Sonographer Safety Education and Training

Overview:

The objective of this document is to provide the background and evidence for sonographers' musculoskeletal injury rates. It also recommends what the educators and trainers of sonographers should consider and do to help student and graduate sonographers mature into safe working professionals.

Generated by the Sonographer Safety Initiative
For more info: South Australian Biomedical Engineering, (08) 8204 4061

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The Sonographer Safety Initiative is a collaborative effort between SA Health (SA Biomedical Engineering and FMC Ultrasound department), FBE Pty Ltd and GE Healthcare.
The initiative's goals were to identify the causes and possible solutions to musculoskeletal disorders that occur in sonographers during ultrasound examinations.
An extensive research period of 6 months resulted in the analysis of the issues as outlined in this report. Potential solutions to these issues are covered by the principles and guidelines, also in this report.

At the end of this 6 month period, SafeWork SA Awarded the Sonographer Safety Initiative a grant to produce three reports describing the OH&S issue. The three reports are targeted to three structurally different aspects of Persons Conducting a Business or Undertaking (PCBU's).

1. The management report is focused on the financial cost benefits of minimising risk to sonographers :
    - Sonographer Safety Workplace Considerations.pdf

2. The administrators' report is aimed at the middle level management to raise the awareness of the issues and to provide practical principles and guidelines that could be implemented (tailored) in any ultrasound clinic to minimise risk to sonographers :
    - Sonographer Safety WHS Report.pdf

3. Finally the educator/trainers' report is aimed at raising the awareness of issues to the educators and mentors of sonographers, and providing practical information of how the sonographer can look after their own bodies through good ergonomic practice :
    - Sonographer Safety Educators Considerations.pdf

These Reports are available for download from the http://www.fbe.com.au/Sonographer/ web directory

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Executive Summary:

This document describes the injury rate and risk to sonographers during their normal daily tasks. The educators and trainers of student and junior sonographers play an important role in teaching the best ergonomic scanning techniques. This report aims to encourage educators and trainers to educate sonographers about the prevalence of musculoskeletal injuries from scanning and how to avoid them by providing recommendations on safe scanning techniques, use of aids and safe practices to follow.

Sonographers are prone to high rates of Musculoskeletal Disorders (MSDs) or repetitive strain injuries due to the nature of ultrasound examinations. International literature shows that 80 to 90% of sonographers experience pain whilst performing ultrasound scans at some stage of their career. 95% of them experience it for more than half of their career and 1 in 5 will sustain a career ending injury" [1-3].

The primary causes of sonographers' musculoskeletal disorders are:

- Abduction of arms – movement of the arm away from the normal vertical position.
- Lengthy examination times.
    - Sonographers are required to hold awkward, stressful positions for long periods of time. Morphology obstetrics examinations typically take 1 – 1.5 hours.
- Constant, repetitive movements which are often forceful or awkward.
    - Creating a vicious cycle of injury whereby micro-trauma and scarring result leading to increased muscle workload and muscle strain, all of which compounds the problem.
- Increase in patient body mass index
    - Obesity in the patient population is increasing. This increased depth of fat makes imaging more difficult to achieve without the sonographer pushing the transducer into the patient. The combination of awkward positioning, abduction and pushing creates a working environment at risk of musculoskeletal disorders.

These four causes typically occur during most ultrasound examinations. The more awkward, and more prolonged, the higher the risk. Furthermore the awkwardness of upper body positions also translates down through the torso and legs, and can cause discomfort and pain [2, 4].

The prevalence of these injuries and degree to which individuals are affected is masked by sonographers who are reluctant to report injury, partially due to the stigma associated with being a 'non performer', but also due to the perceived loss of dignity associated with being on Work Cover. Sonographers are also typically jealous of their professionalism and work ethic, and tend not report pain or injury for fear of losing their reputation in this respect. They therefore work in pain worsening the injury.

Aim of Report

This report iterates the causes of sonographers' Musculoskeletal Disorders (MSDs), and to encourage educators and trainers of sonographers to educate junior sonographers about the prevalence of musculoskeletal injuries and how to avoid them. It provides recommendations on safe scanning techniques, the use of scanning aids, safe practices to follow and educational principles that are designed to mitigate these injuries.

The issue

International literature shows that 80 to 90% of sonographers experience pain whilst performing ultrasound scans at some stage of their career. Furthermore 95% of them experience it for more than half of their career and 1 in 5 will sustain a career ending injury" [1-3].

Factors that mask the severity of this issue

The Sonographer Safety Initiative surveyed over 98 sonographers at the Australasian Sonographer Association conference held in May 2015 with the purpose of investigating the size and impact of work place injuries and approaches taken by sonographers to deal with the consequences. The results of this survey showed that sonographers reduce or change their work to deal with pain and injury in the following ways:

- Opt to work part time to rest the injury.
- Move to or retrain to related allied professions such as imaging administration, education and training, applications, sales, marketing, account management, servicing, MRI, radiography and CT.
- Remediate their health at their own costs.
- Take leave (sick, long service, annual) so as to not appear problematic. They also believe that this will assist them to protect their hard won professional status and subsequent career options.
- Decrease their daily workload and rotate tasks to reduce stress potentially leading to lower income

Through the Sonographers Safety Initiatives' discussions with, and observations of sonographers, the following factors were also determined to contribute to the distortion between injuries suffered and reported injuries.

- Sonographers are typically pedantic, meticulous and proudly professional making them reluctant to report, hence they tend to push their bodies harder and for longer (worsening the injury) to get that '*perfect'* diagnostic picture.
- The profession has a high percentage of females which can lead to part time work for family reasons, assisting the sonographer to manage the pain and injury.

The survey also revealed much about the ingrained culture of Australasian sonographers towards compensation claims and the mind set of sonographers towards managing injuries and reporting pain. Below is a summary of some of the reasons that sonographers are reluctant to report injuries to management, incident reporting systems or make claims:

- Worrying the pain is not serious enough
- Concerned about stigmas i.e. being a 'whinger', 'less productive', 'not able to cope'
- Wanting to please management
- Worry about the profitability and viability of a clinic
- Want to cope and be seen as capable
- Concerned about job loss and future employment ramifications
- Do not want to deal with WorkCover, viewing it as a horrible degrading experience
- Consider themselves at fault for not knowing good ergonomic practices
- Unwilling to let down colleagues and patients
- Fear that patients will get poor clinical diagnosis if junior staff member were to replace them

Sonographers tend to work in pain and manage their injury personally rather than report.

This tendency of sonographers to self-manage the injury masks the problem and prevents the issue from getting the traction it requires to implement workplace health and safety change.

Implications for Educators

Sonographer educators, trainers and mentors need to understand the issue of sonographer work place injuries, and its causes. Once understood, they then need to educate the trainee sonographers to be safe in their approach to ultrasound examinations. To be safe, the trainees need to know the injury risks that may arise and how to minimise their exposure.

It is critical that trainee sonographers are taught good ergonomics from the very start. This prevents them from developing bad habits early, which then become difficult to break later on. Many sonographers that have many years' experience, and started on very immobile heavy ultrasound machines, will likely have habits which could be improved upon. All sonographers regardless of experience level can benefit from good education and training, particularly in regards to good machine setup and good ergonomic principles. This knowledge will reduce their risk of injury and its effects on lifestyle and health. This is important in maintaining a career, and the subsequent quality of retirement. Injury can be very detrimental to both.

Muscle and tendon injuries are usually cumulative rather than instantaneous, students and young sonographers must recognise the precursors of pain to best avoid injury. Good examination setup, workload management and good ergonomic equipment/conditions can also dramatically reduce the risk of injury to sonographers, ensuring long term productivity.

Causes of injury

- **Neck rotation**

Rotating the neck during examinations to either view the screen, or to watch the placement of the transducer must be minimised. Excessive rotation of the head places stress on the neck muscles. Normal neck rotation is 50 degrees to either side from facing forward. The head should not be held at these rotations for long periods.

Whilst many sonographers like to share the screen with the patient as a part of providing a professional caring health service, it is important that this is minimised. Having a second 'patient' screen is a regular and encouraged option, though this 'patient' screen needs to be disabled at the sonographer's discretion.

- **Upper limb abduction**

Extending the arms 20 degrees in any direction away from the body is called abduction (of the arms). This elevation of the arms requires the shoulders and torso to carry and stabilise the weight of the arms. This extra weight or force distributed across the shoulders and upper torso is the primary cause of rotator/cuff joint injuries, bursitis and lower back strain.

- **Angulation of the wrist**

Holding a transducer at an awkward angle, in a hyperflexion/hyperextension angles from a normal relaxed position, puts great strain on the ligaments within the wrist. This angulation along with the constant pressure of holding a transducer can lead to long term tendonitis in the wrist and hands. This is exacerbated when a sonographer needs to 'push' a transducer into a high BMI patient. This 'pushing' into a patient causes greater stress on hands, and wrists, arms, shoulder and torso.

- **Grip stress on the transducer**

Even with the wrist in a neutral position, the tension or grip stress to hold the transducer can cause injury to the tendons in hands and subsequently wrists. There are several types of grips which can be held in a relaxed fashion, yet still provide the required strength to hold a position. By keeping the tension out of a grip, the fingers and the hands, means that after long periods of time, the tendons are not overly stressed, and therefore not exposed to repetitive strain injury.

- **Repetitive strain using keyboard and controls**

Many sonographers reported pain and tenderness in their non-preferred scanning hand and arm. The reason for may be partly due to the setup of the machine in relationship to the patient. If the machine is too far from the scanning site, then the sonographer often has to abduct their non-scanning arm to reach the controls. They also need to over extend their fingers to operate the controls. This strain on the arm, hand and fingers can result in repetitive strain injuries.

- **Using force on the transducer for high BMI patients (pushing).**

The Australian obesity rate is increasing. As the BMI increases, so too does the amount of pressure the sonographers applies to transducer, so as to 'penetrate' the subcutaneous fat sufficiently to enable the organs being examined to be in the focal range. Sustained 'pushing' leads to strain injuries.
Having to hold the transducer in awkward positions and under pressure also translates down through the torso and legs and can cause discomfort.

- **Trunk stability (Core Strength)**

The core stomach muscles and the long muscles in the back and lower back work to maintain stability of the upright sonographer. With sonographers holding awkward positions for long periods of time whilst scanning, and applying force to transducers, the sustained strain can cause back and hip problems, and at times this translates down to the lower limbs. Sonographers must maintain good core strength, and position their bodies in a balanced (weight distributed over both feet) way so as to keep an even distribution of the forces on the torso and lower limbs.

- **Multiple skills sets**

The campus manager of Medical Imaging at the Flinders Medical Centre also strongly believes that sonographers should learn multiple modes of diagnosis, such as CT, X-Ray and MRI. This enables managers to rotate staff to help reduce long term injury, whilst not affecting productivity.

Recommended techniques to reduce MSDs

- **Reducing neck rotation**

Setup the examination so that the ultrasound machine is as close to the area to be scanned as possible. If the machine is extensible, raise/lower, and bring the monitor as close to the front of the sonographer as possible, and at comfortable eye height. Only share the monitor with the patient if it possible to do so without rotating the head more than 20 degrees. If possible use a separate monitor to provide the patient with a view. The sonographers head should rotate as little as possible, and not be tilted forward or back during scanning.

Figure 1. Good setup: machine and sonographer close to patient. Monitor at eye height, and controls are at comfortable reach

Figure 2. Poor setup: patient and machine too far apart causing arm abduction. Transducer and controls are more difficult to manipulate. The sonographers head rotates left to see screen and right to see scan area.

Figure 3. Poor setup: patient and machine are too far apart, the arms are abducted, head rotated left to see the screen and the body leaning away from an upright position.

Figure 4. It is desirable to have a second monitor mounted on the wall that the patient can see. This avoids the sonographer having to rotate their head to see a monitor which is being shared with a patient. Ideally, the second monitor needs to be able to be turned off at sonographers discretion.

- **Reducing upper limb abduction**
  Set up the examination so that the ultrasound machine is as close to the area to be scanned as possible. The sonographer should reduce arm abduction as much as possible. This will significantly reduce the amount of stress on the shoulders, neck, torso, arms and hands. Ensure the controls are close to the scanning area, or use alternatives such as voice control, foot switches or pre-set scan procedures, to minimise the amount of arm movement between scanning arm and controls.

Figure 5. Poor setup: Avoid arm abduction arising from poor setup. Ask the patient to lie close to sonographer's side of the bed. Bring the machine close to the patient.

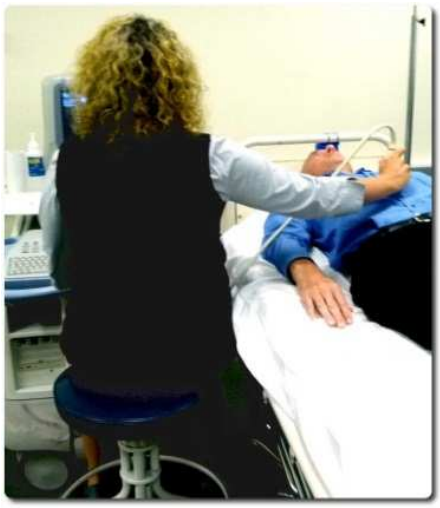

Figure 6.Poor setup: The bed is too high. Set the height of the bed and machine for maximum comfort. A bed that is too high, or to low will cause excessive arm abduction.

Figure 7. Good setup: good bed height, the patient is close, the scanning arm is not abducted and the body is in a relaxed natural position.

Figure 8. Good setup: good bed height, the patient and the controls are close to the sonographers, the scanning arm is not abducted and the body is in a natural position.

- **Reducing wrist angulation**
  The wrist needs to be held with the back of the hand ‘inline’ with the forearm to reduce risk of injury. The tension of holding a transducer tightly translates through the wrist and forearm, and any angulation of the wrist compounds this issue.

Figure 9. Good setup: wrist held naturally in line with forearm and relaxed.

Figure 10. Poor setup: wrist is flexed at a sharp angle. Reposition bed and or the patient to minimise wrist angulation.

Figure 11. Poor setup: When performing bladder pelvic/scans and thoracic scans, find positions that do not result in hyperflexion or hyperextension of the wrist. Manoeuvre yourself, the machine and the patient to encourage the wrist to be in line with the forearm.

Figure 12. Good setup: The wrist is in a natural position and the hands are relaxed resulting in less stress during long examinations and a lower risk of joint strain.

- **Reducing grip tension**
  Holding a transducer with excessive force for long periods of time will cause stress and fatigue on fingers, joints and tendons. Furthermore tension of holding a transducer tightly translates through the wrist and forearm, and any angulation of the wrist compounds this issue. Use a relaxed hold where possible keeping the back of the hand in line with the arm. The use of the 'pinch grip' or a 'power grip' is desirable.

Figure 13. Pinch grip.

Figure 14. Power Grip

- **Reducing repetitive strain from using keyboard and controls**
  Care must be taken to minimise the stress on the non-scanning hand and arm. Keeping the controls close to the sonographer, and particularly close to the patient's scanning area, is critical to minimising abduction, and stress on the sonographers' extremities. Where possible, use alternative controls like foot switches, remote controls or voice activated controls to reduce the amount of non-scanning arm abduction and movement.
  Also use pre-programmed procedures, so that manual annotation is kept to a minimum.

Figure 15. Good setup: non-scanning arm should be held in a right angle at the elbow, close to the controls, and in a natural position.

Figure 16. Poor setup: with incorrect control height, or when the controls are too far from sonographer, the non-scanning arm and hand will experience more stress when operating controls.

- **Reducing the 'force on the transducer' for high BMI patients (pushing).**
  There are no simple solutions to this issue, and many clinics have policies that allow the sonographer to decline to scan obese patients. However, many sonographers are caring people, and want to help diagnose these patients. **Buddy System:** Sonographers should use a team approach to reduce the amount of force, or the awkwardness of the examination.
  For example, a sonographer should use a 'buddy' to help operate the controls whilst the sonographer gets 'behind' the direction of pushing. This may also entail an adjustable bed, that tilts the patient to enable the sonographer to get their body strength, or centre of mass behind the push. Scanning with both hands or constantly moving the machine and equipment into better positions is recommended in these situations.
  Lower frequencies can assist in obtaining good signal penetration, but sometimes this comes at the expense of lost image definition. Try to operate at low frequencies on obese patients until the diagnosis area is found. Use force as a last resort. Avoid pushing whilst the arm is abducted as it can very quickly lead to rotator-cuff and bursitis injuries.

Figure 17. Bad setup: avoid reaching (abduction of arm, and torso) to scanning area. Bring the patient close, or move machine to the opposite side of the bed.

Figure 18. Good setup: If you can't move patient, or machine, have a buddy assist to the hold transducer, or operate controls. This technique works well with obese patients.

The implication of having someone to assist requires a degree of planning. Information that a patient may require the sonographer to have assistance needs to be known at the time of booking. Good information from referring clinician or doctor will help to plan for these situations.

- **Ensuring trunk stability (core strength)**
  Whether standing or sitting, it is considered good ergonomic practice to try to maintain an upright posture “making yourself tall”, with weight balanced evenly over the legs when standing. When sitting, make a broad stance tripod shape with the chair and feet. Core muscles should always be engaged, providing support to the back, spine and upper body. Sonographers should be encouraged to keep their body weight over their legs and hips at all times. When standing, be sure to stand close to the bed, and avoid leaning away from the vertical position.

Figure 19. Good posture: standing can enable good balanced positions over legs, reducing stress on core muscles. Maintiaing a ‘tall’ position and using core muscles can reduce the stress on the upper body. When standing, the keyboard and bed height need to be adjusted to ‘natural’ heights for ease and comfort of scanning.

Figure 20. Bad Posture: avoid ‘leaning’ or reaching to place the transducer. Here the upper body is in poor alignment and unbalanced over the chair. This positioning has the potential for back injury.

Figure 21. Good setup: The sonographer is using foot controls for freeze and capture, enabling them to get into a better position for vascular scans. Note raising the bed ensures the arm is not abducted and the sonographers body is not leaning. Foot controls allows the non scanning hand to be free to put pressure on the leg for vascualr scanning.

Figure 22. Bad setup: avoid leaning (even for short periods) and using the non-scanning hand to put pressure on the leg. Ask the patient to ‘pump’ their leg to look for vascular valve integrity.

Figure 23. Poor setup: The body is not balanced or well supported. Arms are abducted, the machine is at a poor height and away from the scanning area. The head is rotated, the controls are out of reach and the trunk and core muscles are unbalanced.

Figure 24. Goor setup: If the sonographer has to reach to the far side of a patient, rather than lean over the bed, sit on the bed to maintain an upright balanced posture. Sit against the patient if possible and rest the arm against the patient to minimise arm abduction.

- **Core strength and exercising**
  Literature and anecdotal evidence indicate that sonographers who have active lives external to their profession, particularly those who exercise their core and lower back muscles, suffer much less stress whilst scanning. A hospital in Adelaide, South Australia, trialled regular Pilates sessions, and found a significant impact on reducing pain whilst scanning. A survey 6 months after the Pilate sessions ceased showed that the pain levels were increasing again. This demonstrated that ongoing stretching and core strength maintenance is an excellent way of minimising pain and injury in sonographers.

- **Increased dexterity:**
  Surveys and discussions have revealed that some sonographers have reduced potential pain and injury by being ambidextrous. If a sonographer starts to feel stress on one side of the body, they can switch sides, resting the sore side, and evening the stress across the body. It also can help with awkward examinations, whereby using the other hand to scan enables the sonographer to position their body to reduce stress on the body.

Figure 25. Good setup: the bed, machine, monitor, chair, stance are all ideal when the sonographers uses their left hand to scan. Note the bed height supports the left hand elbow. This can be very effective in cardiovascular scanning.

Figure 26. The sonographer is using his right hand to scan the same area as Figure 25. The most ideal position he can achieve is by sitting as close to the patients' back as possible, and resting his elbow against the patient with a minimally abducted arm. Note the machine is in close proximity, with monitor and control height set for comfort. The wrist is inline with forearm, and the sonographer is using the power grip.

Reducing injury by managing external equipment and environment:

- **Room Setup**
  The following recommendations for ultrasound examination and room setup should be encouraged as good practice to trainee sonographers.
  - Rooms should be spacious and have minimal impediments to managing the bed/machine/patients.
  - Rooms should provide a good level of privacy if needed.
  - Secondary video monitors on the wall or on a stand may be offered for patients to view (at the sonographers discretion), leaving the main monitor at a comfortable height and angle for the sonographer.
  - Beds should be electrically driven/motorised, to adjust height and angle to preferable positions.
  - Beds should be mobile which helps to change the examination type from upper body to lower body.
  - Beds should have lateral tilt ability for cardiac and other upper body examinations.
  - Rooms should be air conditioned, and have variable light to ease eye strain.
  - Rooms should have large double doors to assist with patient and bed management.
  - There should be opportunity to use left and right handed setups, so that operators can rest their dominant side.
  - Ultrasound machines should be mobile, and have some degree adjustment of height for ease of use.

- **Equipment aids**
  - There should be various chairs, all adjustable in height available to the sonographer. The ideal scanning chair allows the sonographer to have a broad stance to assist in ‘core’ stability. It may also support arm extension, torso support/strain relief and effectively remove pressure on body parts where possible.

  - Ultrasound transmission gel in squeeze bottles that have a large aperture, and made of soft plastic are also helpful in preventing hand injuries as they reduce the amount of force required on hands to deliver the ultrasound gel.
  - Slings can be invaluable in reducing upper body and upper limb strain that leads to injury. Slings take some time to get used to, and to set them up habitually. Their advantage is that they take the weight of the arm for the long duration exams, vastly reducing stress on the upper body, Figure 27.
  - Cable braces tie the cable of the transducer to the forearm, reducing cable drag. Subsequently the hand does not have the weight of the full length of cable. This can dramatically reduce stress on the wrist and hands, Figure 28.
  - A rolled towel resting on the patient, or a washable cushion supports the weight of arms in a similar way to the sling and may make log repetative examinations less stressful Figure 29.
  - Foot controls to opperate the ultrasound machine allows the sonographer to get to the scanning area, and maintain an upright posture, without having to lean to the machine to obtain pictures, Figure 30.

Figure 27. Sonographer using a sling to support the weight of their arm during a scan.

Figure 28. Sonographer using a cable brace to remove cable drag.

Figure 29. Sonographer using a rolled towel resting on the patient to support their arm during scanning.

Figure 30. Sonographer using a foot swtich to control the ultrasound machine preventing them from leaning over to touch the control panel.

- **Exam rotation**
  - Clinics should program patient lists in such a way as to ensure that:
    - Sonographers get a variety of examinations in a day, making sure that high stress and long examinations are not back to back.
    - Sonographers get a minimum of a 5 minute break between all examinations to allow them to stretch their limbs and back, rest their bodies and relieve tense muscles.
  - A multi-modal clinic/department may rotate sonographers through different modes i.e. X-Ray, CT, MRI etc. To reduce repetitiveness of ultrasound examination stresses.

Sonographer culture and reporting injuries

Sonographers tend to work in pain and avoid reporting their injuries. This culture is ingrained and educators need to teach junior sonographers about the importance of reporting injuries and seeking help when needed. If a sonographers' career is prematurely ended due to injury, this can also be detrimental to their superannuation and retirement lifestyle. Long term serious injury can affect the ability to do normal 'lifestyle' activities, and can be a serious interruption to a 'normal' life, potentially leading to depression and poor health. A sonographer who leaves the profession due to injury also puts pressure on their colleagues to pick up the extra workload, which can lead to risk of injury to them. This displacement of the workload can also cause bad workplace relations, even if short term. The long-term effects of MSDs on a sonographer's career and life should be mitigated through education.

Main areas to cover when educating junior sonographers on how to reduce their risk of MSD:

- The setup of the ultrasound machine close to patient, minimising abduction and providing a good ergonomic sitting/standing position
- How to setup an examination and machine to minimise the number of key strokes required, and degree of control manipulation to reduce repetitive strain
- How to setup examination to reduce neck rotation
- How to get into and maintain good posture, promote a good balanced stance
- How to move during exams to evenly balance weight over legs and feet
- How to obtain good wrist position, and to do examinations using good wrist / hand positioning
- How to have a relaxed grip on transducer and have minimal tension for lengthy periods
- How to focus on good technique to reduce fine movements of transducer
- How to minimise trunk flexion using good posture principles
- The importance of core muscle strength, how to get it and maintain it
- Sonographers need to voice their needs to the purchasing procedure, such that ergonomics pressure is put on the equipment vendors to continually provide better ergonomic features through market pressure.
- The importance of reporting injuries.
- Encourage trainees to practice dexterity, and learn to scan using both sides of the body. This provides opportunity to rest a potential injury, and still be productive.

Summary

Educators and mentors of trainee and young sonographers can have a big impact on mitigating the risk of injury by following the recommendations, guidelines and principles provided in this report. The key to minimising stress on the body and hence to reduce MSDs in sonographers is for the educators to teach young sonographers about the risk of injuring their bodies, and arming them with knowledge on how to minimise the risks. The main ways a sonographer can avoid injury is to have a good initial setup of the bed, machine and patient, avoiding back to back difficult examinations and using good scanning techniques and body position. Additional benefit can also be gained when the sonographer is fit for the work. This is achieved through exercise and stretching, particularly of the core muscles, and upper body. A more long term approach to creating change is to teach sonographers about the need to report and document pain and or stress. This will assist to change the workplace culture and de-stigmatise reporting pain and injury. Furthermore it will allow the generation of injury statistics, allowing the issue to gain traction with managers and work health safety representatives, from which change will evolve upon.

Policy guidelines and principles

The Sonography Safety Initiative has produced a number of guidelines and principles, separated into four separate areas (See Appendix A):

- Workplace Practice Guidelines and Principles
- Environmental Guidelines and Principles
- Educational Guidelines and Principles
- Purchasing Guidelines and Principles

The guidelines and principles as outlined in Appendix A are intended to be the basic considerations when developing workplace procedures and processes in relation to safety of sonographers. Workplace environments need to customise these guidelines and principles to suit their individual models of practice and procedures. In this respect, the guidelines are not comprehensive.

Work Health and Safety Act 2012 health and safety duties state that:

An Officer under the WHS Act is a person who makes or helps make decisions that affect the whole, or a substantial part, of a Person Conducting a Business or Undertaking (PCBU's) activities. A person is also an officer if they have the capacity to significantly affect the financial standing of the business or undertaking. Officers are required to exercise due diligence to ensure a PCBU's health and safety duties are met. They must actively fulfil this duty and not assume that someone else has taken care of health and safety outcomes.
There is no longer a need to appoint and train a 'Responsible Officer'.

Another definition that is very important in this legislation is
Due diligence - Taking reasonable steps
Taking reasonable steps, or demonstrating due diligence, requires officers to:

- acquire and maintain work health and safety knowledge relevant to their workplace
- understand the workplace's operations and associated hazards and risks
- ensure resources and processes are available to eliminate or minimise those risks
- ensure there are appropriate processes for receiving, considering and responding in a timely way to information about incidents, hazards and risks
- ensure the PCBU has in place and implements processes to comply with any duties or obligations such as:
    - reporting incidents
    - consulting with workers
    - complying with notices issued under the WHS Act
    - providing training and instructing workers about work health and safety
    - making sure that Health and Safety Representatives receive training.

It is therefore mandatory for workplace environments to be made as safe and low risk as possible. Educators and mentors are in the prime position to enable sonographers to self-manage themselves in the workplace so as to mitigate their risk of injury.
A workplace reporting system that tracks pain and injury needs to be implemented for a continuous cycle of safety improvement. This raises the issue of culture change, there needs to be a culture developed in all workplaces that reports risk and adverse events and painful results. This provides statistical and meaningful data upon which improvements can be made. This will result in long term productivity improvements.

Appendix A

Workplace Practice Guidelines and Principles:

- Adverse safety event recording systems (for staff and patients) need to be implemented throughout all ultrasound departments and clinics. They should be encouraged to be used without fear of the stigma of weakness or un-employability. This implies a practice that inherently accepts that pain may occur, and that steps to rest injuries can take place.
- A business model that copes with rest periods being taken to mitigate long term pain and injury is essential to long term productivity of sonographers.
- The sonographer should alternate between sitting and standing positions. Saddle chairs assist with posture and need to be adjusted appropriately for the individual user.
- Slings suspended from above can assist in supporting the arm in abduction. Also the use of cable braces reduces the drag a cable puts on hands and wrists.
- Scanning with alternate hands should be encouraged.
- Use appropriate transducers. For a large patient, a lower MHz transducer provides better penetration; however, resolution is reduced and therefore the detail required for the examination needs to be considered, a lower MHz transducer mat be a good trade-off when compared to the use of excessive pressure.
- Rotate examination types throughout the day. Try to not do one type of exam repetitively all day every day. Rotate workloads for days at a time.
- Acquire skills that enable the sonographer to work in other modes such as X-Ray, CT, MRI, etc. Gives opportunity to rest muscle areas, without reducing productivity.
- Ensure work breaks. Time to stretch, relax, rehydrate. Further breaks may be required if difficult patients are scanned.
- Do not push a developing pain. Rest the pain area as soon as possible for periods of days.
- Keep the wrist position as neutral as possible.
- Maintain a stretching regime at least several days a week to keep muscles and limbs limber.
- Maintain fitness and wellness. Stronger people are less prone to musculoskeletal injury in long term repetitive occupations. Whole body strength can help reduce repetitive strain injuries.

Reduce scan durations when possible. Check the patient history to target the examination. If the patient has had a recent CT or MRI, with information gained from these studies it may be possible to target the ultrasound examination more appropriately and reduce scan time. For the difficult 18–20 week obstetric scan when images are not adequate, record images as possible and rebook when the foetus is bigger. For difficult cases it may be appropriate to have the reporting doctor present to help reduce scan time.

Educational Guidelines and Principles:

- Trainees need to know the dangers of Musculoskeletal Disorders and prevention techniques so that they can take an active part in prevention or mitigation.
- From the very beginning trainee Sonographers should be taught to setup the room, the table, chair and the examination to provide the most ergonomic, least stressful approach.
- A general approach to each type of examination should be addressed, and if the exam is likely to be lengthy or awkward, they should be taught to look for assistance.
- They need training on how to use a support person, how to direct them to assist with high BMI patients and how to assist with awkward examinations.
- Trainee sonographers need to know how to use adverse safety event reporting systems, and to use them without fear of the stigma of weakness or inability to cope.
- It may be worthwhile having an occupational therapist create specific Guidelines and Principles for each clinic and provide procedures based on expert analysis of the ergonomics of each situation.

Environmental Guidelines and Principles:

- Rooms should be spacious and have minimal impediments to managing the bed/machine/patients for the purpose of ultrasound examinations.
- Rooms should provide a good level of privacy if needed.
- Secondary video monitors on the walls, or stands may be offered that patients can view (at the sonographers discretion), leaving main monitor at comfortable height and angle for the Sonographer.
- Beds should be electrically driven/motorised, to adjust height and angle for preferable positions for examinations.
- Beds should be mobile which helps to change the examination type from upper body to lower body.
- Beds should have lateral tilt ability for cardiac and other upper body exams.
- Ultrasound machines should be mobile, and have some degree of being able to adjust for height and ease of use.
- There should be various chairs, all adjustable in height at least, though the chair of choice should allow a broad stance with legs to assist in '*core'* stability. It may also support arm extension, torso support/strain relief and effectively remove pressure on body parts where possible
- The rooms should be air conditioned, and have variable light to ease eye strain.
- Large double doors assist with patient and bed management.
- There should be opportunity to use left and right handed setups, so that operators can rest their preferred side. This suitability depends on ambidexterity of the sonographer.
- Use slings, supports and cushions where possible to minimise abduction weight of limbs.

Purchasing Guidelines and Principles:

- Medical Imaging purchasing teams should set requirements on purchases which include ergonomic principles as 'high in importance' selection criteria.
    - Ergonomic criteria include options for an external monitor that patients can view so that the Sonographer can set their monitor to their most ergonomic viewing position. Implicit in this statement is that the primary monitor for the sonographer must be extensible in 3D space, with plenty of extension to allow the sonographer to get correct viewing height and distance without 'craning' their neck, or having to turn their head by 20 degrees.
    - Similarly the key board and controls should have substantial extensibility in 3D space, so as to allow the Sonographer to get into a suitable ergonomic position (minimal abduction or arms, and good physical posture), and then bring controls to easy reach of the location.
    - As wireless transducers become more ubiquitous, this will also help to dramatically reduce abduction of upper limbs due to ability of the Sonographer to get close to the patient.

The Australasian Sonographers Association has a very good library of guidelines.
Visit their site for more information

http://a-s-a.com.au/cms/?c=136&t=asa-guidelines

References

1. Bernadette Mason, V.G., *2006 asa survey results*, in *oh&supdate*, A.A.O.S. COMMITTEE, Editor. 2006.
2. Jakes, C., *Sonographers and Occupational Overuse Syndrome: Cause, Effect, and Solutions.* Journal Of Diagnositc Medical Sonography 2001. **17**(6): p. 74.
3. Coffin, C.T., *Work-related musculoskeletal disorders in sonographers: a review of causes and types of injury and best practices for reducing injury risk.* Reports in Medical Imaging, 2014.
4. http://en.wikipedia.org/wiki/Musculoskeletal_disorder, *Musculoskeletal disorder*, in *Musculoskeletal disorder*, http://en.wikipedia.org, Editor. 2015

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Bernadette Mason	CQ University Senior Lecturer. AMS. Consultant Sono's Safety in the Workplace
Samuel Fiddamen	Cardiac ultrasound applications specialist GE Healthcare Australia
Chris Pilkington	Campus Operations Manager SAMI, SA Health
Robin Newlands	Network Manager / Work Health & Safety Services, SA Health
Lyn Pearson	Senior Work Health & Safety Consultant, SA Health
Brian Adams	Manager, Governance and Systems, SafeWork SA
Mercedes Iasiello	Industry Engagement Adviser Communications and Engagement Team, SafeWork SA
Kate Paddick	Senior Sonographer FMC Imaging, SA Health
Andrea Virgin	Sonographer FMC Imaging, SA Health

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