



# Sonographer Safety Workplace Considerations

---

## *Overview:*

The objective of this document is to provide the background and evidence for musculoskeletal injury rates amongst sonographers. It will also recommend the workplace policies and guidelines that should be used to help mitigate this injury rate, and provide a safer environment for the sonographer to work in.

The report provides an economic rationale for maintaining and keeping sonographers safe via good workplace policies.

## Contents

Executive Summary: .....	2
Introduction:.....	3
Size of the Issue: .....	3
Factors affecting accurate analysis:.....	4
Economic rationale for maintaining and keeping sonographers safe via good workplace policies.....	6
Loss models for injured, non-working Sonographer:.....	6
The economy of doing nothing .....	8
Return on Investment of Safety .....	9
Summary:.....	9
Recommendations to mitigate injury risk: .....	10
Statutory Obligations:.....	10
The importance of ergonomically designed ultrasound machines .....	12
Appendix A: Loss analysis and approximated costs: .....	13
Appendix B: Guidelines and principles and solutions.....	16
References: .....	18
Acknowledgements: .....	18

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 during their normal daily tasks and the guidelines and principles that should be implemented to mitigate this risk. It also provides an economic rationale for maintaining and keeping sonographers safe via good workplace policies.

International literature shows that 80 to 90% of sonographers experience pain whilst performing scans at some stage of their career. Up to 95% experience pain 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:

- Arm abduction.
- Lengthy examination times.
- Frequent, repetitive movements.
- Scanning patients with high body mass index

The awkwardness of upper body positions also translates down through the torso and legs, and can cause discomfort and pain [4, 5].

The prevalence of these injuries and degree to which individuals are affected is masked as sonographers are reluctant to report injury. They work in pain worsening the injury.

The ultrasound industry has one of the most dependent relationships between quality of outcome (diagnosis) and sonographer skill. It takes many years to develop a very skilled sonographer. Furthermore sonography has high replacement costs associated with it, our estimates put training costs for a junior sonographer at \$100K plus time costs of 2 years. To lose such expertise to injury makes little economic sense.

This document reviews this risk in terms of productivity and costs of losing a sonographer through injury and the associated costs of retraining. It highlights the false economy of allowing sonographers to work in pain, and highlights the need for support from management and WHS departments to change this current thinking.

## Introduction:

Sonographers: *“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 many 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, 2, 6-9].

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 [2, 7, 10].

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 policies designed to mitigate this rate of injury and pain. Appendix B itemises these principles and guidelines.

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

- 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. Morphology obstetrics examinations typically take 45 minutes – 90 minutes.
- 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 ultrasound examinations were performed in 2009/10, with the vast majority performed by diagnostic medical sonographers [11].

If we apply the accepted injury statistics to the population, this implies that there may be just fewer than 5000 sonographers in Australia that have or will experience pain during their careers, performing ultrasound examinations. Of that 5000, approximately 1000 will have to prematurely change their careers due to severity of injury.

Although the injury rates are high and the number of people affected is significant there are few Workers 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
<b>Australia***</b>	<b>245</b>	<b>5842</b>

(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 over this period of time.

The Safety Learning System (SLS), used by SA Health, is designed to capture adverse safety events for both patients and staff. A review of this data showed no incidents were reported by sonographers in the 3 years that the SLS data has been available. Source: Directorate of State Wide Clinical Support Service SA Health. 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 is not being used by sonographers to report pain or injury and furthermore that the injuries reported in the literature by sonographers themselves are not reflected in the claims and incident reporting systems. This prevents the issue from getting the traction it requires from WHS and management. 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 of investigating 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 cost.
- 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 higher percentage of females (approximately 89% females) which can lead 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 that 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 a typical sonographer will work in pain and manage their injury personally rather than report. All of these factors above paint a complex picture of the issues surrounding sonographer safety, and the potential solutions. Their tendency to self-manage injuries 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.

## Economic rationale for maintaining and keeping sonographers safe via good workplace policies

### Loss models for injured, non-working Sonographer:

Based on the figures in Appendix A, Loss analysis and approximated costs, if a sonographer is off work it results in a potential cost of

1. Loss of billable hours for an unutilised machine in private practice (machine down time) of between \$800 - \$3200 per day (no replacement of sonographer)
  2. Replacement of sonographer costing
    - o \$0 'zero' if the sonographer is replaced in-house by other staff (of same proficiency)
- OR
- o \$600 - \$1200 per day, depending on the level of expertise of agency staff or locum.

There are also other influencing factors such as overheads, possible overtime arrangements, bonus rates and management of patient lists to be considered as potential costs. For example in public departments, there may be the additional costs of retaining a patient in a 'bed' for the day or overnight. Broadly, this can add from \$1K - \$6K per day depending on locality of 'bed' and it's costs [12].

Apart from loss of billable time, and the subsequent loss of potential income, there are further risks to the business/department as a result of an injured sonographer going to lighter duties, or taking leave. The absence of a sonographer usually transfers the work load to other team members, and in order to manage patient lists, this usually requires the other team members to increase their workload. The risks of this situation are that members may have less breaks to relax their musculature, they may try to hasten scanning times, potentially to the detriment of patients and risking musculoskeletal injury to themselves.

These risks can quickly become detrimental to staff relationships, affect the morale of the staff and eventually deteriorate productivity.

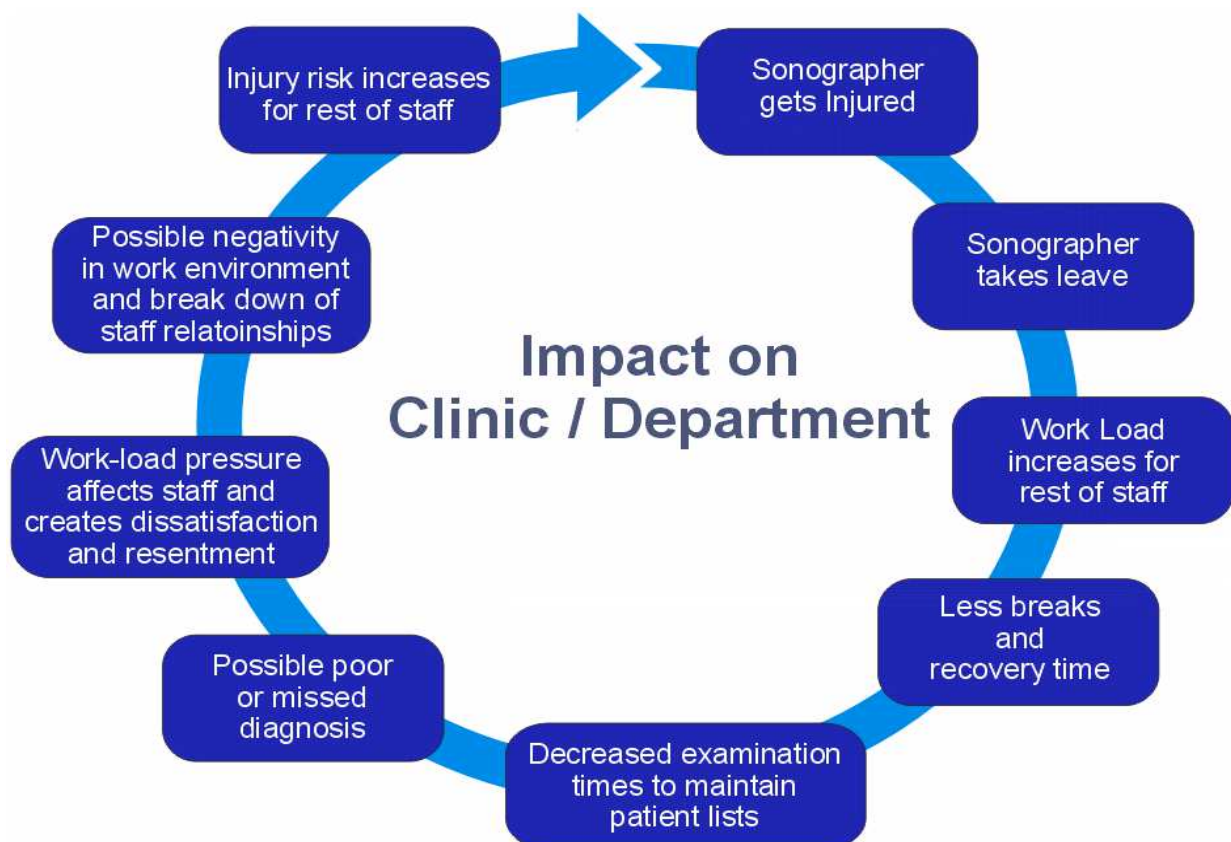


Diagram 1 based on the work of Catrina Panuccio (Women's and Children's Hospital Perinatal Ultrasound Unit)

There are less tangible ramifications to losing an experienced sonographer as well. Sonography is a profession where the quality of patient outcome is very dependent on the clinical skills of the sonographer. Losing a very experienced analytical diagnostician (senior sonographer) can mean that ensuing examinations by less experienced sonographers could take longer, be poorer in diagnosis, and have inadequate quality of image or potentially missed diagnosis.

There are also consequences to the individual sonographer, little of which is positive. The following diagram demonstrates the possible outcomes for an injured sonographer:

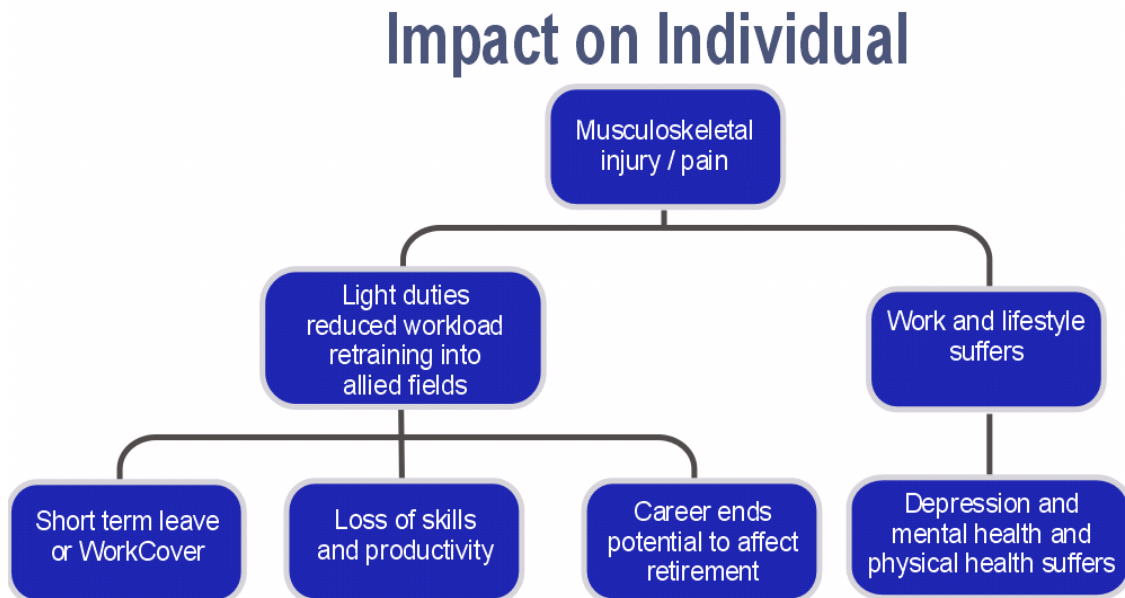


Diagram 2 based on the work of Catrina Panuccio (Women's and Children's Hospital Perinatal Ultrasound Unit)

Diagram 2 demonstrates the concept that there are poor outcomes for the individual as a result of suffering a musculoskeletal injury that requires time off work. Sonographers know this implicitly, if not intuitively. It is one reason many sonographers choose to work part time, so as to ensure they get sufficient time to rest the strain they put their bodies under. From a survey held at 2015 Australasian Sonographers Association conference, 40% of respondents worked 4 days per week or less. Whilst many did this for family, or personal flexibility, they all agreed that it was also necessary to rest the body from the stress of ultrasound examinations.

Those sonographers whose injuries have caused them to seek compensation or to have changed careers tell of the hardships, including depression, inability to enjoy usual activities/lifestyles, ongoing pain, a sense of shame and anxiety all as a result of losing their profession.

Sonographers are very good at managing injury in a way that is not necessarily beneficial to the industry. To manage their pain or injury they:

- May go part time to rest the injury; this implies more people employed to achieve the same work load.
- Move to, or retrain to allied areas such as education and training, applications, sales, marketing, account management, servicing, MRI, Radiography and CT.
- Move into administration, training and service industries related to “*Medical Imaging*”.
- Expend their own money on remediating their health and absences so as to not appear problematic. This is to protect their hard won professional status and subsequent career options.
- Decrease their workload to reduce stress, though this may lead to lower income
- Work whilst in pain, taking Cortisone injections or pain killers to ‘work’ through the pain.



By arranging

- time to rest
- implementing work load and examination type loads in bookings, that do not put strenuous or difficult examinations back to back, and also allow break periods that allow rest and stretching by the sonographer
- maximising the ergonomics of equipment and examination rooms

Injury rates can be substantially reduced.

This will lead to

- higher productivity
- lower staff change over
- lower training/retraining costs
- lower recruiting costs
- reduction in the growing skills shortage in the sonography industry

Management needs to provide the best ergonomic approaches possible to keep sonographers free of injury.

### The economy of doing nothing

Many sonographers would rather work in pain, work less or take leave rather than report pain/injury. It might be perceived that the industry is coping or managing this risk well, and that little needs to change. There is complacency arising from the perception of low claim rates in the Workers Compensation Authority statistics shown in the section "*Size of the issue*" of this report. However, surveys and studies consistently show that sonographers are often working in pain, and 20% of those suffer career changing injuries. The evidence shows it to be a false economy to believe that the industry is coping well and there is little need for change.

**Recruitment of Sonographers:** As a result of the part time nature of sonographers it typical to hire multiple people to fulfil a full time equivalent (FTE) position which can create difficulties for the profession.

Labour Economics Office South Australia Department of Employment Feb 2015, reported the following:

- A survey of employers who had recently advertised for sonographers revealed that only half (50%) of their vacancies were filled within six weeks. This compares with 38% recorded in a survey conducted in 2014.
- On average, there were 2.3 applicants per vacancy compared to 1.6 in 2014.
- Not all applicants were deemed suitable to the vacancies; the ratio of suitable applicants was lower at one per vacancy. By comparison, the survey conducted last year found there were 0.4 suitable applicants per vacancy.
- Due to the difficulties in finding suitably qualified and experienced staff, some employers converted the vacancies to training positions and hired students.

By comparison:

- 18% of Sonographer vacancies in NSW were filled within the survey period in 2014 [13]
- 10% of surveyed sonographer vacancies in VIC were filled from an average of 0.6 applicants per vacancy, with 0.3 applicants per vacancy found to be suitable (2014) and 13% of advertised positions were filled from 0.6 suitable applicants per vacancy [14]
- QLD and ACT had close to 1 applicant per vacancy, depending on the year [15].

This nationwide shortage of sonographers means that there is pressure on wages and conditions to provide competitive work places to attract sonographers that are immediately suitable, or the business needs to provide a training position, and bear the subsequent training costs to develop the required skill level.

In short, losing a sonographer due to injury creates a local skill shortage. The subsequent work load then needs to be distributed over the remaining staff in the interim, until the shortage can be rectified.

### Return on Investment of Safety

Both Liberty Mutual and the American Society of Safety Engineers, regularly produce white papers on the subject that calculate the Return on Investment for safety between \$3 to \$5 for every \$1 dollar of investment [16].

The emerging logic of the statistics in this report is that there is every incentive financially and productivity wise, to minimise risk of injury to sonographers. From the evidence that loss of productivity can cost as much as \$3200 per day and potentially more if training a replacement is required, it makes little sense not to do everything possible to mitigate injury.

### Summary:

The international literature shows that 80-90% of sonographers experience pain whilst scanning at some stage in their career. Of these, approximately 20% will have a career changing and life changing injury.

There is disparity between surveyed injury rates, and claims lodged with SafeWork and Workers Compensation Authority departments. Sonographers are reluctant to report minor injuries, and this masks the issue. This disparity between actual and reported injury rates is largely prevalent in the industry due to the acceptance that injury is part and parcel of the profession.

Senior sonographers are in the \$100K-\$120K per annum wage bracket (depending on state) and charge rates vary from \$100 per hour in public sector to \$400 per hour in private sector (depending on state). Hence daily losses can be anywhere up to \$3200 per day lost due to absent injured sonographers (excludes bed costs in hospitals).

It is possible to get between \$3-\$5 return on investment for each \$1 invested in safety [16], hence there is a strong business case to improve the bottom line by mitigating the risk of injury to sonographers. This case strengthens when one considers there is a further training cost of \$100K across two years to train a replacement sonographer, including recruitment costs and time, and also considering that wage pressure is high in the sonographer industry due to current scarcity.

Aside from the compelling business case to mitigate sonographer injury, there is the ever important consideration of the impact on the workplace when a sonographer's ability to work is compromised. The transfer of work load to other staff increases their injury risk and it can be demoralising to other staff to have to work at very high pressure. Patient lists can suffer and can bring a low morale to the entire business/department.

The MSDs suffered by sonographers has the potential for permanent detriment to a sonographer's life and retirement and can often bring bouts of depression. This can have a severely negative impact on the productivity of a clinic/department.

The rate of workplace injuries to sonographers cannot be ignored; there is a need for action from management and WHS departments to change the current acceptance of the status quo. Guidelines, principles and practices need to be implemented that mitigate the risk of injury as much as possible.

## Recommendations to mitigate injury risk:

Appendix B has a prescriptive set of guidelines and principles that could be used to help mitigate the risk of injury, many of these are mandatory under the Work Health and Safety Act 2012 (see Statutory Obligations section for more on this).

The guidelines and principles cover four main areas

- Environmental / Workplace considerations
- Work balance, load management guidelines
- Educational guidelines
- Purchasing guidelines

These guidelines and principles are the product of analysis of many surveys, medical reports, white papers and research by Occupational Health and safety departments worldwide. They can be tailored to suit most Ultrasound departments/clinics.

## Statutory Obligations:

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](http://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:**

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

### **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 (\* 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.

A note on record keeping:

*Clinic Managers and WHS personnel have pointed out that there may be a case to have two types of reporting systems. One, the recording of adverse safety incident as per WHS Act for which intervention is mandatory for each incident. The second being a diary or data collection type of recording, in which the sonographers record when they feel that their body has been 'stressed' by a particular exam. This separate recording system can help clinics/departments determine if there are common exam types, or work processes which need closer management in order to minimise stressing sonographers' bodies in a normal work day.*

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

For more information about hazardous manual task risk management, visit [www.safework.sa.gov.au](http://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

Safety by Design is included as an objective in the National Health & Safety Strategy and SA WHS Strategy; hence there are statutory obligations to seek machines that inherently reduce injury risk to operators.

Work Health Safety Act. [Ref to S19 (3); 21 (2) – 25 & 27 Safety by design].[17]

### **The importance of ergonomically designed ultrasound machines** (Safety by Design)

Ergonomic design of ultrasound machines should always be considered, especially at the procurement stage. Vendors should be notified in advance that ergonomics will be a deciding factor when purchasing an ultrasound machine. Scanning staff should be consulted on their ergonomic requirements prior to purchase. If all purchasers pressured the equipment providers/manufacturers to continuously improve the ergonomics of machines, injury rates would fall and productivity would increase. The most important ergonomic features to consider are the extensibility of monitor and controls, and lightweight transceivers and cords. If machines can continue to be further extensible, then sonographers will be able to dramatically reduce abduction of their upper limbs, and this will subsequently dramatically reduce stress on sonographers during examinations.

Pressure to improve ergonomics of ultrasound machine design should be brought to bear on manufacturers during the tender stage of purchasing.

## Appendix A: Loss analysis and approximated costs:

The nature of self-management by sonographers means that it is difficult to determine precise figures for time lost by sonographers due to pain and or injury.

Anecdotal evidence and figures from surveys show that sonographers would rather work through painful exams and cope with pain, often via pain killers or Cortisone injections (anti-inflammatory). This is a personal sacrifice so as to not burden the 'team' with extra workload, or to maintain patient lists (bookings) and keep them manageable. Sonographers seem to deem themselves rather poorly if they can't live up to their own high productivity standards. Even to the extent of injuring themselves.

The following analysis uses the available statistics to make estimates. Actual figures for Public departments or private businesses will depend on their individual circumstances, employment policies, ergonomic implementations and work profiles.

### Typical (Average) pay rates for Sonographers (in AUD \$) Assume 37.5 – 40 Hr Week

Source	Hourly Rate	Wage / Year
Result of survey at ASA Conference 2015, As per Appendix D.	\$47.50	\$87.4K
From WPEA Salaried 20143 Page 31 Schedule 1.2 : Allied Health Professionals SA Mean Wage 2015	\$45.54	\$83.79K
From WPEA Salaried 20143 Page 31 Schedule 1.2 : Allied Health Professionals SA Graduate	\$35.50	\$74K
From WPEA Salaried 20143 Page 31 Schedule 1.2 : Allied Health Professionals SA Senior	\$55.00	\$119K
www.payscale.com/research/AU/Job=Sonographer/Hourly_Rate	(Graduate) \$28.67 – (Senior) \$61.89	\$52,416 - \$130,865

### Billable Hours (in AUD \$)

Source	Hourly Rate	Daily
Divisional Manager Department Medical Imaging SAHLN Daniel Walkley of FS Radiology	Public \$100	\$800
	Private \$400	\$3200

### Replacement Sonographer Costs (in AUD \$)

Source : Divisional Manager Department Medical Imaging SAHLN & Private practice FS Radiology	Hourly Rate	Daily
Internal Staff	\$0	\$0
Agency	\$75	\$600
Specialist (Locum)	\$150	\$1200

### Estimating Costs due to lost time for injured Sonographer (in AUD \$)

Normal Day (No Loss)	Day Lost Replacement of Sonographer	Day Lost No replacement of Sonographer
Billable	Difference between normal billable and on cost of replacement	Difference between normal billable and on cost of replacement
Low	Low	Low
\$800 / Day	Junior replaced -\$368 / Day	(replacing junior wage with agency wage difference)
	Senior replaced -\$104 / Day	-\$800 / Day (replacing senior wage with agency)
High	High	High
\$3200 / Day	Junior replaced -\$968 / Day	(lost billable hours)
	Senior replaced -\$704 / Day	-\$3200 / Day (i.e. Billable hours in private practice per machine.)

### Bed Costs per day (in AUD \$)

Source: ihpa.gov.au/internet/ihpa/publishing.nsf/Content/nhcdc-cost-report-2011-2012-round16-html~admitted-acute-product-result~3-5-admitted-cost-overnight-sameday (Table 9)	Same Day	Overnight
Nationally	\$1,180	\$4,851
	(South Australia) \$1,477	\$5970

Direct losses per day can be calculated on the basis of whether external replacement occurs, or internal staff fill lost days due to sonographer injury. This can also be broken down to whether a junior Sonographer is being replaced, or a senior Sonographer

#### Range of Losses

Loss assuming replacement sonographer with cheaper agency (\$600 per day) for a Junior Sonographer

$$\text{Loss} = \text{No. Days} \times \text{\$368 (per day)}$$

Loss assuming replacement sonographer with cheaper agency (\$600 per day) for a Senior Sonographer

$$\text{Loss} = \text{No. Days} \times \text{\$104 (per day)}$$

Loss assuming replacement sonographer with Locum (\$1200 per day) for a Junior Sonographer

$$\text{Loss} = \text{No. Days} \times \text{\$968 (per day)}$$

Loss assuming replacement sonographer with Locum (\$1200 per day) for a Senior Sonographer

$$\text{Loss} = \text{No. Days} \times \text{\$704 (per day)}$$

Range of possible losses without replacing Sonographer -**\$800 to - \$3200** per day. (Billable hours per unused machine)

If the loss of a Sonographer causes a patient's hospital overnight stay due, then costs per patient may jump from (South Australian) \$1,580 to \$5,970 or a loss **-\$4,390** per overnight stay. Nationally this figure is **-\$3,671**.

**Source:** [ihpa.gov.au/internet/ihpa/publishing.nsf/Content/nhcdc-cost-report-2011-2012-round16-html-admitted-acute-product-result-3-5-admitted-cost-overnight-sameday](http://ihpa.gov.au/internet/ihpa/publishing.nsf/Content/nhcdc-cost-report-2011-2012-round16-html-admitted-acute-product-result-3-5-admitted-cost-overnight-sameday) (Table 9)

#### Scenario Estimates :

Sonographer away 1 working week (5 days) injured and needing to rest injury. (Unavailable for light duties)

##### Australian National

Range	Days Lost		Replaced	Not Replaced		Include 1 O/N Stay		Total Loss
Junior Sonographer								
Lower (Agency)	5	x	\$368 /d		+	\$3,671	=	\$5,511
Higher (Locum)	5	x	\$968 /d		+	\$3,671	=	\$8,511
@ Billable Hours	5	x		\$800 /d	+	\$3,671	=	\$7,671
Senior Sonographer								
Lower (Agency)	5	x	\$104 /d		+	\$3,671	=	\$4,191
Higher (Locum)	5	x	\$704 /d		+	\$3,671	=	\$7,511
@ Billable Hours	5	x		\$3200 /d	+	\$3,671	=	\$18,671

##### South Australian

Range	Days Lost		Replaced	Not Replaced		Include 1 O/N Stay		Total Loss
Junior Sonographer								
Lower (Agency)	5	x	\$368 /d		+	\$4,390	=	\$6,230
Higher (Locum)	5	x	\$968 /d		+	\$4,390	=	\$9,230
@ Billable Hours	5	x		\$800 /d	+	\$4,390	=	\$8,390
Senior Sonographer								
Lower (Agency)	5	x	\$104 /d		+	\$4,390	=	\$4,910
Higher (Locum)	5	x	\$704 /d		+	\$4,390	=	\$8,230
@ Billable Hours	5	x		\$3200 /d	+	\$4,390	=	\$20,390

#### Scenario Estimates :

If we take the worst and best case for the National situation of losing a sonographer for a week the estimates are from **\$4,191** to **\$18,671** loss per week.

If we take the worst and best case for the South Australian situation of losing a sonographer for a week the estimates are from **\$4,910** to **\$20,390** loss per week.

The National figures show a range of per annum loss figures (weeks \* 52) from \$233,932 to \$970892 /yr. The SA figures show a range of per annum loss figures (weeks \* 52) from \$ 255,320 to \$1060280 /yr. (Note: These figures are dependent on many variables, and therefore are general in nature.)

An injured sonographer would generally be replaced within a few months. If the injury is substantial then the sonographer would likely be paid compensation for a significant amount of lost time, and hence some costs would be borne by a compensation scheme. Further losses borne by the business via increased premiums, lost productivity and lost clientele.

There is a further cost to be borne specifically by public healthcare departments or businesses, and that is the training costs of new sonographers, which has been estimated at about **\$100K** over approximately 2 years. In addition, the recruitment costs can be estimated to be **\$6K to \$8K**, depending circumstances and policies.

There are significant costs, borne by a variety of bodies. These include the cost of the preliminary education (usually a degree and a post graduate diploma). These can be broken down to student contribution (HELP Scheme), and government subsidies. Other costs include the cost of remedial surgery for the sonographer's injury, which is from government health allocated funds, or private health insurers.

If the sonographer retrains, the secondary costs are associated with this, as well as the cost to the employer whilst the trainee learns to become fully productive.

The quality of clinical outcomes is very operator dependent in ultrasound examinations. It requires experienced, knowledgeable sonographers to locate a specific medical issue, and frame it (pictorially) for clinical analysis. The more professional and experienced a sonographer is, the more likely the quality of diagnosis and treatment will be high. It can be said that the loss of an experienced, high quality sonographer has a potentially big impact on quality of clinical outcome, and this is very difficult to measure financially. It is also at the very core of what hospitals and the health system is trying to achieve.



## Appendix B: Guidelines and principles and solutions

### *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>

## References:

1. 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
2. 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.
3. J, B.S.L.M.D.H., *Submission of ergonomics and work-related injury among sonographers*. , U.D. Labor, Editor. 2001: Washington DC.
4. [http://en.wikipedia.org/wiki/Musculoskeletal\\_disorder](http://en.wikipedia.org/wiki/Musculoskeletal_disorder), *Musculoskeletal disorder*, in *Musculoskeletal disorder*, <http://en.wikipedia.org>, Editor. 2015, <http://en.wikipedia.org>: <http://en.wikipedia.org>.
5. Jakes, C., *Sonographers and Occupational Overuse Syndrome: Cause, Effect, and Solutions*. Journal Of Diagnostc Medical Sonography 2001. **17**(6): p. 74.
6. Bernadette Mason, V.G., *2006 asa survey results*, in *oh&supdate*, A.A.O.S. COMMITTEE, Editor. 2006.
7. ASUM, A.a., *ASA and ASUM joint guidelines for reducing injuries to sonographers/sonologists*. Australian Sonographers Association, Australasian Society for Ultrasound in Medicine, 2010.
8. Thomson, A., *Submission to the Strategic Review of Health and Medical Research*, in *Preventing overuse injuries....* 2014. p. 4.
9. Susan L. Murphey , C.T.C., *Ergonomics and Sonographer Well-being in Practice*. 2002.
10. Bernadette Mason, C.R., Samantha Brinsmead, Lynette Hassall, Sandra Chamberlin, Sonographer Health and Wellbeing COMMITTEE, AMS – ASA OH&S, *The 2014 ASA workplace health and safety survey results*. 2014.
11. Association, A.S., *The future of sonographer education in Australia* 2011.
12. 160, A.I.o.H.a.W.C.C.n.H., *Australias hospitals 2013\_14 ata glance*. 2014.
13. Employment, A.G.D.o., *Labour Economics Office New South Wales Department of Employment ANZSCO 2512-14 New South Wales Sonographer March 2015*. 2015.
14. Labour Economics Office Victoria Department of Employment, A.G.D., *ANZSCO 2512-14 Victoria Sonographer March 2015*. 2015.
15. Labour Economics Office Queensland Department of Employment, A.G.D., *ANZSCO 2512-14 Queensland Sonographers February 2015*. 2015.
16. Yueng-Hsiang Huang, T.B.L., Theodore K. Courtney, Sarah DeArmond, Peter Y. Chen and Michael F. Blair, *Financial Decision Makers' Views on Safety*. Business of Safety, 2009.
17. Government of South Australia., *Work Health and Safety Act 2012*. 2012.

[Work Health and Safety 2012.PDF](#)

## Acknowledgements:

The Sonographer Safety Initiative team would like to thank the following people for their input to this report:

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

*SafeWork SA and the South Australian Government do not endorse the content of this material and the views expressed herein are not reflective of SafeWork SA or the South Australian Government.*