ACI NSW Agency for Clinical Innovation

ICCMU Intensive Care Coordination & Monitoring Unit

IC Manual
best practice guidelines for intensive care

Pressure Injury Prevention for Critically Ill Adults

Guideline provenance

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Disclaimer

- This clinical practice guideline (CPG) is aimed at providing the clinicians of NSW hospitals' intensive care units (ICU) with recommendations to frame the development of policies and procedures related to the prevention of pressure injury development in critically ill adult patients in acute care facilities.
- This CPG is not intended to replace the critical evaluation processes that underpin the development of local policy and procedure nor does it replace a clinician's judgment in an individual case.
- Users of this CPG must critically evaluate this CPG as it relates to local circumstances and any changes in the literature that may have occurred since the dates of the literature review conducted. In addition, NSW Health clinicians must review NSW State Government policy documents to identify any directives that may relate to this clinical practice.
- These guidelines are intended for use in NSW acute care facilities.
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FOREWORD

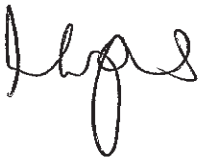
Pressure injuries remain a major problem in healthcare with adults in intensive care at increased risk. For patients, pressure injuries result in significant pain, quality of life impacts and they also slow recovery.

Given the enormous challenges associated with pressure areas for both patients and healthcare systems the National Commission on Safety and Quality has prioritised pressure injury prevention (Standard 8).

The purpose of this guideline is to provide intensive care clinicians with best practice recommendations to ensure that all efforts are in place to minimise the risk of a patient developing a pressure injury while in ICU.

Developed under the auspices of the Intensive Care Best Practice Manual Project, this guideline highlights the ability of the Agency for Clinical Innovation (ACI) to facilitate strong working relationships with clinicians as well other executive branches of the Ministry.

On behalf of the ACI, I would like to thank Susan Pearce, Chief Nursing and Midwifery Officer for providing state executive sponsorship for the project and funds for the Project Officer. I would also like to extend my appreciation to the Local Health District (LHD) executives for facilitating the participation of LHD staff in developing these guidelines, which I commend to you the clinicians of NSW.



Dr Nigel Lyons
Chief Executive, Agency for Clinical Innovation

ABOUT THE ACI

The Agency for Clinical Innovation (ACI) works with clinicians, consumers and managers to design and promote better healthcare for NSW. It does this by:

- Service redesign and evaluation – applying redesign methodology to assist healthcare providers and consumers to review and improve the quality, effectiveness and efficiency of services.
- Specialist advice on healthcare innovation – advising on the development, evaluation and adoption of healthcare innovations from optimal use through to disinvestment.
- Initiatives including Guidelines and Models of Care – developing a range of evidence-based healthcare improvement initiatives to benefit the NSW health system.
- Implementation support – working with ACI Networks, consumers and healthcare providers to assist delivery of healthcare innovations into practice across metropolitan and rural NSW.
- Knowledge sharing – partnering with healthcare providers to support collaboration, learning capability and knowledge sharing on healthcare innovation and improvement.
- Continuous capability building – working with healthcare providers to build capability in redesign, project management and change management through the Centre for Healthcare Redesign.

ACI Clinical Networks, Taskforces and Institutes provide a unique forum for people to collaborate across clinical specialties and regional and service boundaries to develop successful healthcare innovations.

A priority for the ACI is identifying unwarranted variation in clinical practice and working in partnership with healthcare providers to develop mechanisms to improve clinical practice and patient care.

Table 1: Guideline development network members

NAME/POSITION	ROLE	ORGANISATION	HOSPITAL
Kaye Rolls	Chair (from December 2012)	ACI ICCMU	
Sarah Jones	Co-Chair Evidence CNC, Critical Care Specialist Nurse	SES LHD	St George
Deidre Power	Co-Chair Practice Clinical NUM, Critical Care Specialist Nurse	SESLHD	Prince of Wales
Stuart Cook	Critical Care Specialist Nurse	SLHD	Concord
Kimberley Flood	Clinical Nurse Educator, Critical Care Specialist Nurse	FWNSWLHD	Broken Hill
Catherine Hennessy	Critical Care Specialist Nurse	NSLHD	Mona Vale
Kylie Mackenzie	Clinical NUM, Critical Care Specialist Nurse	ILDH	Wollongong
Yve Robertson	A/ CNE	NSLHD	Hornsby
Prof Paul Fulbrook	Academic Mentor	ACU	
Jane Rodgers	Specialist Wound Care Nurse	St Vincent's	St Vincent's
Debbie Blanchfield	Specialist Wound Care Nurse	ILHD	Wollongong
Leila Kuzmiuk	Chair (April 2012-December 2012)	HNE Health	John Hunter Hospital
Rod Masters	Healthcare consumer		

All network members completed a 'declaration of Interest' form based on NHMRC guidelines.
The guideline development network members declared no conflicts of interest.

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The critically ill adult patient is at increased risk of developing painful pressure injuries [1, 2]. For hospitalised patients, independent of their diagnosis, pressure injuries increase length of stay and contribute to increased healthcare costs [3]. Of great importance is that pressure injuries significantly impact health-related quality of life for patients [4]. The Australian Commission on Safety and Quality in Healthcare have created a national standard to focus healthcare clinicians and organisations on this important preventable adverse event [5]. A multidisciplinary approach is required to identify and prevent pressure injuries, from both intrinsic and extrinsic causes. Predicting and preventing pressure injury will improve the quality of care and reduce the financial impact on the healthcare system. This guideline is based on the Pan Pacific Clinical Practice Guideline for the Prevention and Management of Pressure Injury (2011) [Pan Pacific CPG] [2]. The scope of this guideline is prevention of pressure injury in critically ill patients and does not include treatment of pressure injuries. Clinicians should refer to Pan Pacific CPG (2011) for further guidance and clarification of recommendations and pathophysiology of pressure injury.

SECTION	RECOMMENDATION	GOR
	Patients and carers	
1	Patients, families and careers are informed of the risks, prevention strategies and management of pressure injuries. Development of the pressure injury management plan is to occur in partnership with the patient, family and carers if appropriate.	Consensus
	Assessment	
2.	Use a pressure injury risk assessment scale in conjunction with a comprehensive visual assessment to determine the patient's risk of pressure injury and to inform the development of a prevention plan.	Consensus
3.	The Braden Scale for Predicting Pressure Sore Risk is the recommended validated and reliable tool for assessing pressure injury risk in critically ill adults [6, 7].	B
4.	Inspect all of the skin and devices attached to the patient within two hours of admission, at each repositioning and each shift change to identify indications of pressure injury including: [2] • for fair skin races – erythema and for darker pigmented skin – persistent blue or purple hue • blanching response • localised heat • oedema • induration • skin breakdown	C

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SECTION	RECOMMENDATION	GOR
5.	The skin and mucosa impacted by invasive medical devices (including but not limited to nasogastric tubes, tracheal tubes, urinary catheter, faecal management devices, nasopharyngeal airway and intravascular devices) should be inspected: • at the beginning of the shift • each time the patient is repositioned or adjusted • where applicable when dressings are changed.	Consensus IIMS
6.	Documentation of pressure injury risk assessment scale and visual inspection should occur at a minimum of once each shift.	Consensus
7.	All patients are to be regularly assessed for pain, especially in relation to repositioning and in the presence of pressure injuries. If the patient has a pressure injury this should include wound pain assessment [2].	C
Interventions		
8.	Implement preventive strategies to protect the patient's skin as soon as possible following admission or identification of high risk.	Consensus
Interventions: Nutrition		
9.	Conduct nutritional screening and assessment using validated screening and assessment tools appropriate to the population and clinical setting [2].	B
10.	Ensure individual caloric requirements are met for patients at risk of pressure injury [2].	B
Interventions: Support surfaces		
11.	As a minimum use a high specification reactive (constant low pressure) support foam mattress on beds and trolleys for patients at risk of pressure injuries. No one specific high specification reactive (constant low pressure) support foam mattress is better than another [2].	A
12.	Those patients classified as high risk or very high risk of pressure injury should be placed on an active (alternating pressure) support mattress [2].	A
13.	Any device used to prevent heel pressure injuries should be selected and fitted appropriately to ensure pressure is adequately offloaded and hyperextension of the Achilles tendon is avoided.	Consensus
14.	When seated in a chair or wheelchair patients at risk of pressure injury should be placed on the appropriate reactive or active cushion [2].	C

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SECTION	RECOMMENDATION	GOR
	Interventions: Repositioning	
15.	Unless contraindicated at-risk patients should be repositioned at least every two hours [2, 8-12] even if on an active or reactive support surface [2].	C
16.	When deciding on the frequency of repositioning and choice of patient position, the clinician should consider: • risk or presence of pressure injury • skin response • comfort/pain • cognition • ability to move • medical condition • support surface used [2, 8, 13, 14].	Consensus
17.	Reposition patients to reduce duration and magnitude of pressure over vulnerable areas, including under medical devices, bony prominences and heels [2, 8, 13].	A
18.	As a minimum, position patients using 30° lateral inclination alternating from side to side or a 30° inclined recumbent position [2, 8, 13].	C
19.	Patients in seated positions should ideally have pressure relief every 30-60 minutes. For specific patient groups (for example patients with spinal cord injuries) this may need to be more frequent [2, 15].	Consensus
	Infection prevention	
20.	Clinicians should undertake a risk assessment to identity the risk of contamination and mucosal or conjunctival splash injuries during pressure injury prevention and management activities. PPE including impervious gown or apron; goggles/mask or face shield and gloves must be worn according to this risk assessment [16].	NSW Infection Control Policy PD_2007_036
21.	Clinicians must adhere to the Five Moments of Hand Hygiene [17].	NSW Hand Hygiene Policy PD2010_058
22.	To reduce the risk of microbial transmission equipment utilised for each patient must be cleaned as per the Australian Guidelines for Prevention of Infection in Healthcare prior to and following use [18].	Australian Guidelines for Prevention of Infection in Healthcare
	Work, health and safety	
23.	Staff undertaking pressure injury prevention and management activities are to undertake a risk assessment of the intended activity/ies to protect the health and safety of the patient and all staff involved [19].	

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SECTION	RECOMMENDATION	GOR
	Governance, audit and education	
24.	Governance structures and systems are to be in place within each ICU/HDU to support the prevention and management of pressure injuries [20].	Standard 8
25.	As soon as possible after discovery pressure Injuries are to be reported and entered into the appropriate risk management tool as per the NSW Health Pressure Injury Prevention policy [20].	NSW Health policy Standard 8
26.	Equipment and devices are available to implement effective prevention strategies for patients at risk and to manage the patients with existing pressure injuries [20].	Standard 8
27.	Auditing of pressure injury prevention strategies, including: • clinical documentation (i.e. completion of risk assessment tools) • implementation of evidence-based pressure injury prevention strategies • rate of occurrence of pressure injuries • appropriate referral to wound management and allied health • quality improvement and education strategies are to be undertaken on a regular basis [20].	Standard 8 NSW Health Policy
28.	Education in the prevention, assessment and management of pressure injury should be provided to all health professionals.	C

2. INTRODUCTION

Health question/s at focus of clinical practice

The clinical questions underpinning this guideline include:

- what is the prevalence and incidence of pressure injuries in the adult intensive care unit?
- what are the risk factors associated with pressure injuries in the adult intensive care unit?
- what prevention and interventions are required to reduce pressure injury incidence in the adult intensive care unit?

Scope

This guideline is provided so that acute care facilities can develop local practices to support the accurate identification, assessment and associated interventions to reduce the incidence of pressure injuries in critically ill adults in the intensive care environment (individuals aged older than 14). It does not include recommendations regarding assessment, staging of pressure injuries or their associated management. Clinicians should refer to the 2011 Pan Pacific Clinical Practice Guidelines for further details [2].

Target clinicians

This guideline is aimed at clinicians who care for critically ill adults across acute care hospitals in NSW. Specifically, it refers to nursing staff as this clinical practice falls within their scope of practice. Medical Officers were consulted and included during consensus development.

How the guideline was developed

The guideline development methods were based on Rolls and Elliott [21] which was revised to reflect updates from NHMRC [22] and the AGREE tool [23]. A guideline development network (GDN) was formed and this network developed the guideline template that outlined the clinical question and specific areas to be addressed within the guideline. Following this, a systematic review was undertaken (for more details see Evidence review). The practice review was restricted to an evaluation of local practices from the experience of GDN members. A technical report was developed from the systematic review and this document was used to inform discussions and recommendation development at the consensus meeting (March 4, 2013). The discussion was framed around the Pan Pacific Clinical Practice Guideline [2] and edited to reflect intensive care evidence where applicable. NHMRC evidence statement forms were created and formed our evidence audit trail. Following the meeting, the guideline document was written and circulated among group members. Consensus development and organisational consultation was undertaken over three stages:

1. Guideline group consensus – This guideline group received the guideline and technical report. Agreement on recommendations was undertaken using an online survey (Survey Monkey) and a 1-9 Likert scale. Consensus was set as a median of ≥ 7.
2. External validation consensus – another clinician group was recruited from NSW and their agreement with the recommendation statements was sought using the processes outlined above.
3. ACI network consultation – The guideline was circulated through ACI clinical networks with an interest in the guideline.

Following each stage the guideline was revised to reflect the feedback received.

Guideline group

The guideline development network (GDN) (see **Table 1**) was comprised of senior nurses working in NSW intensive care units (ICU) as well as a nursing academic (see author list). This group undertook the bulk of work for the guideline. A consumer who had experienced a pressure injury and had been an intensive care patient reviewed and provided feedback on the guideline.

Evidence review

A systematic literature review was undertaken using the following clinical questions:

1. What is the most reliable method of pressure injury risk assessment in critically ill adult patients?
2. What intrinsic and extrinsic risk factors contribute to the development of pressure injuries in critically ill adult patients?
3. What body position, repositioning regimes and frequency is effective at reducing pressure injuries in critically ill adult patients?
4. Which pressure redistribution devices are effective in reducing the incidence and severity of pressure injuries in critically ill adult patients?

How to use the guideline

This guideline is provided as a tool to inform the development of local practices in NSW acute care facilities. It should be used in conjunction with other processes normally used to develop practice guidelines which may include: local audit of practice and outcomes; review of relevant literature; and reference to other practice guidelines. While a concerted effort was made to include relevant literature, other studies may have been published since this guideline was written and these should be identified, reviewed and considered for inclusion. This guideline should be critically evaluated like all identified literature.

Recommendation grading taxonomy

The Australian NHMRC [24] levels of evidence were used to grade the recommendations (**Appendix 1** NHMRC levels of evidence). Where suitable research evidence was not available, the GDN members formulated a recommendation based on their clinical experience and the NSW survey of practice. These recommendations were then voted upon using a 1-9 (Disagree 1-3, Neutral 4-6 and Agree 7-9) Likert scale with consensus agreement was set as a median of 7.

Table 2: NHMRC Grading of recommendation

GRADE OF RECOMMENDATION	DESCRIPTION
A	Body of evidence can be trusted to guide practice
B	Body of evidence can be trusted to guide practice in most situations
C	Body of evidence provides some support for recommendation(s) but care should be taken in its application
D	Body of evidence is weak and recommendation must be applied with caution
Consensus	Where no evidence could be applied consensus opinion developed by: • formulation of recommendation through discussion • assignment of agreement by individual participants (Likert 1-9) • consensus set at median of 7

Glossary

TERM	DEFINITION
Active support surface	A powered support surface that produces alternating pressure through mechanical means, thereby providing the capacity to change its load distribution properties with or without an applied load. This generally occurs through alternation of air pressure in air cells on a programmed cycle time. Also called an alternating pressure support surface or a dynamic support surface.
Alternating pressure support surface	A powered support surface that produces alternating pressure through mechanical means thereby providing the capacity to change its load distribution properties with or without an applied load. This generally occurs through alternation of air pressure in air cells on a programmed cycle. Also called an active support surface or a dynamic support surface.
Blanching erythema	Reddened skin that blanches white under light pressure. May be difficult to visualise in darker skin tones; the damaged skin will differ from the surrounding area appearing with persistent blue or purple hue.
Bony prominence	An anatomical bony projection.
Constant low pressure support surface	A support surface which, in response to applied pressure, distributes interface pressure over a wider body area through immersing and enveloping the patient. May also be referred to as reactive support surface or a static support surface.
Debridement	The removal of non-viable or infected tissue from or adjacent to a wound.
Density related to foam	Density is the weight of the foam in kilograms per cubic metre kg/m3.
Dynamic support surface	A powered support surface that produce alternating pressure through mechanical means, thereby providing the capacity to change its load distribution properties with or without an applied load. This generally occurs through alternation of air pressure in air cells on a programmed cycle. Also called an active support surface or an alternating pressure support surface.
ETT	Endotracheal tube
Erythema	Redness of the skin caused by dilatation and congestion of the capillaries, often a sign of inflammation or infection. May be difficult to visualise in darker skin tones.
Extrinsic factors	Originating outside of the body
Friction	Friction is a mechanical force that occurs when two surfaces move across one another creating resistance between the skin and contact surface.
High specification foam mattress	A type of mattress exhibiting density-hardness, support factor and depth characteristics superior to a "standard" mattress. Classified as Type H or HR according to Australian Standards (AS2281-1993).
Incidence	The proportion of at-risk patients who develop a new pressure injury over a specific period.
Intrinsic factors	Originating within the body
Interface pressure	The pressure between the patient's body and the support surface in use.
Low air loss	A support surface that allows air to escape from air cells to manage skin heat and humidity. Available as overlays, replacement mattresses or within a whole bed system.
Medical grade sheepskin	A sheepskin that complies with the internationally recognised Australian Standard AS4480.1-1998.

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Moisture	Moisture alters resilience of the epidermis to external forces by causing maceration, particularly when the skin is exposed for prolonged periods. Moisture can occur due to spilt fluids, incontinence, wound exudate and perspiration
Non-blanching erythema	Erythema that remains reddened when pressure is applied and removed
Nutritional assessment	General assessment of nutritional status
Offload	To remove pressure from a skin surface
Oral nutritional supplement	A commercial or other prepared food or beverage that supplements nutrient and caloric intake.
Overlay	A support surface placed onto a constant low-pressure support surface or a standard mattress. Overlays may be reactive (static) or active (dynamic) devices
Positioning	Position of normal body alignment to promote comfort, safety and relaxation, prevent deformities and reduce the effects of tissue strain on skin.
Pressure injury	A localised injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, shear and/or friction or a combination of these factors.
Pressure injury healing assessment scale	A formal tool to assess and monitor condition of pressure injuries.
Pressure redistribution	The ability of a support surface, on which the patient is placed, to reduce the pressure load on bony prominences in contact with the surface by enabling either immersion or envelopment into the surface.
Prevalence	The total number of a given population with pressure injuries.
Reactive hyperaemia	A reddening of the skin in response to blood reperfusing hypoxic or ischaemic tissues when pressure is eliminated.
Reactive support surface	A support surface which, in response to applied pressure, distributes interface pressure over a wider body area through immersing and enveloping the patient. May be referred to as a constant low-pressure support surface or a static support surface.
Reliability	Measure of reproducibility of a measure
Repositioning	Changing a patient's body position to redistribute the pressure on the bony points that were in contact with the surface supporting the body. The frequency is determined by skin response, support surface in use and a patient's general condition.
Risk assessment scale	Formal scale or score used to help determine the degree of pressure injury risk.
Risk assessment tool	See risk assessment scale (above)
Seating cushion	Static (reactive) or dynamic (active) cushions on a chair for pressure redistribution purposes.
Skin assessment	General examination of the skin
Shear	A mechanical force created from a parallel (tangential) load that causes the body to slide against resistance between the skin and a contact surface. The outer layers of the skin (the epidermis and dermis) remain stationary while deep fascia moves with the skeleton, creating distortion in the blood vessels and lymphatic system between the dermis and deep fascia. This leads to thrombosis and capillary occlusion.
Stage I pressure injury	Pressure injury presenting as intact skin with non-blanchable redness of a localised area usually over a bony prominence.

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Stage II pressure injury	Partial thickness loss of dermis presenting as a shallow, open wound with a red-pink wound bed, without slough.
Stage III pressure injury	Pressure injury presenting as full thickness tissue loss in which subcutaneous fat may be visible but bone, tendon or muscle are not exposed.
Stage IV pressure injury	Pressure injury presenting as full thickness tissue loss with exposed bone, tendon or muscle.
Standard care	A term used to describe usual care, most often in research studies. Standard care varies according to the setting and historical context. Within the context of the guideline, a description of the standard care used in research studies has been provided when available.
Standard mattress	The definition of a "standard" mattress is variable, and may change between facilities and over time. Classified as Type N according to Australian Standards (AS2281-1993).
Static support surface	A support surface which, in response to applied pressure, distributes interface pressure over a wider body area through immersing and enveloping the patient. May be referred to as reactive support surface or a constant low-pressure support surface.
Support surface	A surface on which the patient is placed to manage pressure load by distributing body weight pressure more effectively over the support surface. Support surfaces are classified as reactive (constant low pressure) or active (alternating pressure) surfaces. Includes bed, trolley and operating table mattresses and overlays, integrated bed systems and seat cushions and overlays.
Suspected deep tissue injury	Purple or maroon localised area of discoloured intact skin or blood filled blister due to damage of underlying soft tissue from pressure and/or shear. The area may be preceded by tissue that is painful, firm, mushy, boggy, warmer or cooler as compared to adjacent tissue.
Topical opioids	Topical application of morphine and its metabolites to skin ulcers to provide local relief from pain.
Unstageable pressure injury	Full thickness tissue loss in which the base of the ulcer is covered by slough and or eschar in the wound bed. Until enough slough/eschar is removed to expose the base of the wound, the true depth is unknown and therefore unstageable.
Validity	How well a tool measures the concept it claims to measure

Why is pressure injury prevention important in critically ill adults?

Pressure ulcers or injuries are a common consequence of critical illness and have a significant impact on patient recovery [2, 25]. Because many critically ill adults have multiple risk factors eliminating pressure injuries can be difficult. However because the costs to the patient and the healthcare system are significant [3] clinicians and managers must implement programs to reduce the incidence and severity of pressure injuries. This section will briefly describe the:

- pathophysiology of pressure injury
- risk factors for critically ill adults
- pressure injury incidence and prevalence.

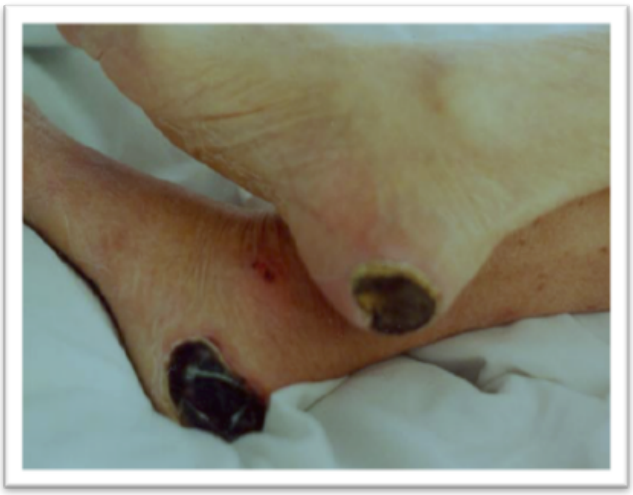
Readers are directed to the 2011 Pan Pacific guideline [2] for a more comprehensive overview.

Pathophysiology of pressure injury

Traditionally, pressure injuries have been attributed to compression of tissue between bony prominences and support surfaces. Current consensus however is that pressure injury development is complex and the result of a number of intrinsic and extrinsic factors. Current research indicates that the important extrinsic factors are pressure, shear and friction forces as well as the micro climate of the skin [25].

When patients are in a bed or chair different mechanical forces will be applied to tissues; these forces include pressure, shear and friction. Pressure injuries occur where

Figure 1: Unstageable heel pressure injury



these forces impair and/or damage microcirculation leading to tissue hypoxia and necrosis [2, 26].

Direct pressure

A direct pressure injury occurs when tissue is compressed between bone and a hard surface. Where this compression exceeds capillary pressure tissue ischemia and cellular hypoxia will occur and if the pressure is not removed tissue damage and ultimately necrosis can occur [27, 28]. Because patient risk factors vary the time to pressure injury may be as little as 30 minutes and up to four hours [29]. Prevention of pressure injuries revolves around positioning patients to minimise and if possible relieve this pressure.

Bending of the tissue lines in B (**figure 2**) shows that when external pressure is applied over a bony prominence, compressive, shear (distorting) and tensile (stretching) stresses occur.

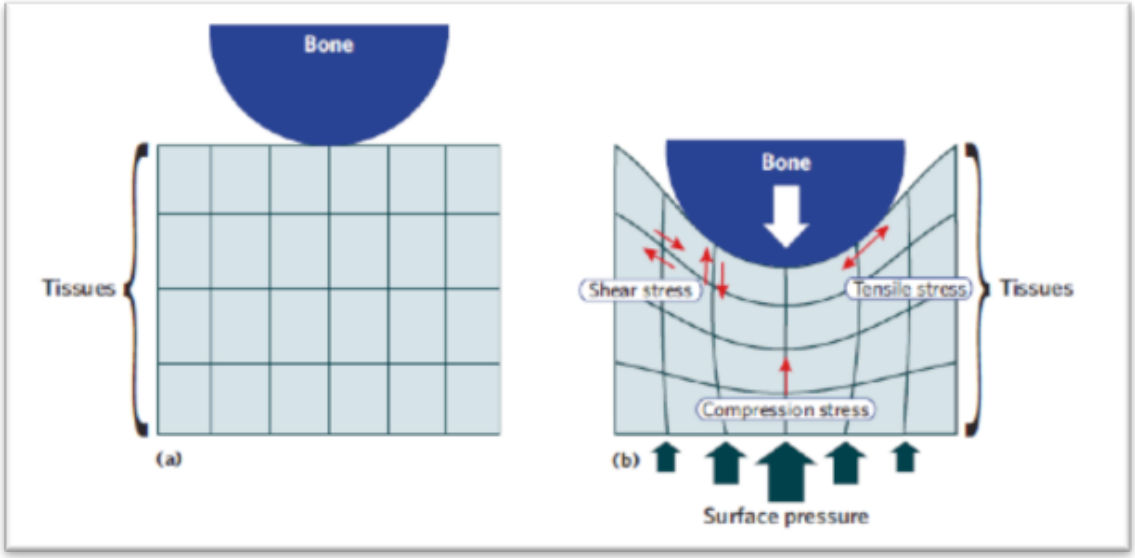


Figure 2: Tissue distortion due to pressure. Taken from Takahashi et al, 2010 [28].

Used with permission.

Shear injuries

Shear injuries occur because the patient's position allows the skeleton to slide, distorting tissue and damaging cells. Prevention of shear injury involves positioning the patient so that they are less likely to slide. Areas susceptible to these injuries include the heels and sacrum [2].

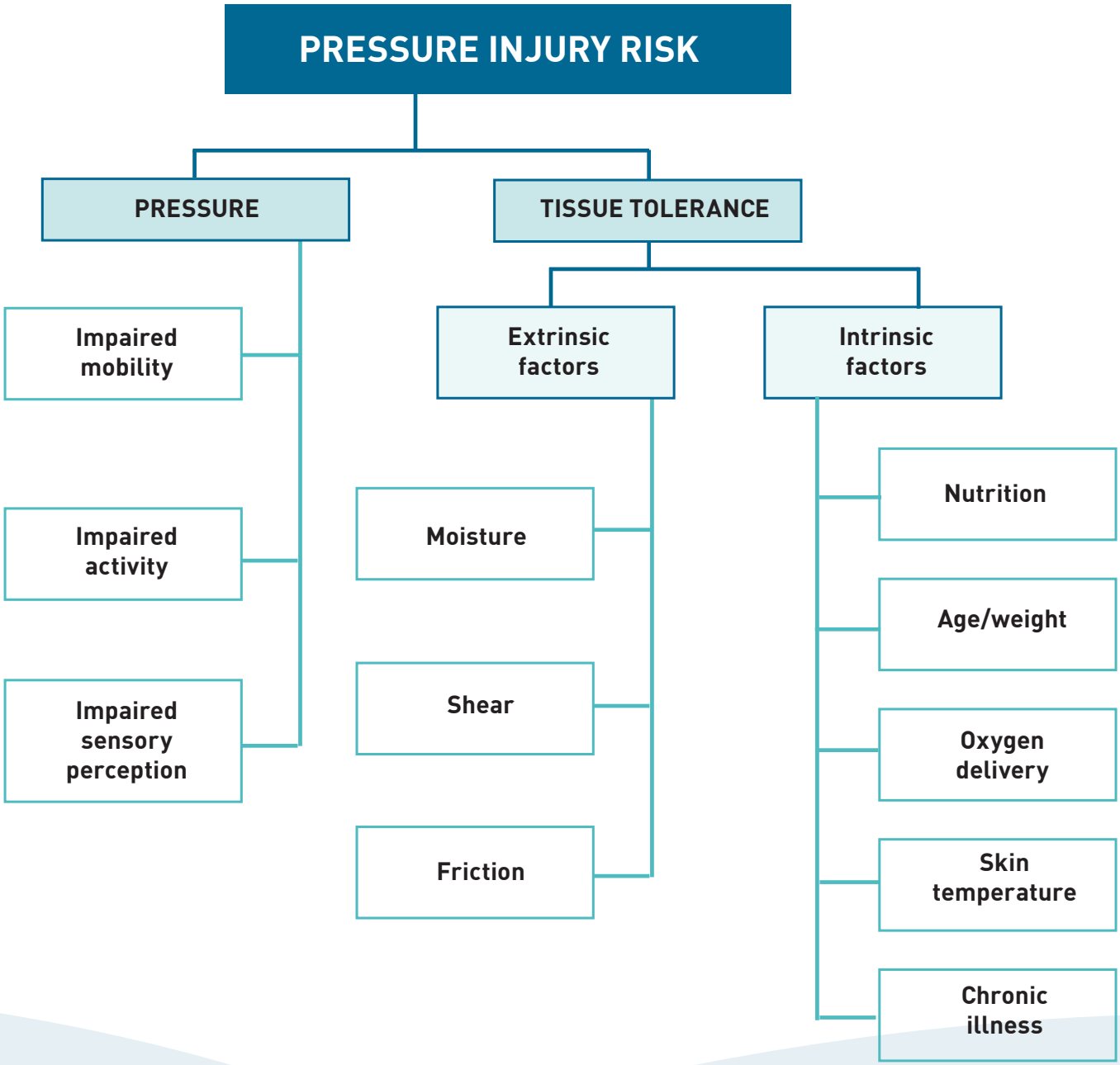
Friction injuries

Friction injuries occur because the patient's skin is dragged across a surface burning the skin and damaging the stratum corneum [2, 26]. To prevent these injuries clinicians should protect the skin by lifting patients and using protective dressings.

Micro climate

Ensuring a favourable microclimate is now seen as an integral component of pressure injury prevention (30). The microclimate includes the skin surface or tissue temperature and the humidity or skin surface moisture at the body-support surface interface [30]. Risk factors that contribute to increased skin moisture include perspiration, incontinence or wound/fistula drainage. Excess skin moisture and relative high humidity can add to skin damage due to pressure, shear and friction. Treatment options include: 1) management of incontinence; 2) use of barrier creams; 3) temperature control; and 4) air-fluidised mattresses [2, 30].

Figure 3: Factors associated with pressure injuries *(adapted from 2)*



Risk factors for critically ill adults

The evidence base for determining pressure injury risk factors among critically ill adults is mixed with few high quality studies. In most studies it is difficult to separate the effects of critical illness and treatment from pre-existing risk factors (see **Table 3**). It is clear however that most, if not all, critically ill adults will be at significant risk of developing a pressure injury, especially patients where delivery of oxygen to peripheral tissues is limited. Clinicians should ensure that clinical practices that restrict patient movement, such as spinal immobilisation, should be removed as quickly as possible.

Table 3: Risk factors associated with pressure injury development in critically ill adults

RISK FACTORS	
LEVEL OF RISK	**RISK FACTOR**
Highly significant	• Age • Length of stay * • Heart failure • Serum albumin/Nutrition • Incontinence • BMI <18 • Immobility/less repositioning • Infection* • Spinal cord injury
Probably significant	• BMI >35 • Vasopressors
Possibly a risk	• Emergency admission
* interaction with critical illness	

For more details please refer to **Appendix 3** Risk factors for critically ill adults

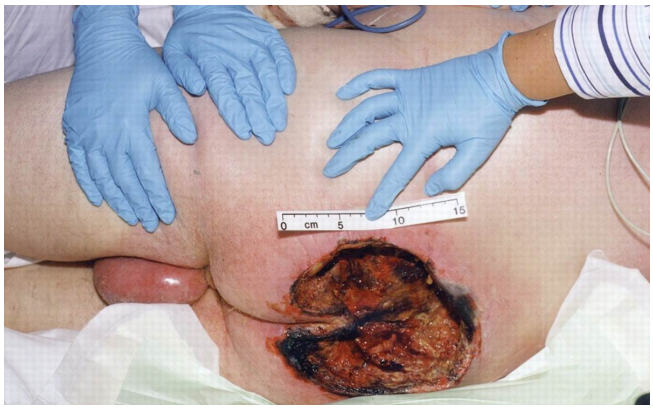


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Figure 4: Sacral pressure injury in elderly patient post spinal immobilisation.

Pressure injuries incidence and prevalence

The current evidence addressing the epidemiology of pressure injuries in the critically ill adult patient is limited by the poor quality of the literature, with a moderate to high level of bias associated with most studies. Pressure injuries are most prevalent in the lower half of the body including the areas over the sacrum, coccyx, buttocks and lower heels [10, 31-33]. Pressure is concentrated wherever weight-bearing points come in contact with surfaces and it is reported that there is an increased prevalence with bony as opposed to non-bony pressure areas [34]. However due to the conjecture on how pressure injuries begin we need to be mindful of more than just bony prominences, especially in the ICU where several invasive adjuncts may be used.

Prevalence of pressure injuries in the critically ill adult in the literature ranged from 4% to 53.4%. The incidence ranged from 12.4% to 18.7% There is a greater incidence of pressure injuries grade 1 – 2 than Grade 3 – 4 [9-11, 31, 33]. However, more recently, with the advent of the classification in 2009 (EUPAP) of the suspected deep tissue injury and unstageable pressure injury, two of the more recent studies [31, 34] do report a higher and increasing incidence of these classifications of pressure injuries.

Pressure injuries in NSW ICUs

In 2012, an evaluation of pressure injuries reported by NSW ICUs during 2009-2011 was undertaken. At this time a suspected pressure injury required mandatory reporting. After data cleaning, 2427 pressure injuries were reported (790 in 2009, 863 in 2010 and 774 in 2011) with the vast majority reported as ICU-acquired (72% in 2009, 61% in 2010 and 73% in 2011). Most incidents were classified as SAC level 3 or 4. In each year, level 6 ICUs reported more than 59% of injuries (70% in 2009, 72% in 2010 and 59% in 2011). The distribution of pressure injuries by body location is shown in Figure 5 Distribution of pressure injuries report in IIMS 2009-2011. The most common specific locations were:

1. Sacrum
   (29% in 2009; 30.1% in 2010; 29% in 2011)
2. Heels
   (19.7% in 2009; 16.3% in 2010; 19.7% in 2011)
3. Buttock
   (11.1% in 2009; 14.8% in 2010; 11.1% in 2011)
4. Lips/mouth
   (9.2% in 2009; 8.8% in 2010; 6.6% in 2011)
5. Nose/nares
   (6.9 % in 2009; 7.5% in 2010; 6.3% in 2011)

Where a pressure injury was reported, 29% were attributed to a medical device. The most common devices were ETT tapes (21-29%), nasogastric tubes (14-16%), ted stockings (9-18%) and cervical spine collars (4-7%).

Given the quality of current studies and the limited reporting of pressure injury skin location data, it is difficult to compare or adequately describe the current local pressure injury problem. The NSW distribution of injuries is similar to an international study [26% heels; 20% sacrum/coccyx; 19% head] [33] but different to that described in a quality improvement project from a local tertiary referral ICU (60% heel; 30% sacrum; 10% other) [36]. These results suggest a high incidence when compared to Australian and international data [37].

Figure 6: Upper lip pressure injury secondary to commercial ETT holder.

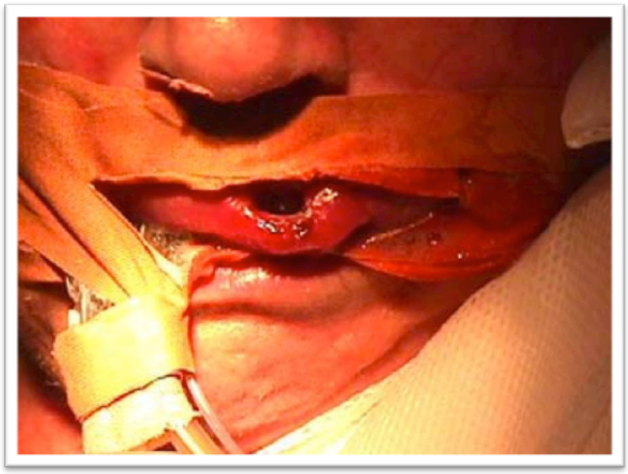
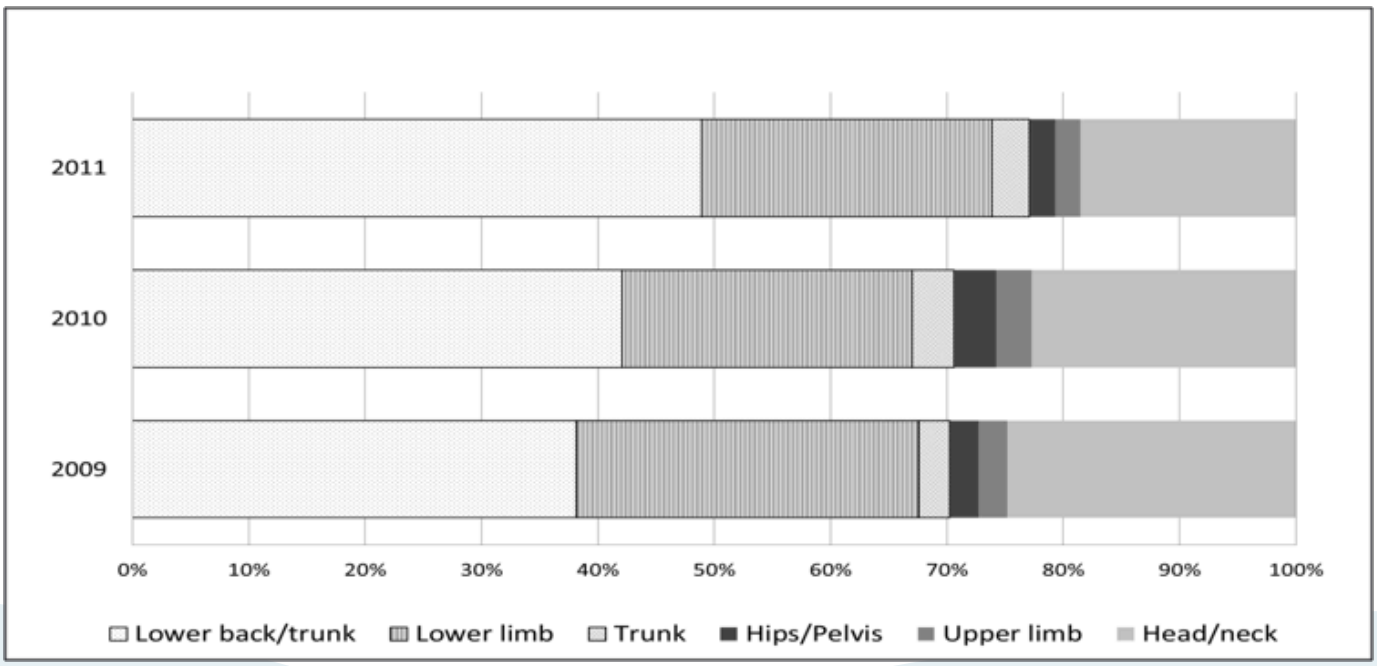


Figure 5: Distribution of pressure injuries report in IIMS 2009-2011



3. RECOMMENDATIONS FOR PRACTICE

Patients and carers

SECTION	RECOMMENDATION	GOR
	Patients and carers	
1	Patients, families and careers are informed of the risks, prevention strategies and management of pressure injuries. Development of the pressure injury management plan is to occur in partnership with the patient, family and carers if appropriate.	Consensus

A pressure injury has a substantial impact on all aspects of a patient's life. There is little data describing the specific impact on patients recovering from critical illness however a systematic review focusing on the impact on the quality of life for the elderly is instructive [4]. A pressure injury causes significant physical symptoms, especially pain, with the consequences of restriction on mobility and insomnia [1]. Rehabilitation from the primary illness, as well as treatment for other conditions, may be delayed further restricting recovery. Once discharged from hospital, patients may experience social isolation as they withdraw from pre-illness activities, further complicated by ongoing management of the pressure injury. In particular the odour from an exudating wound is of particular concern. Patients also experience a loss of control and independence. To promote an understanding of pressure injury prevention practices patients and families should be provided with clear information.

Table 4: Health-related quality of life impact on the elderly

HEALTH-RELATED QUALITY OF LIFE THEME	ELEMENTS
Physical impact and limitations (11 studies)	• Restricted ADLs • Lifestyle change: incorporation of skin care and pressure injury treatment • Need for environmental changes • Loss of appetite and interest in physical activities, insomnia and reduction of engagement in life
Social life (10 studies)	• Restriction in social activity • Social isolation • Problems in interpersonal relationships
Psychological impact (12 studies)	• Alteration in body image and self-concept • Struggle for control • Loss of independence • Negative emotions including mood, anger, frustration, anxiety and depression
Impact of pressure injury symptoms (15 studies)	• Pain impacting on all areas of life • Interference with ADLs
Impact on general health and consequences (12 studies)	• Extended hospital stay • Re-admission • Delays rehabilitation process • Restriction on treatment options for other medical problems

• Compiled from Gorecki [4, 32] • HRQL health-related quality of life

Pressure injury risk assessment

Clinical question: *What is the most reliable method of pressure injury risk assessment for the intensive care patient?*

SECTION	RECOMMENDATION	GOR
	Assessment	
2.	Use a pressure injury risk assessment scale in conjunction with a comprehensive visual assessment to determine the patient's risk of pressure injury and to inform the development of a prevention plan.	Consensus
3.	The Braden Scale for Predicting Pressure Sore Risk is the recommended validated and reliable tool for assessing pressure injury risk in critically ill adults [6, 7].	B
4.	Inspect all of the skin and devices attached to the patient within two hours of admission, at each repositioning and each shift change to identify indications of pressure injury including: [2] • for fair skin races – erythema and for darker pigmented skin – persistent blue or purple hue • blanching response • localised heat • oedema • induration • skin breakdown	C
5.	The skin and mucosa impacted by invasive medical devices (including but not limited to nasogastric tubes, tracheal tubes, urinary catheter, faecal management devices, nasopharyngeal airway and intravascular devices) should be inspected: • at the beginning of the shift • each time the patient is repositioned or adjusted • where applicable when dressings are changed.	Consensus IIMS
6.	Documentation of pressure injury risk assessment scale and visual inspection should occur at a minimum of once each shift.	Consensus
7.	All patients are to be regularly assessed for pain, especially in relation to repositioning and in the presence of pressure injuries. If the patient has a pressure injury this should include wound pain assessment [2].	C

There are three main risk assessment tools used in intensive care units; the Braden Scale, Waterlow Score and the Norton Scale. At this time "there is no high quality risk randomised control trial evidence which identifies that undertaking a structured risk assessment reduces the incidence of pressure injury"[38]. In the critical care setting however, there are a number of studies that have investigated which pressure risk assessment tool is the most appropriate to use in the intensive care unit.

Due to the nature of risk assessment tools, it is difficult to interpret some results of the studies including the specificity and the positive predictive value as these results are influenced by the interventions used when a patient is identified as being at risk. When compared to the Waterlow Score and the Norton Scale, the Braden Scale [6, 7] showed greater reliability at identifying which patients would develop a pressure injury. The negative predictive values for the Braden Scale were also higher than for both the Waterlow and the Norton Scales . The area under the receiver operator curve was also greater in the Braden Scale, recording fair to good results in the area under the curve when compared (See **Appendix 4** Risk assessment tools - Sensitivity and specificity).

Interventions

Clinical question: *What prevention and interventions are required to reduce pressure injury incidence in the adult ICU?*

SECTION	RECOMMENDATION	GOR
	Interventions	
8.	Implement preventive strategies to protect the patient's skin as soon as possible following admission or identification of high risk.	Consensus
	Interventions: Nutrition	
9.	Conduct nutritional screening and assessment using validated screening and assessment tools appropriate to the population and clinical setting [2].	B
10.	Ensure individual caloric requirements are met for patients at risk of pressure injury [2].	C

Support Surfaces

Ideally, all intensive care unit beds should have alternating pressure support mattresses however, all patients who are classified as high risk or who have an existing or greater than grade two pressure injury must have an active alternating pressure mattress. Unless contraindicated, at risk patients should be repositioned at least every two hours. The use of available pressure redistribution surface should be escalated in accordance with the Braden Scale.

SECTION	RECOMMENDATION	GOR
	Interventions: Support surfaces	
11.	As a minimum use a high specification reactive (constant low pressure) support foam mattress on beds and trolleys for patients at risk of pressure injuries. No one specific high specification reactive (constant low pressure) support foam mattress is better than another [2].	A
12.	Those patients classified as high risk or very high risk of pressure injury should be placed on an active (alternating pressure) support mattress [2].	A
13.	Any device used to prevent heel pressure injuries should be selected and fitted appropriately to ensure pressure is adequately offloaded and hyperextension of the Achilles tendon is avoided.	Consensus
14.	When seated in a chair or wheelchair patients at risk of pressure injury should be placed on the appropriate reactive or active cushion [2].	C

Practice point 1: Protect and promote skin integrity

Protect and promote skin integrity by:

- not vigorously rubbing the patient's skin
- developing and implementing an individualised continence management plan
- protecting the skin from moisture by using pH balanced skin cleanser and drying thoroughly
- using water-based skin emollients to maintain skin hydration.

Repositioning

Repositioning has long been thought of as the mainstay practice for pressure injury prevention in critically ill patients in combination with the use of pressure redistribution surfaces [12]. Repositioning regimes often vary according to staff availability, unit protocols, staff skill mix and the patient's severity of illness [39]. Frequent repositioning is thought to have a positive impact on reducing pressure injury incidence and/or severity; however consensus about the frequency of repositioning has not been clearly described in relation to intensive care unit settings [39]. Having reviewed the current literature the group consensus was that all patients within the ICU should be repositioned at a minimum of second hourly unless contraindicated by their medical condition [2, 9]. The frequency of repositioning is considered independent of the type of pressure redistribution surface the patient is on [13].

Repositioning of the patient is classified as a change in the patient's position that changes the area/s of increased interface pressure. It is described as a minimum change in position of 30° lateral incline, supported with pillows behind the back and knees [13]. It is also recommended that patients remain with a head-up position of 30° and knees bent [8]. The 30° head-up position is chosen as opposed to 45° due to the increased risk of shearing forces placed on the body at a 45° angle. An angle of not less than 30° is preferred as it is inline with the ventilator-associated pneumonia prevention bundle (2008) [8].

The patient position should be chosen and alternated at a minimum of two hours according to several factors including, but not limited to, the patient's underlying presentation/illness, patient comfort, position of invasive/non-invasive devices, and haemodynamic stability. This could include the use, where appropriate, of prone positioning [14]. During repositioning staff should always check the positioning of heels, bony prominences, and the location of medical devices. Pressure injuries secondary to medical devices accounted for 29% of injuries reported on IIMS in NSW ICUs between 2009-2011.

Patients in the seated position are shown to have an increased risk for pressure injury [10]. For patients in the seated position it is recommended that, for those patients who are not able to reposition themselves at regular intervals, a minimum of hourly repositioning is attended to [8]. Alternatively, complete removal of the interface pressure should be achieved through standing or elevation from the seated position. If patients are scored 'at risk' according to the Braden Scale for Predicting Pressure Sore Risk, a pressure redistribution surface should also be used in the chair [8].

SECTION	RECOMMENDATION	GOR
	Interventions: Repositioning	
15.	Unless contraindicated at-risk patients should be repositioned at least every two hours [2, 8-12] even if on an active or reactive support surface [2].	C
16.	When deciding on the frequency of repositioning and choice of patient position, the clinician should consider: • risk or presence of pressure injury • skin response • comfort/pain • cognition • ability to move • medical condition • support surface used [2, 8, 13, 14].	Consensus
17.	Reposition patients to reduce duration and magnitude of pressure over vulnerable areas, including under medical devices, bony prominences and heels [2, 8, 13].	A
18.	As a minimum, position patients using 30° lateral inclination alternating from side to side or a 30° inclined recumbent position [2, 8, 13].	C
19.	Patients in seated positions should ideally have pressure relief every 30-60 minutes. For specific patient groups (for example patients with spinal cord injuries) this may need to be more frequent [2, 15].	Consensus

Practice point 2: Repositioning patients

When repositioning a critically ill adult, staff should ensure that:

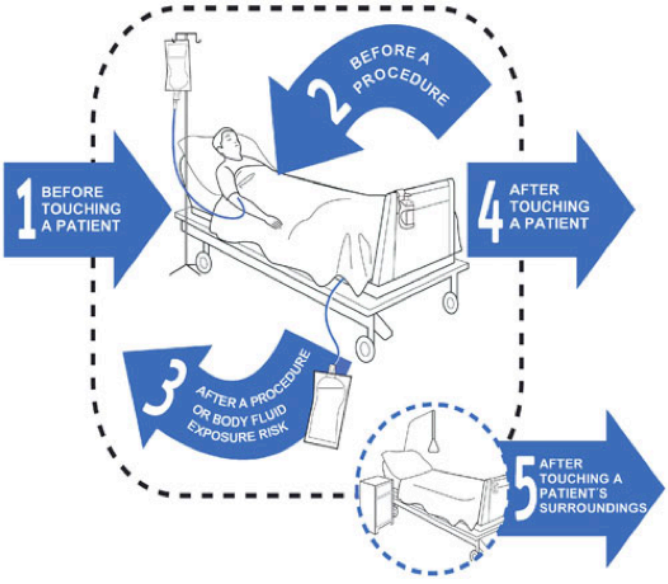
- all medical devices, especially tracheal tubes and central lines, are being monitored to ensure accidental dislodgment does not occur and the tubing and lines are not left where they can lead to pressure or mucosal injury.
- an experienced clinician is holding the tracheal tube to ensure it remains within the trachea. This is especially important for patients where re-intubation is difficult, such as those with tracheostomy tubes in situ for less than 72 hours and/or obese patients with adjustable flange tubes.
- Bedding is not folded underneath the patient.

Infection prevention

SECTION	RECOMMENDATION	GOR
	Infection prevention	
20.	Clinicians should undertake a risk assessment to identity the risk of contamination and mucosal or conjunctival splash injuries during pressure injury prevention and management activities. PPE including impervious gown or apron; goggles/mask or face shield and gloves must be worn according to this risk assessment [16].	NSW Infection Control Policy PD_2007_036
21.	Clinicians must adhere to the Five Moments of Hand Hygiene [17].	NSW Hand Hygiene Policy PD2010_058
22.	To reduce the risk of microbial transmission equipment utilised for each patient must be cleaned as per the Australian Guidelines for Prevention of Infection in Healthcare prior to and following use [18].	Australian Guidelines for Prevention of Infection in Healthcare

Hand hygiene

The NSW Health Hand Hygiene Policy (PD2010_058) states that all staff must perform hand hygiene as per the 5 Moments for Hand Hygiene (http://www.hha.org.au/). Hand hygiene must occur before touching the patient; prior to a procedure; after a procedure or body fluid exposure risk; after touching a patient; after touching a patient's surroundings. Hand hygiene can be performed using appropriate soap solutions and water or alcohol-based hand rub (ABHR). Soap and water must be used when hands are visibly soiled.



'Based on the 'My 5 moments for Hand Hygiene', URL: http://www.who.int/gpsc/5may/background/5moments/en/index.html © World Health Organization 2009. All rights reserved.'

NSW Ministry of Health policies

Prevention of infection is an important aspect of any clinical practice guideline. Users are directed to the following policy directives covering infection control. Local policy must also be consulted.

1. Infection Control Policy - http://www0.health.nsw.gov.au/policies/pd/2007/PD2007_036.html
2. Infection Control Policy: Prevention & Management of Multi-Resistant Organisms (MRO) http://www0.health.nsw.gov.au/policies/pd/2007/PD2007_084.html
3. Hand Hygiene Policy http://www0.health.nsw.gov.au/policies/pd/2010/pdf/PD2010_058.pdf
4. Australian Guidelines for the Prevention and Control of Infection in Health Care http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/cd33_complete.pdf

Personal protective equipment

The Australian Guidelines for the Prevention and Control of Infection in Health Care and the NSW Infection Control Policy (PD2007_036) state that all procedures that potentially expose the clinician to blood or body fluids require the appropriate PPE to be worn. When assessing the patient for pressure injury prevention strategies or undertaking pressure injury prevention activities the clinician is to consider the potential for exposure to blood and body fluids and is to utilise the appropriate Personal Protective Equipment (PPE).

Workplace health and safety

SECTION	RECOMMENDATION	GOR
	Work, health and safety	
23.	Staff undertaking pressure injury prevention and management activities are to undertake a risk assessment of the intended activity/ies to protect the health and safety of the patient and all staff involved [19].	NSW Work Health and Safety Act 2011

Prevention of work injury is an important aspect of any clinical practice guideline. Users are directed to the following policy directives covering work health and safety. Local policy must also be consulted.

NSW Work Health and Safety Act 2011
http://www.legislation.nsw.gov.au/maintop/view/inforce/act+10+2011+cd+0+N

The NSW Work Health and Safety Act 2011 states that organisations must eliminate the health and safety risks to workers where at all possible. When it is not possible to eliminate risks, the risk must be minimised as far as reasonably practicable. Organisations must provide appropriate PPE for use by staff. Staff have a responsibility to use that PPE according to policy.

The worker has an obligation under the NSW Work Health and Safety Act (2011) to;

i) take all reasonable care for their own safety
ii) take care that their acts or omissions do not adversely affect the health and safety of other persons
iii) comply with any reasonable instruction that they are given.

Practice point 3: Preventing staff injury during pressure injury prevention

A risk assessment will help to prevent staff injury by identifying:
- the lifting equipment required
- the number of staff required and the roles that they will complete.

Please refer to **Table 8** Example St George Hospital Manual Task Risk Assessment Form for a Bariatric Patient and **Table 9** Example St George Hospital Safe Work Practice for a slide sheet.

Governance and education

SECTION	RECOMMENDATION	GOR
	Governance, audit and education	
24.	Governance structures and systems are to be in place within each ICU/HDU to support the prevention and management of pressure injuries [20].	Standard 8
25.	As soon as possible after discovery pressure injuries are to be reported and entered into the appropriate risk management tool as per the NSW Health Pressure Injury Prevention policy [20].	NSW Health policy Standard 8
26.	Equipment and devices are available to implement effective prevention strategies for patients at risk and to manage the patients with existing pressure injuries [20].	Standard 8
27.	Auditing of pressure injury prevention strategies, including: • clinical documentation (i.e. completion of risk assessment tools) • implementation of evidence-based pressure injury prevention strategies • rate of occurrence of pressure injuries • appropriate referral to wound management and allied health • quality improvement and education strategies are to be undertaken on a regular basis [20].	Standard 8 NSW Health Policy
28.	Education in the prevention, assessment and management of pressure injury should be provided to all health professionals.	C

4. GUIDELINE DEVELOPMENT HISTORY

1. April 2012 – CPG topic identified; GDN executive formed; guideline scope and systematic review formulated
2. May 2012 – Team building; finalisation of guideline scope and CPG workplan; evidence-based practice education; team plan
3. May 2012 - January 2013 – Systematic review work undertaken culminating in development of technical report
4. November 27 2012 – Consensus development meeting – recommendation development
5. December 2012 - February 2012 – Guideline writing
6. August 2013 – Internal consensus – all recommendations achieve consensus (see Table 1) however IQR of recommendation 20 only 6-9. Therefore wording changed to improve clarity
7. August 2013 – External validation
    - Recommendation 20 was removed after external validation
8. August 2013 – Organisation consultation via ACI networks

Table 5: Guideline consensus results

RECOMMENDATION	1	2	3	4	5	6	7	8	9	10
Internal consensus	8 (8-9)	8 (8-9)	7 (7-9)	9 (9-9)	9 (9-9)	8 (7-9)	8 (8-9)	9 (9-9)	8 (7-9)	8 (7-9)
External validation	8 (7.7-8)	8 (8-8)	8 (7-8)	8 (8-9)	8 (7.7-9)	8 (7-8.5)	8 (7.7-9)	9 (8-9)	8 (8-8.5)	8 (8-8.5)

RECOMMENDATION	11	12	13	14	15	16	17	18	19	20
Internal consensus	8 (7-9)	9 (9-9)	9 (8-9)	8 (8-9)	8 (8-9)	8 (8-9)	8.5 (8.-9)	8 (8-9)	8 (7.-9)	7 (6-9)
External validation	9 (8-9)	9 (8-9)	9 (7.7-9)	8 (8-9)	8 (7-8.5)	8 (8-8.5)	8 (8-9)	8 (7-8)	8 (7-9)	7 (5.7-7)

RECOMMENDATION	21	22	23	24	25	26	27	28	29	30
Internal consensus	8 (7-9)	5 (5-9)	8.5 (6.5-9)	8 (6.75-9)	9 (7.75-9)	8 (7.75-9)	8 (7.75-9)	8 (7-9)	7 (6.5.-9)	9 (8-9)
External validation	8 (7-9)	9 (8.7-9)	9 (8-9)	9 (9-9)	9 (8-9)	8 (8-8.5)	8 (8-8.5)	8 (7..7-8)	9 (9-9)	

5. IMPLEMENTATION TOOLS

The value of quality improvement projects should not be underestimated and is a current standard included in the NSQHS Standard 8 as 8.3.1. Quality improvement projects, including raising awareness through education, have been identified as reducing the prevalence and cost [2, 36, 40-42] of pressure injuries. The effect of closer inspection and correct identification through education included in quality improvement projects is arguably an effective management strategy for reducing incidence and prevalence of pressure injuries.

The development of a pressure area prevention bundle, which outlines assessment and management strategies for pressure injuries, would ideally be introduced for use by clinicians working in Intensive care units. Such a bundle would need to include information addressing impaired mobility, skin health and nutrition. It would also need to include a validated risk assessment tool. [13].

Skin assessment tool

These images are available for NSW Health clinicians by contacting ICCMU.

Figure 7: Dorsal pressure injury sites

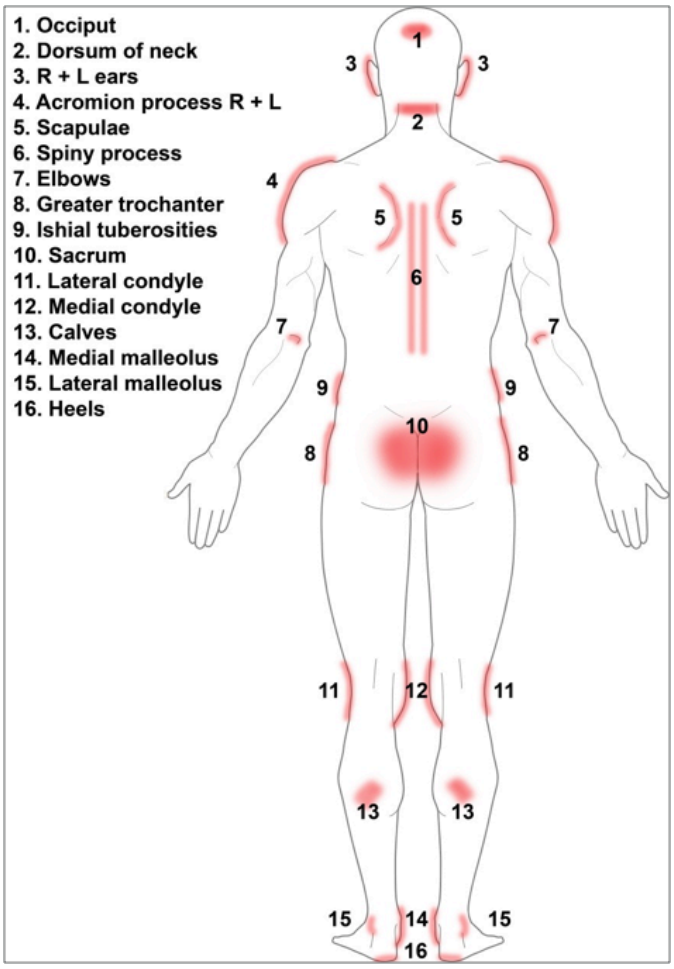
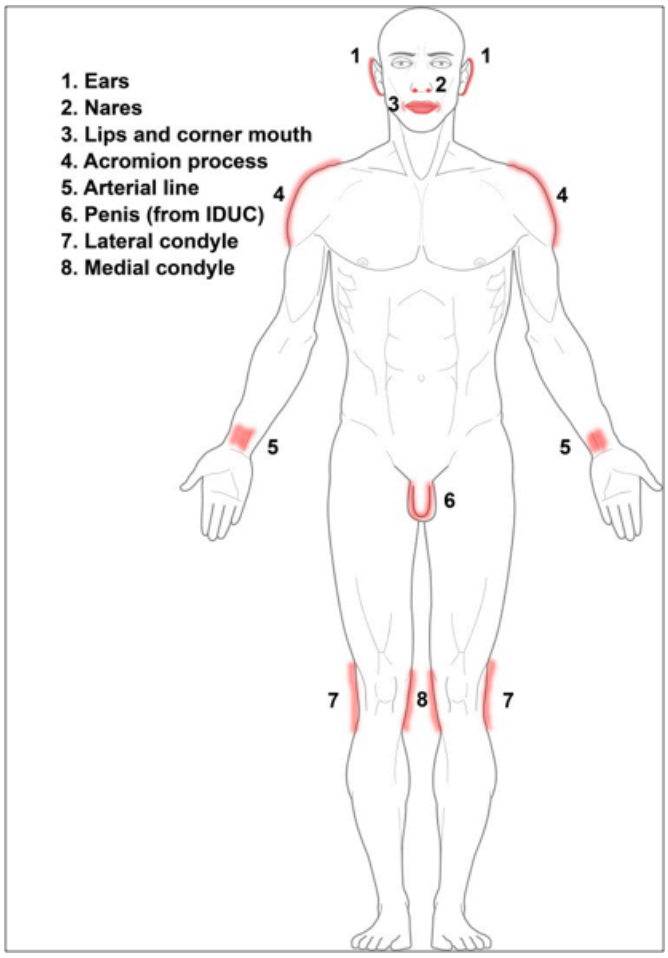


Figure 8: Frontal pressure injury sites



Risk assessment tools

Table 6: Braden Scale for Predicting Pressure Sore Risk

	1	2	3	4
SENSORY PERCEPTION Ability to respond meaningfully to pressure-related discomfort	**Completely limited** Unresponsive (does not moan, flinch or grasp) to painful stimuli, due to diminished level of consciousness or sedation OR Limited ability to feel pin over most of body	**Very limited** Responds only to painful stimuli. Cannot communicate discomfort except by moaning or restlessness OR Has sensory impairment which limits the ability to feel pain or discomfort over ½ of body.	**Slightly limited** Responds to verbal commands, but cannot always communicate discomfort or the need to be turned OR Has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities	**No impairment** Responds to verbal commands. Has no sensory deficit which would limit ability to feel or voice pain or discomfort
MOISTURE Degree to which skin is exposed to moisture	**Constantly moist** Skin is kept moist almost constantly by perspiration, urine etc. Dampness is detected every time patient is moved or turned	**Very moist** Skin is often, but not always moist. linen must be changed at least once a shift	**Occasionally moist** Skin is occasionally moist, requiring an extra linen change approximately once per day	**Rarely moist** Skin is usually dry, linen only requires changing at routine intervals.
ACTIVITY Degree of physical activity	**Bedfast** Confined to bed	**Chair fast** Ability to walk is severely limited or non-existent. Cannot bear own weight &/or must be assisted into chair or wheelchair	**Walks occasionally** Walks occasionally during day, but for very short distances with or without assistance. Spends majority of each shift in bed or chair	**Walks frequently** Walks outside room at least twice a day and inside room at least once every two hours during waking hours
MOBILITY Ability to change and control body position	**Completely immobile** Does not make even slight changes in body or extremity position without assistance	**Very limited** Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently	**Slightly limited** Makes frequent though slight changes in body or extremity position independently	**No limitation** Makes major and frequent changes in position without assistance
NUTRITION Usual food intake pattern	**Very poor** Never eats a complete meal. Rarely eats more than ½ of any food offered. Eats 2 servings or less of protein (meat or dairy) per day. Takes fluids poorly. Does not take a liquid dietary supplement OR Is NPO &/or maintained on clear liquids or IVs for more than 5 days	**Probably inadequate** Rarely eats a complete meant and generally eats only about ½ of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement OR Receives less than optimum amount of liquid diet or tube feeding	**Adequate** Eats over half of most meals. Eats a total of 4 servings of protein (meat or dairy products) per day. Occasionally will refuse a meal, but will usually take a supplement when offered	**Excellent** East most of every meal. Never refuses a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation
FRICTION & SHEAR	**Problem** Requires moderate to maximum assistance in moving. Complete lifting without siding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractures or agitation leads to almost constant friction	**Potential problem** Moves feebly or requires minimum assistance. During a move, skin probably slides to some extent against sheets, chair, restraints or other devices. Maintains relativity good position in chair or bed most of the time but occasionally slides down	**No apparent problem** Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair	

RISK RATING	SEVERE RISK	HIGH RISK	MODERATE RISK	MILD RISK	NO RISK
	≤ 9	10-12	13-14	15-18	19-23

Braden & Bergstrom (1987) [43]

Table 7: Staging pressure Injury

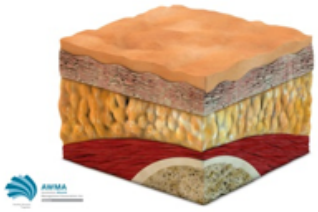
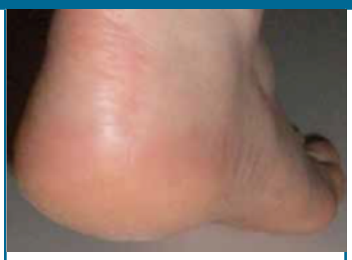
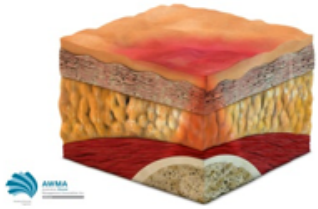
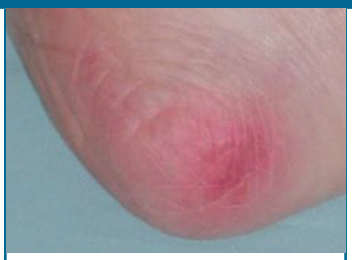
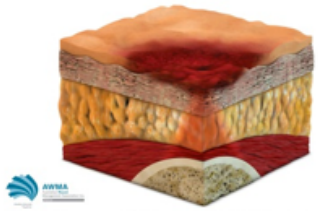
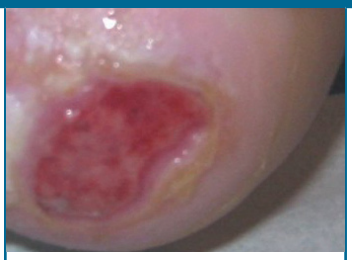
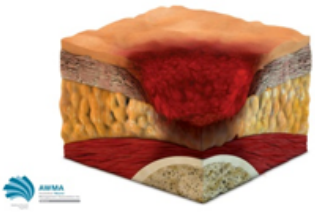
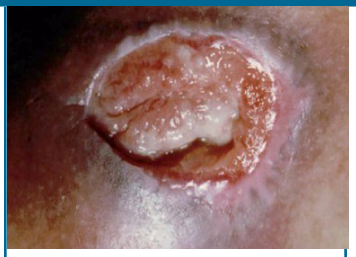
NORMAL - NO INJURY		
 Normal: no injury		
STAGE 1 PRESSURE UNJURY: NON-BLANCHABLE ERYTHEMA		
 Stage I pressure injury: non-blanchable erythema		• Intact skin with non-blanchable redness of a localised area usually over a bony prominence. • Darkly pigmented skin may not have visible blanching; its colour may differ from the surrounding area. The area may be painful, firm, soft, warmer or cooler compared to adjacent tissue. • May be difficult to detect in individuals with dark skin tones. • May indicate "at risk" persons (a heralding sign of risk).
STAGE II PRESSURE INJURY: PARTIAL THICKNESS SKIN LOSS		
 Stage II pressure injury: partial thickness skin loss		• Partial thickness loss of dermis presenting as a shallow, open wound with a red-pink wound bed, without slough. • May also present as an intact or open/ruptured serum-filled blister. • Presents as a shiny or dry, shallow ulcer without slough or bruising (NB bruising indicates suspected deep tissue injury). • Stage II PI should not be used to describe skin tears, tape burns, perineal dermatitis, maceration or excoriation.
STAGE III PRESSURE INJURY: FULL THICKNESS SKIN LOSS		
 Stage III pressure injury: full thickness skin loss		• Full thickness tissue loss. Subcutaneous fat may be visible but bone, tendon or muscle are not exposed. Slough may be present but does not obscure the depth of tissue loss. May include undermining and tunnelling. • The depth of a stage III PI varies by anatomical location. The bridge of the nose, ear, occiput and malleolus do not have subcutaneous tissue and stage III PIs can be shallow. In contrast, areas of significant adiposity can develop extremely deep stage III PIs. • Bone or tendon is not visible or directly palpable.

Table continues on page 26

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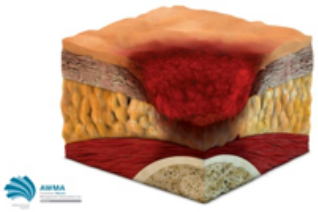
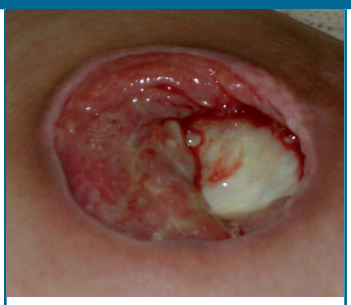
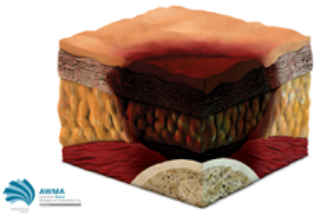
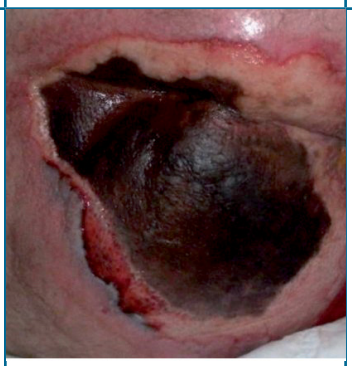
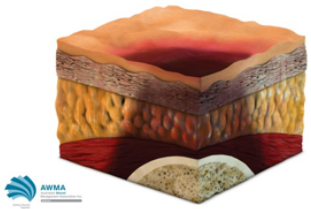
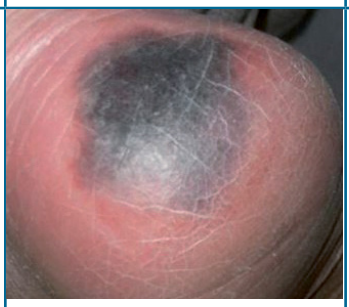
STAGE IV PRESSURE INJURY: FULL THICKNESS TISSUE LOSS		
 Stage III pressure injury: full thickness skin loss		• Full thickness tissue loss with exposed bone, tendon or muscle. • Slough or eschar may be present on some parts of the wound bed. • The depth of a stage IV pressure injury varies by anatomical location. The bridge of the nose, ear, occiput and malleolus do not have subcutaneous tissue and these PIs can be shallow. • Stage IV PIs can extend into muscle and/or supporting structures (e.g. fascia, tendon or joint capsule) making osteomyelitis possible. Exposed bone or tendon is visible or directly palpable.
 Unstageable pressure injury: depth unknown		• Full thickness tissue loss in which the base of the PI is covered by slough (yellow, tan, grey, green or brown) and/or eschar (tan, brown or black) in the PI bed. • Until enough slough/eschar is removed to expose the base of the PI, the true depth, and therefore the stage, cannot be determined. • Stable (dry, adherent, intact without erythema or fluctuance) eschar on the heels serves as the body's natural biological cover and should not be removed.
 Suspected deep tissue injury: depth unknown		• Purple or maroon localised area or discoloured, intact skin or blood-filled blister due to damage of underlying soft tissue from pressure and/or shear. • The area may be preceded by tissue that is painful, firm, mushy, boggy, warmer or cooler as compared to adjacent tissue. • Deep tissue injury may be difficult to detect in individuals with dark skin tone. • Evolution may include a thin blister over a dark wound bed. The PI may further envolve and become covered by thin eschar. • Evolution may be rapid, exposing additional layers of tissue even with optimal treatment.

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Table 8: Example St George Hospital Manual Task Risk Assessment Form for a Bariatric Patient

Manual Task Risk Assessment Form

Health
South Eastern Sydney
Local Health District

1 Identify → 2 Assess → 3 Control → 4 Implement → 5 Evaluate

Hospital/Facility: St George Hospital Department: ICU	Date:	Risk Assessment #: Repositioning Bariatric Patient
Staff completing this assessment:		
Name of task being assessed: Repositioning the bariatric patient		
Reason for assessment : ☒Accident/Incident ☐Planning ☐New Hazard Identified ☐New equipment, ☒Equipment Change/modification ☒Other, Please specify:		

Step 1. Briefly describe the manual handling aspects of the task.

- Rolling patient to place hovermat, HT roller or sheets under the patient
- Moving the patient up the bed
- Repositioning patient to side - side

List any controls that are currently used to prevent harm e.g. Equipment, Training, Safe Work Procedure.

- Lifter –assessment of weight and appropriate SWL
- Hovermat
- Safe Work Practice for all repositioning tasks
- Use at least 6 -7 staff to complete the task as per SWP

Identify the hazard(s) and areas of potential injury or harm in the task –

1. Firstly, tick down the column for all relevant primary task hazard factor(s) in this task.
2. Secondly, tick across the row for all corresponding additional hazard factor(s) in this task.

NB. Sustained = more than 30 seconds, more than an hour at a time or more than 2 hours across a shift.
Repetitive = performed more than twice a minute. Please see Appendix 1 for further explanation.

1. Primary hazard factor/s		2. Additional hazard factor/s: Application of high force	Heavy weight	Awkward posture	Exposure to vibration/ sudden force	Poor visibility = low lighting, Glare, Obstacles	Uneven, slippery, unstable, footing.
Handling a person		X	X	X	X		
Handling an unstable or unbalanced load		X	X	X	X		
Loads which are difficult to grasp or hold		X	X	X	X		
Movement above the shoulder or below the knee							
Cramped or cluttered environment		X	X	X	X		
Stretching or reaching		X	X	X	X		
Heavy weight for the person performing the task.		X	X	X	X		
Sustained posture/position		X	X	X	X		
Repetitive movement							

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Manual Task Risk Assessment Form

Health
South Eastern Sydney
Local Health District

1 Identify → 2 Assess → 3 Control → 4 Implement → 5 Evaluate

Step 2. Assess the risk of injury or harm presented by all the risks identified in the task. Using the NSW Health Risk Matrix	Likelihood	Consequence	Risk Rating
The score provides an indication of the level of injury risk represented by the task with the existing controls in place.			

Step 3. Determine which controls are required to reduce the risk of injury.	
list the identified hazards from Step 1 below Develop control option(s) which would address that hazards risk/s (without creating other workplace hazards) See Appendix 2 for Risk Control examples Follow the hierarchy of controls in the following order of priority: 1. Remove/Eliminate the hazard, 2. Change/Modify, 3. Engineering or 4. Reduce/Administration/SWP.	
Identified Hazard factor/s.	Control Options
• Rolling patient to place the hovermat or placing flat sling under the patient	• Use 6 – 7 staff to complete the task • Roll as per manual handling task SWP
• Moving the patient up the bed	• 1 Person to support head and airway • 3 staff on right and left side of the patient to slide patient up the bed using slide sheets or the hovermat.
• Repositioning patient side - side	• Use lifter or hovermat to move patient off the centre of the bed • Roll patient onto their side as per SWP for HT Roller

Re-assess the manual handling /ergonomic hazard risks with your new/additional controls in place. Using the NSW Health Risk Matrix	Likelihood	Consequence	Risk Rating
If you have not reduced the risk rating for possible staff injury – you need to seek additional help form your network Manual Handling coordinator or OHS consultant.			

Step 4. Form your list of agreed controls points at Step 3. Clearly define what is to be done and develop an implementation plan?	Who will do it?	By when?	Date completed
• Purchase lifter for use in the bariatric with patient in supine position SWL > 120kg	JC & KP & SN	August 2013	
• Ensure current SWP are adapted for use in the bariatric patient	KP	August 2013	
• New RA & SWP for the HT Roller	KP	August 2013	
NB: Once control options have been selected and an implementation plan has been devised, it will be necessary to provide information, training and supervision on the changes made to the task to ensure that all staff carrying out the task understands the work changes and how to carry out the manual handling aspects of the tasks in a safe manner.			

Manual Task Risk Assessment Form

Health
South Eastern Sydney
Local Health District

1 Identify → 2 Assess → 3 Control → 4 Implement → 5 Evaluate

Step 5. Evaluate/monitor the effectiveness of the controls you put in place.	It has now been- ☐ 1 month ☐ 6 months ☐ 12 months ☐ 2 years	Dates reviewed/ evaluated:	
The controls put in place are Working well Need review Need a new Risk Assessment		1st	
		2nd	
Responsible manager: Date: / /	Evaluated by:	3rd	
		4th	

Appendix 1: Explanation of Sustained and Repetitive movements in a task
As a general rule an action or movement would be sustained if it is continued for more than 30 seconds and an overall task would be sustained if done for more than an hour at a time or more than 2 hours across a shift. An action or movement would be repetitive if it is performed more than twice a minute. However if the posture is extremely awkward or the force to be applied or the weight to be moved is high then the length of time and the number of repetitions would need to be decreased. *Ref: National Code of Practice for the Prevention of Musculoskeletal Disorders from Performing Manual Tasks at Work*

Appendix 2: Risk control options and examples. In order of priority
1. Remove/Eliminate
Repetitive actions and movements; Distances of reaches; Heavy weight/s; High force/s; Unstable/unbalanced loads; Work area clutter; Awkward actions and movements.
2. Change/Modify
Workplace layout; Working position; Working posture; Location of loads; Work organisation and flow; Other vision needs; Working characteristics of the equipment; Positions of equipment/controls; Height of equipment or bench or shelf; Directions of actions; Hand holds
3. Engineering / Tool, Machine and/or other Equipment e.g.
Lifting equipment- Lifter electric bed; Moving aids - Wheel chairs, trolleys, tugs, Gusunders, Stamina lifts, hover mats, slide sheets; Openers - pedal, handle, electric eye; Raisers – document holders, spring loaded platforms, jacks; Extenders – grab handles, levers, extensions, shelves, belts, slides; Lights - floor, stand, bench, desk. Magnifiers, hand held illuminated, cabinet.
4. Reduce/Administration/SWP
Frequency of task; Posture and lack of variety; Duration of task; Distances moved; Distances of reaches; Size of item; Repetitive actions and movements; Awkward actions and movements; Heavy Weight/s; High force/s; Unstable/unbalanced loads; Work area Cluttered; Distances of reaches; Duration of operation or holding

Table 9: Example St George Hospital Safe Work Practice for a slide sheet

Safe Work Procedure

Health
South Eastern Sydney
Local Health District

SWP #:	Name of Task /Equipment: Moving a Patient up the Bed - Slide sheet		
Department Name: ICU		Facility/Service: St George Hospital	
Risk Assessment No:	**Risk Level:** e.g. Extreme, High, Med, Low	**Date Developed:**	**Date Review Due:**
	High	May 2013	

Risk of Injury:

- Manual Handling
- Potential for patient to fall off the bed or to hit their head on infusion pumps at the back of the bed.
- Aggressive/unreliable or unstable patients

Safety Rules:

- Check the weight of the patient
- Check the patient's mobility and ability to assist
- Explain the procedure to the patient
- Communicate to staff assisting so that everyone understands the process
- Nominate one team member as the leader
- Use slide sheets which should be stored at every bed
- Ensure the slide sheet is the correct size and has a slippery surface
- If the patient is > 120kg the Hovermatt should be used for this task. Please refer to SWP for repositioning bariatric patient using a hovermatt.

Safe Work Procedure

Health
South Eastern Sydney
Local Health District

Job Steps:

1. Bed at hip height (top of thigh, greater trochanter). If two staff are very different in heights:
   - Height of bed to be positioned at hip height for the shorter person.
   - The taller person has to bend their knees more to lower their body.
   - Brakes on.
2. Position slide sheets under patient:
   - Put the head of the bed down.
   - Roll patient onto their side to place slide sheets underneath
   - Two slide sheets are recommended. One on top of the other, lengthwise along the bed.
   - May use one folded slide sheet, if the patient <80kgs the slide sheet is big enough and is not very tall.
3. Assess patient mobility. If possible, patients may assist by bending their knees with their feet on the bed (not on the slide sheet).
   - During the slide, patient may, assist by pushing through their feet or take some weight through a monkey bar.
4. Place upper foot near level of patient's shoulder
5. Place lower foot in line with patient's hip. Bend knees.
6. Grasp top side slide sheet at level of patient's shoulder and hip. Use palms - down .
7. Brace upper arm- keep upper arms at side of body, "lock" elbows and wrists in position.
   -
8. Ask patient to put "chin to chest" if possible.
9. Transfer weight from the lower foot (nearest foot end), to upper foot (nearest head end)
   - Use your body weight and bent knees, rather than the strength of your arms;

   Slide the patient along the bed, do not try to life the sheet.
10. Remove slide sheet(s)
    - If 2 slide sheets were used, reach under the patients legs and grasp the far corner of the bottom sheet, pull diagonally (so that it slides against itself).
    - Then reach under patient's legs and grasp corner of remaining sheet, pull underneath itself and pull diagonally (so that it slides against itself)
    - If using a folded slide sheet, pull bottom corner out diagonally (so that it slides against itself).

Safe Work Procedure

Health
South Eastern Sydney
Local Health District

PPE Required:					
Approved for use by Manager:					

6. APPENDIX

Appendix 1: NHMRC levels of evidence

LEVEL	INTERVENTION
I	A systematic review of level II studies
II	A randomised controlled trial
III-1	A pseudo-randomised controlled trial
III-2	A comparative study with concurrent controls: • non-randomised, experimental trial • cohort study • case-control study • interrupted time series with a control group
III-3	A comparative study without concurrent controls: • historical control study • two or more single arm study • interrupted time series without a parallel control group
IV	Case series with either post-test or pre-test/post-test outcomes
GPG	Guidelines from international organisation

Appendix 2: NHMRC grading of recommendations

Component	A Excellent	B Good	C Satisfactory	D Poor
Evidence base [1]	One or more level I studies with low risk of bias or several level II studies with a low risk of bias	One or two level II studies with a low risk of bias or an SR/ several level III studies with a low risk of bias	One or two level III studies with a low risk of bias, or level I or II studies with a moderate risk of bias	Level IV studies, or level I to III studies/ SRs with a high risk of bias
Consistency [2]	All studies consistent	Most studies consistent and inconsistency may be explained	Some inconsistency reflecting genuine uncertainty around clinical question	Evidence is inconsistent
Clinical impact	Very large	Substantial	Moderate	Slight or restricted
Generalisability	Population/s studied in body of evidence are the same as the target population for the guideline	Population/s studied in the body of evidence are similar to the target population for the guideline	Population/s studied in body of evidence differ to target population for guideline but it is clinically sensible to apply this evidence to target population [3]	Population/s studied in body of evidence differ to target population and hard to judge whether it is sensible to generalise to target population
Applicability	Directly applicable to Australian healthcare context	Applicable to Australian healthcare context with few caveats	Probably applicable to Australian healthcare context with some caveats	Not applicable to Australian healthcare context

Appendix 3: Risk factors for critically ill adults

	Risk factor	Level of risk	Level of evidence £ Risk of bias ¥	References
Patient	Age	Highly significant Mean 50 years Average 75 years	2 X III-2 low, 1 X III-2 high, 1 X III-3 low, 2 X III-3 mod	(9, 31, 34, 44-46)
	BMI <18	Highly significant	1 X III-2 mod 2 X III-3 mod	(34, 42, 47)
	BMI >35	Probably significant	1 X III-2 high 1 X III-3 low	(31, 48)
	Serum albumin/ Nutrition	Highly significant	1 X III-2 low 2 X III-2 high 1 X IV high	(11, 33, 44, 46)
Critical illness	Emergency admission	Possibly a risk	1 X III-2 high	(11)
	Length of stay	Probably highly significant and a function of critical illness	2 X III-2 mod 1 X III-2 high 1 X III-3 low 2 X III-3 mod 1 X III-3 high	(9, 31, 34, 46, 47, 49, 50)
	Heart failure	Highly significant	1 X III-2 low 2 X III-2 high	(10, 31, 45, 46)
	Vasopressors	Probably significant	1 X III-2 low 1 X III-3 low 1 X III-3 mod	(10, 31, 34)
	Incontinence	Highly significant	1 X III-2 high 1 X III-3 mod 1 X IV high	(33, 42, 46)
	Spinal cord injury	Probably highly significant	2 X III-2 high 1 X III-3 mod	(34, 46, 48)
	Immobility/less repositioning	Highly significant	1 X III-2 low 1 X III-2 high 1 X III-3 mod	(10, 11, 51)
	Infection	Probably highly significant and a function of critical illness	1 X III-3 mod 1 X III-3 high	(9, 50)
	NHRMC levels of evidence		¥ SIGN risk of bias (low, moderate, high)	

Appendix 4: Risk assessment tools - sensitivity and specificity

Study	Year	Setting	Sample	Type of study	LOE	Risk bias	RAS - Braden (<18 at risk)	RAS - 4 factor model	RAS - Jackson - Cubbin	RAS - Norton (<14 at risk)	RAS - Subjective	RAS - Waterlow	RAS - VAS
Compton [52]	2008	Med ICU Germany	698 pts	Prospective epid	111-2	High					ROC 0.82	ROC 0.59 (0.54–0.65)	
Boyle [53]	2001	3 ICUs in Australia	534 pts	Prospective observational	111-3	Mod						ROC 66.14	
Feuchtinger [44]	2007	Cardiac ICU Germany	53 pts	Prospective cohort	111-2	High	Cut-off score 20 = Sens 97%, Specific 5%, pos pred 69% neg pred 50%)	Sens 85% Specif 31% Pos Pred Value 70% Neg PredVal 38%		Cut-off 19 Sens 25%, Specif 100%, Pos Pred value 100% negat pred value 39%)			
Kottner [54]	2010	2 ICUs in Germany	53 pts	Inter-rater validity study	111-3	High	IRR 0.72/0.84					IRR 0.36 (fair)/0.51 (moderate)	IRR 0.51 (moderate) /0.71 (substantial)
Pancorbo-Hidalgo [6]	2006	33 studies		Systematic review			High inter-rater reliability. Sensitivity 38.9 – 100%, specificity 26 – 100%, PPV4.5 – 100%, NPV 50 – 100%, AUC range 0.55 0 0.74		No validation due to low use	High inter-rater reliability, low reliability. Sensitivity 16 – 81%, specificity 31 – 94%, PPV 7.1 – 38%, NPV 64.7 – 98.3%, efficacy 39.6 – 80.5%. AUC 0.56 – 0.74.		Sensitivity 75.8 – 100%, specificity 10.3 – 38%, PPV 5.3 – 33.3%, NPV 65.7 – 100%, efficiacy 16.2 – 44.6%.	

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Study	Year	Setting	Sample	Type of study	LOE	Risk bias	RAS - Braden (<18 at risk)	RAS - 4 factor model	RAS - Jackson - Cubbin	RAS - Norton (<14 at risk)	RAS - Subjective	RAS - Waterlow	RAS - VAS
Serpa [7, 55]	2011	4 cardiology units, 2 neurology units and general unit in 1 hospital in Brazil		Retrospective and prospective methodological study	1V	High	Sensitivity was 85.7%, 71.4% and 71.4% and specificity was 64.6%, 81.5% and 83.1%, respectively						

Appendix 5: Pressure injury locations by study

Study	P-Stage 1	P-Stage 2	P-Stage 3	P-Stage 4	Unstageable/ SDTI	Sacrum/ coccyx	Buttocks	Heels	Head	Other
Bours [15]	10.55	11.80%	5.20%	1.30%						
Schuurman [47]		59.30%								
Powers [48]			BMI >35+oedema							
Jenkins [33]	36%	34%	11%	19%		20%		26%	19%	
Elliott [36]						30		60		10
Alderden [56]	2.7%	45%	1%	1	28.8% 20.7%					Bony = 60.4% non-bony = 39.6%
Cox [31]	31%	35%	2%	2%	23%	58%	34%	5%		3%
Kaitani [11]	35.7	57.1	7.1							
Nijs [57]	16.10%	25%	10%	5.60%				13.50%	3.30%	9.80%

Appendix 6: Incidence and prevalence evidence

Study	Setting	Sample	Study type	LOE	Risk of bias	Prevalence	Incidence
Pender [55]	MICU	40	Prospective correlation	III.3	Moderate	20%	
Bours [15]	Multiple		Retrospective of existing dataset	III.3	High	28.7% (n=244)	
Fife [58]		186 over 3 months	Prospective audit	III.3	High		12.4% (23/186)
Schuurman [47]	CTR		Prospective cohort	III.2		53.40%	
Powers [48]		484 trauma Adult/paeds	Prospective descriptive	III.2	High	6.80%	
Cho [59]	SICU	715	Retrospective case control		High	5.90%	198/1000 bed days
Jenkins [33]	Med/surg ICU	310	Cross-sectional		High		
Jenkins [33]	Med/surg ICU		Prospective observational	III.2	High	50% $8%	
Vanderwee [60] 2011	Whole of hospital		Prevalence	III.3	High		12.40%
Alderden [56]	Trauma	91 (n=77 ICU)	Prospective observational	III.3	Moderate		
Cox [31]	Med/surg ICU	347	Retrospective correlational	III.3	Moderate		18.7% (n=347)
Kaitani [11]	HDU/ICU	98/606	Prospective cohort	III.2			11.20%
Nijs [10]	SICU	>48hrs LOS 573	Prospective descriptive	III.2	Moderate	Data not reported	Data not reported
Shahin [61]			Literature review	III.2	Moderate	Wide variation 4-49%	3.8-26.1%

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