

# Evaluation of a newly designed moisture management product for use in women giving birth at the Canberra Centenary Hospital for Women and Children

## ABSTRACT

### Introduction

Although the incidence is rare (<1%), patients receiving care in hospital maternity wards are at risk of developing pressure injuries. These injuries create a significant economic burden worldwide. Reported risk factors for pressure injuries include epidural analgesia, immobility during labour, and increased temperature and excessive moisture, especially during birthing. Traditionally used moisture management devices often damage skin integrity, further heightening the risk for pressure injury. Here we describe an innovative moisture management product designed to better meet women's needs during pregnancy and birth.

### Methods

Clinicians worked together with the product manufacturer to develop an improved disposable absorbent sheet for moisture control before, during, and after birth. Pregnant women (n=79) used either the disposable sheet or sanitary pads alone, or the disposable sheet in conjunction with sanitary pads for moisture control; in-patients and their midwives (n=93) then completed surveys to evaluate the effectiveness of the various moisture control measures. Because multiple personnel caring for a single patient over the course of several shift changes, more surveys were completed by midwives than by patients. Four factors were considered during product evaluation: comfort, moisture management, mobility, and absorbency.

### Results

Both midwives and patients rated the comfort level of the new disposable absorbent sheet with sanitary pads significantly higher than that of the disposable

absorbent sheet or sanitary pads alone. Additionally, most patients reported that they were comfortable lying on the sheet and that using the sheet enabled them to worry less about embarrassing body fluid stains on their sheets or clothing. Similarly, the majority of midwives reported that the disposable absorbent sheet appeared to be comfortable and not restrictive. It also effectively managed moisture.

### Discussion

This study demonstrates the efficacy of the new disposable absorbent sheet for moisture management in patients treated in hospital maternity wards.

### Clinical Significance

Redesigning the disposable absorbent sheet for maternal moisture management in collaboration with clinical experts has heightened awareness of the importance of efficient and safe moisture management while facilitating a Wellness Model of Care within the maternity setting.

### Keywords

Pressure injuries, microclimate, maternity, birthing, midwifery, skin integrity, moisture management.

### INTRODUCTION

Despite the advancements in health care throughout the past century<sup>1</sup>, pressure injuries remain a challenge for health care providers. In Australia, the annual economic burden associated with pressure injuries is estimated at US \$1.65 billion, and many other countries world-wide experience a similar economic burden<sup>2</sup>. Pressure injuries also indirectly impact hospital operations by delaying



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discharge and further adding to the health facilities budget. The burden to the patient is also not negligible, as pressure injuries negatively impact patient quality of life, with many feeling as though they are hostage to the injury<sup>3</sup>. Pressure injuries also increase caregiver workload<sup>3</sup>.

Pressure and shear forces are key factors in the development of pressure injuries; however, there are many other risk factors. Several of these factors may be short lived; however, because they contribute to skin or tissue damage, which in turn contribute to the development of pressure injuries, they inherently place patients at higher risk. Importantly, increasing evidence suggests that the microclimate between the skin and the supporting surface plays a role in pressure injury development, especially stage 1 and stage 2 pressure injuries<sup>4</sup>. Moisture Associated Skin Damage, an overarching term to describe skin damage caused by different types of moisture sources also contributes to development of pressure injury<sup>5</sup>.

Although pressure injuries do not appear specific to age or medical condition, pregnant women experiencing long-term care in maternity wards are an important group that may be at higher risk for pressure injury due to the “perfect storm” mixture of risk factors they experience: immobility, poor microclimate management, temperature, and increased moisture at the skin surface. Pressure injuries also occur during labour and birthing, especially because increased usage of epidural analgesia and caesarean sections over the past 30 years have led to increases in the amount of time women may lay immobile during the labour and birthing process<sup>6,7,8,9</sup>. Additionally, women may also experience incontinence, amniotic fluid leakage, ruptured membranes, antepartum haemorrhage, and increased loading on the buttocks during labour, as well as postpartum haemorrhage and infection<sup>10</sup>, all of which place the skin at further risk of injury and therefore increase the probability of developing a labour-associated pressure injury<sup>5</sup>.

Although historically the incidence of pressure injury in the maternity setting has been rare (<1%), it has also been suggested that the risk of tissue damage from pressure experienced by women in labour has been underestimated. Therefore, it is critical to not only understand the risk factors contributing to pressure injury in women during labour, but to identify effective prevention mechanisms that will enable healthcare providers to make the birthing process safer and more comfortable for mothers.

In an attempt to address known risks factors around, the Canberra Hospital adapted a practice change resulting in the introduction of a new product to replace the existing moisture management product utilised throughout the hospital. However, the product did not meet the expecta-

tions of midwives caring for birthing women, indicating that new product was too small, potentially uncomfortable to lie on due to crinkling between the mattress and the skin surface, and that it did not adequately address moisture management at skin surface areas. Midwives also discussed the increased risk of occupational hazards, such as spills of excessive amniotic fluid and blood during the birthing process.

These concerns prompted a meeting between the product manufacturer and hospital staff from the Centenary Hospital for Women & Children (CHWC) to design an improved product that would effectively control moisture during before, during, and after birthing. Through consultation and testing, a disposable absorbent sheet was specifically designed to address the requirements of maternity patients at the CHWC. This new product has three layers to manage moisture: an air permeable layer, an absorbent inner layer, and a breathable waterproof backing. It is designed to absorb moisture as well as wick moisture away from the patient’s skin, and it maintains these wicking properties regardless of the patient’s weight. Furthermore, the new product is larger than previous versions, accommodating the width of birthing beds and available with or without tuck-in wings.

## METHODS

### Study Design and Materials

A prospective qualitative study using survey method was undertaken. The aim of this study was to determine whether the newly designed disposable absorbent sheet was suitable and effective for moisture management within this specialised clinical environment from the perspective of both women and clinicians.

The research team developed staff and patients surveys based on a review of the current literature, in consultation with the maternity staff to assess their requirements for the new product. The surveys were similar, with minor relevant changes made to better align terminology with the group being surveyed. For example, patients were asked, “Which clinical area were you admitted to?” whereas midwives were asked, “Which clinical area were you working in?” The survey comprised multiple choice responses and free-text comments to assess four main factors: comfort, moisture management, mobility, and absorbency. Participants (both patients and midwives) were asked to rate comfort level from 0-10, with 10 being the most comfortable. To replicate current practice, the study compared the comfort level of a sanitary pad alone, the newly designed disposable absorbent sheet alone, or the absorbent sheet and sanitary pad together.

## Participants and Study Location

This project was conducted during a five-week period in the maternity ward of the CHWC, a tertiary referral hospital within ACT Health. The CHWC employs approximately 130 midwives and nurses across the Birthing Suite (BS), Birthing Centre (BC), Antenatal (AN), and Postnatal (PN) units. The maternity unit is composed of 21 birthing, 15 postnatal, and 15 antenatal beds.

Participants were patients in the BS, BC, AN, and PN units. Employed midwives and in-patients were recruited into this study and participation was voluntary. Midwives were asked to complete surveys to assess the comfort of the patients in their care. They were permitted to complete a survey for each woman under their care; therefore, individual midwives may have completed multiple surveys. Due to shift changes and the length of admission or labour, two midwives may have completed a survey related to caring for the same women.

Women in each unit were invited to complete surveys to indicate their perception of the comfort level, moisture management ability, mobility, and absorbency of the product either during labour or after birth. As in current practice, patients could choose to use a sanitary pad alone, the newly designed disposable absorbent sheet alone, or the absorbent sheet together with a sanitary pad, and they were asked to comment accordingly.

A Low Risk Ethics Application was submitted to ACT Health Human Research Ethics Committee (ACTHHREC) in July 2015. The response from this committee was that formal ethics approval was not required as the project met Quality Improvement Project Guidelines.

## Staff Education

Prior to launching the study, the study coordinator held five staff in-services. The in-services detailed the study outline and staff members were given a copy of survey tool. Numerous ad hoc one-on-one education sessions were also conducted across the four clinical areas within the CHWC.

## Data Collection and Analysis

Completed surveys were placed in collection boxes at various locations throughout the four clinical areas; surveys were then manually transcribed to an Excel spreadsheet and exported to IBM® SPSS Statistics v20 2011. Survey responses were placed into two groups: Birthing Units (BU) and Antenatal/Postnatal Wards (APW). Simple descriptive statistics were used to evaluate the new disposable absorbent sheet based on patient and midwife responses. To compare the comfort of the sanitary pad alone, the disposable absorbent sheet alone, and the absorbent sheet

together with the sanitary pad, we used an ANOVA (reported as the scale mean (m) and standard error of mean (SEM)). Staff comments and feedback were analysed using descriptive thematic analysis.

## RESULTS

During the five-week survey period, surveys were returned from a total of 93 midwives and 79 patients (n=172). Patient surveys were completed by 32% (n=25) of women admitted to the BU and 68% (n=54) from the APW. Midwife surveys were completed by 48% (n=45) of midwives working in the BU and 52% (n=48) of midwives working in APW. Women appeared to spend more time in bed in the APW. Based on midwife responses, 64% of women in the APW spent at least 8–12 hours in bed daily compared with 28% of woman in the BU. Women in the BU averaged between 4–8 hours in bed daily. These results highlight the need for effective skin care measures for these patients. Extended periods of time in bed pose a risk factor for skin damage and subsequent pressure injury. Additionally, these results support the relevance of our cohort in testing the efficacy of the new disposable absorbent sheet. Because participants rated comfort level on a scale, these results were reported separately from the other reported results.

### Patient Surveys: Comfort

When rating the comfort level of the disposable absorbent sheet, women in both the BU and APW rated their comfort level highest when they used the disposable absorbent sheet in conjunction with sanitary pads, as opposed to the disposable absorbent sheet or sanitary pads alone (ANOVA scale mean (SEM): 8.40 (.26), 7.97 (.23), and 2.76 (.34), respectively; see Table 1). The majority 91% (n=72) of women felt most comfortable with the product over their bed sheet both during the day and at night. Participants (96%) commented that disposable absorbent sheets were “comfortable”, “unnoticeable”, “stayed flat”, and that the larger new absorbent sheet was “much better than the little ones”.

### Midwife Surveys: Comfort

In contrast to the patient surveys, midwives in the BU did not perceive patient comfort level to be significantly different when the disposable absorbent sheet was used alone or in conjunction with a sanitary pad, or if only a sanitary pad was used [ANOVA scale mean (SEM): 8.31 (.24), 7.96 (.20), and 2.30 (.27), respectively], both were superior to a sanitary pad alone (see Table 1). However, midwives in the APW did indicate that using the disposable absorbent sheet in unison with sanitary pads was the most satisfactory method of supporting client comfort. Midwives comments about the new disposable absorbent

pads included “more comfortable”, “stays still”, “wings comfy for longer use”, and “more comfortable for non-mobile women”.

### Patient Surveys: Moisture management

Similar to results obtained when assessing product comfort, the majority 86% (n=68) of participants reported that moisture management most effective when using the disposable absorbent sheet together with sanitary pads. Nearly three-quarters of participants 73% (n=58) reported that the new product was effective for minimising stains on their clothing, making comments such as “the disposable absorbent sheet was comfortable and I felt confident knowing any leakage would be caught by this instead of bedding and/or stain my clothes”. Participants (84%) also responded that their skin had not felt sticky while lying on the disposable absorbent sheet (See Figure 1).

### Patient Surveys: Mobility and Absorbency

Notably, due to maternal and birthing issues, 60% (n=47) of the participants spent more than 12 hours in bed in a 24-hour period, but 96% (n=76) indicated that they could find a comfortable position on the disposable absorbent sheet without requiring assistance. Over 60 % of participants suggesting the sheet need only be changed 8th hourly. Importantly, participant feedback highlighted that the patients felt that their dignity and privacy needs were maintained through using the disposable absorbent sheet. One participant stated; “The product is awesome, so easy to use I had peace of mind as would be embarrassed about leaking on sheets, comfortable directly next to skin, reassuring when limited clothes on”.

### Midwives Survey: Moisture Control

Midwives participating in the study also had a positive perception of moisture control offered by the new dispos-

able absorbent pad. A total of 78% (n=73) of midwives indicated that the disposable absorbent sheet promoted effective moisture management for the women in their care.

### Midwives Survey: Mobility

Midwives additionally indicated that the product was comfortable and did not restrict patient mobility, with positive response rates to both questions greater than 90% (See Figure 2). One midwife commented that the sheets were “Easy to roll and place under patient with wings, they don’t move with the patient, less folds and they are more comfortable for our women who have limited movement”.

### Midwives Survey: Absorbency

The majority 66%, (n=62) of midwives reported having used the disposable absorbent sheet during a large spillage of body fluids (rupture of membranes or postpartum haemorrhage); while 85% (n=48) of these midwives indicated that the pad was able to efficiently absorb the bodily fluids, some indicated that it took some time to absorb a large spill (See Figure 2). For example, one midwife indicated that the product was “Particularly good with a birth and sudden loss of amniotic fluid great absorbency, much better at containing the fluid spill”. When asked how frequently the disposable absorbent sheet needed to be replaced, BU midwives reported changing the sheet every 2-4 hours, while APW midwives reported changing the sheet every 6-8 hours, on average.

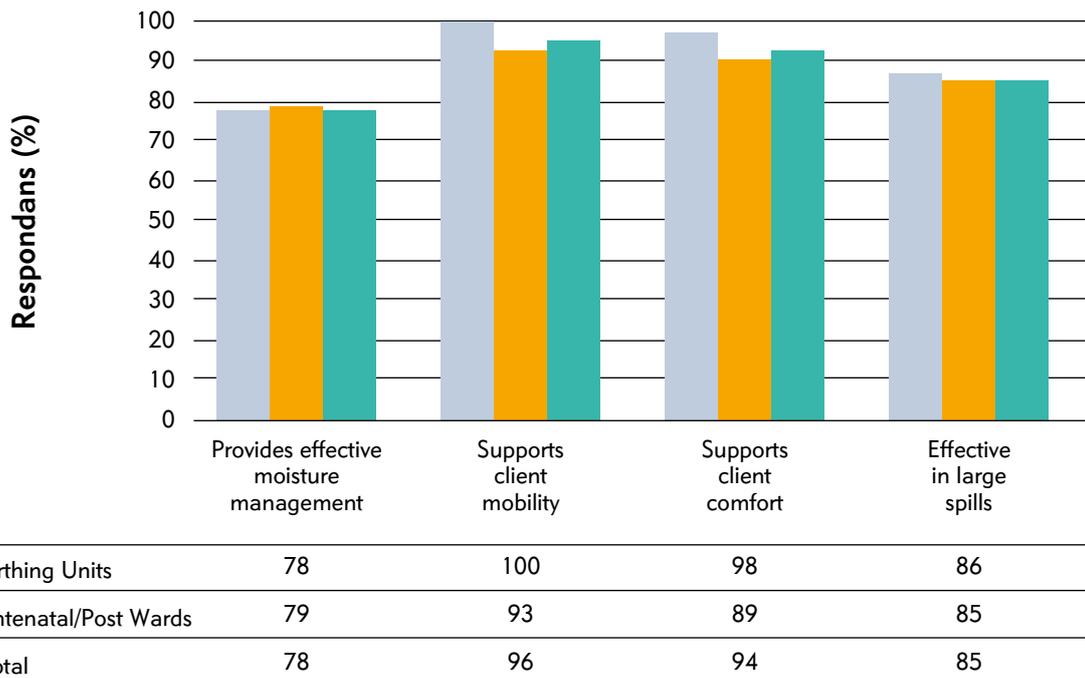
## DISCUSSION

Here we present the efficacy of a newly designed disposable absorbent sheet for moisture control among birthing women as perceived by both the patient and the caregiver. Patient survey responses indicate that the new product is effective at moisture control and reducing stickiness

**Table 1: Comparison of patient and staff perceived comfort levels: Scale mean [SE]**

Area (n)	Disposable absorbent sheet with Sanitary pad	Disposable absorbent sheet	Sanitary pad alone
<b>PATIENTS</b>	<b>MEAN</b>	<b>MEAN</b>	<b>MEAN</b>
Birthing Unit (25)	8.06 (.45)	7.14 (.44)	2.76 (.61)
Antenatal/Post Wards (54)	8.56 (.30)	8.35 (.25)	2.76 (.42)
Total (79)	8.40 (.26)	7.97 (.23)	2.76 (.34)
<b>MIDWIVES</b>			
Birthing Unit (48)	7.77 (.37)	7.79 (.20)	2.59 (.37)
Antenatal/Post Wards (43)	8.93 (.23)	8.15 (.36)	1.96 (.38)
Total (91)	8.31 (.24)	7.96 (.20)	2.30 (.27)

**Figure 1: Midwives Satisfaction Survey**

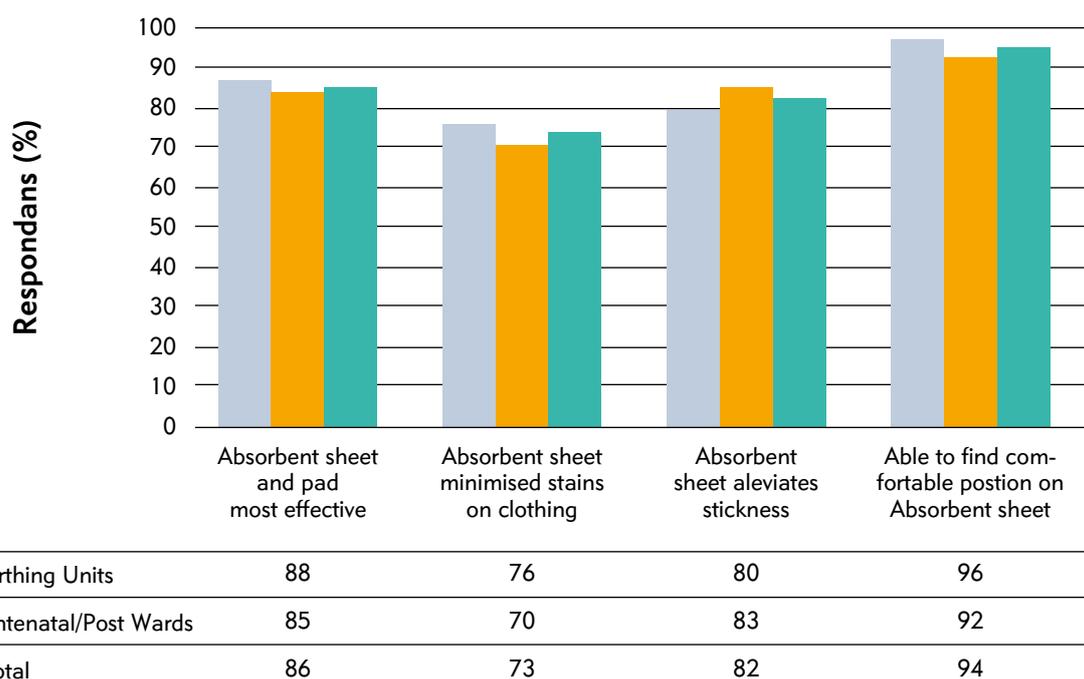


while improving comfort before, during, and after birthing. Midwives similarly indicated that the product improves patient comfort, mainly by reducing moisture and controlling body fluid spillage, while not hindering patient mobility. Importantly, both women and midwives indicated that the product effectively controlled and facilitated clean-up of body fluid spills, suggesting that the product can reduce the risk of occupational hazards such as spillage of amniotic fluid or blood during birthing. This also has psychological implications for the patients, who have

expressed fear of embarrassment due to body fluids staining their clothing or bed linens, especially when visitors are present.<sup>3</sup>

Notably, 60% (n=47) of women surveyed stated that they had spent over 12 hours in bed during a single 24-hour period. This lack of mobility may be due in part to increased immobility associated with epidurals, which have been increasingly used over the past 30 years<sup>7</sup> and are a

**Figure 2: Patient Satisfaction Survey**



recognised risk factor for development of pressure injuries among birthing women. Although traditionally the maternal wellbeing and birthing process has been treated as a wellness model, increased usage of pain control measures such as epidurals are causing a shift towards a medical model. Epidural-associated immobility increases the chance that women will experience a pressure injury, as long periods of pressure with impaired sensory perception place the patient at risk of a tissue injury. This highlights the need for standardised protocols and informed best practice procedures, which are currently lacking for maternity patients.

We initiated this study due to the lack of informed best practice procedures in the maternity setting<sup>11</sup> especially surrounding moisture control and pressure injury prevention in birthing women. Although this study provides important evidence for effective moisture control, and subsequently, pressure injury risk management, the actual risk for pregnant women to develop pressure injuries remains unknown, representing an important knowledge gap that needs to be filled by further study.

### **Implications for Clinical Practice**

This product is the result of extensive collaboration between industry and clinicians. Although several articles have summarised the potential benefits of industry-clinician collaborations to develop products that effectively meet clinical needs, such collaborations are rare<sup>12,13,14</sup>. Our study, which summarises the design of a high-quality, clinically effective product through an industry-clinician partnership serves as a proof of principal for additional industry-clinician collaborations. Such collaborations are likely to pay large dividends in terms of improving patient quality of life, reducing caregiver burden, and, ultimately, reducing economic burden due to complications or unnecessarily extended hospital stays.

### **Study Limitations**

This study was performed at a single hospital and included data collected from patients and midwives located at four different maternity wards. While surveys such as the one we employ here are cost-effective means for gathering feedback, they can only provide qualitative data in terms of patient and caregiver impressions of product performance. More rigorous studies are necessary to fully evaluate the performance of the disposable absorbent sheet in moisture control and, ultimately, prevention of pressure injuries.

### **Future Directions**

Since completing the study, the disposable absorbent sheet has been further refined based on patient and midwife feedback. The sheet is now available throughout the ma-

ternity department at CHWC and is widely used in maternity facilities across Australia. The product is proving cost-effective for hospitals, as the cost difference between the new product and previous moisture control products is negligible, and its widespread use guarantees product availability from the manufacturer. We will re-evaluate the effectiveness of this product in twelve months to determine whether the results we obtained in our small-scale study are universal across Australian hospitals. Further studies necessary to evaluate product effectiveness in pressure injury prevention will also be facilitated by the widespread use of the product, and will be necessary to fully evaluate the utility of this product in maternal care. It may also be of interest to evaluate the efficacy of the disposable absorbent sheet for moisture control and pressure injury prevention in other groups at risk for pressure injuries, such as the elderly or oncology patients.

### **Conclusions**

This industry-clinician collaborative effort led to a first of its kind innovative solution for moisture control in the maternity wards at CHWC which is now being widely used throughout Australia. Further research is needed to fully ascertain the specific risk for pregnant women to develop pressure injuries and to optimise pressure injury prevention in this group via moisture control and skin integrity maintenance.

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### Implications for Clinical Practice

- This study is a proof of concept for effective collaboration between industry and clinicians to improve patient care
- The new product described not only improves patient quality life, but is also likely to reduce caregiver burden and associated healthcare costs
- The new product may reduce the risk of occupational hazards, such as excessive spillage of amniotic fluid and/or blood during the birthing process

### Further Research

- Future research could evaluate the efficacy of this product for moisture control in other vulnerable groups at risk for pressure injury, such as the elderly or oncology patients
- More studies are needed to fully evaluate the ability of the new moisture management product presented here to prevent pressure injury in birthing women

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