WHITE PAPER

# Pressure Care – Essential Elements of Reactive Mattress Surfaces

April 2023

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## INTRODUCTION

A support surface is a surface on which the patient is placed to manage pressure load, shear, friction and microclimate [1] with the goal of preventing and/or treating Pressure Injury.

Reactive support surfaces are designed to reduce interface pressure through increasing the body surface area, thus facilitating pressure reduction [1]. In response to applied pressure, the support surface distributes interface pressure over a wider body area through immersing and enveloping the patient [1]. They can also be referred to as pressure redistribution, static or constant low pressure support surfaces.

When differentiating a 'standard' foam mattress and a medical grade foam mattress the term high specification foam mattress is used. This is a foam mattress that exhibits density-hardness, support factor and depth characteristics superior to a 'standard' mattress [1]. (Figure 1)

A high specification foam mattress tends to provide greater support, more resilience and better resistance to softening in use. They are produced using a combination of chemical technologies and mechanical processes [2].

People lying on ordinary foam mattresses are more likely to get pressure ulcers than those lying on a high specification foam mattress. [3]. Use of a high specification foam mattress can help reduce the incidence of pressure injuries by up to 60% [4].

The Pan Pacific Clinical Practice Guideline recommended that a high specification foam mattress should be used on beds for patients at risk of pressure injuries [1]. This forms part of a holistic approach to Pressure Care Program. The International guidelines also recommend use a high specification in preference to a 'standard' mattress for individuals at risk of developing pressure injuries [5].

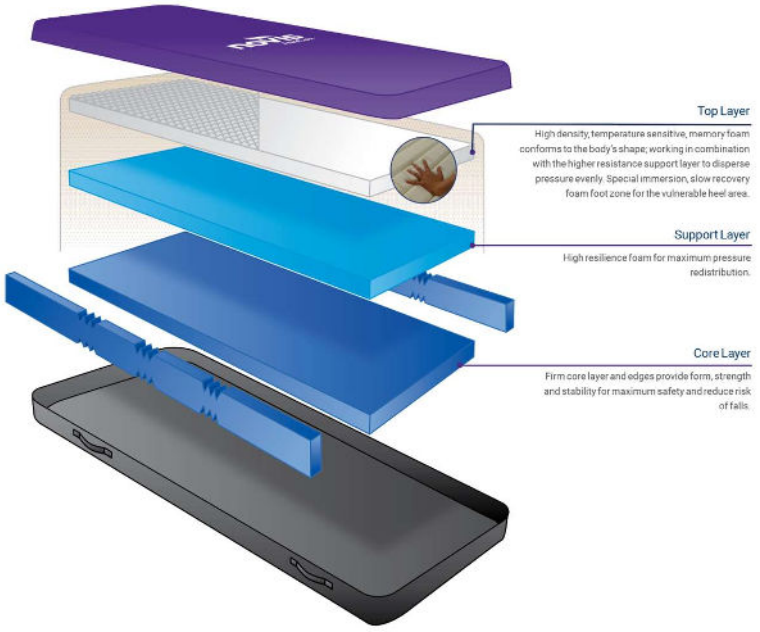


Figure 1: AreaCare High Specification Foam Mattress Range

## BACKGROUND

There is no international definition of what constitutes foam hospital mattress [3]. The evidence provides little guidance to selection of the most appropriate high specification support surface for various patients [1]. With lack of conclusive evidence, the Pan Pacific Guideline determined that no one specific high specification foam mattress is better than any other [1].

Currently, clinicians must base product selection on a clear understanding of the therapeutic features of various products and how well they meet the patient's needs [4]. The selection of support surface must be based on a full assessment of the patient's condition and needs, and not solely on the patient's risk for pressure injury [4].

Understanding the key features of high specification support surfaces is critical to a Therapist's ability to adequately ensure that the selected surface is able to meet the person's clinical and personal needs. A Therapist needs to choose a support surface for their client based on product performance [6].

Construction of a support surface is a complex and technical process, the careful design and use of materials have significant impact of the performance of the surface to provide effective pressure redistribution without immersing the person too deeply to reduce their mobility in bed.

High specification foam mattresses are most effective in reducing risk of PIs [1]. However the degree of effectiveness may be assessed by understanding all scientific parameters used in mattress design.

The Pan Pacific Guidelines provides assistance to Therapists on considerations when selecting a support surface [1]. (Figure 2) By analysing all elements contributing to the mattress performance, a more informed decision can be made regarding the therapeutic benefits and suitability of varied reactive support surfaces. They allow us to differentiate the available options and make informed choices.

| | | |
|---|---|---|
| **Patient factors** | ▪ Risk factors - See section 5.2<br>▪ Risk and skin assessment<br>▪ Weight, height and BMI<br>▪ Age<br>▪ Incontinence needs<br>▪ Cognitive ability | ▪ Mobility<br>▪ Clinical condition<br>▪ Comfort<br>▪ Personal preference |
| **Environmental factors** | ▪ Shear<br>▪ Friction<br>▪ Pressure | ▪ Moisture<br>▪ Temperature |
| **Equipment characteristics** | ▪ Durability<br>▪ Ability to conform to bony prominences without resistance<br>▪ Allows immersion without "bottoming-out"<br>▪ Ability to offload body parts<br>▪ Ability to manage microclimate at the skin's surface<br>▪ Impermeable to fluid and bacteria<br>▪ Fire retardant properties<br>▪ Maximum weight, weight and width limits | ▪ Ease of use<br>▪ Ease of transferring<br>▪ Ease of transport<br>▪ Ability to stabilise<br>▪ Cleaning and maintenance<br>▪ Availability<br>▪ Cost |
| **Service provider factors** | ▪ Funding provisions<br>▪ Ability to provide cleaning and maintenance | ▪ Care setting (e.g. home, residential aged care, hospital) |

Figure 2: Considerations in selecting a support surface [1]

## PRESSURE REDISTRIBUTION

The amount of pressure applied to tissue is related to the weight of the patient and the size of the contact area between the patient and the support surface. Support surfaces minimise pressure damage to tissues by redistributing the mechanical loads imposed on the skin and soft tissues [7].

The rationale behind the use of a reactive support surface is pressure redistribution. That is "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" [1]. As the patient sinks down, more of the patient's body comes into contact with the support surface, so that the patient's weight is spread over a larger area. This produces an overall reduction in the pressure placed on the tissues [7].

A reactive support surface has the ability to change its load distribution properties in response to a pressure load. A reactive support surface moulds to the patient's shape [1], achieved through immersion and envelopment into the support surface. (Figure 3)

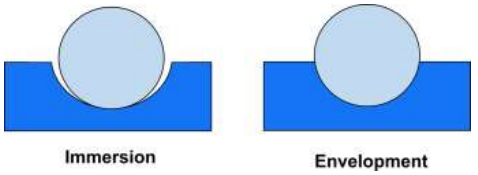

Figure 3: Pressure redistribution 26

Immersion refers to the ability of a support surface to allow a patient to sink into it [1]. Envelopment refers to how well

a support surface moulds to body contours and accommodates irregular areas [1] which could include bony prominences.

## POLYURETHANE FOAM

High Specification Foam mattresses are constructed utilising flexible polyurethane foam. Polyurethane foam is used to improve mattress performance, both therapeutically and for improving patient comfort [2].

All foam is comprised of a network of interconnecting elastic plastic struts and cavities that form cell structures. High performance foam, used in high specification foam mattresses, is characterised by fairly coarse, random cell sizes. By comparison standard polyurethane foam has more consistent, finer cell structure [8].

These random sized cell sizes interspersed through the high specification foam perform quite differently based on cell size. Some cells are fine and give way easily to slight force, other cells have ability to resist compression force providing buoyant support and resisting bottoming out. Their combined effect of the varied cell sizes create the ability of the foam to facilitate the cradling of the body [8]. Conventional foam cells all collapse at the same rate, and thus cant provide the immersion and envelopment needed in a high performance foam mattress [7].

## VISCOELASTIC FOAM

A category of Poleurethane foam that demonstrates unique characteristic is viscoelastic foam, commonly known as memory foam. (Figure 4). Due to its conforming aspect, viscoelastic material makes for a comfortable yet supportive mattress [9] and as such is frequently included in high specification mattress design.

Viscoelastic increases the surface area contact, redistributes pressure, reduces peak pressures and allows immersion of bony prominences [1]. A viscoelastic polyurethane foam mattress contributes to reducing pressure by 20–30% compared to a standard mattress [10].

Figure 4: Viscoelastic Foam

Compared to other types of foam, viscoelastic foam has unique properties in firmness, density, thickness, and elasticity. These physical characteristics help to achieve a maximum contact area between the body and the surface, via immersion and envelopment, to effectively reduce the interfacial pressure [11].

It is typified by its slow recovery after compression. When the body is positioned in viscoelastic foam, it progressively conforms to the shape (envelopment) and after the weight is removed the foam slowly returns to its original shape [2]. With the heat of the body the foam softens and improves its ability to contour [8].

Unlike traditional foam processing, viscoelastic formulation is more restrictive. Raw materials must be carefully altered to generate foam with varying properties. Cutting, profiling and other fabrication techniques may also require more care due to the slow recovery aspect of the foam. These considerations affect product economics [9].

The physical properties of viscoelastic foam can be greatly influenced by temperature. Even slight changes in room temperature can affect measured firmness and recovery rates. Recovery rate has been positively correlated to heat, so that as the foam increases in temperature, pliability and compression and recovery rates increase. In colder conditions, viscoelastic products tend to become firmer or even stiff. The optimum range for best 'memory' action is typically between 13°C and 29.5°C [9].

Similar to temperature effects, viscoelastic foams also react to humidity. Viscoelastic products tend to soften in more humid conditions [9].

## RESILIANCE

Resilience is an indicator of the surface elasticity or 'springiness' of foam. Resilience can relate to comfort [2].

Resilience is typically measured by dropping a steel ball onto the foam cushion and measuring how high the ball rebounds. Foam resilience ranges from about 20 percent ball rebound to as high as 80 percent rebound. Higher resilience in a foam often means that the mattress has a better surface feel [2]. Foams can also be made to have very low resilience for certain applications. Viscoelastic products typically exhibit very low resilience.

The Pan Pacific Guidelines recommend use of a high resilience or conventional heavy duty foam. This is in line with the classification system in the Australian Standards (AS2281-1993).

However, use of high resilience foam this has implications on the comfort as surface resilience is highly correlated to comfort [2].

## MULTI LAYERING

High resilience foams make up important layers of reactive support surfaces. Oftentimes the transitional layer or base

layer of a foam mattresses will contain high resilience foam at high densities. This is especially important in ensuring the weight limit of a mattress is suitable [1]. High resilience foam provides a more even feel across the mattress, and less risk of 'bottoming out' that viscoelastic foam alone would have [2].

Bottoming out is when the deepest point of the patient's immersion in a reactive support surface provides insufficient support to adequately redistribute pressure so the patient presents as sitting or lying on the underlying structure of the bed [1]. (figure 5)

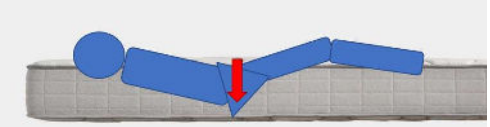

Figure 5: Bottoming Out

Multi-layering (Figure 6) of various grades/types of foam allows for variations to be made in mattress design, facilitating different effects on therapeutic performance and comfort. Combining the Pressure Care and support qualities of higher resilience foam with the comfort factor of low resilience foam can lead to a balance that facilitates optimal outcomes.

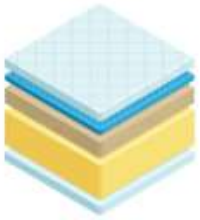

Figure 6: Multilayers of foam

Combining varied foam layers facilitates the potential for improved mattress outcomes. A combination of at least 2 foams will create an optimal higher specification foam mattress for Pressure Injury prevention [21].

## DENSITY

Density is a measurement of the mass per unit volume. Measured and expressed in kilograms per cubic meter (kg/m3), density is one of the most important of all foam properties [2].

Density is a function of the chemistry used to produce the foam and additives included with the foam. Density affects foam durability and support. Typically, the higher the density, the better the foam will retain its original properties and provide the support and comfort it was originally designed to produce [2].

## FIRMNESS

Firmness can be described as the ability of foam to 'push back' and carry weight.

Firmness is an indicator of the surface feel of the foam. It is measured using the force in Newtons or Kilograms required to indent a foam sample by a percentage of its original height. This measurement is called Indentation Force Deflection (IFD). In Australia and Europe hardness is measured at 40% IFD.

Firmness is independent of foam density. It is possible to have high density foams that are soft or low density foams that are firm, depending on the IFD specification [2].

Normally, the firmness of foams can range from supersoft to semi-rigid. The potential for surface pressure reduction is closely associated with firmness. Desired firmness is achieved through custom formulation.

Viscoelastic products with a lower IFD tend to exhibit increased conformance and can distribute body weight more efficiently to alleviate pressure. However, if the IFD is very low, and there is not sufficient foam density or thickness to provide support, the product may 'bottom out', negating the benefits of pressure reduction.

Variance in the firmness exists in top and middle and base layers of multilayer designs [1]. (Figure 7)


Figure 7: Foam Density in multilayered foam

Density/hardness defines the grade of foam and is stated with density followed by hardness [1]. Ideally the minimum requirement for a single layer foam mattress will be 35 : 130 kg/m3 minimum [1].

## SUPPORT FACTOR

Support Factor assesses the foam's ability to support weight. Quantifying support factor requires an IFD measurement based on compressing a foam sample by 25% and then by 65% of its height.

IFD at 65%
IFD at 25% = support factor

The recommended IFD is in the range of 1.6 to 2.6 [1].
Multilayering allows a foam with lower support factor, for comfort and immersion, to be placed over a foam with higher support factor, to reduce risk of 'bottoming out' [2].

Typically, the higher the foam density, the better the support factor [2].

## DEPTH

The height or depth of mattress is important in relation to its density and firmness. Different foam grades require different depth to manage upper body weight and prevent 'bottoming out' [1].

It is recommended that a minimum depth of 150 mm is achieved [1]. Additionally, mattress depth needs to be increased to support a bariatric load [1].

## DURABILITY

There are several tests that are used to determine foam durability, or how well foam retains its original firmness properties and height [2].

Density greatly affects foam durability in terms of progressive loss of height and firmness change [8].

High durability is essential in ensuring the mattress structure retains its therapeutic benefit with usage and age.

The cover of the mattress needs to resist abrasion and tolerate chemical cleaning. Abrasion includes tearing, scoring or puncture, which compromise the cover and expose the foam to fluid and infection.

The surface needs to be able to tolerate being wiped clean and ideally able to tolerate washing in a machine. A list of appropriate solvents for cleaning and washing machine temperatures will be specified by the manufacturer.

The consequences of mattress cover failure are considerable, consuming staff time, putting a strain on financial resources [12], by the reduction of the lifespan of the mattress, reduced therapeutic ability and risk of contamination by infection.

## SHEAR & FRICTION

Development of Pressure Injury is a dynamic and complex process that involves the combined effect of mechanical forces, shear and friction, in addition to pressure [13].

Shear is produced by displacement or deformation of tissue, usually in a diagonal direction, that alters the original alignment of tissue as one layer of tissue and the deeper structure slide in opposite directions (bony skeleton moving in an opposite direction to the surface skin). Deformation disrupts the cell structure, obstructs lymphatic drainage, reduces blood flow and potentiates ischemia [14]. (Figure 8)

In contrast, friction describes the resistance to movement created between two surfaces such as the superficial layers of skin and the adjoining support surface [14].
(Figure 8)

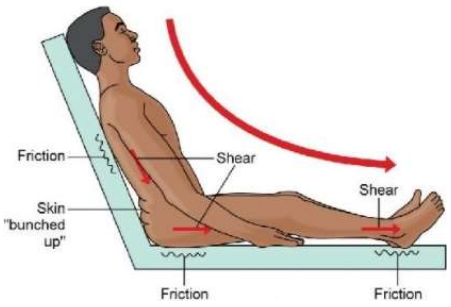

Figure 8: Shear and Friction due to gravity

Risk of friction and shear can be reduced with a low friction fabric [1]. This can be achieved utilising a specialist designed smooth fabric that has a multi directional stretch.

The balance is achieving the appropriate amount of friction reduction, without it becoming too slippery whereby the sheet and person will slide down the bed when in a fowler position.

All equipment should be used with an appropriately sized, specified cover as determined by the manufacturer [1]. It must have a good fit and resist wrinkling as this may add additional pressure at the skin surface [1].

## COVER STRETCH

The mattress cover needs to mimic the foam in allowing the foam's immersion and envelopment qualities to be maintained. It needs to support the body for partial immersion in the foam [1].

A multidirectional stretch fabric allows the cover to conform in all directions, facilitating its ability to immerse and envelop. A 2 or 4 way stretch only conforms in these distinct planes and may decrease the flexibility of the cover.

Multidirectional stretch improves the ability of the cover to resist delamination [15].

Delamination is when the external surface of the cover begins to form microdamage, the cracking of the surface creates potential exposure of the foam to contamination.

## MICROCLIMATE

Microclimate refers to the environment at or near the skin surface that is influenced by the combined effect of skin temperature, humidity, moisture and air movement [16].

An increase of 1°C in skin temperature results in an increase of approximately 13% in tissue oxygen demand, making the skin more vulnerable to mechanical damage [16]. Excess moisture from incontinence, sweating and wound exudation can cause skin maceration, weakening the connections between epidermal cells and collagen fibres. The interruption of normal barrier function increases skin permeability to irritants and pressure damages [16]. Certainly, heat and moisture accumulation are directly related to air movement at the interface between the skin and the support surface [16].

Skin that is too wet is up to five times more likely to ulcerate, and skin that is too dry is 2.5 times more likely to ulcerate than normal skin [17].

This air movement, or breathability of the surface is referred to as the vapour permeability. (Figure 9)

In assessing vapour permeability, the relevant measurement is moisture vapour transmission rate (MVTR). Increasing the MVTR potentially allows the trans epidermal water loss of intact skin to transpire through the cover. Decreasing the MVTR of the cover protects the foam from moisture degradation, increasing MVTR improves the vapour permeability. Changing the MVTR becomes a compromise between managing local climatic conditions and the person's trans epidermal water loss [1].

The recommended MVTR is a minimum 150-200 g/m2/ 24 hrs, which is equivalent to normal patient trans epidermal water loss [1].

It is essential that any printing on the mattress surface is minimised under high risk areas and does not alter the flexibility or breathability of the fabric [15].

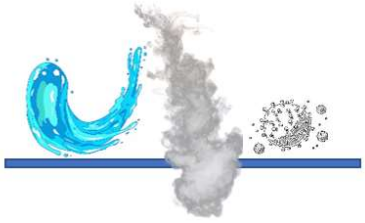

Figure 9: Fluid resistant, vapour permeable and antimicrobial

## WATER RESISTANCE

In addition to vapour permeability the surface is required to be water resistant. (Figure 9) This is a fine balance in the space between the fibres of the cover to be wide enough to facilitate breathability, whilst small enough to prevent liquid ingress. This is known as 'strike through'

'Strike through' (Figure 10) occurs when the mattress cover is compromised allowing fluid to permeate in and expose the foam to fluid and contaminants. This can occur through a poor quality mattress cover, delaminated cover, or cover abrasion. Exposure to non-recommended cleaning solvents will increase the risk of cover breakdown and 'strike through'.

A mattress with a compromised cover provides suboptimal pressure area care, due to changes to the mattress core occurring following fluid contact [12].

Figure 10: Example of 'strike through' [21]

## INFECTION CONTROL

Features of the mattress need to be designed to resist the potential of the mattress to be contaminated and pass infection. The main goal of these features is to minimise the potential ingress of fluid or contaminants into the foam layers.

A damaged, compromised mattress cover leads to a contaminated core, and is a major vector in the spread of healthcare-acquired infection [18].

Examples of these infection control features are: [1]

- Moisture Resistant cover
- Welded seams at all cover joins
- Fabric waterfall flap to cover over zips
- Cleaning according to facility protocol and manufacturers guidelines

The mattress must also account for the ingress of bacteria, virus, fungi and other contaminating microbes. The mattress cover needs to possess anti bacterial, anti microbial, antiviral and fungistatic qualities through type of material, reduced size of space to permeate through, and treatment agents impregnated in the cover.

To minimise risk of infection the cover should be wipeable and tolerate a 10,000ppm disinfection chemical concentration with a contact time of at least 1 minute [19].

The cover needs to be easily removable to facilitate regular washing in a machine. For microorganisms to be deactivated a wash must be completed at a minimum of 65°C for 10 minutes or at a minimum of 71°C for no less than 3 minutes, according to AS/NZS 4146:2000. This also prevents build up of microorganisms in the washing machine causing cross contamination.

### SEAMS

Although welded seams are a necessity for infection control, the durability of this fixation is reduced. Stitched seams are stronger, but not able to prevent ingress of fluid. A combination of stitched and welded seams give durability whilst ensuring adequate infection control is maintained.

### FIRE RETARDANT

Once ignited, all flexible polyurethane foams have the potential to burn vigorously, emitting great heat and dense smoke [9].

Foam can be manufactured to perform with varying degrees of ignition and combustion resistance. Polyurethane products can be combined with barrier materials in mattresses designed to comply with flammability specifications and Standards [9].

Additionally, a mattress sub cover, between the mattress cover and foam can improve the fire retardant properties of the support surface (Figure 11)

Figure 11: Fire resistant sub cover

Mattresses must meet the criteria specified in Local Fire Standards [1]. A good indication of ignition resistance is the support surface compliance to CRIB 5 and BS 7177.

### CASTELLATIONS

Castellated foam (Figure 12) is created when partial thickness cuts are made in a regular block pattern on the top section of the foam increases surface contact area and potentially reducing friction and shear [1].

Figure 12: Castellated foam

When the gap between the castellations is larger, the ability for air flow through the mattress is facilitated, this can improve microclimate due to increased airflow, and the tracking of moisture vapour away from the person's body.

### HINGED SIDE WALLS

Side walls are a border or stiffener along the edge increases firmness. This has advantages for stability when sitting on the edge of the bed. It also assists a person orientation themselves in the centre of the bed when lying, by providing proprioceptive prompt of where the mattress edge is.

Although of benefit, this leads the mattress to resist bending in line with the bed profiling for position change. A hinge system assists in the flexibility of the mattress to bend to conform to the bed position.

A hinge system (Figure 13) are wedges removed on the side wall border to allow for folding or bending of mattress to accommodate back rest and upper and lower leg sections to conform to profiling beds [1].

Figure 13: Hinged side walls

### GENERAL MAINTINENCE AND USE

The Pan Pacific Guidelines specifies several general guidance for mattress maintenance and use: [1]

- Avoid excess linen between the support surface and the patient's skin

- Check all support surfaces are functioning and correctly positioned every time a patient is repositioned or transported
- Any support surface should be used and maintained according to manufacturer instructions
- Annual safety audits to ensure the integrity devices are recommended. Document annual equipment audits
- Ensure the support surface and bed are appropriate for use together (e.g. there are no excessive gaps for entrapment) and appropriate for the patient
- Frequency of repositioning should consider the patient's risk of pressure injury development, skin response, comfort, functional level, medical condition, and the support surface used

Nurses and other staff who have ongoing exposure to support surfaces during bedding or room changes should cultivate continual awareness of support surfaces and observe for signs of aging or wear, such as reduced height or thickness, discoloration, altered integrity of cover, seams, or zipper/zipper cover flap and odour [4].

It is not recommended to not rely solely on the product's stated lifespan [4] as an indication of replacement timing.

Nurses who note signs of wear should refer the surface to engineering/maintenance for testing or evaluation for continued use. Deterioration of the support surface presents a high risk for moisture penetration with potential for infection due to 'strike through' [4].

When a mattress is opened and inspected and a stain is noted, various actions are required to ensure that the patient has a replacement surface that is fit for purpose and poses no risk of cross contamination [12].

## COMFORT

It is also important to take the views of patients and carers into account when selecting a support surface [7].

In general, foam mattresses provide a higher level of comfort in comparison with other construction materials and are widely used at home or in care settings [3]. Powered active air-surfaces probably reduce pressure ulcer incidence, but are probably less comfortable than standard hospital surfaces [20].

Participant-assessed outcome measures show the highest comfort on a viscoelastic foam mattress [22].

A high specification foam mattress was associated with a significantly reduced incidence of pressure injuries and postponed the occurrence of pressure injuries without compromising comfort [11].

The amount of immersion and envelopment are critical benchmarks that determine comfort.

The most comfortable system may not be the most therapeutic and vice versa. However, comfort may clearly be linked to compliance [21].

## INTERFACE PRESSURE

While it is widely accepted that clinical outcomes represent the best method of proving clinical efficacy for a support surface, laboratory measurements still play an important role when assessing pressure care qualities of a mattress. This is done by pressure mapping.

Interface pressure (IP), or the pressure load between the patient's body and the support surface, is assumed to be related to the development of PIs [1]. IP is important when designing a mattress and is then used to simply describe the performance characteristics of a support surface [21].

The pressure exerted between the patient and the support surface is measured in terms of IP. "IP is defined as the pressure exerted by the compression system over the surface of the skin," [26]. To measure interface pressure, manufacturers and Clinicians use pressure mapping to evaluate the effectiveness of the support surface.

The goal of a reactive surface is that the interface pressure remains constant while the patient remains in the one position, but is redistributed over a wider surface area [1].

Some terminology needs to be correctly understood when interpreting Pressure Mapping results: [23]

- Interface pressure-the pressure load between the skin and the support surface
- Peak interface pressure-the highest pressure load between the skin and the support surface
- Average interface pressure-the average pressure load between the skin and the support surface.
- Skin contact area-the total surface area or contact area between the skin and the support surface.

The Pressure Area Index (PAI) is used to compare reactive mattress surfaces. It can be used to visually compare the way in which different support surfaces redistribute the pressure applied (Figure 14) The key difference between support surfaces is the degree of immersion, which is directly related to the degree of pressure reduction and can be simply measured using the PAI [21].

PAI also shows that pressures are constant over time and that some areas of the body are clearly under greater load (yellow-red areas), serving to illustrate why individualised patient repositioning programs continue to be important, even on sophisticated low pressure support surfaces [21].

Peak pressure is often used as an indication to the effectiveness of the support surface to offer adequate pressure redistribution away from bony prominences.

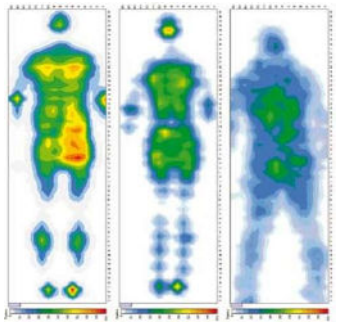

Figure 14: Example of Pressure Mapping

Considerations when comparing PAI of varied mattresses

- Utilising different pressure mapping equipment can lead to varied results
- Weight and size of the test subject can vary between comparative tests
- Limitations of equipment in reporting high pressures effecting peak pressure measurement
- Colour representation can be changed to varying levels when the pressure mapping is performed, ensure you look at the pressure scale to determine the exact IP at each point, rather than the colour alone. (Figure 15)
- PAI and Average pressure should not be looked at with the exclusion of accounting for peak pressures under bony prominences
- Closing pressure of venules largely accepted as 32mgHg will in fact have significant variance between individuals, thus varied pressure and duration metrics will be tolerated
- Measures pressure alone without consideration for shear, friction, microclimate [21] or an individual's tissue tolerance.

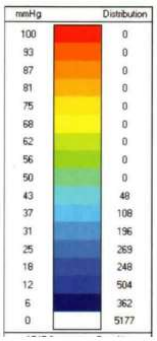


Figure 15: Example of Pressure Mapping colour scale

A more effective method for analysing outcomes of pressure mapping is reviewing specific metrics measured during the pressure mapping, rather than simply looking at colour representation. This will allow a more valid comparison of maximum peak pressure, average pressure, skin contact surface area, and percentage of areas within specific pressure ranges (Figure 16)

It is essential that IP is not considered independently as the duration of exposure to pressure also needs to be considered [21].

**Interface Pressures**

| | |
|---|---|
| Maximum Interface Pressure | 44.1 mmHg |
| Minimum Interface Pressure | 0 mmHg |
| Average Interface Pressure across contact interface | 22.3mmHg |
| Maximum contact area (immersion) | 4617.74cm$^8$ |
| Percentage of surface area between 40-50mmHg of pressure | 2% |
| Percentage of surface area between 30-40mmHg of pressure | 24% |
| Percentage of surface area between 20-30mmHg of pressure | 25% |
| Percentage of surface area between 10-20mmHg of pressure | 49% |
| Percentage of surface area between 0-10mmHg of pressure | < 2% |

Figure 16: Analysis of IP

## SUMMARY

A Pressure Injury is defined as an area of localized damage to the skin and underlying tissue mainly caused by pressure, or pressure combined with shear [1].

A high specification foam mattress, a reactive constant low pressure is associated with a significantly reduced incidence and postponed occurrence of pressure injuries. It is recommended to use a high specification foam mattress is used for patients at risk of developing pressure injuries [1].

The provision of a high-specification foam mattress significantly reduces the risk of Pressure Injury development [24]. This includes all individuals admitted to secondary care, dependent upon individual characteristics (for example, their clinical condition), as well as people requiring ongoing care in primary care settings, people with significant limited mobility and all other individuals considered at risk of developing Pressure Injuries [24].

Support surfaces should be used in conjunction with a comprehensive prevention strategy based on frequent observation and assessment, individualised turning regimen and measures to increase the tissue's tolerance to pressure [24].

Analysing the therapeutic benefit of individual support surfaces involves comparison of individual performance factors. By increasing knowledge of these features a more informed decision can be made in regard to individual suitability of one mattress over another.

## REFERENCES


1. Australian Wound Management Association, Pan Pacific Guideline for the Prevention and Management of Pressure Injury. 2012
2. Polyurethane Foam Association (PFA) 2023
3. McInnes E, Jammali-Blasi A, Bell-Syer SE, et al. Support surfaces for pressure ulcer prevention. The Cochrane Database of Systematic Reviews. 2015. (9):CD001735
4. McNichol, L, Mackey, Watts, C, Zuecca, N. Choosing a support surface for pressure injury prevention and treatment. Nursing 2020. 50(2):41-44
5. European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel and Pan Pacific Pressure Injury Alliance. Prevention and Treatment of Pressure Ulcers/Injuries: Quick Reference Guide 2019
6. Mackey D. Support surfaces: beds, mattresses, overlays-oh my! Nurs Clin North Am. 2005. 40(2):251-65
7. Ovens, Liz How to guide: Selecting a support surface, Wounds International. 2017
8. Polyurethane Foam Association. Flexible Polyurethane Foam in Mattress Construction. In Touch. 2018 5(1)
9. Polyurethane Foam Association. Viscoelastic (Memory) Foam. In Touch. 2016. 11(1)
10. Defloor T. The effect of position and mattress on interface pressure. Applied nursing research. 2000. 13(1):2–11.
11. Bai DL, Liu T, Hsu Y. Relationship between a pressure redistributing foam mattress and pressure injuries: An observational prospective cohort study. PLOS ONE. 2020.
12. Laidlaw et al. Strikethrough Resistant Technology™: a possible solution to mattress audit failures. Wounds UK 2015 11(3)
13. Black JM, Edsberg LE, Baharestani MM, Langemo D, Goldberg M, McNichol L, Cuddigan J; National Pressure Ulcer Advisory Panel. Pressure ulcers: Avoidable or unavoidable? Results of the National Pressure Ulcer Advisory Panel Consensus Conference. Ostomy Wound Manage. 2011;57(2):24-37
14. Smith G, Ingram A. Clinical and cost effectiveness evaluation of low friction and shear garments. J Wound Care. 2010. 19(12):535-42
15. Trelleborg, Dartex zoned coatings 2023
16. Woo K. Effective Support Surface Selection in Preventing and Treating Pressure Ulcers. Wound source white papers. 2013
17. Stevens L (2013) The Clinical and Cost-Efficiency of Strikethrough Resistant Technology. Wound Care Today Supplement 2013: 16–9
18. Callaghan R. Is mattress cleaning increasing the risk of healthcare associated infection? Wound Care Today
Supplement 2013: 9–12
19. Centre of Disease Control and Prevention, Guideline for Disinfection and Sterilization in Healthcare Facilities. 2008
20. Shi C, Dumville JC, Cullum N. Support surfaces for pressure ulcer prevention: a network meta-analysis. PLOS one. 2018. 13(2).
21. Philips, L. Interface pressure measurement: Appropriate interpretation of this simple laboratory technique. Primary Intention. 2007 15(3)
22. Bredesen, IM. Interface Pressures of New and Worn Standard and Viscoelastic Hospital Mattresses: A Comparative Study. Index Wound Management & Prevention. 2020. 66(8):26–31
23. Kirkland-Walsh H, Teleten O, Wilson M, Raingruber B. Pressure Mapping Comparison of Four OR Surfaces. AORN J. 2015. 102(1):61.e1-9.
24. National Institute for Health and Care Excellence (NICE). The Prevention and Management of Pressure Ulcers in Primary and Secondary Care. 2014. 179(12).
25. Australian Wound Management Association Inc, Clinical Practice Guidelines for the Prediction and Prevention of Pressure
Ulcers. 2001.
26. Levasseur A, Mac-Thiong J, Richard-Denis A. Diagnosis and Treatment of Spinal Cord Injury, Chapter 22 - Bed support surfaces for preventing pressure injuries after spinal cord injury. 2022. Pages 287-298
27. Soppi E, Lehtiö J, Saarinen H. An overview of polyurethane foams in higher specification foam mattresses. Ostomy Wound Manage. 2015. 61(2):38-46
28. Kumar 2014