

Sonographer Safety WHS Perspective

Overview:

The objective of this document is to provide the background and evidence of sonographer musculoskeletal injury rates. It provides recommendations on Work Health and Safety guidelines and principles that should be used to assist in reducing these injury rates, and provide a safer work environment for sonographers.

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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

Executive Summary:

This document describes the injury rate and risk to sonographers (ultrasound machine operators) during their normal daily tasks in the profession, and the guidelines and principles that should be implemented in order to mitigate this injury and risk.

Ultrasound machines are heavy and bulky medical devices, comprised of a large processing unit, fitted with a monitor (screen) on top for viewing of the image, a transducer for image capture attached via a long cord and a keyboard and track ball mouse for data input. Due to this design, sonographers have had to position the machine as close as possible to a patient, and then reach (abduct) the arm holding the transducer to the area that needs to be imaged, while controlling the machine via the keyboard and viewing the image on the screen. This reaching forward and back to control the image and rotation of the head from the screen to the transducer, causes significant stress on upper body, particularly shoulders, neck and back.

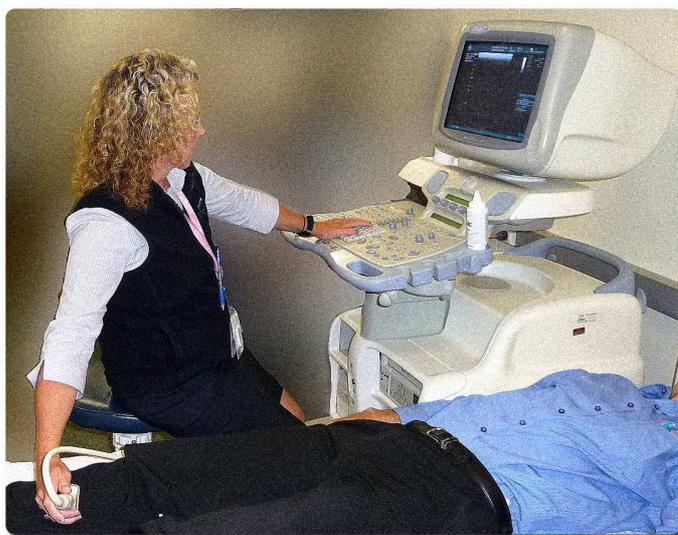


Figure 1. Sonographer in an awkward position whilst performing an ultrasound examination.

International literature shows that between 80 to 90 percent of sonographers experience pain when performing ultrasound examinations, 95 percent of them experience it for more than half of their career and 1 in 5 will sustain a career ending injury [1,2,5]. The degree and variance of pain depends on the type of examinations being performed. Obstetrics, cardiology and vascular ultrasound examinations have the biggest impact on injury rate and risk, although any type of examination can contribute and the injury is cumulative over time.

The literature shows that the primary causes of sonographers' musculoskeletal disorders are due to:

- Abduction of the arms away from the normal vertical position.
- Lengthy examination times.
 - Sonographers are required to hold awkward, stressful positions for long periods of time. A morphology obstetrics examination may 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 results 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 extra layer of fat makes imaging more difficult to achieve without pushing into the patient. The combination of awkward positioning, abduction and pushing creates a working environment at risk of musculoskeletal disorders.

These causes are typically occurring during most ultrasound examinations. The more awkward, and more prolonged, the higher the risk.

The prevalence of these injuries and degree to which individuals are affected is masked due to that fact that sonographers are loathe 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 a compensation claim. Sonographers are also typically jealous of their professionalism and work ethic, and do not report pain or injury for fear of losing their reputation in this respect. They therefore work in pain worsening the injury.

This document recommends various guidelines and principles that can be implemented in all work places to try and mitigate this risk and rate of injury. It arises from research performed by the Sonographer Safety Initiative team comprising of SA Medical Imaging and SA Biomedical Engineering within SA Health (in particular the Flinders Medical Centre Imaging and Biomedical Engineering departments), GE Healthcare and consultation with ergonomists, physiotherapists and senior sonographers from private clinics.

Introduction:

Sonographers are healthcare professionals who specialise in diagnosing internal organ issues using ultrasound imagery.

Sonographers have been shown to be prone to higher rates of Musculoskeletal Disorders (MSDs) or repetitive strain injuries due to the nature of ultrasound examinations. In countries that regularly use ultrasound equipment to assist clinical diagnoses, there have been many articles that highlight this problem and often the associated escalating costs [1-6].

Twenty years of international surveys and studies have shown that 80 to 90% of sonographers experience pain whilst performing ultrasound scans at some stage during their career. More alarming is that 20% of these sonographers who are experiencing pain will end up with a career changing injury [1,2,5].

Injury prevention, the management of the workplace environs, work place practices and policies that should help to avoid injury, is the purview of SafeWork Australia and its state branches.

Given the prevalence of sonographer pain and injury, there is an expectation that the MSD issue should and would receive a great deal of attention. There are subtle underlying reasons as to why this isn't the case, and this document aims to examine those reasons, and to look at a possible hierarchy of guidelines and principles designed to mitigate this rate of injury and pain.

The literature shows that the primary causes of sonographers' musculoskeletal disorders are due to:

- Hyperextension (abduction) of arms from the body away from the normal vertical position.
- Lengthy examination times.
 - Sonographers are required to hold awkward, stressful positions for long periods of time. A morphology obstetrics examination may typically take 1 – 1.5 hours.
- Constant, repetitive movements which are often forceful or awkward.
 - Creates a vicious cycle of injury whereby micro-trauma and scarring occurs leading to increased muscle workload and muscle strain compounding the problem.
- Increase in patient body mass index
 - Obesity in the patient population is increasing. This extra layer of fat makes imaging more difficult to achieve without pushing into the patient. The combination of awkward positioning, abduction and pushing creates a working environment at risk of musculoskeletal disorders.

These four general bodily risks are typically occurring during most ultrasound examinations. The more awkward, and more prolonged, the higher the risk.

Size of the Issue:

Over 6.25 million Medicare-rebateable [7] ultrasound examinations were performed in 2009/10, with the vast majority performed by diagnostic medical sonographers highlighting that the ultrasound examination are a core routine service within public and private institutions within Australia.

From the ASAR (Australian Sonographer Accreditation Registry Limited) there are 5990 accredited sonographers in Australia (all specialities included, 2015)

	Australia	SA	VIC	NSW	ACT	NT	TAS	WA	QLD
Sonographers	6216	539	1367	2051	107	49	100	539	1462
Female: Male ratio	76% : 24%	-	-	-	-	-	-	-	-
Qualified: student ratio	87% : 13%	-	-	-	-	-	-	-	-

Based on the literature findings of sonographer injury rates approximately:

- 5000 sonographers in Australia have or will experience pain during their careers
- 5000 of them will have the work related pain for more than half of their career
- Of that 5000, approximately 1000 will have a career ending injury.

Although the injury rates are high and the number of people affected is significant there are few compensation claims in Australia.

Table 1 outlines the number of serious musculoskeletal and connective tissue disease claims* and associated costs for the *medical imaging professional* occupation group over 2000-01 to 2012-13 (13 years)**.

NB Only states with more than 5 such claims are shown.

* Serious claims: one or more weeks of time lost from work

** Only accepted serious workers compensation claims included

Table 1: Distribution of Worker Compensation Claims and time lost for Medical Imaging group by Jurisdiction of Serious musculoskeletal and connective tissue disease claims 2000 – 2013.

Jurisdiction	Serious claims	Total compensated time lost (in full time equivalent working weeks)
New South Wales	40	596
Queensland	35	455
South Australia	30	400
Victoria	115	3070
Western Australia	20	631
Australia***	245	5842

(Source: SafeWork Australia Statistics 2001 - 2013). Note that the *medical imaging professional* occupation group is broader than just sonographers; it also includes radiographers, radiation therapists and nuclear medicine technologists. The compensation claims for sonographers alone was not able to be individually extracted from the SafeWork Australia data.

*** Australian total includes claims from smaller jurisdictions with less than 5 claims over this period.

Table 1 shows 245 compensation claims in Australia by the medical imaging profession over 13 years. This is a relatively small number for an industry employing just over 5000 professionals during this period of time.

No incidents were reported in the 3 years that the Safety Learning System has been available for Local Health networks across South Australia. Source : Directorate Manager of State Wide Clinical Support Service SA Health

(Note: There were four claims in Medical Imaging, none specific to Sonographers)

SLS is a Safety Learning System used by SA Health that is designed to capture adverse safety events for both patients and staff. Sonographers as staff are failing to report their work related pain believing it to be a usual side effect of the profession, not an adverse event.

This highlights that the SLS system is not being used by sonographers to report pain or injury and furthermore that the injuries reported in the literature by the sonographers themselves is not reflected in the claims and incident reporting systems. The sonographer safety initiative believes there are a number of factors that create this distortion in accurate reporting and analysis, which is discussed in the next section.

Factors affecting accurate analysis:

The Sonographer Safety Initiative surveyed over 98 sonographers at the Australasian Sonographer Association conference held in May 2015, with the purpose to investigate the size and impact of work place injuries and approaches taken to deal with the consequences. The results of this survey showed 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.
- 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 entitlements (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 will to push their bodies harder and for longer (worsening the injury) to get that '*perfect*' diagnostic picture.
- The profession has a higher percentage of females (inherent demographic, Table 1) which naturally leads to part time work for family reasons, assisting the sonographer to manage the pain and injury.

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

- Worrying the pain is not serious enough and wanting to cope and be seen as capable
- Concerned about the stigma of being a 'whinger', 'being less productive', 'not being able to cope'
- Wanting to please management and are committed to the profitability and viability of a clinic over their own health and safety
- Concerned about job loss and future employment ramifications*
- Do not want to deal with Workers Compensation Authorities, viewing it as a "degrading experience"
- Consider themselves at fault for not knowing good ergonomic practices
- Unwilling to let down colleagues and patients

It is therefore evident that your typical sonographer will work in pain and manage their injury personally rather than report. In summary all of these factors discussed above paint a complex picture of the issues surrounding sonographer safety, and the potential solutions. Their tendency 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.

* This fear about employment options is mentioned often by the majority of interviewed sonographers, trainees and educators. The perception given is that this is recognised as a major problem, but that it is also selectively talked about, and people take care to not own this view, due the fear it may also affect employment prospects. If these allegations were as prevalent as implied, then this is perhaps the most parlous cultural issue (within the sonography profession) that needs to be addressed in order to reduce injury rates to sonographers.

Policies guidelines and principles:

What policies and solutions can help reduce the risk of sonographer MSDs and what can WHS do? Below are suggested improvements based on the Sonographer Safety Initiatives' findings, they are also mandatory (statutory) obligations according to WHS Act 2012[8] (See 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 may 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>

Recommendations going forward:

Appendix A outlines the statutory obligations of employers or Person/s Conducting a Business or Undertaking (PCBU's). It also outlines how the risk assessment procedures recommended by SafeWork SA should be used, and that the risk assessment could use the Hazardous Manual Tasks process to define WHS procedures and processes for sonographers.

WHS officers (PCBU's) need to use the listed guidelines and principles as a basis to create workplaces that:

- Allows recovery time for injury either through
 - o Planned patient lists
 - o Planned breaks
 - o Planned rotations of examination type
 - o Planned part time work
- Encourage reporting of pain via adverse safety event systems
- Maximise the ergonomics of the environment and equipment
- Encourage good ergonomics practice in the process of performing ultrasound exams, and hence will need good ergonomic understanding of the human body and stress
- Educate junior sonographers in good ergonomic practice
- Actively pursues good ergonomic machine design, and pushes continuous improvement of ergonomics back onto equipment suppliers.

Machines have made great leaps in ergonomic improvement in the last decade. However, sonographers still need to do a surprising amount of work with arms abducted, one to the patient with the transducer, the other to operate the ultrasound machine. Also, the body mass index of the population is increasing, and this requires the sonographer to have to 'push' the transducer into the patient to get a picture. Both the arm abduction, and the 'pushing' are major contributors to MSDs. Pressure needs to be placed via purchasers onto manufacturers to use the latest technologies to reduce this abduction, or to improve the mobility of controls and transducer, so that the sonographer can get into the most comfortable scanning position, and in a position to 'push' with least stress on the body.

Conclusion:

There is a disparity between surveyed knowledge of injury rates and the officially reported rates. The inconsistency arises because sonographers are very reluctant to report injury for a variety of reasons, mostly related to fear of stigma.

The range of motions and the current conventional methods of ultrasound scanning are inherently stressful on the human body. This must be recognised and good workplace guidelines and principles as mentioned above should be used to minimise this risk of injury. There are also obligations on the sonographer to look after their own body by using good ergonomic principles, managing their workloads to suit their individual physiology, and to maintain good core and body fitness. The WHS officer needs to understand these and champion good policy and procedure, and are legally obliged to do so.

There is a current shortage of sonographers in Australia, and wages and conditions are rising rapidly due to the foreshortened careers of sonographers. It behoves business and clinics to minimise this risk as it is also an economic imperative.

Finally it is also a moral imperative to provide a safe place for employees, one in which their normal work practices do not expose them to long term physical injury that affects lifestyle and their ultimate retirement.

Appendix A: (Statutory obligations for WHS)

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

Any Person Conducting a Business or Undertaking (PCBU's) has a primary duty of care to the health, safety of staff, patients and people within the PCBU's premises.

This duty of care also applies to any person who makes or helps make decisions that affect the whole, or a substantial part, of a business or undertaking. It also extends this duty of care to any person if they have the capacity to significantly affect the financial standing of the business or undertaking. These people 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 matters.

Due diligence: - Taking reasonable steps, or demonstrating due diligence, requires PCBU's 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.

Businesses and managers are therefore legally bound to minimise risks to sonographers.

Sonography is a 'Manual Task'.

The following is an abstract from SafeWork SA's Document 'Hazardous Manual Tasks Overview' (available on the SafeWork SA website at safework.sa.gov.au)

What is a hazardous manual task?

A task that requires a person to lift, lower, push, pull, carry or otherwise move, hold or restrain anything involving one or more of the following:

- repetitive or sustained force
- repetitive movement
- sustained or awkward posture
- high or sudden force
- exposure to vibration.

The first three elements involving force/strain are most pertinent to sonography. Sonographers often have to sustain force, and do repetitive movements. They also have to scan in awkward positions. Each of these is a serious risk, and must have the risk assessment process applied.

Once these risks are identified, the PCBU, or clinic manager must implement the following:

Manage Work Health and Safety Risks:

Risk management

The risk management process involves four steps:

1. Identify hazards
2. Assess risks
3. Control risks
4. Review control measures

1. Identify hazards

Identifying hazards involves finding all of the things and situations that could potentially cause harm to people.

2. Assess risks

A risk assessment should be done when:

- There is uncertainty about how a hazard may result in injury or illness
- The work activity involves a number of different hazards and there is a lack of understanding about how the hazards may interact with each other to produce new or greater risks
- Changes at the workplace occur that may impact on the effectiveness of control measures.

3. Control risks

The ways of controlling risks are ranked from the highest level of protection and reliability to the lowest. This is known as the hierarchy of risk control.

You must work through the hierarchy of control in order and, where possible, implement risk controls high in the order as follows:

1. Eliminate – remove the hazard completely.
2. Substitute – substitute or replace the hazard with a less hazardous work practice.
3. Isolate – as much as possible
(Applicable to isolating from vibration, less important in sonography).
4. Engineering controls.
 - a. Use aids that relieve stress and strain during examinations.
 - b. Provide ultrasound machines, beds and chairs that are height adjustable, and extensible.
5. Administrative controls.
6. Personal protective equipment (PPE) – this should be the last option.
(usually applicable to industries other than sonography).

4. Review control measures

Control measures that have been implemented must be reviewed, and if necessary, revised to make sure they work as planned.

Keeping records

Keeping records of your risk management process can assist in demonstrating potential compliance with work health and safety legislation. It can also help you to monitor the health and safety performance of your business.

It may be necessary to introduce cultural change to encourage sonographers to document their physical stress and pain, but this data is invaluable in developing a safe sonography environment.

Abstracted from SafeWork SA's Code of Practice Fact Sheet:

(The Code of Practice – How to Manage Work Health and Safety Risks is available on the SafeWork SA website at safework.sa.gov.au).

For more information about hazardous manual task risk management, visit www.safework.sa.gov.au or contact the SafeWork SA Help Centre on 1300 365 255.

The following publications contain more information:

- Work Health and Safety Regulations 2012 (SA) (Chapter 4 Part 2 Hazardous Manual Tasks)
- Code of Practice – Hazardous Manual Tasks

References:

1. Bernadette Mason, Val.Gregory., *2006 asa survey results*, in *oh&supdate*, A.A.O.S. COMMITTEE, Editor. 2006.
2. ASUM, A.a., *ASA and ASUM joint guidelines for reducing injuries to sonographers/sonologists*. Australian Sonographers Association, Australasian Society for Ultrasound in Medicine, 2010.
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. Thomson, A., *Submission to the Strategic Review of Health and Medical Research*, in *Preventing overuse injuries....* 2014. p. 4.
5. Susan L. Murphey , C.T.C., *Ergonomics and Sonographer Well-being in Practice*. 2002.
6. Sonography, S.o.D.M. *Industry Standards for the Prevention of Work-Related Musculoskeletal Disorders in Sonography*. in *Consensus Conference on Work-Related Musculoskeletal Disorders in Sonography*. 2003. Texas USA
7. Association, A.S., *The future of sonographer education in Australia* 2011.
8. SA, G., *Work Health and Safety Act 2012*. 2012.

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