and task management.

Ninety-four percent (n 5 30) of respondents had not undergone assessment of their physical capability to do the US course before commencing it. Similarly, 94% (n 5 30) stated that they were not routinely asked to complete a health questionnaire at 6-month or annual intervals to monitor overall physical health during their employment.

Almost all respondents (97%, n 5 31) stated that they had received some education from their university about WRMSD prevention in the form of a single 2-hour lecture. The most common aspects of WRMSD-prevention training included scanning technique (100%, n 5 32), the risks of WRMSDs in US (97%, n 5 31), the ergonomics of US equipment (94%, n 5 30), and the ergonomics of computer workstations (78%, n 5 25). The aspects of WRMSD prevention that were less well represented were job or task management (56%, n 5 18), muscle-strengthening exercises (41%, n 5 13), reporting of any injury (31%, n 5 10), personal health and well-being (28%, n 5 9), and stress management in the workplace (25%, n 5 8).

The respondents who had received training in the prevention of WRMSDs at their university (28%, n 5 9) found this training either useful (44%, n 5 4) or very useful (56%, n 5 5). The majority stated that they had received training from their clinical educators and colleagues in the prevention of WRMSDs (81%, n 5 26), yet six participants (19%) stated that they had not received any training from those instructors.

Scanning technique (72%, n 5 23) and room layout and ergonomics (69%, n 5 22) were the most common aspects of training given by clinical colleagues. The least common aspects covered in the clinical setting were risk of WRMSDs in US (16%, n 5 5), job task management (31%, n 5 10), ergonomics of computer workstations (28%, n 5 9), reporting of injury (22%, n 5 7), muscle-strengthening exercises (19%, n 5 6), personal health and well-being (9%, n 5 3), and stress management in the workplace (9%, n 5 3). Three percent (n 5 1) mentioned that their physiotherapy department staff was actively involved in assisting sonographers in preventing WRMSDs.

The respondents believed that improvements in education to prevent WRMSDs in US should be made in the following areas: student training at the university (improving the educational program), postqualification updates at the university (regular study days and short courses for qualified sonographers), clinical-mentor demonstrations (setting an example and educating on safe technique), departmental protocols (establishing breaks and session planning), risk management (both assessment and equipment), personal risk assessments

(before and during training), and input from physiotherapists and ergonomic experts (personal ergonomic assessment and training, such as Alexander-technique training).

The participants were also asked to consider how likely they would be to consider the risks caused by their posture during US scanning after their training: 23% (n 5 7) said they were very likely, and 45% (n 5 14), quite likely; 32% (n 5 10) said that they were unlikely.

The WRMSD-prevention strategies taught to students were proportionate to the techniques the students actually put into practice. The techniques that students were taught and which they stated they put into practice are maintaining an upright posture; avoiding unnecessary stretching and leaning; adjusting the machine, the room layout, and the positioning of themselves and the patient for an ergonomically comfortable scanning position; maintaining an upper-arm position at 30 degrees' abduction or less; minimizing their grip on the transducer; being aware of the pressure and force on the patient when using the transducer; and taking regular 5-minute rest breaks. Respondents also identified that these positions are for the most part self-determined and that regular checking of their position by a colleague may assist in maintaining a more ergonomic position.

TABLE 1

WRMSD Prevention Techniques Taught and Adopted into Practice

Areas Taught and Put into Practice to a Greater Extent	Areas Taught and Put into Practice to a Lesser Extent
• Maintain upright posture	• Use cushion to support arm
• Avoid leaning over patients for prolonged periods	• Encourage appointment staff to book a varied list (incorporating mini-breaks)
• Adjust monitor height appropriately	• Use textured examination gloves to maximize grip on transducer with minimal pressure
• Do not abduct arm more than 30 degrees	• Perform muscle-strengthening exercises
• Minimize pressure on transducer	
• Apply less prolonged pressure on the patient (with transducer)	
• Take regular mini-breaks	

However, the study also highlighted that more emphasis needs to be placed on the following subjects: educating students in the use and positioning of a support cushion to reduce muscle fatigue in their scanning arm, encouraging appointments staff to schedule more manageable and varied appointments, the use of textured examination gloves to maximize grip on the transducer, and incorporating musclestrengthening exercises into the workweek.

Seventy-two percent (n 5 23) of the respondents highlighted that they are observed, as part of their clinical assessments, for their ability to scan safely, incorporating preventive methods to avoid WRMSDs. The remaining 28% (n 5 9) of the respondents stated that they are not assessed in this area.

The majority of respondents, after receiving sufficient education and training on WRMSD prevention, said that they were more likely to consider and alter their practice. Eighty-four percent (n 5 27) of respondents

said they were either extremely likely or quite likely to consider WRMSD care and prevention in the future (Table 1).

DISCUSSION

Friesen et al10 highlighted that ignorance among sonographers is a large problem in that many sonographers just continue getting their work done without any regard for their personal safety or well-being. This view was supported by the respondents in this study, reflecting the lack of regard sonographers have for themselves and their ignorance of the need to learn about strategies to reduce WRMSDs in their role. Nieuwenhuijsen16 highlighted that changing behaviors is a difficult process, and he advocated further research in this area. This is something that may need to be brought into sonographer training and education, when behavioral change in terms of health and safety could be incorporated into the US educational program. The work of Cole et al20 supports this, suggesting the need to establish educational sessions for employees to reduce WRMSDs. This study did, however, imply that there are areas that could be improved in terms of educating sonographers on the risks of WRMSDs, with suggestions for how these improvements could take place, such as bringing in physiotherapists and giving Alexander-technique sessions.11,20 Further research in this area was also advocated by Morton and Delf,5 who suggested that the exact causes of WRMSDs and their prevention need to be found to establish a suitable prevention program in US training.

The focus group discussion seemed to illustrate that the sonographers who took part in the study seem to be aware of the problem but not familiar enough with exactly how to lessen their risk of acquiring a WRMSD or being willing to change their practice to a great extent to do so, admitting that "[T]here are things we can do but we don't seem to be doing them." This unwillingness to change is discussed by Peper et al,7 who suggested that people become "captured" by their work and forget to take any breaks until they experience pain or discomfort.

Our findings also highlighted the fact that universities are now attempting to educate their students about the risks of WRMSDs in US; improvements are slowly coming into place across the United Kingdom in terms of improving education for the awareness and reduction of WRMSDs.5 However, it also showed that aspects of education are lacking in the clinical environment and that universities are not educating students about the need to report personal injury at work, how to improve and maintain personal health and well-being, and how to manage work-related stress.

Clinical educators on the whole are not encouraging students to perform regular muscle-strengthening exercises; to consider the ergonomics of their computer workstations (now a major aspect of a sonographer's work, with image archiving and communication systems in place in most United Kingdom NHS hospitals); to look after their personal health and wellbeing, including stress management; to be aware of the risks of WRMSDs in US; and to the overall task management of the sonographers' role. There is evidence that improvements are being made in US departments in terms of encouraging sonographers to openly discuss the issues around WRMSD prevention.5 It currently seems unclear as to what is happening across the United Kingdom, and further research to identify the precise causes of WRMSDs and proven preventive measures to combat these is required.

This study further highlighted an interesting trend in that prevention techniques taught appear to be almost directly proportional with whether the students implement the techniques in their practice. Peper et al7 looked at WRMSD prevention in computer users, concluding that personnel who carry out computer-based activity tend to become captured by the task at hand, forgetting to take a rest break, until they experience

pain or discomfort, even though they had previously been made aware of the associated dangers of acquiring a WRMSD from the task. Cole et al20 advocated team learning, which would allow students to openly discuss problems and solutions to the task of streamlining workflow to remain efficient but be safer. This is further supported by Bade and Eckert,15 who suggested the creation of an "ergonomic team," through which relevant personnel can become involved together in an educational program to combat WRMSDs, as part of a mandatory health and safety scheme at work.

Many of the participants suggested that risks should be assessed before commencement of training and also during a sonographer's training and professional career. No direct suggestion was made about this in our literature review, and only two respondents stated that they had undergone a risk assessment carried out by their occupational health department before commencement of their training. This study suggests that many sonography students and sonographers are aware of the risks of WRMSDs in their role and are also aware of many of the preventive strategies that might be used to reduce their chances of acquiring a WRMSD when scanning. However, many sonographers and students, because of the pressures of workload, prioritize getting through their scanning list and adopt suboptimal postures and techniques that in turn put them at risk for acquiring a WRMSD.5,11

Visschers et al13 referred to some other occupations associated with increased risk for acquiring a WRMSD in which employees who attended educational programs about risk reduction quickly forgot or completely ignored these learned techniques. This may also happen among US students and sonographers. Even though universities, clinical sonographers, and educators try to educate students on the prevention of WRMSDs, great care would need to be taken to design this program in such a way that it would be effectively adhered to in the future and not forgotten. This issue could provoke further research because changing behavior is complex and challenging.13

Many of our questionnaire respondents made positive suggestions on how improvements could be made in educating sonographers on WRMSD prevention, and much emphasis was made on regular short group-training sessions to allow development and reinforcement of the techniques and skills and encourage peer support and idea sharing.20 This strongly supports the idea of a combined educational method between universities and clinical educators, which could improve the overall education of sonographers in the prevention of WRMSDs.

Muscle-strengthening exercises seem to be an important aspect of WRMSD prevention.5 However, this does not appear to be an area that is currently taught to or performed by US students, with only six respondents reporting having been taught or carrying out these exercises. This was also discussed in the focus group, and it supports the importance of sonographers' incorporating these exercises into their workday routine; however, no research was found to show that sonographers who regularly perform muscle-strengthening exercises are actually less at risk of acquiring a WRMSD than those who do not. The sonographers who took part in the focus group stated that they have posters in their department demonstrating how to perform several different muscle-strengthening exercises, which is a strong suggestion that information is being put across to sonographers. The problem with WRMSDs, however, seems to be that there are numerous causative factors, and no single method of prevention is available.

Occupational therapists or physiotherapists could be valuable in educating staff as part of a prevention program for sonographers. They could create a structured program of rehabilitation to grade and adapt physical-strengthening exercises and link these to specific job tasks for sonographers.15 All the respondents suggested that the current education and teaching are not enough.

As a direct result of these findings, the principal investigator (now an US course leader) has implemented a WRMSD-prevention session into a core module of the US course, which is taught jointly by a physiotherapist and a sonographer. The aim of this session is to teach students the underlying theory of how WRMSDs are

acquired and then relating prevention methods to US practice using a skills laboratory. The creation of an ideal system, which would include a thorough assessment of the situation, brings in the knowledge and skills of suitable professionals, such as physiotherapists and occupational therapists, and finally, looks into the psychological background of preventing WRMSDs, which may help promote future changes in this area.5,28

Limitations of the Research

The low response rate achieved in this study is acknowledged to have affected the overall validity and reliability of the research and that to accurately answer the research question, the entire sample would need to have been asked to complete a questionnaire and a 100% response rate achieved.26 In reality, this is rarely possible in the research process. However, a degree of generalization was achieved, allowing us to gather the views of a sample of potential respondents and make assumptions about the wider population of trainee sonographers.1 Future studies may benefit from conducting one-on-one interviews, which in this study may have allowed us to gather more detailed answers from the respondents and perhaps lessen the need to generalize the results.29

CONCLUSIONS

The results of this study highlight some useful information about the types of education on WRMSD prevention that trainee sonographers are currently receiving in the United Kingdom, in both university and clinical environments.

Many respondents do seem to be receiving some education from both their university (97%) and their clinical mentors (81%) about WRMSD prevention. The common areas of WRMSD prevention being taught to students highlighted by the study are room layout and ergonomics, computer workstation ergonomics, scanning technique, and overall risks of WRMSDs in US.

It is interesting that despite the debate in the literature on the usefulness of educational programs in terms of their success in bringing about changes in behavior, this study demonstrated that the aspects of WRMSD prevention taught to student sonographers seem to be generally proportional to the types of WRMSD prevention they actually put into practice. The study also revealed considerable room for improvement. There is clear awareness among trainee sonographers of the importance of muscle-strengthening exercises, which was illustrated by the focus group and to some extent by the postal questionnaire, although this does not seem to be included in education to a large enough extent. Other areas of WRMSD prevention that seem to be underrepresented both in US education and in being put into practice by trainee sonographers are using cushions for arm support, encouraging appointments staff to book a varied scanning list to vary which muscle groups the sonographers must use, and finally, using textured examination gloves to increase the sonographers' grip on the probe.

We conclude that students are receiving some useful training on the prevention of WRMSDs in US scanning, although the subject seems to have been greatly underresearched. Not enough is known yet about exactly how to bring about the required changes in terms of developing an acceptable prevention-training program. More research in this area is suggested to establish such a program and create an ideal system. It seems apparent that both clinical and academic teaching staff strive to educate students about the risks of WRMSDs

to reduce the number of sonographers acquiring WRMSDs, but the knowledge base is not sufficient yet to standardize the overall training given on a national level.

With the creation of an ideal system of successful educational-program awareness among sonographers from the beginning of their training, the incidence of WRMSDs among them as a professional group may be reduced.

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