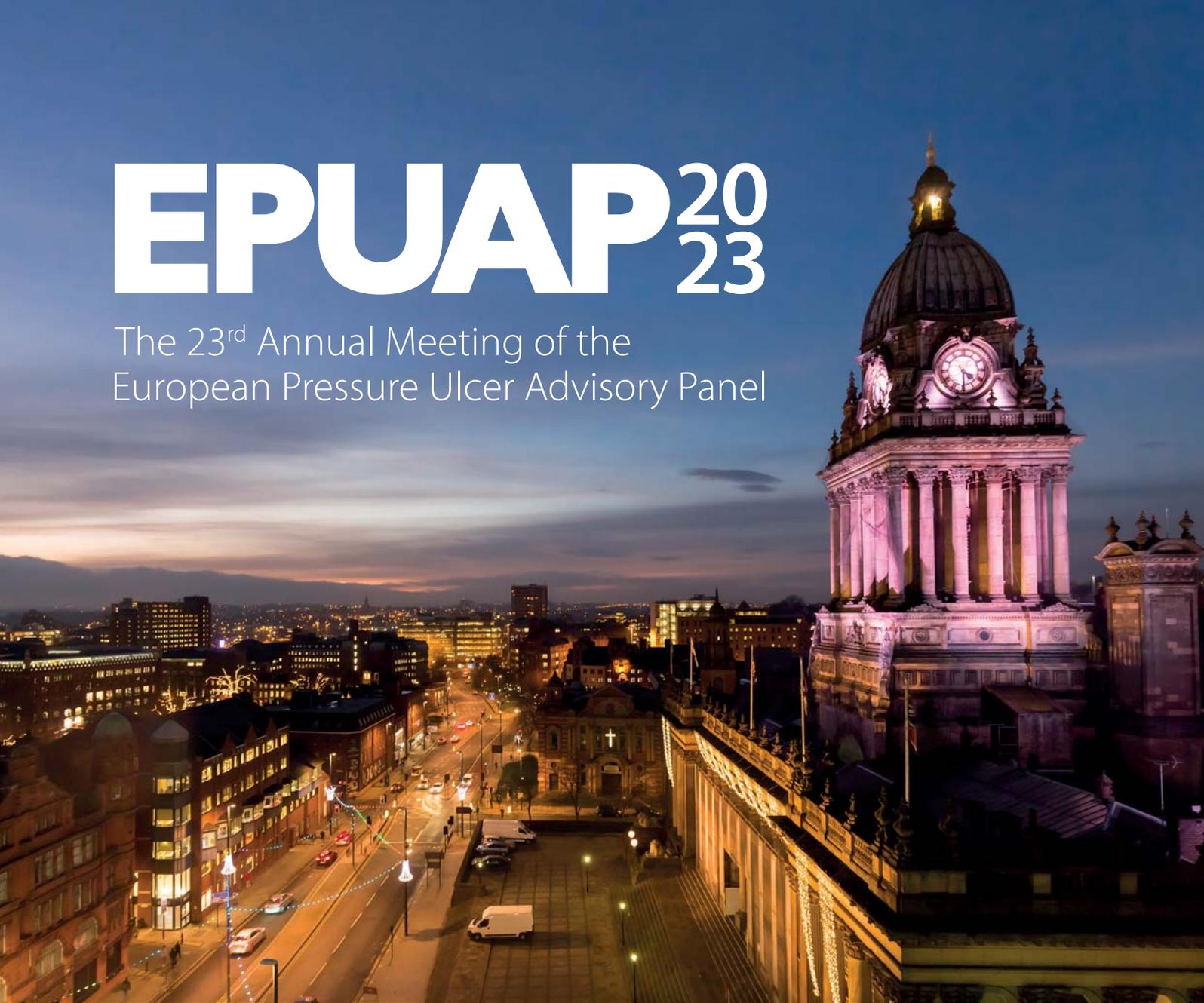


# EPUAP<sup>20</sup><sub>23</sub>

The 23<sup>rd</sup> Annual Meeting of the  
European Pressure Ulcer Advisory Panel



## ABSTRACT BOOK

INNOVATIONS IN PRESSURE ULCER  
PREVENTION AND TREATMENT

13 – 15 September 2023, Leeds, United Kingdom

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## KS1.1

# EXPERT BY EXPERIENCE: A SERVICE USER STORY

**Delia Muir**<sup>1</sup>

<sup>1</sup> *University of Leeds, Leeds United Kingdom*

Patients and families are often the only constant factor in their journey through complex health services. As such, there is much to learn from their experiences. During this interview style presentation, we will hear from a patient with lived experience of pressure ulcer development. She will share her journey through acute care services, where she developed a grade 3 pressure ulcer. We will discuss the impact of that experience, where things went wrong, and what lessons can be learnt for pressure ulcer research and practice.

### KS1.3

## A NEW CONCEPTUAL MODEL FOR COMMUNICATING ABOUT PRESSURE UICER RISK AND MANAGEMENT

**Lisa Ledger**<sup>1</sup>, **Pete Worsley**<sup>2</sup>, **Jo Hope**<sup>2</sup>, **Lisette Schoonhoven**<sup>2</sup>

<sup>1</sup> University of Derby, Derby, United Kingdom

<sup>2</sup> University of Southampton Highfield Campus, Southampton, United Kingdom

**Introduction:** Prevention of pressure ulcers (PUs) remains a key priority within healthcare settings, with risk assessment and preventative care planning alongside the patient central to a preventative approach. Patient involvement in decision-making has become an increasing focus in recent years, with an emphasis from professionals instructing patients what to do, to a more patient centred care model whereby patients are more active partners in the decision-making process (NHS England, 2020). It is important to understand further how a more person-centred approach can be adopted within practice as much of the research to date has largely focused on the professional view rather than the patient (Ledger et al, 2020). The focus of this presentation is to share the key findings from a PhD research project that led to the development of a new, person-centred conceptual model for communicating about PU risk and management.

**Methods:** An explorative, qualitative research design was chosen to focus on the patient perspective and understanding of PU risk. An overall pragmatist approach was used to collect a range of data, including observations of interactions between district nurse and patient, follow up interviews with patients themselves and analysis of the pressure ulcer leaflet. A total of 15 patients were recruited to the study that were living in the community and identified as at risk of developing pressure ulcers. All data was uploaded to Atlas-ti and thematically analysed.

**Results:** There were several key results from the study. The focus of this presentation is to share some of the key findings, particularly the importance of the type of nursing approach used in encouraging patient involvement and patient factors, leading to a new conceptual model of risk communication. The type of nursing approach employed was found to be critical to active patient involvement, understanding of key patient factors and subsequent adherence (Ledger et al, 2023).

**Conclusion:** This study provides useful insights from a patient perspective around patient understanding of risk and the importance of involvement in decision-making and introduces a new conceptual framework for communicating risk by the author.

### References:

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Ledger L J, Worsley P R, Hope J and Schoonhoven L (2023) Patient perceptions and understanding of pressure ulcer risk in the community. *Journal of Advanced Nursing*. DOI: 10.1111/jan.15637.

## KS2.1

# ROBOTIC TECHNOLOGIES IN EFFICACY RESEARCH OF WOUND CARE PRODUCTS

Amit Gefen<sup>1</sup>

<sup>1</sup> Tel Aviv University, Department of Biomedical Engineering, Faculty of Engineering, Tel Aviv, Israel

**Introduction:** Difficult-to-heal wounds are currently considered among the most important, unsolved and expensive medical burdens. The major chronic wound types are pressure ulcers (PUs, also known as pressure injuries in the US, Canada and Australia), diabetic foot ulcers (DFUs) and venous leg ulcers (VLUs). Each of these wound aetiologies involves a considerable mortality risk, for example, PUs cause deaths of 5 per 100,000 people each year at the ages of 65-84, and of 24-30 per 100,000 annually among those older than 84 years [1]. The first line of defence in treating all these wounds, PUs, DFUs and VLUs, is by means of wound dressings.

**Methods:** However, the effectiveness of wound dressing performance in exudate management is commonly gauged in simple, non-realistic laboratory setups, typically where dressing specimens are submersed in vessels containing aqueous solutions, rather than by means of clinically relevant test configurations. Specifically, two key fluid–structure interaction concepts: sorptivity—the ability of wound dressings to transfer exudate, including viscous fluids, away from the wound bed by capillary action, and durability—the capacity of dressings to maintain their structural integrity over time and particularly, at removal events, have not been properly addressed in existing test protocols. This talk will review our recent published research concerning the development of clinically relevant testing methods for wound dressings, focussing on the clinical relevance of the tests as well as on the standardisation and automation of the laboratory measurements of dressing performance.

**Results:** Specifically, work at the Gefen laboratory has led to development of novel robotic wound systems simulating chronic wounds of different aetiologies (PUs, DFUs and VLUs) for quantitative efficacy research of existing and new wound care technologies and products [2-8]. Robotic technology-based wound simulators are needed because clinical trials in wound prevention and care are becoming extremely expensive and complex to conduct, and typically, lack the statistical power to be able to differentiate between product performance parameters.

**Conclusions:** Examples will focus on compiling experimental results characterising the performance of foam, gelling fibre and superabsorbent dressings as acquired using the robotic wound systems to demonstrate differences across products, including for products that apparently belong to the same dressing family but differ remarkably in materials, structure and composition and thereby, in their fluid handling and mechanical strength performance.

### References:

1. Verdú-Soriano et al. *J Tissue Viability*, 30:147-154, 2021. 2. Gefen et al. *Wounds Int Suppl*, London, 2021, [www.woundsinternational.com](http://www.woundsinternational.com). 3. Lustig et al. *Int Wound J*. 18:194-208, 2021. 4. Lustig & Gefen A. *Int Wound J*, 18:670-680, 2021. 5. Lustig & Gefen. *Int Wound J*, 19:305-315, 2022. 6. Lustig & Gefen. *Int Wound J*, 19 Suppl 1(Suppl 1):3-21, 2022. 7. Orlov et al. *Adv Skin Wound Care*, 35:326-334, 2022. 8. Orlov & Gefen. *Int Wound J*, doi: 10.1111/iwj.13985, 2022.

COI: Funding from multiple sources as specified in References no. 3 – 8 of the Gefen research group.

## KS2.2

# MACHINE LEARNING APPROACHES FOR MOVEMENT MONITORING TO AID THE PREDICTION OF PRESSURE ULCERS

Peter Worsley<sup>1</sup>, Silvia Caggiari<sup>1</sup>

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**Introduction:** One of the major causes of pressure ulcers is prolonged immobility [1]. In recent years advances in wearing and sensing technologies have enabled us to monitor movement, for example walking steps. However, there is a need to develop sensors and algorithms to detect bed and chair movements to classify posture and mobility, to support pressure ulcer prevention. The aim of this talk is to discuss recent developments of this technology and future applications.

**Methods:** A series of lab-based [2] and clinical studies [3] have been employed to evaluate the use of wearable (accelerometers) and interface sensors (continuous pressure monitors). Studies have employed volunteers to adopt specific postures to train machine learning and artificial intelligence algorithms for the detection of posture and mobility. These have then been translated into clinical studies where distinct patterns of movement were assessed in the light of the development of pressure ulcers (spinal cord patients and those living in the community).

**Results:** Accelerometers and continuous pressure monitors were able to detect both large scale (macro) and small scale movements (micro). This was achieved using the derivative signals from selected parameters, which were identified using receiver operator curves. Specific postures could also be identified through deep learning approaches (CNN), with an accuracy ranging from 60-90% in classification (Figure 1a). When the algorithm was used on patient groups, distinct trends were observed where those individuals with prolonged periods of immobility acquired skin damage.

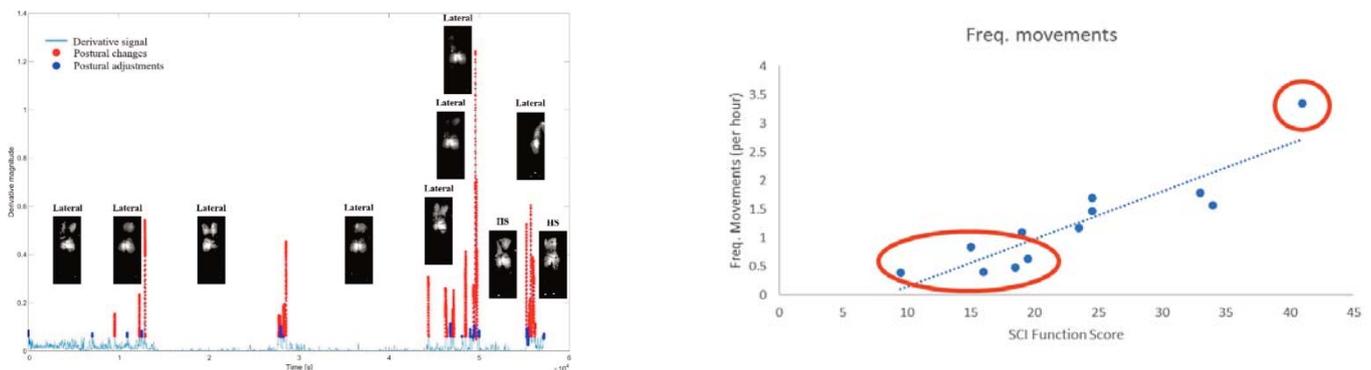


Figure 1. (A) Detection of movement from derivative interface pressure signals and prediction of posture. (B) Identification of individuals who have skin damage from movement frequency ( $n=13$  spinal cord injured inpatients).

**Conclusions:** Technologies to monitor movement show potential to identify individuals who are at risk of pressure ulcers. This could improve self-management of pressure ulcer risk and support the personalization of interventions for posture and mobility. Further studies are required to established thresholds of movement in accordance with individual tolerance to pressure for the creation of objective risk stratification.

### References:

[1] PUAP/NPIAP/PPPIA. In: E Haesler, ed. *Prevention and Treatment of Pressure Ulcers/Injuries: Quick Reference Guide*. 3rd ed. EPUAP/NPIAP/PPPIA; 2019. [2] Caggiari, NS, et al. *MEP*, 91, 39–47. [3] Fryer, S, et al. *Spinal cord*, 61(2), 111–118

**KS2.3**

# RESHAPING WOUND CARE PRACTICE USING ARTIFICIAL INTELLIGENCE

**Sebastian Probst<sup>1</sup>***1 HES-SO University of Applied Sciences and Arts Western Switzerland, Geneva, Switzerland*

Wound care has become increasingly complex due to various factors such as patient complexity, staff shortages, and diverse decision-making processes. Accurate wound documentation plays a pivotal role in determining the most effective treatment options and facilitating the wound healing process. However, the challenges posed by these complexities have paved the way for innovative solutions, including the integration of artificial intelligence (AI) technologies and portable devices like smartphones.

AI's potential in wound care is substantial and multi-faceted. The incorporation of novel AI methodologies holds promise for revolutionizing wound care practices. Machine learning (ML) algorithms have been implemented to diagnose acute and chronic wounds, enhancing the care delivered to hospitalized patients and optimizing clinicians' time allocation.

Integrating AI-powered wound care algorithms with cloud computing using smartphones or tablets as platforms demonstrates practicality and promise. By leveraging artificial intelligence, wound care practitioners can gain access to a wealth of knowledge, thereby enhancing their specialized clinical approach. "Apps" and other technology systems facilitate the collection of vast datasets, which can then be analyzed through AI and ML techniques to identify critical focus areas for standardizing practices. Despite the potential benefits, there are challenges associated with implementing AI in wound care. Data management, algorithm robustness, stakeholder consensus, and ethical AI development guidelines pose hurdles that need to be addressed. Presently, AI in wound care remains in its infancy, but its transformative potential is evident. AI's role in enhancing accuracy and care efficiency is undeniable. In the diagnosis and management of chronic wounds, algorithms based on machine learning exhibit promise, potentially leading to more efficient work schedules and improved patient outcomes.

It's important to note that AI doesn't replace human expertise; rather, it serves as a valuable tool in decision-making concerning patient care. As technology advances, the alliance between human judgment and AI-driven insights strengthens, leading to more informed, efficient, and personalized wound care practices.

In conclusion, the landscape of wound care is evolving with the integration of AI technologies and portable devices. The convergence of AI with wound care practices offers immense potential in enhancing accuracy, efficiency, and specialized patient care. Despite challenges, the trajectory of AI in wound care is positive, and its impact is set to reshape the way clinicians approach wound diagnosis, treatment, and management.

**KS3.1****THEORY AND PRACTICE OF PRESSURE ULCER/INJURY RISK ASSESSMENT: A CRITICAL DISCUSSION****Jan Kottner<sup>1</sup>**<sup>1</sup> Charité-Universitätsmedizin Berlin, Berlin, Germany

Pressure ulcer/injury risk assessment is widely considered as an essential component in clinical practice. It is a complex and broad concept including different approaches such as clinical judgement, using standardized risk assessment instruments, skin assessments or using devices to measure skin or tissues properties. A distinction between pressure ulcer/injury risk assessment and early detection is important. Pressure ulcer/injury risk measures the individual susceptibility to develop a pressure ulcer/injury under a specific exposure (primary prevention) and early detection includes the assessment of early (sub)clinical signs and symptoms to prevent progression and to support healing (secondary prevention). Pressure ulcer/injury risk is measured using prognostic/risk factors or prognostic models. Every risk estimate is a probability statement containing varying degrees of uncertainty. It follows, that every clinical decision based on risk estimates contains uncertainty, too. There is a huge body of evidence indicating that risk assessment, outcomes of risk assessment, the selection of preventive interventions, and pressure ulceration are not well connected. Methods for prognostic model development and testing in pressure ulcer/injury risk research must be improved following state-of-the-art methodological standards. Despite these challenges, we do have substantial knowledge about pressure ulcer/injury risk factors that helps to make better clinical decisions. A striking next step in development of pressure ulcer/injury risk prediction might be the combination of clinical and other predictors for more individualized care. Any prognostic test or procedure must lead to better prevention at acceptable costs.

## KS3.2

# PROGNOSTIC MODELS FOR PREDICTING PRESSURE ULCER RISK: CURRENT STATUS AND FUTURE NEEDS

**Chunhu Shi**<sup>1</sup>

<sup>1</sup> University of Manchester, United Kingdom

**Introduction:** Pressure ulcers are common but preventable wounds. The NPUAP/EPUAP/PPPIA 2019 international pressure ulcer guideline suggests (1) including a comprehensive skin assessment and (2) supplementing use of a risk assessment tool with assessment of additional risk factors in assessing an individual's pressure ulcer risk. Risk assessment and skin assessment inform use of subsequent preventative interventions.

We aimed to address the question: in pressure ulcer prevention what is the current evidence regarding the prognostic performance of empirically-derived prognostic models in predicting pressure ulcer risk; and skin status that could be prognostic for pressure ulcer development?

**Methods:** We conducted (1) a prognostic model review identifying and evaluating empirically-derived risk assessment tools for pressure ulcer prediction; (2) a prognostic factor review investigating the prognostic value of specific skin statuses on pressure ulcer incidence; and (3) an individual patient data meta-analysis investigating the prognostic value of non-blanchable erythema on pressure ulcer incidence. Within these reviews we conducted rigorous searches, screening, risk of bias assessment, data collection and meta-analysis appropriate to each review. We used GRADE, where available, to assess the certainty of evidence.

**Results:** Findings from the prognostic model review of 24 included studies suggest that all 22 available, empirically-derived tools were developed using low-quality methods. The prognostic factor review included forty-one studies (162,299 participants) investigating skin status-ulcer incidence associations. Aggregate data suggest the odds of ulcer development are increased by 2.58 in those with non-blanchable erythema compared with those without (low-certainty evidence). Further analysis of individual participant data from four studies (3,223 participants) found moderate-certainty evidence that people with non-blanchable erythema have higher odds of developing a Stage 2 or above pressure ulcers than those without (odds ratio 2.73, 95% confidence interval 2.10 to 3.52). The prognostic value of 14 other poor skin statuses with aggregate data meta-analyses is uncertain.

**Conclusions:** It is unclear if empirically-derived risk assessment tools can help distinguish between people at risk and not at risk due to the low-quality development process. People with non-blanchable erythema are more likely to develop an ulcer than those without. It is important to identify non-blanchable erythema in practice and to intervene appropriately to prevent ulceration. However deep tissue injury might have occurred without nonblanchable erythema.

## References:

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Shi C, Bonnett LJ, Dumville JC, Cullum N. Nonblanchable erythema for predicting pressure ulcer development: a systematic review with an individual participant data meta-analysis. *Br J Dermatol.* 2020;182(2):278-286.

Shi C, Dumville JC, Cullum N. Evaluating the development and validation of empirically-derived prognostic models for pressure ulcer risk assessment: A systematic review. *Int J Nurs Stud.* 2019;89:88-103.

**COI:** This research was funded by the President's Doctoral Scholar Award of The University of Manchester.

## KS3.3

## PURPOSE-T FROM DEVELOPMENT TO EVALUATION

**Susanne Coleman**<sup>1</sup>, **Jane Nixon**<sup>1</sup>, **Joanne Greenhalgh**<sup>1</sup>, **Lisette Schoonhoven**<sup>2</sup>, **Maureen Twiddy**<sup>3</sup>

1 University of Leeds, Leeds

2 Umcutrecht, Umcutrecht

3 Hull York medical school, Hull

**Introduction:** The Pressure Ulcer Risk Primary Or Secondary Evaluation Tool - PURPOSE-T was developed as part of a National Institute for Health Research (NIHR) funded Research Programme (PURPOSE: RP-PG-0407-10056) and has since been implemented into routine care. PURPOSE-T differs to standard RAIs as it includes a screening step, considers whether a patient already has a PU and facilitates consideration of the patients risk profile (rather than a score) to prompt appropriate preventative or treatment interventions.

**Methods:** A realist evaluation was undertaken to facilitate a deeper understanding how nurses use PURPOSE-T in practice. From a realist perspective PURPOSE-T is a resource to clinicians and its impact on care will be dependent on how it is used, which will differ according to context [1-2]. A combination of methods including a literature review, semi-structured interviews with staff and patients, record review and observation were used.

**Results:** Programme theories and supporting evidence relating to the use of PURPOSE -T along an implementation pathway will be explored in this presentation. These relate to how PURPOSE-T informs clinical judgement, prompts care planning and delivery and facilitates multi-disciplinary and patient communication about pressure ulcer risk.

**Conclusions:** Findings reinforce that PURPOSE-T is a complex interventions as its delivery contains several interacting components [3] along an implementation pathway, including the assessment itself, the potential outcomes and decisions about care interventions set within the delivery context of complex health care environments. Understanding how PUPROSE-T is used in different contexts informs local implementation strategies and future evaluation methods.

**References:**

[1] Pawson, R. and N. Tilley, *Realist Evaluation*, B.C. Office, Editor. 2004

[2] Wong, G., et al., *RAMESES II reporting standards*. *Bmc Medicine*, 2016.

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**COI:** This report is independent research arising from a Post -Doctoral Research Fellowship (PDF-2016-09-054) supported by the National Institute for Health Research. The views expressed in this publication are those of the author(s) and not necessarily those of the NHS, the National Institute for Health Research, Health Education England or the Department of Health.

## KS4.2

# THE PRESSURE ULCER PREVENTION AT HOME STUDY: A PARTICIPATORY APPROACH

**Delia Muir**<sup>1</sup>

<sup>1</sup> University of Leeds, Leeds, United Kingdom

**Introduction:** People with Long Term Neurological Conditions (LTNC) often self-manage their care and can fall between the gaps in health and social care services. There is currently a lack of pressure ulcer prevention support for this group, despite many people living with long-term risk. People with LTNC, their families, and Personal Assistants (PAs) are often uniquely placed to spot and respond to pressure ulcer risk. Despite this, they are rarely included in conversations about risk, and they are underrepresented in pressure ulcer research. Through this project, we are exploring what people want and need to help them prevent pressure ulcers at home.

**Methods: Aim:** To develop a theory of change pathway to facilitate the development of a multi-component intervention package, supporting PU risk identification and management, in partnership with people with LTNC, their informal carers and PAs.

Population:

- People with LTNCs (e.g. MS, spina bifida and spinal injury) which impact mobility, who self-manage care and live at home.
- Their informal carers (e.g. family members and friends who provide ongoing support).
- Their PAs (a type of non-clinical, paid carer).

This is a participatory project, meaning it is led by people whose lives are the focus of the research. People with LTNCs, carers and PAs are involved in, or leading, all aspects of this study, in collaboration with the University of Leeds.

The study is split into 4 work packages:

- 1 – Forming co-operative inquiry groups (research groups) with service users, carers and PAs.
- 2 – Peer to peer interviews and mobile ethnography.
- 3 – Engagement with strategic / professional partners from health, social care and third sector organisations.
- 4 – Systems mapping and theory of change development.

**Results:** This is an ongoing project. During our presentation, we will share emerging findings from work packages 1 – 3. Including, the emotional impact of managing LTNC and pressure ulcer risk; the challenge of integrating pressure ulcer prevention activities within broader self-care routines and daily lives; the importance of peer support and learning; the challenges of escalating concerns and navigating complex health systems; avoiding blame and stigma; and barriers to discussing / negotiating risk (from both a professional and service user perspective). We will also share methodological learning about the participatory approaches being used within the study, including the perspective of research group members.

**Conclusions:** Findings from this study will inform the development of interventions to support pressure ulcer prevention at home. In addition, we are generating valuable methodological learning about how to conduct participatory research in the context of pressure ulcer prevention research.

### KS4.3

## SERVICE USER INVOLVEMENT IN GUIDELINE DEVELOPMENT

**Zena Moore**<sup>1</sup>

<sup>1</sup> Royal College of Surgeons in Ireland, University of Medicine and Health Sciences, Dublin, Ireland

**Introduction:** Service user involvement in guidelines is considered to be an essential component of the development process. As such, many international organisations, such as the WHO, NICE and others, make specific reference to the importance of service users and the need to include them in the whole process. Because individuals themselves are often experts in their own health, service involvement is conceptualised as 'making sure the voices of people are heard and they are able to actively shape and improve the services they use' (The Advocacy Project UK, 2023). This presentation will elaborate on the concept of service user involvement in international guideline development, and in doing so will address the following:

- What does service user involvement mean?
- Why involve service users in guideline development?
- How should service users be included in guideline development?
- What are EPUAP, NPIAP & PPPIA doing about service user involvement for the current guideline update?

### References:

The Advocacy Project UK, 2023. Available from: <https://www.advocacyproject.org.uk/home/user-involvement/>

**COI:** Professor Zena Moore is The European Pressure Ulcer Advisory Panel Chair of the Guideline Development Group

## KS5.2

# BARRIERS AND ENABLERS TO FAMILY CAREGIVERS PROVIDING PRESSURE ULCER CARE TO OLDER PEOPLE LIVING AT HOME: PRELIMINARY FINDINGS FROM A QUALITATIVE STUDY INFORMED BY THE THEORETICAL DOMAINS FRAMEWORK

Kathleen Mulligan<sup>1</sup>, Shashivadan Hirani<sup>1</sup>, Nicola Sears<sup>1</sup>, **Caroline McGraw**<sup>1</sup>

<sup>1</sup> City, University of London, London, United Kingdom

**Introduction:** Approximately two-thirds of pressure ulcers (PUs) occur in older people. Today, most older people live at home with support from family, friends and community networks. Family caregivers play an important role in PU care in the home. Whilst PUs have been found to be a significant source of caregiver burden, few studies have explored family caregivers' experiences of caring for an older person with pressure ulceration or assessed their PU related support needs. This study explored the views and experiences of family caregivers for older people with a focus on identifying the PU behaviours performed by family caregivers and understanding the barriers and enablers to providing PU care.

**Methods:** The study adopted a qualitative design, using semi-structured interviews with adult family caregivers who provided at least twice weekly assistance to a person aged >65 years with a category >2 PU. Participants were drawn from district nursing caseloads in England. The Theoretical Domains Framework (TDF) informed data collection and analysis. To identify PU behaviours undertaken by family caregivers, Framework Analysis was used. To identify influences on behaviour, analysis followed a five-step process including deductive coding of the transcripts into TDF domains and the inductive generation of specific belief statements.

**Results:** In total, 26 family caregivers participated, including 15 female and 11 male carers, and 5 same generation and 21 next generation carers. The study found participants were undertaking a wide range of PU behaviours: making the most of support surfaces, undertaking regular skin inspection, managing incontinence and moisture, maintaining mobility, turning and repositioning, ensuring adequate nutrition and hydration, keeping the wound clean and covered, initiating, facilitating and coordinating professional care, managing PU pain, and monitoring for signs of wound infection. Data analysis is ongoing. However, the TDF domains emerging as especially important include: Knowledge, Social Role and Identity, and Beliefs about Consequences. The presentation will share specific belief statements that convey the factors influencing family caregiver behaviours, including statements relating to knowledge deficits, ideas about family duty and responsibility, activities undertaken to acquire PU knowledge, and beliefs about the negative impact of PUs on caregiver wellbeing.

**Conclusions:** The study is intended to be the first phase in a series of work leading to the development of a family caregiver focused intervention. In the interim, given the range of PU activities undertaken by family caregivers, care pathways for community-acquired PUs need to give consideration to the information and support needs of family caregivers.

**COI:** Seed Grant for Research funding from Barts Charity.

## KS6.1

# THE QUEST TO PREVENT SKIN AND TISSUE DAMAGE: ACCESSIBLE EDUCATIONAL MATERIALS FOR THE MULTI-PROFESSIONAL TEAM WORKING WITH VULNERABLE VENTILATED PATIENTS.

**Anika Fourie<sup>1</sup>, Dimitri Beeckman<sup>1,2</sup>, International expert panel \***

1 Skin Integrity Research Group (SKINT), University Centre for Nursing and Midwifery (UCVW), Department of Public Health and Primary Care, Ghent University, Ghent, Belgium

2 Swedish Centre for Skin and Wound Research, School of Health Sciences, Örebro University, Örebro, Sweden

Digital, on-demand, and easily accessible educational resources could be a valuable adjunct to practical hands-on training in managing critically ill patients in the prone position<sup>1</sup>.

Multiple societies<sup>2</sup> strongly recommend mechanically ventilating patients with moderate to severe acute respiratory distress syndrome (ARDS) in the prone position for > 16 hours. Even though prone positioning elicits a significant benefit to the patient in improving oxygenation and reducing mortality, the incidence of skin and subdermal tissue damage, such as pressure ulcers/injuries, remains high<sup>3</sup>.

Education is critical in improving patient quality care and mitigating the risks of skin/tissue damage<sup>4</sup>. Updated procedures, educational resources and protocols are often not readily available for complex procedures (prone manoeuvre) infrequently used in daily practice.

A digital platform was created dedicated to managing the prone ventilated patient and preventing skin/tissue damage such as pressure ulcers/injuries, moisture-associated skin damage and skin tears<sup>5</sup>. The PRONect Education Hub ([www.pronecteducation.com](http://www.pronecteducation.com)) hosts eight simulation videos, a protocol, a checklist, and a slide deck for didactic teaching.

The PRONect Education Hub could be a resource for students during their internships, new critical care staff, or the current multidisciplinary staff for refresher training. For hospitals, the simulation videos can be added to their local intranet, the protocol can be downloaded, adapted to their local context and available equipment, and the educational departments can use the slide deck for didactic sessions.

This resource could be a valuable adjunct to practical hands-on training in managing critically ill patients in the prone position<sup>6</sup>.



\*International Expert Panel: M. Ahtiala (Finland), D. Beeckman, A. Fourie, S. Smet (Belgium), J. Black, K. Vollman (USA), H. Hevia Campos (Chile), F. Coyer (Australia), A. Gefen (Israel), K. LeBlanc (Canada), Y. Walsh (South-Africa)

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## KS6.2

# THE IMPACT OF PRESSURE ULCER PREVENTION EDUCATION ON HEALTH CARE ASSISTANTS KNOWLEDGE SKILLS AND PRESSURE ULCER INCIDENCE IN HEALTH CARE SETTINGS

**Noreen O'Brien<sup>1</sup>, Tom O Connor<sup>1</sup>, Zena Moore<sup>2</sup>**

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<sup>2</sup> RCSI University of Medicine & Health Sciences, Nursing & Midwifery (SWaT centre), Dublin, Ireland

**Introduction:** Pressure ulcers (PUs) are a significant clinical issue, and their prevention is a priority for health care settings. Older adult patients are susceptible to PUs due to the presence of co- morbidities and reduced mobility (Ousey 2015, Moore 2011). Health care assistants (HCAs) represent most of the workforce in long-term care settings and play a significant role in PU prevention and the provision of education is an integral component of PU prevention (EPUAP/NPIAP/PPPIA, 2019). The overall aim of this systematic review (SR) was to investigate the impact of education for health care assistants on their knowledge and skills in PU prevention and on the incidence of PUs.

**Methods:** Using systematic review methodology and the PRISMA guidelines, in November 2021 key databases were searched, CINAHL, EMBASE, SCOPUS, MEDLINE and Cochrane Wounds Group Specialist Register and Cochrane Central Register of Controlled Trials, with no limitations on date of publication. The search yielded an initial 449 records, of which 14 met the inclusion criteria. The methodological quality of the studies was evaluated using the Evidence-based Librarianship checklist (Glynn, 2006). Data was analysed using narrative and meta-analysis.

**Results:** Eleven studies (79%) reported outcome measures of HCA knowledge scores, with four studies reporting a statistically significant improvement in knowledge scores post education intervention. Nine studies (64%) found a statistically significant reduction in prevalence (OR 1.69, p= 0.01) and incidence rates (OR 2.20, 95%, p<0.0001) post-education intervention.

**Conclusions:** This SR affirms the benefits of education of health care assistants on knowledge and skills of PU prevention and on PU incidence. However, there was broad methodological heterogeneity and low-quality evidence within the included studies. Further research is needed.

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### KS6.3

## TELEHEALTH USED AS A REMOTE EDUCATIONAL STRATEGY BETWEEN THE HOSPITAL AND THE PRIMARY CARE SETTING

**Steven Smet**<sup>1</sup>

<sup>1</sup> Ghent University Hospital, Wound Care Centre, Gent, Belgium

**Introduction:** Due to COVID-19, physical consultations were reduced to a minimum. To ensure continuity of care, remote consultations, including video consultations, were promoted. Despite the evidence that already proved multiple benefits in wound management, experiences in clinical practice indicated also an increased need for education and training in the primary care setting regarding wound management and pressure ulcer prevention. Smart glasses, multidisciplinary digital meetings and a uniformization in wound assessment, can amplify a remote educational exchange between the primary care and hospital setting

**Methods:** A mixed methods design consisting of: (1) a questionnaire-based, multicentric cross-sectional study of facilitators and barriers for the implementation of smart glasses and (2) a phenomenological study examining the needs and requirements of caregivers, residents and their relatives in the implementation of smart glasses in a transmural wound care context. Additionally, Ghent University Hospital implemented video consultations with the primary care setting during the multidisciplinary discussions of pressure ulcer patients in May 2023.

**Results:** The questionnaire was completed by 68 caregivers. The results showed a significant effect between the outcome expectations, effort expectancy, attitude, social influence, facilitating conditions, fears and risks regarding the intention to use smart glasses. Three main themes emerged from the focus group interviews (n=8): (1) perception of residents and caregivers about smart glasses, (2) important preconditions for implementation of smart glasses and (3) barriers for caregivers. Positive preliminary experiences were reported by the caregivers that were involved during the multidisciplinary video consultations. A study protocol to pursue more uniform and valuable transmural wound assessment, including possible support of AI and smart dressings, has been developed.

**Conclusions:** Smart glasses can facilitate the use of telehealth as a remote educational strategy in wound management and pressure ulcer prevention, considering important barriers that have to be overcome. Remote involvement of clinicians from the primary care setting during in-hospital multidisciplinary meetings, and an increased uniformization of transmural wound assessment and reporting, offer additional educational opportunities within telehealth.

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**COI:** No conflict of interest

## KS7.1

# HOW COMMUNICATION SUPPORTS LEADING WOUND CARE INNOVATIONS: CHANGING TIMES, CHANGING THE TEAMWORK AND ITS RELATIONSHIP BETWEEN CAREGIVERS, PATIENTS, PROFESSIONALS

**Andrea Pokorná<sup>1</sup>**

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**Introduction:** Effective communication is considered a key skill and tool by which we identify the needs of patients, their loved ones, and other people involved in the care process. We communicate from birth; as humans, most of us are gifted with non-verbal and verbal communication components. Nevertheless, at the same time, the communication process is still one of the most significant barriers that leads to misunderstandings and can have far-reaching consequences on the quality and safety of care. So what is the cause of the possible shortcomings, and how to avoid them, if possible? The challenges we face in caring for people with wounds are multifactorial (e.g. age, gender, education, social role). We usually communicate with the patient and the whole team simultaneously (i.e., lay carers and experts in different medical fields). A specific situation is, for example, the dressing change of an extensive wound, in which the layman's world collides with the world of experts, looking for a common language and outlook on the world. We are talking to people who live their own stories and have personal barriers and different expectations. Of course, this applies to patients in general. Still, wounded patients are chronically ill with many comorbidities and have many experiences and views. A specific area is when caring for a child with a wound - we are caring for several people at once (sometimes up to 3in1 - child, parent, grandparent). Expectations and real options are often significantly different and must be properly communicated. And most importantly, there are no simple and one-size-fits-all solutions. Therefore, it is advisable to use appropriate, effective communication strategies with tools that can facilitate communication. Effective communication has emerged as a response to the growing recognition that communication is necessary for impacting interpersonal relationships. Effective communication should save time, help coordinate, control, and issue instructions, and improve speaking abilities, listening, interacting, writing, convincing, and persuading. Using the 7C's and 4S's strategies is advisable in connection with this. The 7C's strategy includes Credibility, Courtesy, Clarity, Correctness, Consistency, Concreteness and Conciseness. This should also build confidence when using 4S's strategy (including shortness, simplicity, strength, and sincerity). We live in a time of information boom in all medical fields, and we must be aware that this also affects communication in wound management, and this could influence it positively (use of special channels, different tools, newly recognised technologies and dressings) and also negatively in the use of not relevant or even harmful information. Within the framework of person-centred care, it is important that we do not focus only on what is said because the most important thing in communication is "hearing" what isn't said. So, let's not focus directly on how we respond but on the content of the message itself. Maybe an immediate response is not always expected, but only belonging and understanding.

**COI:** Nothing to declare

## KS7.2

# SPECIFIC BIODEGRADABLE SCAFFOLD ACCELERATES PRESSURE ULCERS HEALING AND REDUCES DEEP SCARS IN CHILDREN AND ADOLESCENTS

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The new concepts of biocompatibility, biodegradability and biofragmentation combine the ability of the new dermo-epidermal substitutes to heal complex lesions of various types in a short time, without undesirable effects of toxicity or local/systemic allergic reactions.

In particular, IFSG (Intact Fish Skin Graft) has proven similarities with human skin and today represents a leading alternative in promoting rapid cellular regeneration, at low cost compared to amniotic membranes, and in severe acute and chronic injury conditions such as burn injuries, diabetic ulcers, post-traumatic losses and pressure ulcers.

Collagen, proteoglycans, glycosaminoglycans and especially Omega 3 and 6 are the basis for the anti-inflammatory, regenerative and antimicrobial activities showed by the IFSG of cod-derivation.

This study shows the results obtained in a single center series of 28 consecutive pediatric patients (cohort study) affected by severe losses of substance following complex injuries and which represented the springboard to start treating pressure ulcers.

After 36 months, the study demonstrates on the one hand the ease of positioning and integration into wound beds, together with a reduction of more than 50% of healing times if IFSG is used together with NPWT. On the other hand, considering pediatric patients and the concept of the fourth dimension (the growth), a cosmetic efficacy and scarless healing even in very complex situations.

IFSG is a decellularized biomedical therapy, which induces controlled fibroblastic activity and an orderly reconstruction of tissue layers similar to lost tissues.

Both reconstruction and refashioning are respected and the possibility of restoring a "Body Identity" make it a first choice in children.

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## KS7.3

## FOUR STAGE PRESSURE ULCERS: A SPARING RECONSTRUCTION CHOICE

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**Introduction:** Pressure sores are often present in patients who are bedridden for acute or chronic disease. In these years many have been the surgical procedure proposed, but most of them required the "sacrifice" of a muscle as the gluteus maximus for the treatment of the sacral sores, or the femoral biceps for the treatment of ischiatic sores. In order to avoid this "sacrifice", nowadays the use of surgical procedures associated to a previous debridement with medical devices as negative pressure therapy, it has allowed us to use faster and "simpler" surgical techniques that provide for muscle sparing.

**Methods:** After debridement, we proceed to the muscle sparing technique. Depending on the patient and the localization of the ulcer, the flap can be mono or bilateral, and can be fasciocutaneous, locoregional, as for example the advanced VY flap, or even of propeller type.

**Results:** This new kind of flap permit us to treat patients avoiding the "sacrifice" of the muscle, preventing infections and providing an adequate skin coverage to, for example, a bone exposure.

**Conclusions:** The spare muscle technique is a very useful choice that can also be combined with negative pressure therapy.

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**COI:** no funding

## KS8.1

## EFFECTIVENESS OF SURGICAL RECONSTRUCTION TO CLOSE FULL-SKIN THICKNESS PRESSURE ULCERS: DESCRIBING CURRENT PRACTICES IN THE UK

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on behalf of the SIPS investigators (NIHR reference 127850)

**Background:** Surgical reconstruction is used to treat severe pressure ulcers but there is a lack of evidence of its effectiveness. Before such evidence can be generated, insights about current practices and target patient populations are required.

**Objectives:**

To explore:

- If and how surgical reconstruction is being delivered in the UK including barriers and facilitators;
- Health professionals' views on who may benefit from surgical reconstruction.

**Design:** Firstly, we surveyed three groups of health professionals using on-line questionnaires tailored for each group: nurses, surgeons, and general practitioners. Questionnaires, constructed in SurveyMonkey™, were circulated via relevant professional organisations, social media, and specific contacts. Closed-ended questions, analysed descriptively, asked about care pathways and patient and wound level factors that impacted treatment decisions. Free-text responses to open-ended questions about barriers and facilitators were analysed qualitatively using thematic analysis.

Secondly, we conducted an on-line binary choice experiment. This presented health professionals with vignettes on hypothetical patients for surgical reconstruction, allowing patient and wound factors to be presented in a multifactorial manner. Respondents made a yes or no decision about whether the hypothetical patient should be considered for surgery. The data were analysed by regression methods to identify key factors perceived to impact eligibility for surgery.

**Results:** We received 250 on-line questionnaire responses (59 from GPs; 146 from nurses; 45 from surgeons) and 62 responses to the binary choice experiment (52 nurses, 10 surgeons).

Delivery of surgical reconstruction to people with pressure ulcers in the UK

Half of GP respondents (52%) were not aware that surgical reconstruction is a treatment option for people with pressure ulcers and 57% had never referred a patient for reconstruction. Nurses were more likely to have referred a patient for surgical reconstruction within the previous year (81% of nurse respondents). Of surgeon respondents, 39% said they had not offered surgical reconstruction to a patient and a further 52% offer surgery to fewer than half the patients referred to them. Flap surgery was the only surgical method reported. Free-text responses emphasised the lack of care pathways and multidisciplinary teams for this patient group and the barriers to surgery that this creates.

Health professional's views on who may benefit from surgical reconstruction.

Key factors conferring eligibility for surgical reconstruction were identified from responses to the open- and closed-ended questions and decisions in the binary choice experiment. These included people who:

- Are willing to have surgical reconstruction;
- Have tried all conservative / non-surgical methods to close a severe pressure ulcer;
- Are fit for surgery or able to become fit for surgery;
- Are able and motivated to adhere to post-operative regimens to prevent ulcer recurrence.

**Conclusions:** The characteristics of patients eligible for surgical reconstruction, and access to surgery by current and potential referral pathways are critical to the design and feasibility of future research.

**KS8.2**

# EFFECTIVENESS OF SURGICAL RECONSTRUCTION TO CLOSE FULL-SKIN THICKNESS PRESSURE ULCERS: EVIDENCE AND FEASIBILITY OF RESEARCH

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on behalf of the SIPS investigators (NIHR reference 127850)

**Background:** Case series describe surgical reconstruction to close severe (full-skin thickness) pressure ulcers (SPUs). The percentage of SPUs closed by surgical reconstruction is unclear and the effectiveness of surgical reconstruction compared to non-surgical treatment (except for debridement only) has not been evaluated.

**Objectives:**

- To describe the frequency of surgical reconstruction.
- To compare health outcomes in patients who have had surgical reconstruction with patients having non-surgical treatment.

**Design:** Retrospective cohort studies using Hospital Episode Statistics (HES) for England from 01/04/2011 to 30/09/2018, and Clinical Practice Research Datalink data for England from 01/04/2008 to 31/03/2019.

We first identified all adult hospital admissions with an ICD-10 diagnosis of a category 3, 4 or unclassifiable (severe pressure ulcer, SPU), then identified patients with at least one surgical reconstruction. Additional filtering steps were applied to try to isolate a group having surgical reconstruction to close a SPU: SPU diagnosis at the time of admission, SPU as the primary diagnosis, elective admissions, etc. We estimated annual rates of surgical reconstruction in England with and without additional filtering and the distribution of surgical reconstruction across hospitals.

We then attempted to emulate a randomised controlled trial of surgical reconstruction vs non-surgical treatment using Hospital Episode Statistics data, identifying patients admitted with a SPU who did and did not have surgical reconstruction.

Finally, we sense-checked the annual rates of surgical reconstruction in a cohort derived from primary care (Clinical Practice Research Datalink data).

**Results:** 291,268 patients had an admission with a SPU. A minimum of 404, and a maximum of 1,018, patients had surgical reconstruction during the index admission, i.e. 43 to 136 per year. Ten NHS trusts accounted for half the surgical reconstructions. Patients who had surgical reconstruction had a mean age between 50 and 60 years, about 70% were male and 50-75% had a cause of impaired mobility coded on admission, i.e. injury or neurodegenerative disease.

The emulation compared 325 in a surgical reconstruction group with 1,388 in a non-surgical treatment group. Surgical reconstruction extended the time to a subsequent admission with a SPU diagnosis and time to any further admission (neither effect was statistically significant). However, the non-surgical treatment group had a higher risk of death in 6 months after discharge and may not have been comparable.

The sense-check in a cohort derived from primary care (Clinical Practice Research Datalink data) found an annual rate of surgical reconstruction which was consistent. However, pressure ulcers appeared to be poorly coded by the Clinical Practice Research Datalink in primary care.

**Conclusions:** In England, surgical reconstruction is carried out too infrequently for future research on its effectiveness currently to be feasible. The comparative analyses gave some relevant insights but had limited validity. If evaluation of surgical reconstruction is a priority, stakeholders should need to increase access to surgical reconstruction.

## KS9.1

# THE BIOMECHANICAL PRINCIPLES UNDERLYING EFFECTIVE PREVENTION OF MEDICAL DEVICE-RELATED PRESSURE ULCERS

**Amit Gefen**<sup>1</sup>

<sup>1</sup> Tel Aviv University, Department of Biomedical Engineering, Faculty of Engineering, Tel Aviv, Israel

**Introduction:** In 2019, the third edition of the Clinical Practice Guideline on Prevention and Treatment of Pressure Ulcers/Injuries (PUs/PIs) has been published including an extensive aetiology chapter [1]. This talk will summarise our current understanding of this reported aetiology with a focus on the effects of sustained soft tissue deformations caused by skin-contacting medical devices on cell and tissue viability. Sustained deformations of soft tissues by device-caused forces result in initial, direct deformation-inflicted cell death and tissue damage that leads to secondary inflammatory damage and tertiary ischaemic and lymphatic dysfunction damage and ultimately, may lead to the formation of irreversible tissue damage manifested clinically as surface or deep medical device-related PUs/PIs (MDRPU). Elevated focal tissue deformations (known as mechanical stress concentrations in tissues) result in cell damage on a microscopic level within just a few minutes, although it may take hours of sustained tissue loading for the damage to accumulate and become clinically visible on the skin surface. Superficial skin damage appears to be caused primarily by excessive shear (strain/stress) loading acting on the skin, whereas deeper PUs/PIs predominantly result from high pressures in combination with shear under stiff medical devices, which translates to intense combined compression, tension and shear stresses acting on cells at the tissue depth.

**Methods:** According to the above scientific framework [1,2], primary PU/PI prevention approaches should always target the minimisation of exposure to sustained cell and tissue deformations (both on the skin and internally), by either alleviating (i.e., redistributing) the highest strain/stress values in the susceptible soft tissues, or by decreasing the (continuous) exposure time to the localised tissue loading. The talk will further describe advanced bioengineering methods and selected published study results for efficacy research of technologies for PU/PI prevention with a focus on prevention of MDRPUs and in this context, will discuss principles of selection of materials and products for effective MDRPU prophylaxis.

**Results:** Alleviation of localised, sustained tissue loads and microclimate management are the most critical performance criteria for materials in use for PU/PI prevention, such as in prophylactic dressings, padding or cushioning. These material performance criteria can be evaluated by calculating the extents of matching between the material stiffness (e.g., elastic modulus) and the thermal conductivity of the protective dressing, padding or cushioning with the corresponding properties of native skin, separately or in combination.

**Conclusions:** There is remarkable variability in modulus and thermal conductivity matching levels of different material types that are currently used for MDRPU prevention; some are inadequate for this purpose.

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**COI:** None.

## KS9.2

## THE IMPORTANCE OF SHEAR AT LOADED BODY AND DEVICE INTERFACES

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**Introduction:** Device related pressure ulcers (DRPU) are prevalent across many healthcare settings with complex aetiology. Mechanical loading and interaction at the skin/device interfaces generates multidirectional forces i.e. pressure and shear, which are known external causes for DRPU [1]. This talk provides details of tri-axial pressure and shear (TRIPS) sensors [2] that are designed to be applied at skin/device interfaces. Shear, in combination of pressure, obtained at lower limb prosthetic socket-residuum interfaces and foot-insole interfaces are studied.

**Methods:** Multiple TRIPS sensors were placed at load bearing anatomical sites of the socket interfaces of a transfemoral (TF) and a transtibial (TT) amputee (Figure 1 a and b) respectively. Dynamic pressure and shear during walking were collected and analysed.

Sensorised insoles, incorporating TRIPS sensors at heel, 1st (1MH) and 5th (5MH) metatarsal heads and hallux, were placed on top of two different commercial therapeutic insoles (Fig. 1c). Ten healthy participants conducted walking tests and in-shoe plantar pressure and shear were studied.

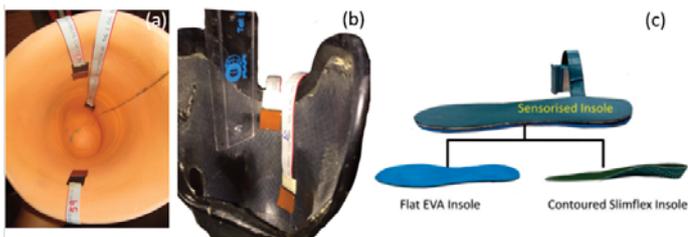
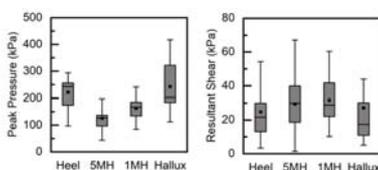


Figure 1: Sensor placements at the (a) transfemoral and (b) transtibial prosthetic socket wall; (c) on top of different insoles.

**Results:** Peak pressure and shear up to approx. 52kPa and 32kPa were measured at the TF [3], and 340kPa and 141kPa at the TT socket interfaces respectively [4]. Up to 380kPa for in-shoe plantar pressure and 85kPa for shear were obtained. High ICCs for pressure (0.869–0.973), shear (0.758–0.987) confirmed good reliability. Figure 2 shows peak plantar pressure and shear when walking at self-selected cadence. Higher pressures appeared at heel and hallux, while higher shear was observed at forefoot which are commonly known plantar sites for ulcerations. However, larger fluctuations were observed at the heel and hallux, as compared with those at the forefoot, when walking at slower and faster than self-selected speeds. Compared with a flat insole, the use of a flexible contoured insole resulted in shear increase at the heel and hallux, especially in the anterior-posterior direction [5].



**Conclusions:** Shear, in combination with pressure, was reported at lower limb socket-residuum interfaces and foot plantar sites. Directions and magnitude of shear varied across anatomical sites due to localized mechanical interactions at these critical device interfaces which may play an important role in DRPU prevention.

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- [4] Devin et al., 2023 Appl. Bionics Biomech. Vol. 2023: Article ID 3257059
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## KS10.1

## HEALTH ECONOMIC ANALYSIS OF PROPHYLACTIC DRESSINGS IN PU PREVENTION

**Dimitri Beeckman**<sup>1,2</sup>

1 Skin Integrity Research Group (SKINT), Ghent University, Belgium

2 Swedish Centre for Skin and Wound Research (SCENTR), Örebro University, Sweden

This keynote presentation sheds light on the expanding realm of research concerning the efficacy of prophylactic dressings in mitigating pressure, shear, and friction-induced skin damage. A notable highlight is the 2021 Belgian study by Beeckman, Fourie et al., which underscores the success of silicone foam dressings in diminishing category 2 or worse pressure ulcers among high-risk hospitalized patients, when integrated with standard care. While the sacral region exhibited reduced incidents, statistical insignificance was not observed in the heel and trochanteric areas.

Anticipating an economic assessment for prophylactic dressings within Belgian inpatient care, a systematic review of prevailing economic evaluations was conducted. This endeavor aimed to forge context-specific evaluations by drawing insights from diverse regions including the United Kingdom, United States, Australia, Germany, and Italy. Across these studies, multilayer silicone foam dressings consistently emerged as a cost-saving solution. Key determinants driving results included pressure ulcer incidence rates and dressing prevention costs. Notably, factors like dressing usage volume, costs of pressure ulcer treatment, and frequency of dressing changes exerted substantial influence.

Collectively, the research supports the adoption of multilayer silicone foam dressings, underlining their suitability within distinct usage contexts. Further guidance is offered through the exploration of patient selection criteria, a crucial element impacting intervention cost-effectiveness, based on individual pressure ulcer risk profiles.

Building on these insights, the 2021 Belgian pragmatic randomized controlled trial reaffirms the efficacy of silicone adhesive multilayer foam dressings in reducing sacral pressure ulcers. Quality of life findings between treatment groups remained similar, although advancements were hindered by pressure ulcer developments. A comprehensive cost-consequences analysis, spanning multiple perspectives, suggests the potential for intervention cost neutrality. This hinges on factors such as reduced length of stay for specific pressure ulcer categories. Additional considerations, such as potential dressing discounts and extended stays for select pressure ulcers, further contribute to enhanced economic viability.

In sum, the evidence provides substantial backing for the preventive deployment of silicone adhesive multilayer foam dressings for sacral pressure ulcers. The combination of clinical effectiveness and positive economic implications bolsters their application within populations analogous to the pragmatic trial. This presentation underscores the significance of evidence-driven decisions in healthcare interventions and policymaking.

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**COI:** The study was funded by the Belgian Health Care Knowledge Centre (KCE).

## KS10.2

## THE ROLE OF HEALTH ECONOMICS IN GUIDELINE DEVELOPMENT

**Zena Moore**<sup>1</sup><sup>1</sup> Royal College of Surgeons in Ireland, University of Medicine and Health Sciences, Dublin, Ireland

**Introduction:** Health economics is defined as the 'application of economic theory, models and empirical techniques to the analysis of decision-making by individuals, health care providers & governments with respect to health and health care' (Morris et al., 2007). As such, Gray et al (2018) argue that to improve the value of health care, integration of health economics into guideline development is essential. Further, because the health service has limited resources, taking this approach helps to contribute to a cost effectiveness and efficiency (NICE 2012). Conversely, ignoring health economic evidence in the guideline development process could result in recommendations that might not represent a cost-effective use of resources (Knies et al., 2019). This presentation will elaborate on the concept of the role of health economics in guideline development, and in doing so will address the following:

- Why is health economics an important element of guideline development?
- How should we include health economics?
- How is this being addressed in the 2025 Prevention and Treatment of Pressure Ulcers/Injuries?

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**COI:** Professor Zena Moore is The European Pressure Ulcer Advisory Panel Chair of the Guideline Development Group

## KS10.3

# CHALLENGES IN PROSPECTIVE OBSERVATIONAL STUDIES EVALUATING PRESSURE ULCER COSTS: HOW TO PRICE THE ITEMS CORRECTLY

**Andrea Pokorná<sup>1</sup>, Lenka Krupova<sup>2</sup>, Miroslav Krupa<sup>3</sup>**

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*2 University Hospital Ostrava, Department of Dermatology, Ostrava, Czech Republic*

*3 Prague University of Economics and Business, Faculty of Business Administration, Prague, Czech Republic*

The financial impact of pressure ulcers (PUs) is significant, especially in light of limited healthcare resources. Understanding the comprehensive economic landscape associated with PU prevention and treatment is essential for effective resource allocation and budgetary planning. The wider societal consequences of indirect and non-medical costs should not be forgotten. While numerous studies approach the issue from an economic standpoint, there remains a conspicuous gap in fully understanding the economic outcomes associated with PU management. Our study sought to bridge this gap by adopting a holistic lens. We focused on a system-wide approach in which we sought to describe costs throughout each step of the care process. Our analysis went beyond merely tabulating the expenses of topical skincare products. We delved deeper into the indirect costs, systemic therapeutic approaches, and other pertinent variables. However, accurately determining the pricing of various resources was challenging. Valuing items with extended use in healthcare settings, like mattresses, allocating the cost of local and systemic therapy, including antibiotics, and factoring in staff workloads presented unique hurdles. Another layer of complexity arose from specific challenges and barriers. Technical challenges required a user-friendly online interface for data collection, coupled with mechanisms to validate the data's accuracy. The personnel aspect was multi-faceted, given the prevailing shortage of general nurses, which added to the workload related to data input. This shortage, combined with varying proficiency levels in data recording, prompted us to initiate a comprehensive training program for nurses, reinforced by peer support and non-punitive quality checks. Moreover, accurately valuing certain medical resources became a task. Items usable for multiple patients or those with long-term service life were challenging to price. Waste disposal costs added another dimension, where differentiating between municipal and biological waste disposal became essential. Building on our methodical approach, we adopted a bottom-up, patient-focused cost analysis. Unlike previous research, our data mostly came from precise, patient-specific consumption records. This effort resulted in a predictive model to estimate the treatment costs for hospitalized PU patients, a potentially invaluable tool both for use in clinical practice and for future studies. In conclusion, our cost analysis illuminates the financial implications of PUs. By providing this insight, we hope to foster the development of cost-effective prevention and treatment strategies, aiming to enhance patient outcomes while optimally utilizing healthcare resources.

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**KS11.1****PRESSURE ULCERS AND PEOPLE WITH DARK SKIN TONES ARE EVERYONE'S BUSINESS: IT'S TIME FOR CHANGE****Neesha Oozageer Gunowa<sup>1</sup>**<sup>1</sup> *University of Surrey, Guildford, United Kingdom*

**Introduction:** Pressure ulcers and people with dark skin tones are everyone's business. There is a recognised delay in identifying early-stage pressure ulcers among people with dark skin tones. This coupled with pressure ulcers causing suffering, prolonged care periods, and increased mortality, means it's time for change.

**Results:** Through this presentation, attendees will be updated about results from recent empirical studies focusing on pressure ulcers, wound care and people with dark skin tones. Furthermore, attendees will be exposed to resources, hints and tips on the early assessment of pressure ulcers among people with dark skin tone which is essential for health equity. Attendees will have the opportunity to reflect on their own practice and recognise immediate changes that can be made to safeguard patients with dark skin tones in practice.

**COI:** None to declare

**KS11.4**

# EXPLORING THE IMPACT OF DIVERSITY IN PRESSURE ULCER DIAGNOSIS ACROSS DIFFERENT SKIN TONES

**Dimitri Beeckman**<sup>1,2</sup>

1 *Skin Integrity Research Group (SKINT), Ghent University, Belgium*

2 *Swedish Centre for Skin and Wound Research (SCENTR), Örebro University, Sweden*

This presentation provides a compelling exploration of a critical aspect of pressure ulcer care - the impact of diversity in diagnosis across varying skin tones. Pressure ulcers remain a major challenge for health care providers and their accurate assessment is of paramount importance. This presentation addresses the complicated relationship between diverse skin tones and pressure ulcer diagnosis and seeks to uncover potential disparities and solutions for equitable healthcare.

By focusing on the intersection of skin tone diversity and pressure ulcer diagnosis, the presentation aims to unravel the nuances that can hinder or promote accurate detection across different ethnic backgrounds. Varied levels of melanin and distinct tissue characteristics influence the appearance of pressure ulcers and can lead to diagnostic discrepancies. This presentation uses a multidisciplinary approach that brings together insights from clinical practice, research, and technological advances to unravel the complexity of skin tone variations in pressure ulcer diagnosis.

It addresses both challenges and opportunities and emphasises the need for inclusive and culturally sensitive diagnostic practice. This presentation is consistent with the overarching goals of advancing pressure ulcer prevention and management through interdisciplinary collaboration and evidence-based practices. The presentation provides a platform for healthcare professionals, researchers, and stakeholders to engage in a stimulating dialogue about the importance of diversity in the diagnosis of pressure ulcers. By promoting a deeper understanding of the impact of different skin tones, the presentation contributes to the pursuit of equitable care and ensures that pressure ulcer diagnosis remains effective regardless of variations in skin pigmentation.

**COI:** No conflict of interest.

## EWMA1

# RARE AND ATYPICAL WOUNDS MIMICKING PUS

**Elena Conde Montero<sup>1</sup>**

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When a wound is located in a typical pressure ulcer area, it is easy to misdiagnose it as a pressure ulcer. Misdiagnosis is specially common with moisture lesions.

When the patient does not have immobilisation or a device to justify the development of a pressure ulcer, or the location does not exactly match the suspected pressure zone, another cause must be suspected.

Additionally, a wound bed with heterogeneous and easily bleeding overgranulation, and pigmented or raised edges, and the absence of response to an adequate aetiological treatment (pressure relief) should lead us to suspect other causes. Aetiologies of wounds that can simulate a pressure ulcer include tumours, infections, e.g. herpes, autoimmune diseases, e.g. scleroderma or pyoderma gangrenosum... Moreover, foot arterial ulcers are prone to arise on pressure areas and consequently they may be misdiagnosed.

In addition, the error can be in the other direction, when we do not suspect that the trigger for the wound is pressure.

Furthermore, we will talk about a very frequent but under-diagnosed condition because it is not very well known: the "sitter sign" or "gluteal senile dermatosis". This refers to the rough, thickened skin (hyperkeratotic, scaly, poorly-defined, brownish-red to greyish plaques) that people with little mobility often develop near the intergluteal cleft and on both buttocks. They are usually asymptomatic lesions, but can be uncomfortable and cause erosions and ulcers of variable depth.

## EWMA2

# THE ROLE OF NURSE ACADEMICS IN SKIN AND WOUND CARE: FROM EVIDENCE GENERATION TO IMPLEMENTATION, EDUCATION, AND LEADERSHIP

**Dimitri Beeckman**<sup>1,2</sup>

1 *Skin Integrity Research Group (SKINT), Ghent University, Belgium*

2 *Swedish Centre for Skin and Wound Research (SCENTR), Örebro University, Sweden*

The World Health Assembly designated the year 2020 as the International Year of the Nurse, recognizing the pivotal role that nurses play as frontline caregivers. The onset of the COVID-19 pandemic further underscored the indispensable contribution of nurses and emphasized the urgent need to globally invest in bolstering the nursing workforce, thus meeting the pressing demands of worldwide healthcare. In addition to their critical caregiving role, nurses have emerged as frontrunners in the realm of research. A notable instance is their involvement in advancing knowledge about skin and wound care.

In a comprehensive systematic review encompassing articles from eminent international wound care journals in 1998, 2008, and 2018, Gethin et al. (2020) revealed a substantial upsurge in nurse-led articles, accounting for 29% of the total (n = 286). Over time, the overall volume of articles escalated, paralleled by an increase in the proportion of nurse-led contributions. Among various categories, nurse-led research particularly excelled in the domains of cohort studies (46%, n = 44), systematic reviews (46%, n = 19), and the critical appraisal of literature and evidence-based guidelines (47%, n = 55).

Academics in nursing and esteemed national/international wound care organizations, such as the European Pressure Ulcer Advisory Panel and the European Wound Management Association, are continuously engaged in evaluating wound care curricula. This ongoing assessment ensures the preparation of upcoming generations of healthcare providers to effectively address public health needs. Beyond merely ascertaining the benchmarks for quality wound care education, it is imperative to reevaluate the role of faculty within an increasingly intricate learning milieu, where research, instruction, practical application, and service are all pivotal. In today's academic landscape, scholarship must cater to researchers, educators, practitioners, and policymakers alike.

Among the most noteworthy milestones in twentieth-century nursing, the introduction and evolution of Advanced Practice Nursing stood out as a pivotal achievement (Oddsdottir & Sveinsdottir, 2011). The International Council of Nurses (ICN) defines Advanced Practice Nurses (APNs) as "registered nurses who have acquired an advanced knowledge base, intricate decision-making abilities, and clinical proficiencies, which are influenced by the context and/or nation in which they hold licensure." A master's degree is recommended for entry into this advanced role (Shober & Affara, 2006). Defining competencies and job roles, as outlined by Hamric et al. (2013), encompass clinical and professional leadership, change management, innovative thinking, research acumen, clinical expertise, adept guidance and mentoring, consultation, and fruitful interdisciplinary collaboration.

In 2016, the American Association of Colleges of Nursing (AACN) released a seminal report titled "Advancing Healthcare Transformation: A New Era for Academic Nursing." This report outlined recommendations to enhance nursing's contribution to improving healthcare and national wellness. It notably introduced a revised definition for academic nursing. Within this context, this presentation seeks to delve into the multifaceted role of academic nurses in the sphere of skin and wound care. It aims to highlight how these roles bear a substantial impact on the generation and implementation of evidence, education, and leadership.

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**COI:** No conflict of interest to declare.

## EWMA3

# ANTIMICROBIAL STEWARDSHIP

### **Sebastian Probst<sup>1</sup>**

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Antimicrobial resistance, particularly in the context of antibiotic resistance, has emerged as a pressing global health crisis, exposing populations worldwide. A pivotal consequence of antimicrobial resistance is the prolonged healing of wounds, as infections hinder the natural recuperative process. Consequently, it is of utmost importance to not only avert and manage wound infections but also to prudently administer antimicrobial agents. This twofold strategy shows potential in limiting the proliferation of antimicrobial resistance and upholding the efficacy of current treatment methods.

Recognizing the importance of vigilant wound monitoring and infection detection, health care professionals are urged to familiarize themselves with the signs of infection. The deployment of tools such as the Therapeutic Index for Local Infections (TILI)-Score can provide valuable assistance in this regard. In the context of wound management, the use of antimicrobials such as antiseptics should be temporally limited, generally spanning 10 to 21 days. The rationale for using topical and localized antimicrobial treatments for non-healing wounds relies on criteria such as improved healing rates or reduced recovery durations, in addition to preventing and resolving infections. A rigorous study design is crucial to establish the connection between antimicrobial interventions and resulting outcomes. As a comprehensive approach to address non-healing wounds, an effective antimicrobial strategy necessitates of routine assessment for wound infection; implementation of surveillance programs to monitor wound infections; clear and achievable performance metrics; formulation of local policies for reviewing antimicrobial utilization appropriateness; involvement of interdisciplinary specialist teams overseeing Antimicrobial Stewardship (AMS) efforts, accessibility to multiprofessional educational initiatives; establishment of antimicrobial guardianship programs; and dissemination of patient awareness campaigns.

In summary, combating antimicrobial resistance demands multifaceted strategies that encompass wound infection prevention, judicious antimicrobial use, rigorous study design, and the integration of health care expertise across various disciplines. The gravity of this global challenge underscores the need for proactive measures at every level of healthcare.

## QIP1

## ELECTRICAL STIMULATION TO PREVENT RECURRING PRESSURE ULCERS IN INDIVIDUALS WITH A SPINAL CORD INJURY: PRELIMINARY RESULTS

Boas Wijker<sup>1</sup>, Sonja de Groot<sup>1,2</sup>, Thomas Janssen<sup>1,2</sup>, Johanna van Dongen<sup>1</sup>, Maurits van Tulder<sup>1</sup>

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<sup>2</sup> Reade rehabilitation & rheumatology, Amsterdam, Netherlands

**Introduction:** Pressure ulcers (PUs) on the buttocks are among the most common secondary complications in individuals with chronic spinal cord injury (SCI). Despite current preventive methods, up to 85% of all individuals with SCI develop a PU once or more in their life. Compared with usual care, activation of paralyzed muscles using electrical stimulation (ES) has been shown to markedly increase paralyzed muscle mass, to improve local blood circulation in the skin and muscles, and to improve sitting pressure distribution. ES might therefore be a useful method to reduce PU incidence among individuals with SCI. The purpose of this study was to investigate whether daily ES of gluteal and hamstring muscles is more effective than usual care only among individuals with SCI in reducing incidence of PUs and improving risk factors for PUs like local circulation or muscle thickness.

**Methods:** A multicenter randomised controlled trial (RCT) is being conducted with the aim to include 100 participants with a chronic SCI. Inclusion criterion: complete or incomplete SCI, intact gluteal and hamstring muscles and at least 1 PU in the last 5 years. The intervention group receives usual care plus ES; a portable electrical stimulator<sup>1</sup> with either self-adhesive electrodes or a custom-made lycra garment with built-in surface electrodes<sup>2</sup>. ES is given at home for at least 60 minutes, 4 days a week, for a year. The control group receives usual care only, which does not include the provision of ES. The primary outcome is PU incidence which is evaluated every 2 weeks with a standardized picture of the buttocks. Secondary outcomes include blood flow in and the diameter of the deep femoral artery in rest<sup>3</sup>; muscle thickness of the gluteus maximus and biceps femoris measured with the ultrasound<sup>3</sup>. Data are collected at baseline (T0), 3 (T1), 6 (T2) and 12 (T3) months. These preliminary data are of the first 6 months.

Statistical analysis: To obtain the PU incidence at T2 a logistic regression analysis was performed comparing the intervention and the control group. A linear regression was performed to look at the intervention effect at T2 with a correction for the baseline differences.

**Results:** The participants' characteristics are shown in table one for both groups separately.

No significant difference in PU incidence was found between the groups at T2 (Odds ratio: 0.643 (95%CI: 0.127 – 3.246; p=0.593). No significant intervention effect was found in change over time in the secondary outcomes (table 2).

Table 1: participants' characteristics

	Intervention N or Mean ± SD	Control N or Mean ± SD
N	18	13
Male/ female	16/ 2	9/ 4
Age (years)	55 ± 12	53 ± 12
Traumatic /non-traumatic	14/ 4	11/2
Time Since Injury (years)	19 ± 14	14 ± 9
Cervical/ Thoracic/Lumbar	10/7/1	3/ 9/1
AIS score (A/B/C/D)	11/4/2/1	9/2/1/1

Table 2: change over time in the secondary outcomes (mean ± SD).

	Intervention (N=18)		Control (N=13)		Beta	95% CI	P-value
	T0	T2	T0	T2			
Blood Flow (l/min)	0.42 ± 0.19	0.63 ± 0.27	0.35 ± 0.21	0.48 ± 0.17	0.088	-0.046 - 0.223	0.189
Diameter (cm)	0.36 ± 0.01	0.39 ± 0.1	0.36 ± 0.09	0.36 ± 0.07	0.024	-0.12 - 0.060	0.179
MT* Gluteus maximus	1.7 ± 0.49	1.8 ± 0.53	1.7 ± 0.31	1.7 ± 0.41	0.129	-0.076 - 0.335	0.208
MT* Biceps femoris	1.5 ± 0.25	1.6 ± 0.24	1.6 ± 0.33	1.6 ± 0.31	0.063	-0.089 - 0.216	0.402

\*MT; muscle thickness

**Conclusions:** Preliminary results showed no significant changes yet in PU incidence, blood flow or diameter, and muscle thickness on this short term in this small sample. We will continue including participants and follow them until 1 year after starting the intervention, to investigate the long-term effects of the ES-intervention.

## References:

1. EMP 4 Eco+; Wuxi Jiajian Medical Instrument Co., Ltd; China
2. ES lycra garment; Berkelbike BV; Netherlands
3. Lumify L12-4 ultrasound system; Philips; USA

## QIP2

# CHOICE AND IMPLEMENTATION OF A HIGH QUALITY DYNAMIC MATRASS WITH ATTENTION TO PRICE, QUALITY, COMFORT AND ERGONOMIC FACTORS

**Annelies de Graaf<sup>1</sup>, Kris Bernaerts<sup>1</sup>**

<sup>1</sup> UZ Leuven, Leuven, Belgium

**Introduction:** Pressure ulcers are still a current and growing Flemish problem also in our hospital (incidence rates 4-20%). We have a high risk population (33%) and the main focus of our preventive protocol is the repositioning. Additional use of pressure distributing materials is provided. The rent of these materials results in costs up to 500.000€/year in rental expense. By Belgian law we're obliged to open a tender dossier every 4-5 years. That's why the aim from management was to reduce costs. The main goal for the CNS wound management was to do this without loss in quality, service, comfort and ergonomics.

**Methods:** The challenge to develop a good dossier containing clear qualitative criteria and a strong distribution between of quality, price and service. Extensive testing was performed on standard operations, comfort, quality, innovation, alarms and patient safety. Additional testing was performed for identification of ergonomic strengths, weaknesses and hygienic risk points. In vivo testing was performed together with reference nurses; patients confirmed or gave feedback on the chosen mattresses. After the clinical trials were carried out, three decision documents were solidified in 3 advices: clinical, ergonomics and safety. They were endorsed in various working groups and committees in an attempt to involve the stakeholders. After further negotiations by the purchasing department a qualitative feedback to both firms were provided. So even a losing firm becomes a winner.

But the end of this tender dossier is only the start of the implementation process. An instruction movie was developed and educational sessions for nurses and allied health professionals were held as part of a hospital wide communication plan.

**Results:** As a result of this tender we got a strong price setting and the additional identification on overshoot, will result in potential savings of around 100.000€/year. Furthermore we continue to have a good quality mattress for the patient with the same high preventive index. Due to alterations on the older mattresses by the remaining firm we gained ergonomic advantages such as faster deflation time, easier manipulation, better fixation to the bed and the possibility of more compact storage. The additional development of a portable ergonomic connector to compressed air and vacuum units; results in an accelerated inflation and deflation time of the mattresses. This is a big gamechanger with the start, compliance and ending of the preventive measures.

**Conclusions:** Proper handling of dossiers takes time and a thorough approach. Sufficient attention to testing by nurses and patients is needed. As is to involve experts in the process, as well as checking-in with stakeholders and management. The transmission of the decision to the work floor can be established through a communication plan and training. A good price must not have any disadvantage for the quality of patient care or for ergonomics of the nursing staff.

References:

Skivington et al. A new framework for developing and evaluating complex interventions: update of Medical Research Council guidance. *BMJ*2021; 374:n2061

### QIP3

## RE-AUDIT ON THE CLINICAL PRACTICE OF PREVENTION AND MANAGEMENT OF PRESSURE ULCERS

**Vinod Saranga**<sup>1,2</sup>, **Hewa Malawige Sasindu Sudara de Silva**<sup>1,2</sup>, **Lalitha Piyarisi**<sup>2</sup>

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2 Sri Jayewardenepura General Hospital, Nugegoda, Sri Lanka

**Introduction:** The audit conducted among 73 inward patients already having pressure ulcers (PU) or at moderate to high risk of PU in surgical units of a teaching hospital from 01.04.2020 to 31.08.2020 revealed critical deficiencies in the practice of prevention and management of PU compared to current recommendations in clinical practice guideline 2014.

**Methods:** We introduced applying Braden score and risk assessment and a checklist for documentation (as per guidelines) from 01.09.2020 onwards following education of nursing staff.

Re-audit was carried out among inward patients fulfilling the above criteria from the same setting from 01.10.2020 to 28.02.2021, where we assessed the standards of care under six selected domains of guidelines and compared with previous audit results using chi squared test.  $P < .05$  was considered significant.

**Results:** The following increment rates were observed in defined domains compared to previous results (all  $p < .001$ ). Risk assessment within 8 hours 9.6% (n=34) to 38.6% (n=7), skin inspection within 8 hours 17.8% (n=13) to 72.7% (n=64), documentation of individualised PU prevention plan 15.1% (n=11) to 79.5% (n=70), assessment of existing PU and documentation of findings at least once a week 19.2% (n=14) to 61.3% (n=54), documentation of individualised treatment plan with goals 16.4% (n=12) to 47.7% (n=42), education of patients and caregivers 39.75% (n=29) to 88.6% (n=78).

**Conclusions:** Adherence to standard practice in prevention and management of PU showed statistically significant improvement in all 6 domains following introduction of the risk assessment tool and checklist.

### References:

National Pressure ulcer advisory panel, European pressure ulcer advisory panel, Pan Pacific pressure injury alliance. (2014). Prevention and treatment of pressure ulcers Clinical Practice Guidelines

## QIP4

# PROMOTING QUALITY IN CARE USING TECHNOLOGY TO ELIMINATE PREVENTABLE PRESSURE ULCERS IN COMMUNITY NURSING UNITS.

Vicky McGauley<sup>1</sup>, Keelin McGauley<sup>1</sup>

<sup>1</sup> Health Service Executive, Louth, Ireland

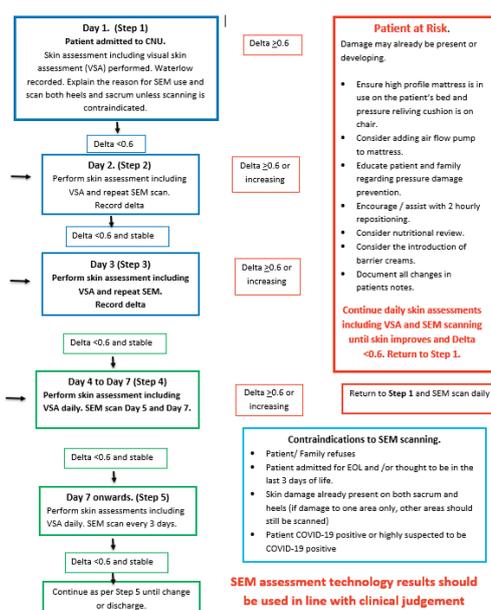
**Introduction:** Our aim was to introduce a Sub-Epidermal Moisture (SEM) scanner in the Community Nursing Units to assess the pressure ulcer risk status of residents, in adjacent with the current documentation that is in existence (Waterlow/SSKIN). We identified an increased prevalence of grade 1 PU. As there is evidence-based research on the challenges of visual skin assessment, a visual skin assessment only triggered an intervention when the damage was already done.

**Methods:** An analysis of the PU's in the CNU's, showed there was a clinical gap in practice in identifying early recognition of PU development. A literature review was completed on tools for early detection, it was identified that visual skin assessment and pain complaints were limited indications for PU prevention and diagnosis. According to the literature review SEM assessment technology (SAT) along with visual skin assessment, was shown to have better diagnostics and patient outcomes (Ross & Gefen 2019). It was agreed that the introduction of the SAT would be an essential foundation for PU prevention with a clear objective assessment. Using the Quality Improvement Toolkit (HSE) an implementation plan was developed and a Standard Operating Procedure (SOP) was completed. The objective was to complete a timely anatomical assessment and intervention using the sensor based technology to assist in prevention of PU to enhance patient outcomes.

The introduction of implementation plan/SOP/flowchart (Fig.1) was to provide education to support nursing practice, assessment and intervention, thus promoting quality care in relation to PU identification. Thus providing nurses with the skills to assess for risks and implement intervention and therefore increasing better patient outcomes. This would be audited using the Quality Care Metric's (HSE 2018) to measure improvements (Fig. 2).

**Results:** The introduction of the SOP and SAT, provided staff awareness of digital technology in pressure ulcer identification in conjunction with existing risk assessment. It highlighted the need for further education, staff participation and the need to review existing documentation for PU prevention.

SEM Assessment Technology Flowchart



SKIN INTEGRITY	
I = indicator, A = Data Collectors Advice, N/A = Not Applicable	
1	<p><b>I</b> A skin care inspection has been completed on admission, transfer and prior to discharge.</p> <p>Mark <b>Yes</b> if a skin care inspection has been completed on admission/transfer. If discharge is imminent, check that the skin care inspection has taken place prior to discharge.</p> <p>Mark <b>No</b> if a skin care inspection has not been completed on admission/transfer.</p> <p>Mark <b>N/A</b> if the individual is in residence for longer than 6 months.</p>
2	<p><b>I</b> The skin integrity care plan identifies and manages the risk factors associated with impaired skin integrity.</p> <p>Mark <b>Yes</b> if the risk factors (malnutrition, incontinence, immobility) are identified / documented in the skin integrity care plan.</p> <p>Mark <b>Yes</b> if a skin care management plan is in place to limit negative effects of these factors on skin integrity (both elements must be present to Mark Yes).</p> <p>Mark <b>No</b> if the risk factors associated with skin integrity are not identified /documented.</p> <p>Mark <b>No</b> if a skin care management plan to limit negative effects has not been initiated.</p> <p>Mark <b>N/A</b> if there is documented evidence that these risk factors are not of concern to this individual.</p>

**Conclusions:** The introduction of this is still in progress and has not been without challenges such as; Covid, Staff resources, education, compliance, record keeping and culture changes. To date there have been several positive outcomes noted:

- Enhanced safe practice by putting in preventative measures for safety of the residents adhering to NMBI scope of practice as a result of the SEM findings.
- Supporting the reduction of healthcare-acquired pressure ulcers.

## References:

Ross G, Gefen A (2019). Assessment of sub-epidermal moisture by direct measurement of tissue biocapacitance. *Medical Engineering and Physics*. Vol 73:92-99.

HSE (2018) National guideline for nursing and midwifery quality care-metrics data measurement in older person services.

**COI:** "the team were grateful for the guidance of the manufacturer's clinical expert on supporting the implementation of the technology"

## E1

# USING INTERACTIVE COMPUTER-BASED CASES TO ENHANCE KNOWLEDGE, SKILLS AND COMPETENCE DEVELOPMENT IN WOUND CARE AND TISSUE VIABILITY POSTGRADUATE EDUCATION

**Aglécia Budri<sup>1</sup>, Zena Moore<sup>1</sup>, Tom O'Connor<sup>1</sup>, Declan Patton<sup>1</sup>, Pinar Avsar<sup>1</sup>, Helen Strapp<sup>1</sup>, Chanel Watson<sup>1</sup>**

<sup>1</sup> Royal College of Surgeons in Ireland, School of Nursing and Midwifery, Dublin, Ireland

**Introduction:** In recent years, mannequin simulations have gained popularity as educational tools, allowing for the development of clinical reasoning and skills beyond traditional classrooms (Webb et al., 2017). Online, computer-based simulations have emerged as a flexible mechanism to train healthcare students, enabling active participation regardless of location or time. A meta-analysis supports the effectiveness of computer-based simulations in enhancing nurses' knowledge and skills (Hegland et al., 2017).

**Methods:** Project implementation

**Results:** In 2020, the Wounds program underwent a transformation, transitioning into a hybrid online format that incorporated the ABC Learning design and other methodologies. The previous combination of face-to-face and asynchronous online interactions was restructured into a hybrid online platform, with interactive elements added to the asynchronous content and engaging discussions facilitated through virtual synchronous activities. The shift towards more reflective questions resulted in a significant increase in student participation, not seen in previous years. The course's hybrid online nature allowed students from diverse backgrounds and geographical locations to participate actively. To address the need for a structured learning approach, evidence-based clinical concepts such as the TIME CDST and the SSKIN bundle were adopted, and computer-based interactive cases were developed to showcase their clinical application. The project comprised two arms: a simple interface for question-answer interactions (figure 1) and a higher fidelity approach using virtual gaming simulation (figure 2). Within the first arm, students had access to patient information and a toolbox of explanations. The first arm has been successfully implemented, offering students the opportunity to apply tools and reflect on their new competencies. Reflections were captured through discussions, journal entries, and written assignments. The utilization of these activities provided an opportunity for less-experienced nurses to gain comprehensive experience in wound care, while more experienced students can stay updated on recent advancements in the field.

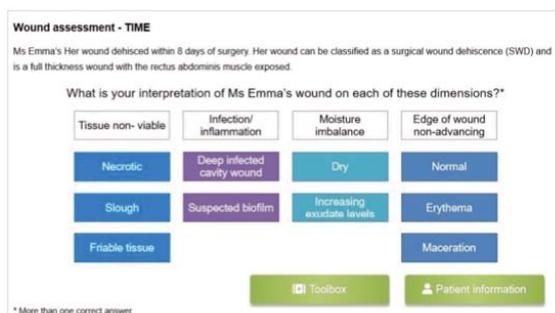


Figure 1 Computer-based interactive case



Figure 2 Virtual gaming simulation

**Conclusions:** The transformation of the Wounds program into a hybrid online format and the use of computer-based interactive patient cases has been highly successful, revolutionizing the learning experience for students in wound care. The integration of innovative methodologies, interactive content, and interactive scenarios has led to increased engagement, reflection, active participation, and practical application of evidence-based clinical approaches.

## References:

Hegland, P. A., et al. (2017). "Simulation-based training for nurses: Systematic review and meta-analysis." *Nurse Education Today* 54: 6-20.

Webb, L., et al. (2017). "The utility and impact of information communication technology (ICT) for pre-registration nurse education: A narrative synthesis systematic review." *Nurse Education Today* 48: 160-171.

## E2

# THE QUEST TO PREVENT SKIN AND TISSUE DAMAGE: ACCESSIBLE EDUCATIONAL MATERIALS FOR THE MULTI-PROFESSIONAL TEAM WORKING WITH VULNERABLE VENTILATED PATIENTS.

**Anika Fourie<sup>1</sup>, Dimitri Beeckman<sup>1,2</sup>, International expert panel \***

1 Skin Integrity Research Group (SKINT), University Centre for Nursing and Midwifery (UCVW), Department of Public Health and Primary Care, Ghent University, Ghent, Belgium

2 Swedish Centre for Skin and Wound Research, School of Health Sciences, Örebro University, Örebro, Sweden

Digital, on-demand, and easily accessible educational resources could be a valuable adjunct to practical hands-on training in managing critically ill patients in the prone position<sup>1</sup>.

Multiple societies<sup>2</sup> strongly recommend mechanically ventilating patients with moderate to severe acute respiratory distress syndrome (ARDS) in the prone position for > 16 hours. Even though prone positioning elicits a significant benefit to the patient in improving oxygenation and reducing mortality, the incidence of skin and subdermal tissue damage, such as pressure ulcers/injuries, remains high<sup>3</sup>.

Education is critical in improving patient quality care and mitigating the risks of skin/tissue damage<sup>4</sup>. Updated procedures, educational resources and protocols are often not readily available for complex procedures (prone manoeuvre) infrequently used in daily practice.

A digital platform was created dedicated to managing the prone ventilated patient and preventing skin/tissue damage such as pressure ulcers/injuries, moisture-associated skin damage and skin tears<sup>5</sup>. The PRONect Education Hub ([www.pronectection.com](http://www.pronectection.com)) hosts eight simulation videos, a protocol, a checklist, and a slide deck for didactic teaching.

The PRONect Education Hub could be a resource for students during their internships, new critical care staff, or the current multidisciplinary staff for refresher training. For hospitals, the simulation videos can be added to their local intranet, the protocol can be downloaded, adapted to their local context and available equipment, and the educational departments can use the slide deck for didactic sessions.

This resource could be a valuable adjunct to practical hands-on training in managing critically ill patients in the prone position<sup>6</sup>.



\*International Expert Panel: M. Ahtiala (Finland), D. Beeckman, A. Fourie, S. Smet (Belgium), J. Black, K. Vollman (USA), H. Hevia Campos (Chile), F. Coyer (Australia), A. Gefen (Israel), K. LeBlanc (Canada), Y. Walsh (South-Africa)

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E3

# CHASING ZERO HOSPITAL ACQUIRED PRESSURE INJURY

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The objective of this quality improvement project was to decrease the number of Hospital-Acquired Pressure Injuries (HAPIs) at Kaiser Permanente Anaheim Medical Center. This poster reviews the effectiveness of multifaceted interventions including simple reminder tools like “pink paper reminder,” protocols and education about prevention order set and monthly multidisciplinary team meetings. The result shows our Hospital-Acquired Pressure Injuries (HAPI) rate per 1,000 days from October 2019 to March 2023 evaluation.

**Methods:** The overall goal of this quality improvement project was to reduce the rate of HAPIs by identifying extremely high-risk patients of developing pressure injuries.

Pink Sheet Protocol is conducted by Nursing for patients with Braden Score 18 or less. This helps to focus attention on high-risk patients and to provide helpful reminders for basic pressure injury prevention.

Multidisciplinary HAPI Committee that meets monthly consists of Skin Champion Doctors Nurses, Charge Nurses, managers, Directors, Dietician, and other multidisciplinary Team.

Skin champions support the nursing units. When a patient met the pink criteria, the Physician Champions placed the order set in the patient’s EHR. Then a pink piece of paper titled “SKIN AT RISK” was placed at the head of the patient’s bed.

Created bed and wound algorithms to simplify workflow.

Partnering with dieticians for malnutrition screening; updated Malnutrition Screening Tool

Dieticians complete focus assessments to diagnose malnutrition.

Mist therapy for patients with DTIs

Quarterly HAPI Prevalence Study conducted by Nursing Quality Council

HAPI audits monthly

Skin Champion Physician and Nursing 24 Hour Pause.

**Results:** Prior to these interventions, there were 10 HAPIs per 1,000 days in 2019. Following the initiation of the interventions and collaboration, there was a significant decrease in the quarterly HAPIs per 1000 patient days. For Q1 2023, our hospital had 146 days of no HAPIs!

**Conclusions:** Chasing Zero Goal helps the hospital to focus on “Every patient’s right, everyone’s responsibility. By focusing on our purpose, we are able to build a system that is effective, budget-neutral system that can reduce HAPIs. The system was effective in identifying high risk patients. By doing the following below, the hospital was able to establish a Learning patient safety culture.

REWARD and RECOGNIZE reporting.

OBSERVE workflows and practices.

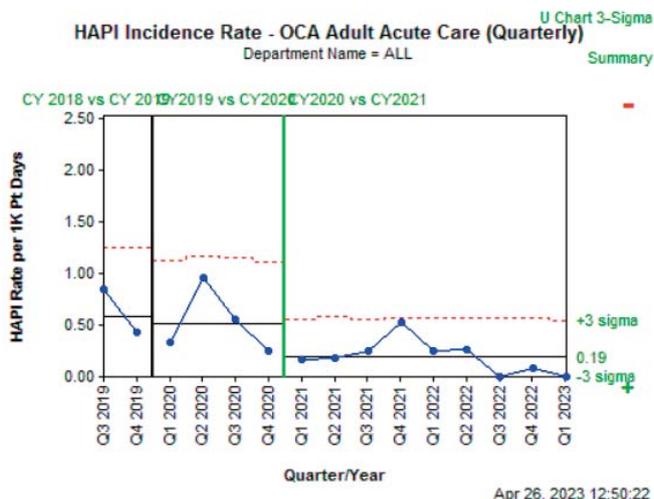
COACH and CORRECT

FOLLOW the Just Culture Algorithm

Look for trends and patterns.

**References:** NDNQI.NPIAP

**COI:** Nothing to declare any funding here.



Year	Total No. of HAPIs	Patient Days	HAPI Rate per 1K Pt Days
2023	0	12350	0.00
2022	7	66267	0.11
2021	13	67082	0.19

## NATURAL WOUND CARE

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The need of wound healing has born together with humanity and the very first written evidences of wound healing treatments are dated back to the Ancient Egypt, to the Chinese Shang dynasty or to Indus Valley Civilization. Subsequently the first who understood the importance of hygiene to prevent infections thus increasing public health were the Romans.

Later on, the knowledge of herbal remedies became a prerogative of the monks. During the Renaissance and Illuminism, natural remedies were set aside in favor of modern medicine. Europe has been the cradle of antibiotics, overload of pharmaceutical usage, and industrialization, the setting of both the world's wars, this probably contributed to a further detachment from nature and its compounds. In some other continents as Asia, south America or Oceania, ancient traditional medicine, not only survived until nowadays but have become complementary or integrated into modern medical practice, with the wish to become also preventive and not only curative. This is well representative of what happened with Tibetan and traditional Chinese medicine all recognized and reimbursed by their national Health care service.

The World Health Organization (WHO) defined traditional medicine as "the health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicine, energetic therapies, manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illness or maintain well-being".

Since the last 4 decades, an increasing interest was reserved to Natural Wound Healing and Natural Ways to assist Wound Healing. Researchers tried to link traditional knowledges (Etno-botanical survey) to scientific validation by testing natural compounds from a molecular point of view.

In this context, some Natural Compounds, Animal compounds and derivatives, Active Natural Principles and Phytochemicals will be explained and applied with some new technologies to the wound care. In particular the Stable-Ozonides coupled with EVO and Bio Olive Oil will be described as part one and wound care treatments with CE-certified Medical Honey of different types will be described as part two.

Clinical results obtained in fragile patients will be shown as clinical cases and comprehensively discussed in more details with both biological and biochemical mechanisms triggering molecular effects clinical analysis. The current evidence confirming the antibacterial properties, regenerative local effects, induced by activation of immune-local pathways should encourage wound care professionals in using Natural device, tools and technologies with greater final respect for a local vision of protection of the entire organism from aggressive and unnecessary antibiotic therapies.

Discussion will be carried forward by a Team including a Biologist, Nurse, Surgeon, Bioengineer in a stimulating context and with the possibility of observing all the different products and different active formulations, during a Bio vegetarian Lunch.

# MATERIALS FOR PRESSURE ULCER PREVENTION IN CHILDREN

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*1 Bambino Gesù' Children's Hospital Rome, Italy*

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The different ages of life encompassed within the pediatric age designation make it a real challenge to prevent pressure ulcers identically to adults and yet evenly across neonatal, infant, and children patients, toddlers, adolescents and nearly adults.

The understanding of prevention necessarily passes through Team-work which includes the Skin-Rounds and the TEAM-UP.

The pathway includes risk factors, educational strategies but also an accurate analysis of materials in their various components and assemblies and how to best use them. Familiarizing yourself with stretching, permeability, memory, viscoelasticity and resilience improves the cultural approach but also the choice of the most suitable materials to select.

This, together with the mobilization and early mobilization aspects, allows to minimize pressure injuries in the most critical settings, such as operating theaters and intensive care units.

In this journey from body anatomy to fetal tissues, up to the approach with skin contact materials and mobilization maneuvers, a pediatric plastic surgeon and a physiotherapist will guide you and answer your questions with a first phase of frontal lesson and a second of interaction with simulation on the pressure redistributing themselves.

# WHERE TO DISSEMINATE YOUR RESEARCH: NAVIGATING OPEN ACCESS, H INDEX AND PRE-PRINTS

**Peter Worsley**<sup>1</sup>

<sup>1</sup> *University of Southampton, School of Health Sciences, Southampton, United Kingdom*

Where to disseminate your research: Navigating open access, H index and pre-prints.

**Introduction:** Publishing research and audit is vital to support evidence based practice. However, there are a number of challenges to publishing and there is a changing landscape of open access journals and pre-print sites. This talk will provide some top tips on navigating the publishing process and how to ensure your work reaches the most relevant audience. We will also discuss how you can maximise your reach when publishing to share your new insights in pressure ulcer prevention and treatment.

**Methods:** This will be a participatory workshop, hosted by Elsevier with Journal editor Professor Declan Patton and Professor Alison Porter-Armstrong chairing. We want to encourage the audience to describe their publishing journey's and highlight top tips.

## 1.1

# EVALUATION OF A PRESSURE ULCER PREVENTION EDUCATION PROGRAMME FROM THE PERSPECTIVE OF PATIENTS, HEALTH CARE ASSISTANTS AND DIRECTORS OF NURSING IN LONG TERM CARE SETTINGS:

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<sup>2</sup> Royal College of Surgeons in Ireland University of Medicine and Health Science, Nursing, Dublin, Ireland

**Introduction:** Pressure ulcers (PUs) are a significant clinical issue, and their prevention is a priority for health care settings. Older adult patients are susceptible to PUs due to the presence of co-morbidities and reduced mobility (Ousey 2015, Moore 2011). Health care assistants (HCAs) represent most of the workforce in long-term care settings and play a significant role in PU prevention and the provision of education is an integral component of PU prevention (EPUAP/NPIAP/PPPIA, 2019). The overall aim of this study was to evaluate the impact of a PU prevention education programme for HCA's on their knowledge skills and attitudes and PU incidence in long-term care settings.

**Methods:** This paper reports on the qualitative data as part of a wider mixed methods design. A qualitative descriptive design was adopted. Semi structured interviews were conducted with a purposeful sample of Patients, HCA's and Directors of Nursing from each study site in order to elicit their experiences and perception of the education intervention from their perspective. Individual interviews were conducted to create opportunities for participants to share their personal experiences related to the education programme. Cognitive interviewing techniques were employed for HCA interviews in order to elicit their thought processes in answering questions related to the classification of PU's. Interviews were recorded and transcribed verbatim. Reflexive Thematic Analysis was used to analyse the qualitative data.

**Results:** The Braun & Clarke Framework informed the analysis of the data. Analysis followed a six step process including deductive coding of the transcripts and the generation of themes. N= 8 patients took part in the patient interviews, N= 6 Directors of Nursing and N= 40 HCA participated in the cognitive interviews. All participants highlighted the importance of pressure ulcer prevention for improved outcomes of care. Education was highlighted as a key enabler to the implementation of evidence based pressure ulcer prevention practice. Identified barriers included lack of time and high workloads of HCA's.

**Conclusions:** Education is a recognized strategy for pressure ulcer prevention. HCA's must be included in pressure ulcer education programmes in order to have the competence to deliver effective patient care.

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European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel and Pan Pacific Pressure Injury Alliance. Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline. The International Guideline. Emily Haesler (Ed.). EPUAP/NPIAP/PPPIA: 2019 <http://www.epuap.org/guidelines/> {accessed March 2020}.

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**COI:** This study has been funded by the RCSI Department of Nursing and Midwifery, Dublin Ireland as part of a Ph. D Scholarship.

## 1.2

# FLAP SURVIVAL AFTER RECONSTRUCTIVE SURGERY FOR PRESSURE ULCER IN THE GLUTEAL AREA - A COHORT STUDY

**Mari Nööjd**<sup>1</sup>, *Ingrid Steinvall*<sup>2</sup>, *Alexander Wyckman*<sup>2</sup>, *Moustafa Elmasry*<sup>1</sup>

<sup>1</sup> Linköping university, The department of Hand and Plastic surgery and Burns, Linköping, Sweden

<sup>2</sup> Linköping university, Linköping

**Background:** Pressure ulcers in the gluteal area are troublesome for patients and require considerable resources to resolve. Previous studies have focused on recurrence while there are few studies on flap survival. The aim was to describe the group and to analyse possible factors for flap survival.

**Method:** A descriptive retrospective analysis of all operations between 2008–2020 was carried out. Flap survival at 40 days was assessed. A flap was classified as a failure if it had to be removed or replaced before, or in connection with, the first return visit. Variables of patient demographics, details of the pressure ulcers and surgical treatment and care were analysed with multivariable logistic regression for their effect on flap survival.

**Results:** A total of 111 flaps were included, 78 (70%) with random blood supply and 33 (30%) with axial or perforator-based blood supply, 54 (49%) of the flaps were fasciocutaneous. Body mass index (BMI) was 25 (IQR 22–28). Flap survival rate was 90%. Variables associated with flap outcome were higher BMI, congenital spinal cord injury, type of blood supply to the flap and the use of methylene blue to guide debridement of the wound.

**Conclusions:** The findings show factors that can be modified to improve future results, including: a normalised BMI and use of methylene blue in surgery to outline wound edges and depth as this has been shown to protect against flap failure. Our data suggest that random flaps, such as v-y, are preferable to axial flaps in the studied group.

**Keywords:** reconstructive surgery, pressure ulcer, flap failure, blood supply, surgical technique

### 1.3

## IMPROVING THE QUALITY OF NURSING PRACTICES BY UTILIZING KNOWLEDGE MANAGEMENT METHODS - THE PILOT OF REPORTING PRESSURE ULCERS

**Tiina Kortteisto**<sup>1,2</sup>, **Pia Seppänen**<sup>1</sup>

<sup>1</sup> Wellbeing Services County of Pirkanmaa, Tampere, Finland

<sup>2</sup> Tampere University Hospital, Tampere, Finland

**Introduction:** In order to assess the quality and effectiveness of treatment, systematically and comprehensively produced information is needed. However, recording patient data must not increase the nurse's workload. In the pilot of reporting pressure ulcers (PU), a mobile application (MA) was developed, which can be used to standardize and streamline recording practices. In addition, by using visual reporting, the prevalence of pressure ulcers can be monitored online, and manual data collection is no longer needed.

**Methods:** The specific MA was developed in cooperation with the application designer and knowledge management and nursing specialist. In nursing practices, by using MA it is possible to record the data next to the patient and timely. The information to be recorded structural way about the PU is 1) grade 2) location and 3) was it caused by treatment device.

The recorded data are transferred to the patient information system and can be used for reporting. This pilot utilized the visual reporting platform Tableau, which is designed for data integration, visualization, and data analysis. PU data of the report is updated once a day, which facilitates the utilization of information as part of development of nursing practices.

**Results:** The PU recording and reporting pilot was implemented in six units of the university hospital, during the one-year period 2022. By the technical perspective both systems operated perfect. All recorded PUs were reported as planned. While practical perspective recording PUs by using MA was not realized comprehensive. More attention should be target to implementation process and offer nurses enough information and support for changing their recording practices.

**Conclusions:** After piloting the model of recording and reporting PU will be increased all hospital units. This process is ongoing in the year 2023. However, by learning of the pilot we should offer more support and follow up into the implementing process.

In the future, wide use of the MA guides nurses to uniform and systematic recording about PU. In addition, by utilizing knowledge management methods, it is possible to reduce and prevent financial and human harm caused by PU.

## 1.4

# CO-DESIGNING PRESSURE ULCER PREVENTING CLOTHING FOR PERSONS WITH SPINAL CORD INJURY

**Maria Suong Tjønnås**<sup>1</sup>, **Tore Christian Storholmen**<sup>1</sup>, **Unn Svarverud**<sup>2</sup>, **Ingebjørg Irgens**<sup>2</sup>

<sup>1</sup> SINTEF, SINTEF Health, Trondheim, Norway

<sup>2</sup> Sunnaas sykehus HF, Oslo, Norway

**Introduction:** Pressure ulcers (PU) are a major complication in people with spinal cord injury (SCI). Many of these are wheelchair users and have higher risk of getting PUs especially around the buttocks area (trochanters and coccyx). Innovative pressure distributing textiles integrated into clothing may help to reduce the risk of getting these ulcers (1). With the use of co-design methodology our research team consisting of persons with SCI, specialist clinicians, product designers, and physiologist researchers, have developed a pressure preventing underwear specifically designed for those who are vulnerable to getting PUs on their buttocks. In this study we have conducted interface pressure testing, and semi-structured interviews to explore user experiences.

**Methods:** The study employed a mix methods **design:** interface pressure testing and semi-structured interviews. Wheelchair users with SCIs were invited to join the study, which involved planning the study, product designing, pressure testing and sharing their user experience of the end product.

**Results:** Thirteen wheelchair users with SCI joined the study. The pressure tests showed that the underwear had a pressure reducing effect on participants' seat area compared to underwear without integrated pressure distributing textile. For 85 % of the participants, reduction in peak pressure ranged from 2 mmHg to 75 mmHg, and an average reduction of 32.6 % (SD =45.9 %) of total high pressure contact area was seen when testing with the pressure preventing underwear. The participants gave positive feedback on the design, aesthetics, fit, functional finishings, textile care, and the elastic waist band, however, depending on participants' sweat rate, for some, the pressure preventing underwear accumulated moisture.

**Conclusions:** The pressure preventing underwear showed promising potential with results demonstrating reduced peak pressure, and reduction in total high pressure contact area. Although participants gave positive feedback on many of the underwear features, negative features such as moisture accumulation was reported. Moisture accumulation in clothing remain a great risk factor for getting PUs, especially for those with excessive sweating due to their SCI. Improvement in breathability properties of the pressure distributing textile is essential going forward. Co-designing pressure ulcer preventing clothing is a highly complex task as there are many user needs and technical factors to consider, in addition to the pressure preventing properties. More research is needed to develop better materials in order to design better pressure ulcer preventing clothing.

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## 2.1

## GETTING UNDER THE SKIN OF A STAGE I PRESSURE ULCER

Peter Worsley<sup>1</sup>, Silvia Caggiari<sup>1</sup>, Nkemji Abiakam<sup>1</sup>, Hemalatha Jayabal<sup>1</sup>, Ana Evora<sup>2</sup>

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<sup>2</sup> Birmingham, Birmingham, United Kingdom

**Introduction:** The most common type of pressure ulcer is a stage 1, characterized by non-blanchable erythema over intact skin [1]. However, little is known regarding the local changes in skin structure and function over the site of injury and what factors are implicated in its prognosis (healing or progression to a wound). The aim of this study was to evaluate local changes in skin structure and function over the site of a stage 1 pressure ulcer in cohort of elderly inpatients.

**Methods:** This was a single center longitudinal cohort study based at a large university hospital [2,3]. Skin was characterized in 50 patients over 2-3 time points using an array of measurements including biophysical parameters (Transepidermal water loss, hydration), biomarkers (inflammatory markers in sebum, local cell changes in the corneocytes) and imaging (optical coherence tomography). Two sites were assessed including the stage 1 pressure ulcer (sacrum or buttock) and a contralateral control site (10mm away) (Figure 1). Analysis was conducted to evaluate the spatial and temporal changes in each skin site.

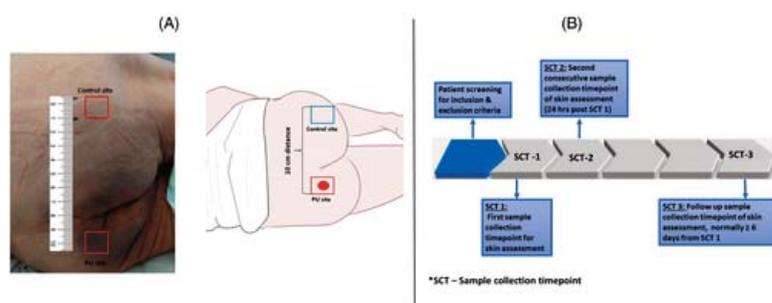


Figure 1. (A) Measurement sites of the stage 1 pressure ulcer. (B) Time course of measurements.

**Results:** There were significant difference between the PU site and control site in skin barrier function (Figure 1A), inflammatory biomarkers (Figure 1B) and corneocyte properties (Figure 1C). By contrast, there were no differences between stratum corneum hydration levels, with a high degree of inter-subject variability. The optical coherence tomography revealed distinct differences in skin roughness, microvascular function, and attenuation in the skin layers. Changes in these skin properties varied substantively over time, with additional analysis ongoing to evaluate their prognostic capability.

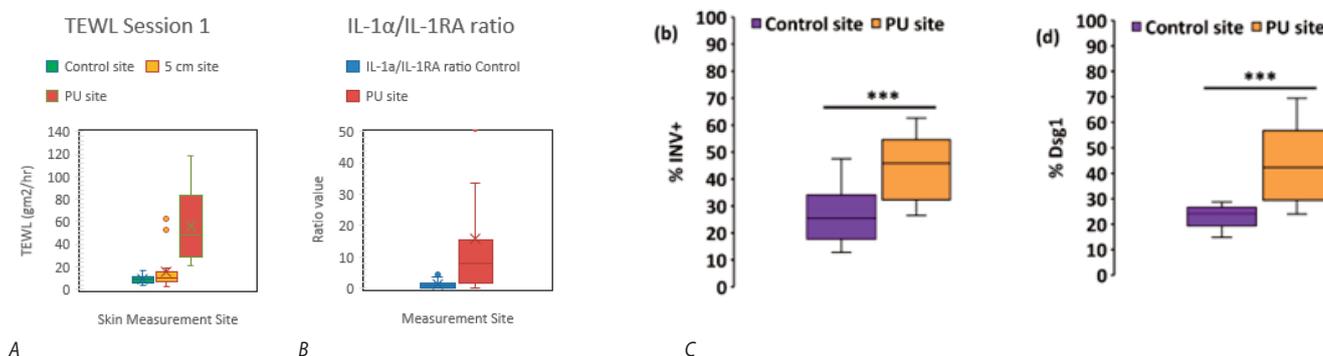


Figure 2. Values from PU and control site for (A) TEWL, (B) cytokines and (C) % INV corneocyte envelopes and % Dsg1.

**Conclusions:** This study represents a comprehensive characterization of local changes in skin structure and function over stage I pressure ulcer, with distinct changes in skin barrier, inflammation and cell properties observed. These have the potential to support skin assessment when diagnosing damage and with further analysis could provide indication regarding the prognosis of pressure ulcer development.

## References:

[1] PUAP/NPIAP/PPPIA. In: E Haesler, ed. *Prevention and Treatment of Pressure Ulcers/Injuries: Quick Reference Guide*. 3rd ed. EPUAP/NPIAP/PPPIA; 2019. [2] Abiakam, NS, et al. *Int Wound J*. 2023; 1- 13. [3] Jayabal, H, et al. *Int Wound J*. 2023. 10.1111/iwj.14131.

**COI:** None. This work was funded by an EU ITN grant 'Skin Tissue Integrity Under Shear (STINTS)

## 2.2

# MICROCURRENT STIMULATION SHOWS ANTI-INFLAMMATORY AND ANTIOXIDANT EFFECTS WITH ALTERATION OF INTERCELLULAR METABOLISM IN MACROPHAGES

**Mikiko Uemura**<sup>1,2</sup>, **Noriaki Maeshige**<sup>1</sup>, **Atomu Yamaguchi**<sup>1</sup>, **Xiaoqi Ma**<sup>1</sup>, **Hidemi Fujino**<sup>1</sup>

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**Introduction:** Chronic inflammation caused the delay of pressure injury healing. Electrical stimulation (ES) is recommended for wound healing in the guidelines, yet the underlying mechanisms of its efficacy remain unclear. When inflammatory stimulation is occurred, reactive oxidative stress (ROS) activates nuclear factor-kappa B (NF- $\kappa$ B) and inflammatory cytokines are released. HIF-1 $\alpha$  is closely related glycolytic and is stabilized by lactate, which induces the polarization of macrophages to M1 macrophages, inflammatory macrophages. We focused the effects of ES on inflammatory response and metabolic reprogramming in macrophages polarization. This study aimed to clarify the effect of ES on inflammation-stimulated macrophages.

**Methods:** Bone marrow-derived macrophages (BMDMs) were stimulated with lipopolysaccharide (LPS) (100ng/mL) for 1.5 h, and then microcurrent stimulation (intensity: 200 $\mu$ A, frequency: 2Hz, pulse duration: 200msec) was conducted for 4h. ROS, inflammatory cytokines expression, HIF-1 $\alpha$  and NF- $\kappa$ B expressions were analyzed. Additionally, metabolites of BMDMs after ES were analyzed to investigate the mechanisms and effects of ES on inflammatory response and oxidative stress.

**Results:** ES significantly suppressed ROS production which was increased 3.5 times compared to the control group by LPS. ES also significantly reduced the production of inflammatory cytokines (IL-1 $\beta$ , and IL-6) which was increased by LPS. Moreover, ES decreased HIF-1 $\alpha$ , NF- $\kappa$ B p50, and p65 expressions compared to the LPS group, demonstrating its anti-inflammatory and antioxidant effects. Regarding metabolites, LPS enhanced glycolysis and pyruvate production, while ES increased D-Glucose 1-phosphate (G1P), metabolite of glycogen, but decreased pyruvate production. Moreover, ES increased NADPH, which has an antioxidant effect, and sedoheptulose 7-phosphate production, an intermediate metabolite of the pentose phosphate pathway (PPP). These results indicate that ES facilitated glycogen metabolites, activated PPP and enhanced the production of NADPH.

**Conclusions:** ES showed anti-inflammatory and antioxidant effects by changing intracellular metabolism and reducing NF- $\kappa$ B expression.

**COI:** The authors have no financial conflicts of interest disclose concerning the study.

## 2.3

## LABORATORY BIOENGINEERING TESTING TO COMPARE THE SKIN STIFFNESS WITH MATERIALS IN COMMONLY USED SKIN-CONTACTING MEDICAL DEVICES AS A RISK MEASURE FOR DEVICE-RELATED PRESSURE ULCERS

Aleksei Orlov<sup>1</sup>, Orel Belo<sup>1</sup>, Susan Solmos<sup>2</sup>, Janet Cuddigan<sup>2</sup>, Amit Gefen<sup>1</sup><sup>1</sup> Tel Aviv University, Biomedical Engineering, Tel Aviv, Israel<sup>2</sup> University of Nebraska Medical Center, Omaha, United States

**Introduction:** Medical device-related pressure ulcers (MDRPU) are common hospital-acquired injuries caused by life-supporting devices, e.g., masks, nasogastric tubes (NTs) and tube holders (THs). Prolonged use of respiratory equipment during COVID-19 resulted in various forms of skin damage [1]. Alleviating mechanical loads on skin at contact sites by matching stiffness of skin-contacting materials to native skin can prevent MDRPUs [2]. Poor stiffness matching leads to intensified tissue stresses and higher MDRPU risk.

**Methods:** Using an experimental-computational approach we compared the biomechanical performance of medical devices and materials commonly used for pressure ulcer prevention with native skin properties [2]. The 'reverse engineering' approach involved inputting the experimentally measured stiffness values of the skin-contacting materials into the finite element simulations to extract the elastic moduli of the individual material components, thereby allowing for a more comprehensive comparison of the medical devices and materials with native skin properties.

**Results:** The stiffness of hydrogel-based and foam-based dressing materials is within the 30-100 kPa range, which falls within the range of stiffnesses of adult skin, so in terms of modulus matching, there is a good fit [2-4]. In contrast, tubing devices demonstrated stiffness within the 30-400 MPa range, which is distant by two to three orders of magnitude from the stiffness of skin, i.e., all the tested tubes had poor modulus matching (Figure 1).

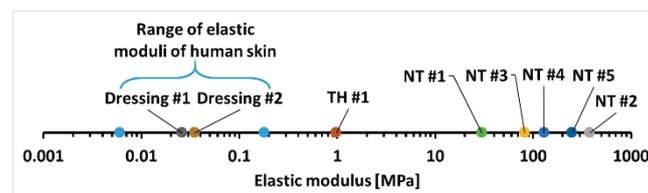


Figure 1: Mapping of the stiffness properties of prophylactic dressings and skin-contacting materials in medical devices with respect to the stiffness of an adult skin (NT – nasogastric tube; TH – tube holder).

**Conclusions:** We report here a practical approach and metrics for quantitative evaluations and rating of materials for pressure ulcer prevention or for assessing the biomechanical risk involved in selection of certain skin-contacting materials for inclusion in the design of skin-interfacing medical devices, in the context of MDRPUs.

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**COI:** This work is supported by the Israeli Ministry of Science & Technology (Medical Devices Program Grant no. 3-17421 awarded to AG in 2020), by the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No. 811965; project STINTS, Skin Tissue Integrity under Shear (AG), and by the American Association of Critical Care Nurses (AACN) Impact Research Grant (SS, AG, JC).

## 2.4

## INFLUENCE OF THERMAL PROPERTIES OF DRESSINGS USED FOR PREVENTING MEDICAL DEVICE-RELATED PRESSURE ULCERS: THE CASE OF A CONTINUOUS POSITIVE AIRWAY PRESSURE MASK

Cecile Marche<sup>1</sup>, Aleksei Orlov<sup>1</sup>, Amit Gefen<sup>1</sup><sup>1</sup> Tel Aviv University, Tel Aviv-Yafo, Israel

**Introduction:** Prolonged use of continuous positive airway pressure (CPAP) masks imposes a risk to the health and integrity of facial soft tissues as these tissues are simultaneously subjected to sustained mechanical and thermal loads caused by the CPAP materials facilitating the air-tight seal necessary for oxygen delivery [1]. The risk of developing CPAP-related pressure ulcers/injuries (CPAPrPUs) can be reduced through suitable cushioning/dressing materials placed at the skin-mask interface. The specific effects of the properties of such commonly used materials on the skin temperature at the interfaces between a CPAP device and the facial skin is currently unknown, however, thermal conductivity matching, resulting in a healthy release of heat from the skin, is a design target or a selection criterion for cushioning/dressing materials to prevent CPAPrPUs [2].

**Methods:** We developed a new computational model to determine thermal matching of cushioning/dressing materials applied for preventing CPAPrPUs. The model considers the contact of the CPAP mask with the skin tissue in a simplified geometry and is used to calculate steady-state facial skin temperatures, accounting for metabolic heat generation, natural air convection and forced convection within the CPAP mask space due to breathing. The steepness of the temperature gradient under the applied cushioning/dressing material is used to compare the thermal matching of material alternatives and normalize data with respect to the no-dressing case.

**Results:** The modeling successfully demonstrates the temperature distribution of facial skin under a selected applied cushioning/dressing material and the gradient of skin temperatures between the skin contained in the inner CPAP space and skin outside that region, including the influence of the thermal conductivity of the applied cushioning/dressing material on the above transition (Figure 1).

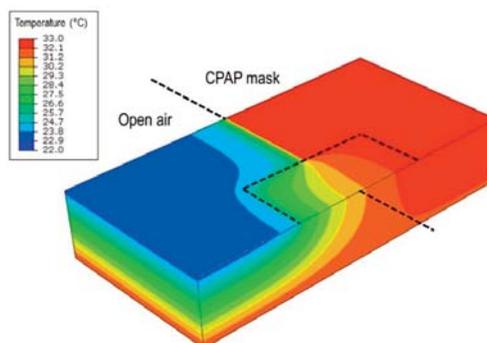


Figure 1: Simplified geometry for the study of the skin temperature (°C) at the interface areas under the CPAP mask space and outside the mask space, under an applied cushioning/dressing material (outline shown in dashed lines).

**Conclusions:** We report in this study a first-of-its kind computational model for investigating thermal matching of cushioning/dressing materials with facial skin, which can be used for quantitative evaluations and comparisons (ratings) of thermal matching performance in a CPAPrPUs context.

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**COI:** This work is supported by the Israeli Ministry of Science & Technology (Medical Devices Program Grant no. 3-17421 awarded to AG in 2020) and by the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No. 811965; project STINTS, Skin Tissue Integrity under Shear (AG)

## 2.5

## TOWARDS PERSONALIZED CONTROL OF SCARRING: NOVEL SCAR-MODELS TO CLASSIFY AND MINIMIZE SCAR FORMATION IN INDIVIDUALS

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**Introduction:** Skin, the largest organ, covers the body's outer surface and provides a protective barrier. The skin barrier shields internal tissues and organs from pathogens and limits external damage such as mechanical injuries from ulcers, cuts, and burns. Skin damage can produce scarring, which changes the skin's appearance and its functionality, for example, its elasticity, thereby affecting the quality of life. Thus, analyzing scar formation following healing of a pressure injury and how it may change between individuals has widespread implications. Studies of scarring typically include experiments in human or animals, which are complex, expensive, and may be ethically questionable. To reduce the necessity for such experiments, various laboratory, cell-models have been generated, yet those are limited in physiological relevance, and do not consider differences between individuals, such as those related to age or gender; skin and its healing capacity vary between individuals and change throughout life.

**Methods:** We will generate novel laboratory skin-models that will include scar-associated cell-layers (such as subcutaneous fat). The models will be tuned to mimic different individuals, for example by changing layer thickness to study genders-associated differences. The experimental results will be used to generate finite-element computational models, as digital-human-models of mimicked individuals, to predict effects in potentially varying conditions in different individuals.

**Results:** We will describe which skin layers participate in scarring and when that occurs. The experimental lab-model will be used to identify conditions that can produce scarring in different individuals and to develop and test new approaches for scar minimization. For example, the effects of non-damaging low-level strains<sup>1,2</sup> will be evaluated. The mechanical effects of such treatments on the skin layers will be demonstrated via computational modeling.

**Conclusions:** Effects of innovative stimuli on healing and scarring can be evaluated by combining experimental and computational models of different individuals.

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**COI:** No conflict of interest.

## 2.6

## A PRELIMINARY STUDY ON THE IMPACT OF MATERIAL PROPERTIES IN THE SIMULATED TISSUE RESPONSE IN THE CONTEXT OF HEEL PRESSURE ULCER PREVENTION

Carla Cornillon<sup>1</sup>, Bethany Keenan<sup>2</sup>, Claudio Vergari<sup>1</sup>, Pierre-Yves Rohan<sup>1</sup>

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<sup>2</sup> Cardiff University School of Engineering, Cardiff, United Kingdom

**Introduction:** The prevention and treatment of Pressure Ulcers (PU) remains a major challenge in healthcare. PU have been shown to develop in regions where mechanical loading induces large strains in the soft tissue, usually over bony prominences such as over the heel. Finite element (FE) models have been used to investigate the mechanical response of the heel tissue, but there are inconsistencies in the research (Keenan et al., 2022). One source of model variability is the many approaches to integrating material properties. In this study, we used a previously reported MRI-derived patient-specific FE model of the lower leg (Keenan & Rohan 2022) and evaluated the impact of using personalized material properties as opposed to average literature-based values on the simulated displacement and strain in the heel, and we compared these results to experimental measurements.

**Methods:** Ultrasound images of the heel contact region in unloaded and loaded configurations for one healthy subject were collected to evaluate the tissue displacement and strain using digital image correlation, along with the measured shear modulus using shear wave elastography (SWE) (Figure 1A). A previously reported MRI-derived FE model of the subject's lower leg (Keenan & Rohan 2022) was adapted to fit the experimental configuration in terms of bone alignment (Figure 1B). Multiple simulations were computed with different material properties: values retrieved from literature were tested, along with the experimental shear modulus (Figure 1C). The simulation results were then compared to the experimental data.

**Results:** The model displays differences in the displacement and strain of the tissue depending on the integrated material properties. While the overall behavior of the strain field resembled that of the experimental results, the magnitude of the strain varied between simulations (~50% increase in peak strain), and the location of the strain in the heel also changed (Figure 2).

**Conclusions:** This study illustrates the need to better characterize the material properties of the heel soft tissues for a model to accurately simulate a patient's biomechanical response. Current techniques, such as shear wave elastography, could be adapted to achieve personalized parameters capable of producing results that approach the experimental response measured.

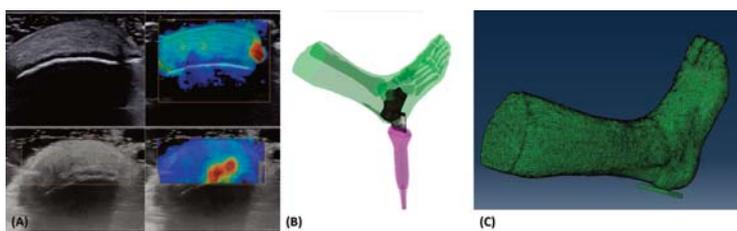


Figure 1: Experimental and simulated heel tissue response. (A) Ultrasound images of heel tissue, including SWE. (B) FE model configuration and ultrasound data alignment. (C) Simulation generated from FE model with adapted material properties.

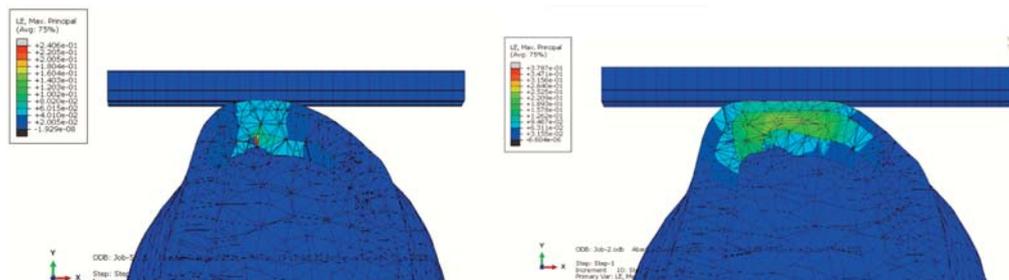


Figure 2: Distribution of mechanical strain in the soft tissues predicted by the model with different literature-based values integrated in the model.

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### 3.1

## A SYSTEMATIC REVIEW OF MOVEMENT MONITORING DEVICES TO AID THE PREDICTION OF PRESSURE ULCERS IN AT RISK ADULTS

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2 University of Southampton, Southampton, United Kingdom

**Introduction:** Immobility/impaired mobility is accepted as a primary causal factor. Immobility/impaired mobility might be considered that patients who are unable to independently change position are at increased risk of developing a PU, due to pressure exerted over bony prominences which results in reduced blood flow to the tissues and subsequent hypoxia. To understand the role of these devices to support the identification of those individuals at particular risk of pressure ulcers (PUs) and how this information could be used to aid clinical decision making and inform personalised interventions.

**Methods:** Using systematic review methodology, we included original research studies employing a prospective design, written in English, assessing adult patients' movement in bed, using a movement monitoring device. The search was conducted in March 2021, using PubMed, CINAHL, Scopus, Cochrane, and EMBASE databases, and returned 1537 records, of which 25 met the inclusion criteria. Data were extracted using a pre-designed extraction tool and quality appraisal was undertaken using the Evidence-based librarianship (EBL).

**Results:** In total 19 different movement monitoring devices were employed in the studies, using a range of physical sensing principles. The studies focussed on quantifying the number and types of movements. In four studies the authors compared the monitoring system to PU risk assessment tools, with a variety of high and low correlations observed. Four studies compared the relationship between movement magnitude and frequency and the development of PUs, with variability in results also identified. Two of these studies showed, as expected, that those who made less movements developed more PU, however, the two studies also unexpectedly found that PUs occurred in both low movers and high movers. In the final two studies, the authors focused on the concordance with recommended repositioning based on the results of the monitoring device. Overall, concordance with repositioning increased with the use of a monitoring device.

**Conclusions:** The synthesis of the literature surrounding bed monitoring technologies for PU risk prediction revealed that a range of physical sensors can be used to detect the frequency of movement. Clinical studies revealed some correlation between parameters of movement and PU risk/incidence, although the heterogeneity of approaches limits generalisable recommendations.

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## 3.2

# THE EVOLUTION OF THE SCIENCE OF SUB-EPIDERMAL MOISTURE (SEM) ASSESSMENTS FROM THE BENCH TO THE BEDSIDE; THE DETECTION EFFECT, THE TREATMENT EFFECT AND THE PREVENTION EFFECT

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**Introduction:** The contemporary understanding of pressure ulcer (PU) aetiology and pathophysiology is that localised oedema or SEM, is one of the earliest indicators of pressure-induced cell damage (1). Persistent localized edema can progress to severe pressure ulcers if untreated. This analysis aims to describe evidence-based approaches that demonstrated the three distinct effects resulting from SEM assessments that enabled translating the science of SEM from the bench to the bedside: the detection effect, the treatment effect and the prevention effect.

**Methods:** A clinical strategy was developed to conduct clinical studies by independent researchers that investigated individual SEM assessment effects. Laboratory studies evaluated the detection effect. Observational blinded studies evaluated the early detection effect of spatial SEM measurements (SEM delta) and the diagnostic accuracy of SEM assessments. Controlled studies described the impact of anatomy-specific interventions and clinical actions prompted by SEM assessments on the risk of developing PUs; SEM delta ( $\Delta$ )  $\geq 0.6$ . Real-world implementations of SEM assessments were then studied for the prevention effect.

**Results:** Phantom modelling studies and porcine skin models validated the detection of localised oedema or SEM, reporting a consistent increase in SEM delta ( $\Delta$ ) scores with increasing volumes of injected fluid, representing increasing levels of localised oedema in skin tissues ( $p < 0.001$ ). Early detection of PU development via SEM assessments was reported by a median of 5 days before visual assessments ( $N = 189$ ;  $P \leq 0.001$ ). In a dual-arm study of 175 subjects, SEM assessments reported a diagnostic sensitivity and specificity of 86.8% and 88% in detecting PUs, resulting in an Area-Under-the-Curve clinically, significantly exceeding clinical judgement ( $P < 0.0001$ ). In a controlled trial of 149 acute care patients, the odds of reducing the risk of developing PUs (SEM  $\Delta < 0.6$ ) were 6 times more likely when anatomy-specific treatment interventions were based on SEM data ( $p < 0.0001$ ). Clinicians implementing SEM assessment technology in routine clinical PU care pathways were twice likely (OR:1.99) to respond to SEM assessments and direct anatomy-specific interventions than by clinical judgement alone. Acting on SEM data reduced PU incidence in all population types across care settings (RR=0.38; 95% CI 0.26-0.56;  $P < 0.001$ ).

**Conclusions:** Use of SEM measures provides reliable, objective and anatomy-specific data on the damage that is occurring invisibly, but measurably, beneath the skin. The result is data which addresses readily and in real time the complexities of detection and interventional latency in existing PU care pathways. SEM measures enable HCPs to detect localized oedema even before visual skin assessments, provide anatomy-specific interventions to treat this persistent focal oedema and then effectively prevent broken skin PUs.

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**COI:** Industry Submission

## 3.3

## IMPROVING NURSING COMPLIANCE TO PRESSURE INJURY PREVENTION PROTOCOL FOR HIGH RISK PATIENTS

**Batla Alshammari<sup>1</sup>, Ghassan Watfa<sup>1</sup>**

<sup>1</sup> KSMC, Riyadh, Saudi Arabia

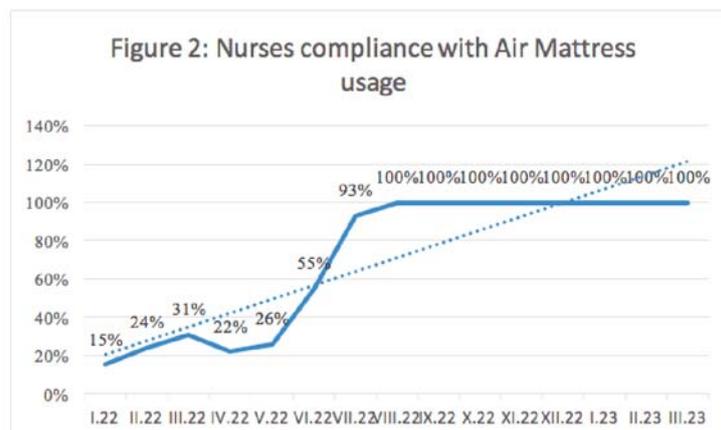
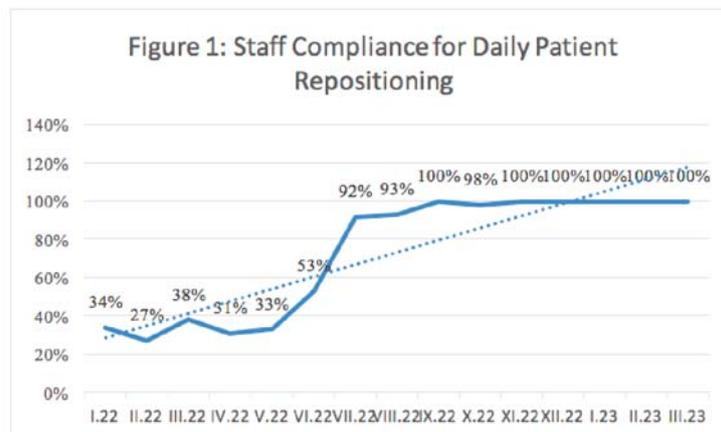
**Introduction:** Nurses have a key role in the prevention and management of pressure injuries (PI). Hospital Acquired Pressure Injury (HAPI) is one of the common and evolving hospital acquired problems. The main objective of this initiative is to boost PI prevention guidelines compliance.

**Methods:** A performance improvement project was launched in the 2nd half year of 2022 in a unit whose scope of service is intended to accommodate high-risk patients. To begin, a Rapid Cycle Improvement methodology was utilized. A guideline of PI prevention was created in parallel with awareness sessions and coaching. A wearable sensors\* was introduced to monitor and detect patient's posture and position and provides an alarm to the clinical nurse that patient is due for turning or repositioning. KPI's (Key Performance Indicators) were initially selected to gather baseline information and monitored continuously on a monthly and quarterly basis.

**Results:** Since the project implementation in July 2022, the compliance of daily repositioning of the bedridden patients was increased, from 34% in January 2022, followed by 92% in July then finally 100% in September (Figure 1). Similar results were observed for the use of air mattresses by nurses which increased from 15% in January 2022 to 93% in July 2022 and 100% in August 2022 (Figure 2). Clinically, the incidence of new unit HAPI improved from 14.81% in the first half of 2022 to 0% in the second half of 2022. All KPIs were maintained through April 2023.

**Conclusions:** The improving nursing compliance to PI prevention protocol demonstrated to enhance the clinical outcome of high-risk patients. The utilization of the sensor intensifies nurses' response and level of care as well promotes and uplifts the quality of care rendered to high risk patients.

\*Centroid Masimo



### 3.4

## INVESTIGATING AWARENESS OF INTENSIVE CARE NURSES ON BETWEEN INCONTINENCE ASSOCIATED DERMATITIS AND PRESSURE INJURIES

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**Introduction:** Many critical diseases can damage skin and tissue integrity due to natural immobility, hemodynamic instability, poor tissue perfusion, use of medical devices and many other internal and external factors (Callaghan et al, 2018). Skin damage frequently seen in intensive care units can be listed as skin tears and secondary cutaneous infections, pressure injuries (PI) and incontinence-associated dermatitis (IAD) (Banharak vd., 2021; Beeckman, 2017). Especially, IAD and PI are frequently seen together. IAD, which develops on the skin exposed to urine and faeces, is not only a skin damage that needs to be examined on its own, but also paves the way for the development of pressure injuries and can also progress together with pressure injuries. Therefore, correct assessment of IAD and PI is key point for nursing care.

**Methods:** This research was designed as a multi-center descriptive study to investigate the awareness of intensive care nurses about the separation of incontinence associated dermatitis (IAD) and pressure injury (PI).

The data collection form was applied between March 2019 and May 2019 with 235 intensive care nurses. Number Cruncher Statistical System 2007, Kolmogorov-Smirnov, Shapiro-Wilk, Mann Whitney U, Kruskal Wallis, Bonferroni-Dunn, Pearson and Chi Square test have been used for evaluating the data.

**Results:** Demographic characteristics of the nurses and knowledge of IAD and PI were evaluated. 74.9% of nurses have licence graduated degree and 49.4% have experienced intensive care unit between 1-5 years. The score of IAD knowledge level of is  $43.19 \pm 27.47$ , while the score of PI knowledge level is  $78.26 \pm 22.00$ . The nurses often choose wrong answers about the pathophysiology of IAD and the prevention of IAD. On the other hand, PI questions mostly were answered correctly.

**Conclusions:** In this study, the knowledge level of IAD of the nurses was significantly lower than the knowledge level of PI. Comprehensive basic nursing education and clinical training programs on IAD are recommended in addition to PI.

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**COI:** No funding for this study.

**4.1****PRESSURE ULCERS IN GERMAN HOSPITALS: ANALYSIS OF LENGTH OF STAY, COSTS AND REIMBURSEMENT**

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3 AiM-Assessment in Medicine, Berlin, Germany

**Introduction:** The presence of a pressure ulcer is painful and distressing for patients and hospital-acquired ulcers are also costly for the hospital. The aim was to estimate the resource impact on hospitals in Germany of hospital-acquired ulcers, and to assess whether additional costs are covered by increased reimbursement.

**Methods:** Hospitals in Germany provide activity data to the German Institute for the Reimbursement System in Hospitals (InEK GmbH), and these data are made available to researchers through the InEK Data Browser. Data were extracted covering inpatient cases discharged from German hospitals between January 1st and December 31st, 2021. Cases for analysis were selected according to the presence of a pressure ulcer diagnosis using ICD-10-GM codes L89.0-L89.3 corresponding to pressure ulcer stages 1-4. A total of 335,497 cases were identified where pressure ulcer was a secondary diagnosis, and for these cases the 10 most common DRG codes were selected. For each DRG information was extracted on mean length of stay, the proportion of cases with length of stay above the norm for the DRG and the mean DRG reimbursement per case. Length of stay was compared between cases with a pressure ulcer diagnosis and cases in the same DRG with no ulcer diagnosis, to estimate the ulcer-associated excess length of stay.

**Results:** Mean length of stay was higher in patients with a pressure ulcer by between 1.9 (all-ages) and 2.4 days (age  $\geq 65$ ) per case. In patients aged  $\geq 65$ , 22.1% of cases had a length of stay above the norm for the DRG compared with 7.1% of patients without an ulcer. Cases with length of stay above the norm are loss-making or less profitable for the hospital because reimbursement does not cover the full costs of treatment. Valued at an average cost per occupied bed-day, the nominal loss to the hospital per case would be between 1,633€ (26%) and 2,074€ (62%). In practice, saving some of the excess bed-days by reducing the incidence of hospital-acquired ulcers could release capacity which could be used to generate additional revenue.

**Conclusions:** The analysis highlights the importance of pressure ulcer prevention. Quite apart from its resource impact on German hospitals, the reason why avoiding preventable pressure ulcers is a key quality indicator is because of their effect on the quality of life of patients physically, emotionally, and socially.

**COI:** The research reported in this Abstract was funded by an unrestricted grant from ArjoHuntleigh.

## 4.2

## SAVINGS TO NHS TRUSTS ASSOCIATED WITH IMPLEMENTATION OF MODEL HOSPITAL ACQUIRED PRESSURE ULCER PREVENTION STRATEGY.

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2 APA Parafriacta Ltd, Thame, United Kingdom

3 St Helens and Knowsley Teaching Hospitals NHS Trust, Rainhill, United Kingdom

**Introduction:** Outcomes for prevention of hospital acquired pressure ulcers ("haPUs") between English NHS Trusts are difficult to compare, owing to differences in reporting. Various authors have estimated the cost to the NHS of treating pressure ulcers ("PUs") in the acute hospital setting and post discharge in the community. Outcomes at an NHS Trust ("the Trust") that is rated overall as Outstanding by the Care Quality Commission and has had PU risk assessment highlighted as an area of outstanding practice, were audited and compared with the national average to estimate savings to the Trust.

**Methods:** Validated incidence of PUs and the proportion of haPUs were audited for the year 2019-20 at the selected Trust. These outcomes were compared with the average Trust using data from Hospital Episode Statistics for England ("HES") adjusted for underreporting.

ICD-10 diagnostic codes recording PUs (L89) were taken from HES. The duration of stay in the hospital was correlated with PU occurrence, stratified by the ten primary diagnoses most associated with PUs. Calculation of the excess bed-day costs and community nursing visit costs were used to construct a model of the potential savings associated with the Trust's PU prevention strategy.

**Results:** The total annual recorded incidence for the Trust was 2810 PUs of any category. This is 1000 more than the number recorded by HES, which indicates how ICD-10 coding from patient notes fails to capture the real, validated incidence of PUs. Only 100 out of the total were haPUs. This translates to 2220 total PUs/100,000 admissions and 79 haPUs/100,000 admissions. The calculated national figure was 2990 total PUs and 675 haPUs. On average, patients coded with a Category 2 PU stay in hospital for 2.4 days longer and/or require 30 community nurse visits. The measures taken by the Trust to prevent patients at high risk (including with a Cat 1 PU) from progressing to a Cat 2+ were estimated to reduce incidence and hence associated costs by 88%, therefore saving at least £596,000 per year/100,000 admissions if applied to the average NHS Trust.

**Conclusions:** Rigorous implementation of measures to prevent Cat 2+ haPUs can free up beds and community nursing time for treatment of other, less preventable, conditions. The cost of these measures at the Trust, including at the point of entry (A&E) intervention and use of medical devices to reduce friction and associated shear on the heels of at-risk patients, in addition to measures commonly employed elsewhere, can easily be justified by the savings made.

**COI:** The manufacturer of some products employed at the Trust funded the analysis of the HES and assisted in calculating some of the cost saving esti

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england.nhs.uk/costing-in-the-nhs/national-cost-collection (2020-21)

## 4.3

## PROGRAM FOR THE TREATMENT OF HARD-TO-HEAL WOUNDS AND DEMOGRAPHIC PROFILE OF ONE OF THE WOUND CARE CENTERS OF SAO PAULO MUNICIPALITY, BRAZIL

Viviane Helena VIVIANE HELENA<sup>1</sup>, Renata Amos da Silva<sup>2</sup>

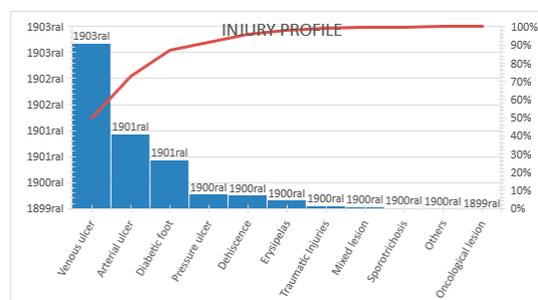
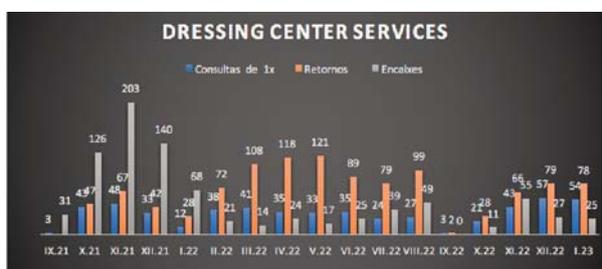
1 APS Santa Marcelina, São Paulo

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**Introduction:** Difficult-to-heal wounds present a significant challenge in healthcare, requiring a multidisciplinary approach and access to adequate resources. The Dressing Center Program, provided by the São Paulo City Hall, offers free treatment to address this demand. This study evaluated the effectiveness and cost-effectiveness of the program, collecting demographic data, wound profiles, treatments, and outcomes. Results showed a high healing rate, improved pain levels, and enhanced quality of life for patients. With limited free alternatives available, the program stands out as a crucial initiative in healthcare.

**Methods:** Each dressing center is responsible for managing patients with difficult-to-heal wounds in a specific region. Primary healthcare nurses schedule appointments using a designated system. Patients are assessed by wound care specialists at the Dressing Center, and appropriate treatment technologies are selected and provided by the center's pharmacy to the primary healthcare unit, along with detailed treatment instructions.

**Results:** The Dressing Center in São Paulo's eastern region serves 30 primary healthcare units, four multiprofessional homecare teams, and two hospitals. Over the course of one year, 2,548 appointments were conducted, including initial consultations, follow-ups, and patient discharges with healed wounds. The data revealed the prevalence of various wound types, such as venous insufficiency, arterial ulcers, diabetic foot ulcers, and pressure ulcers, among others. Most patients were male, and the most common location for wounds was the left lower limb.



**Discussion:** The high incidence of wounds in the left lower limb may be related to circulatory issues, such as iliac vein syndrome. The Dressing Center Program demonstrated significant benefits, including reduced amputations, healing of chronic wounds, and improved quality of life for patients.

**Conclusions:** The Dressing Center Program offered by the São Paulo City Hall is an essential initiative for the treatment and prevention of difficult-to-heal wounds. The results underscore the need for an interdisciplinary approach involving specialized professionals. The program has shown positive impact, benefiting patients and reducing the burden on healthcare services, including a decrease in amputations. Continued improvement of treatment and prevention strategies for these wounds, based on insights obtained from the Dressing Center Program, is of utmost importance.

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**COI:** I declare that I have no conflicts of interest with any industry related to the content discussed in this text.

## 5.1

## ENHANCING SKIN HEALTH AND SAFETY IN AGED CARE: AN EXPLORATORY CLUSTER-RANDOMISED PRAGMATIC TRIAL

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**Introduction:** The skin of aged nursing home residents is prone to develop a wide range of undesirable skin conditions, such as xerosis cutis, skin tears, intertrigo, pressure ulcers, and incontinence-associated dermatitis. Currently, multiple guidelines and recommendations, that address these skin conditions individually, are available in residential long-term care. However, implementing an evidence-based skincare algorithm that targets multiple skin conditions simultaneously may prove to be effective in promoting healthy skin.

**Methods:** A two-arm exploratory cluster-randomized controlled trial was conducted in n = 17 residential long-term care facilities. In nursing homes being assigned to the intervention group, an evidence-based and structured skin care and prevention programme was implemented for six months. Nursing home residents in the control group received standard care as usual. Blinded dermatologists conducted head-to-toe skin assessments. Outcomes included the cumulative incidence of incontinence-associated dermatitis, skin tears, pressure ulcers, intertrigo, and changes of skin dryness. Additionally, residents reported outcomes pruritus, pain and quality of life were estimated after three and six months.

**Results:** In total, n = 9 nursing homes were randomized to intervention group (IG, n = 165 participants), and n = 8 nursing homes were randomized to control group (CG, n = 149 participants). The implementation of an evidence-based skincare and prevention package reduced the incidence of skin tears, pressure ulcers and intertrigo in intervention compared to control group, but seemed not to prevent incontinence-associated dermatitis. Changes of skin dryness were assessed and implied a minor improvement at all skin areas in the intervention group. The impact of the skincare programme on pain, pruritus, and quality of life was rather negligible.

	Intervention Group (after 6 months)	Control Group (after 6 months)
<b>Incontinence-associated dermatitis</b>		
Cumulative incidence (ITT), % 95% CI	26.3 (17.9 – 36.8)	23.1 (14.6 – 34.5)
<b>Skin Tears</b>		
Cumulative incidence (ITT), % 95% CI	19.2 (12.8 – 27.8)	27.2 (19.3 – 36.9)
<b>Pressure ulcer</b>		
Cumulative incidence (ITT), % 95% CI	13.6 (8.1 – 21.9)	16.9 (10.6 – 25.9)
<b>Intertrigo</b>		
Cumulative incidence (ITT), % 95% CI	27.0 (18.4 – 37.7)	37.8 (27.5 – 49.4)

**Conclusions:** Study results indicate that adequate nursing interventions are powerful to improve skin health and safety. Evidence suggests that adverse skin conditions can be prevented by adequate skin assessments and individually tailored skincare.

## 5.2

# THE CLINICAL APPLICABILITY OF SENSOR TECHNOLOGY WITH BODY POSITION DETECTION TO COMBAT PRESSURE ULCERS IN BEDRIDDEN PATIENTS

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**Introduction:** Pressure Ulcers (PUs) are a major healthcare issue and lead to prolonged hospital stays and decreased quality of life. One measure to prevent PUs is to detect non-movement which can be time-consuming for nurses. Monitoring body position changes with the aid of sensors could reduce workload, improve turn compliance and decrease PU incidence.

**Methods:** This systematic review assessed the clinical applicability of different sensor types capable of in-bed body position detection.

**Results:** We included 38 articles. In clinical studies, inertial sensors showed to reduce PU incidence and increase turn-compliance. Overall, inertial sensors were most commonly used (n=13). This sensor type has a high accuracy and is equipped with a 2-4 hour turn-interval warning system that leads to increased turn compliance. The second-largest group were piezoresistive (pressure) sensors (n=12) arranged in different configurations, followed by load sensors (n=4), piezoelectric sensors (n=3), radio wave-based sensors (n=3) and capacitive sensors (n=3). All sensor types except inertial sensors showed a large variety in the type and number of body positions that were detected. However, the clinically relevant position changes such as trunk rotation and the head of bed elevation were not detected or tested.

**Conclusions:** Inertial sensors are the benchmark sensor type with regard to accuracy and clinical applicability. However, these sensors have direct patient contact and (re)applying the sensors requires the effort of a nurse. Other sensor types without these disadvantages should be further investigated and developed. Directly comparing accuracy and clinical usability was difficult, because sensors were tested with small sample sizes, in a variety of settings and with a different number and type of detected positions. To resolve this issue, we propose the PU Prevention System (PUPS) guideline which describes a minimal set of body positions that should be detected to align a sensor system with clinical practice. This could lead to more sensors which are optimized to combat PU occurrence and reduce nurse workload.

**COI:** Authors declare that they have no competing interests.

## 5.3

## INNOVATIVE AND MODULAR STRATEGY IN THE THERAPY OF 4° PRESSURE ULCER OF HIGH-RISK PATIENTS

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**Introduction:** The ageing of the European population will become an increasing problem in the coming years. Increases in morbidity, immobilisation and a lack of the care imply an increase in positioning injuries. Long stays in intensive care units, inadequate remobilisation have increased the number of sacral decubital ulcerations (1). Additionally, most patients are in reduced general and nutritional conditions, so that too radical debridement and frequent anaesthesia represent a considerable risk factor. To counteract this, a new modular surgical concept was developed. Most procedures were performed under tumescent local anesthesia (TLA) (2), debridement was switched to a less radical ultrasound-assisted wound debridement (UAW) and defect coverage was achieved with simple fasciocutaneous flaps

**Methods:** A retrospective study was performed from 2017 -2022. 48 patients with 4° pressure ulcers could be surgically rehabilitated according to this new therapeutic strategy.

**Results:** : n= 48, Age: Ø 72.875 years; F17/31M; comorbidities (Ø 6.25); ECOG (median 4); CFS (Ø 7.36); sacral n=35, other location n= 13 ; TLA n=37, general anesthesia n=6, combination n= 5; number of operations incl. closure (Ø 3.9); NPWT n= 31 ; V-Y flap n=24, keystone flap n= 5, other n= 6, no coverage n= 13; inpatient stay (Ø 19.5 days); 17 had minor wound healing disturbances. 7 cases with recurrence or a new pressure ulcer. Only 2 patients died during the inpatient phase due to their massive comorbidities (10/12).

**Conclusions:** The fundamental change to this innovative strategy with a gentle form of anaesthesia, a hardly traumatising UAW, a NPWT with subsequent optional defect coverage by a simple, stable flap plasty represents a valuable alternative to the previous standard therapy. Even large, deep ulcerations and/or patients with extremely poor initial conditions can be rehabilitated promptly and sustainably without general anaesthesia, surgery-related bleeding after radical debridement or severe wound pain. The modular design allows methodological flexibility and patients can be sufficiently rehabilitated even without a mandatory defect closure. Overall, there is a significant gain in quality of life, reduction of perioperative complications and excellent quality of results.

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## 5.4

## INTERACTIONS BETWEEN PRESSURE-REDISTRIBUTING MATTRESSES AND TRANSFER DEVICES: A LABORATORY STUDY

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**Introduction:** Repositioning patients while in bed is a common practice undertaken to prevent pressure ulcer (PU) development. The use of transfer devices intended to be left in-situ upon a bed may compromise the pressure redistribution provided by the bed mattress. This study identified the effects of two transfer devices upon the pressure redistribution provided to healthy volunteers resting upon two static and two active mattresses.

**Methods:** Sacral and heel contact pressures were measured across ten healthy volunteers over 18 years old. Participants visited the test laboratory over two days, no more than 48 hours apart, and rested on each static mattress for 45 minutes (no transfer device in use 15 minutes, slide sheet for 15 minutes and then a sling for 15 minutes). The participant rested upon each active mattress for 90 minutes, with each transfer device in place for 30 minutes. The order of presentation of the mattresses and transfer devices was made using a pre-determined randomization schedule. Contact pressures were measured using a pressure measurement mat\* sized 203 cm by 86 cm with a measurement range of 0 to 100 mmHg with a stated accuracy of +/- 20%. The mat was calibrated following manufacturer's recommendations before use. The study was approved by the local university research ethics committee.

**Results:** The 10 participants ranged from 19 to 69 years (mean 41.8, standard deviation (SD) 15.8), 3 were male. Body Mass Index (BMI) ranged from 19.6 to 37.2 (mean (SD) 25.8 +/-5.4).

The four mattresses applied similar maximum contact pressures at the sacrum and heel when no transfer device was in place. Introduction of a transfer device significantly changed contact pressures in three test combinations - one static mattress had lower maximum heel contact pressures where the slide sheet was in place, while one active surface applied lower maximum and minimum sacral contact pressures when either the transfer sheet or sling was in place. No other comparisons of contact pressures achieved statistical significance.

**Conclusions:** The finding that maximum contact pressures were similar across all four test mattresses was unexpected, and it is interesting to speculate whether the four surfaces would provide similar clinical outcomes in terms of PU incidence? The introduction of a transfer device rarely resulted in any marked changes in contact pressure and in no case did the transfer device result in increased contact pressures being applied to the study participants.

**COI:** This study was funded by the Direct Healthcare Group who had no influence over test methods, results, analysis, and reporting of the data.

\*BodiTrak 1

## 5.5

## SPECTROPHOTOMETRY MEASUREMENT OF ERYTHRMA ACROSS SKIN TONES

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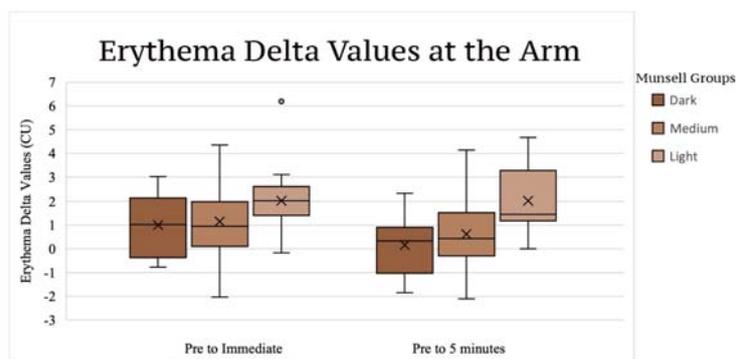
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<sup>3</sup> Emory University School of Medicine, Atlanta, United States

**Introduction:** Individuals with darker skin tones are more likely to develop more severe, more frequent, and earlier onset pressure injury damage [1]. This is recognized as a major health disparity requiring improved strategies to visualize and quantify erythema across varying skin tones.

**Methods:** A convenience sample of 61 healthy adults with diverse skin tones measured with the Munsell Soil Chart was recruited from the local community. Two body locations were studied: the ulnar head and a location approximately 2/3 proximal to the ulnar head on the dorsal forearm. At each site, the color measuring device used narrowband tristimulus reflectance spectrophotometry to measure erythema of the skin. Erythema was induced by using a cupping procedure, pulling a -25 to -30 kPa vacuum over a 1" diameter region for 2-3 minutes. Measurements were collected before induction of erythema, immediately following induction of erythema and 5 minutes following completion of the first round of measurements.

**Results:** Out of 61 participants, 59 were categorized according to the Munsell Value on their forearm: seven with dark skin, 34 with medium skin, and 18 with light skin. Visible erythema was induced in all but 5 participants' arms and all ulnar heads and was typically brighter at the ulnar head. After five minutes, visible erythema reduced in brightness for many participants. The colour measuring device\* erythema measurement was on average 16.3 CU units\*\* at the ulnar head and 17.4 CU at the arm prior to inducing erythema. Immediately following erythema induction, there was a significant increase in erythema reading of 1.3 (arm) and 2.1 (ulnar head). Five minutes later, erythema readings relative to the control were still significantly increased, but as with the visible observations, they were less distinct than the immediate observations (1.0 CU at the arm and 1.5 CU at the ulnar head). Light and medium Munsell skin tone groups demonstrated larger differences in measured erythema after five minutes than the dark skin tone groups at both locations. (Figure 1).



**Conclusions:** Although erythema is difficult to visualize in darker skin tones, an objective assessment of erythema can be valuable both for clinical assessment and for developing clinically relevant training tools.

### References:

1. Oozageer Gunowa N, et al. Pressure injuries in people with darker skin tones: A literature review. *Journal of Clinical Nursing*. 2018;27(17-18):3266-3275.

\*ColorMeter DSM III

\*\* ColorMeter Units (CU)

## 5.6

## RESHAPING PRESSURE ULCER WOUND CARE: EVALUATION OF AN ARTIFICIAL INTELLIGENCE APP AMID THE COVID-19 PANDEMIC

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**Introduction:** Recent advancements in wound photography, particularly digital wound applications, have revolutionised wound care, leading to improved wound management and patient outcomes (1,2). Recognising the potential benefits, a leading quaternary health service identified a digital wound application as a valuable solution capable of capturing wound images, facilitating accurate wound assessment and classification of pressure injuries, aggregating wound data, enabling telehealth consultations, and providing treatment options for clinicians. The study aimed to evaluate the usability and effectiveness of this digital application from both clinician and patient perspectives.

**Methods:** A quasi-experimental design was implemented across four healthcare settings, spanning from July 2019 to October 2020, with a temporary pause in March 2020 due to the coronavirus disease pandemic. The study promptly resumed after a three-week hiatus. Data collection encompassed patients from both the standard group (n = 166, 243 wounds) and the intervention group (n = 124, 184 wounds). Clinicians contributed to the study through surveys (n = 10) and participation in focus group interviews (n = 13). Additionally, patient interviews were conducted with a sample size of four individuals. Descriptive analysis was applied to the wound documentation data, while thematic analysis was employed to examine the interview data.

**Results:** The evaluations yielded highly positive results, highlighting notable enhancements in various aspects of wound care. These included instantaneous objective wound assessment, shared wound plans, improved patient adherence, especially pressure ulcer prevention and increased efficiency in delivering virtual care. Notably, the intervention group demonstrated a significant improvement in pressure injury wound documentation compared to the standard group, with an increase of over 70% (p < .001) in the number of documented items. Throughout the intervention, 101 out of 132 wounds exhibited improvement, resulting in an average wound size reduction of 53.99%.

**Conclusions:** The utilisation of the digital application revolutionised pressure injury prevention and management by offering real-time wound data and establishing seamless communication channels between patients and clinicians across diverse healthcare settings, including hospitals, communities, and outpatient facilities. This digital application facilitated remote patient monitoring, while simultaneously ensuring the delivery of optimal wound.

**References:**

[1] Khoo R, Jansen S. The evolving field of wound measurement techniques: a literature review. *Wounds*. 2016;28(6):175-181.

[2] Sirazitdinova E, Deserno TM. 3D documentation of chronic wounds using low-cost mobile devices. *Stud Health Technol Inform*. 2017;245:1237.

**COI:** Nil.

## 6.1

# INFLUENCE OF A STRUCTURED SKIN CARE ALGORITHM ON CLINICAL SIGNS OF SKIN DRYNESS AND SKIN BARRIER CHARACTERISTICS IN RESIDENTIAL LONG-TERM CARE

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**Introduction:** Aged residents in long-term care facilities are affected by dry skin (xerosis cutis), which has been discussed as a possible risk factor for pressure ulceration. The aim of this study was to describe the effects of an evidence-based comprehensive skin care and prevention package, including recommendations for skin cleansing and applying leave-on products to treat dry skin.

**Methods:** A two-arm exploratory cluster-randomized controlled trial was conducted in n = 17 long-term care facilities. In the intervention group, an evidence-based skin care and prevention programme was implemented for the duration of six months. In the control group, skin care was provided as usual. Throughout the study, trained dermatologists conducted comprehensive skin assessments of the whole body and researchers conducted skin measurements at the upper and lower extremities. Outcomes included the skin barrier characteristics skin surface pH, stratum corneum hydration, transepidermal water loss, skin temperature, as well as severity of dry skin using the Overall Dry Skin score.

**Results:** Xerosis cutis was diagnosed in 95.2% of the participants in the intervention group, and in 96.6% of the participants in the control group. Highest Overall Dry Skin scores were observed at the legs and feet. After six months the Overall Dry Skin score was lower in the intervention compared to the control group at all skin areas.

At the right midvolar forearm, stratum corneum hydration was 40.8 AU (SD 15.9) at intervention group, and 41.1 AU (SD 12.0) at control group and the transepidermal water loss was 12.4 g/m<sup>2</sup>/h (SD 7.0) at intervention group compared to 11.8 g/m<sup>2</sup>/h (SD 7.7) at control group after six months.

At the right lateral lower leg, stratum corneum hydration was 36.0 AU (SD 16.5) at intervention group, and 34.9 AU (SD 11.1) at control group and the transepidermal water loss was 9.6 g/m<sup>2</sup>/h (SD 7.6) at intervention group, and 9.1 g/m<sup>2</sup>/h (SD 6.5) at control group after six months. Group differences of skin pH-value and skin temperature were rather negligible.

**Conclusions:** The measured skin parameters showed biological variation over the study period, while the visual inspection showed an improvement of skin dryness. This indicates that the skin care regimen seemed to have positive effects on skin dryness, but skin parameters did not indicate changes of the skin barrier function.

### References:

Kottner J, Hahnel E, El Genedy M, Neumann K, Balzer K. Enhancing SKIN health and safety in aged CARE (SKINCARE Trial): a study protocol for an exploratory cluster-randomized pragmatic trial. *Trials*. 2019 May 29;20(1):302. doi: 10.1186/s13063-019-3375-7

## 6.2

# SELF CARE IN WOUND CARE

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**Introduction:** The self-treatment of wounds is part of a self-care concept that mainly focuses on the ability of individuals, families, and communities to promote and maintain health, prevent disease, and cope with illness and disability, with or without the support of healthcare providers. Little research has been done on the self-care of chronic wounds, especially pressure injuries. It is also important to distinguish overall self-care between self-treatment or self-medication. Both of these terms became more important through COVID-19 pandemic and will be more important due to health care practitioners shortage.

**Methods:** Using a systematic review methodology, six databases were searched for full-text papers from 2010-2022 published in peer-reviewed journals with no limits on language

**Results:** There were 40 articles, 14 of which included self-care as a part of an investigation. Most of them were oriented to prevention activities or pressure devices, and none of them on the procedure in direct wound treatment is conducted by a patient or informal caregiver.

**Conclusions:** Education was the main generator of positive behavior in pressure injury prevention. However, more research is needed to focus on patients' and caregivers' activities when they are not under the health care providers supervision.

**References: Available**

**COI:** I declare no funding.

### 6.3

## PRESSURE ULCER PREVENTION - AN INTERVENTION PROJECT

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**Introduction:** Pressure ulcer is an injury that frequently occurs in elderly, dependent individuals, often with associated comorbidities. It is known that this pathology has a great individual, familiar and socioeconomic burden, and it is necessary for physicians to understand its etiology, risk factors and prevention measures in order to adequately advise the general population. The aim of this project is to raise awareness and empower caregivers of dependent individuals, improving their knowledge on the prevention methods of pressure ulcers.

**Methods:** The intervention focused on caregivers of dependent people in the authors' primary care unit, taking place between March and May 2023. Two sessions were held with the nursing team, divided into theoretical and practical parts. The intervention was evaluated using an anonymous questionnaire, distributed at the beginning and end of the session, which contained 40 questions about pressure ulcers and a self-assessment of knowledge, classified from 1 to 5.

**Results:** The questionnaire was applied to 25 caregivers (84% female; mean age = 59.7 years). Pre-intervention, the average of correct answers was 29.0 (minimum 9 and maximum 39). After the session, there was a statistically significant increase ( $p < 0.001$ ) in the average number of correct answers to 35.1 (minimum 22 and maximum 40). The percentage of caregivers who believed to know what a pressure ulcer is and how to prevent it increased by 52% (48% vs 100%) and 64% (36% vs 100%), respectively, as did their self-assessment of knowledge (mean of 2.04 vs 3.9), also in a statistically significant pattern ( $p < 0.001$ ).

In this sample, gender, age, family relationship, level of literacy, degree of patient dependency, length of care and previous practice did not influence the final score in the test ( $p < 0.001$ ).

**Conclusions:** This study showed that the project increased the knowledge and self-confidence of caregivers regarding pressure ulcers. With regular sessions and improvements the program would constitute a great tool for caregivers, helping to reduce the incidence of pressure ulcers in the community.

#### References:

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2. Berlowitz, Dan. "Clinical Staging and General Management of Pressure-Induced Skin and Soft Tissue Injury." Uptodate.com, Accessed Apr. 2023.
3. Berlowitz, Dan. "Clinical staging and general management of pressure-induced skin and soft tissue injury" Uptodate.com, Accessed Apr. 2023.

**COI:** Authors have no conflict of interest to declare.

## 6.4

# GLOBAL MANAGEMENT OF PRESSURE ULCERS IN OLDER OUTPATIENTS : A EUROPEAN STUDY ON HEALTHCARE PROVIDERS PRACTICE

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**Introduction:** Pressure ulcers (PUs) in older patients is frequent, and its prevalence and management well known in hospitalized patients. However, it remains poorly described in outpatients. The aim of this study was to assess the proportion of outpatients with PUs among patients treated by health care providers (HCPs) as well as the management of these PUs in older patients.

**Methods:** HCPs working in private practice across three European countries (UK, France and Germany) answered a two-part online survey. First part reported the proportion of patients with PUs managed by the HCP, and the second part collected data on the last 4 PUs managed by each HCPs.

**Results:** 340 HCPs participated, following a mean number of 39 patients with PUs each, representing 14.7% of their patients. Information on 1043 older outpatients, mean age 83, with stage II (60%) and III (40%) PUs were collected. 55% of the patients were female, 68% had major to complete dependence and 46% incontinence. Only 14% were underweight. PUs were usually located on the sacrum (52%) and the heel (44%). Limited number of patients benefit from a pressure relief device, such as air mattress (37%). Only 12% of these patients required an hospitalisation for the management of the PUs.

**Conclusions:** We describe a large cohort of older outpatients with PUs as well as the management of these wounds by HCPs working in private practice. Our results highlight the frequency of this pathology, the limited access to pressure relief devices and to hospital cares.

### References:

2007 European pilot survey undertaken by the European Pressure Ulcer Advisory Panel (EPUAP)

## 6.5

## LIFTING THE LID ON PREVENTING PRESSURE ULCER IN LOCAL RESIDENTIAL HOMES

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<sup>1</sup> MCH, Tissue Viability, Rochester, United Kingdom

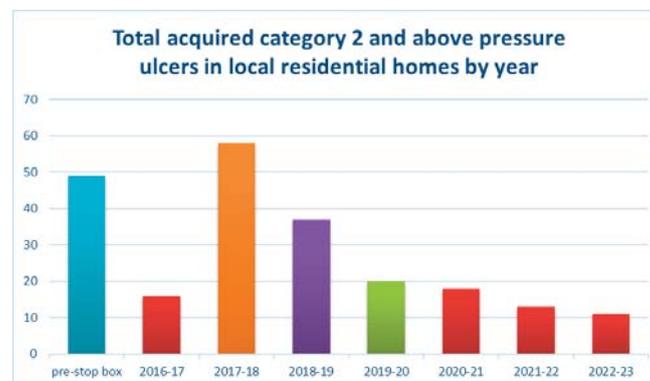
**Introduction:** Pressure ulcers are a high priority for patient safety within the UK. Wood et al. (2019) found that there are 700,000 incidences of patients suffering with a pressure ulcer each year with a cost to the NHS of £1.4-2.4 billion.

The stop box is a local innovation that has vastly reduced the level of acquired pressure ulcers within residential homes within the community. This includes a selection of products used to aid pressure relief and off-loading, barrier creams and dressings suitable for the treatment of skin tears.

This idea was initially commenced in 2015 and year on year has been found to be effective in the reduction of pressure ulcers and for the first aid management of moisture lesions and skin tears. In phase 1 (2015) this was implemented in just one residential home and has now been implemented into 31 residential homes.

**Methods:** Initially the tissue viability reviewed the incident reports for acquired pressure ulcers within residential homes within the local area, initial data showed that there were 47 incidences within a 12-month period (2014-15). A new pathway was designed to aid the reduction of pressure ulcers in the residential homes using a tripartite approach with community nursing teams, carers, and the tissue viability service with a lead for the project.

This pathway included engaging residential home managers and providing each home with a large red box with pressure relieving products, basic dressings and moisture barrier creams in conjunction with training package for the residential home carers to educate them on pressure ulcer prevention.



**Results:** From the graph above there has been a year on year reduction in the number of acquired pressure ulcers within local residential homes. The has decreased over 8 years from 47 to 11 incidences.

**Conclusions:** This pathway has been found to be very effective across residential homes in reducing acquired pressure ulcers, this has been extended to supported living homes and local Continuing healthcare community teams.

## 6.6

## REDUCTION AND PREVENTION OF PRESSURE ULCERS IN A CARE AT HOME SETTING

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**Introduction:** The study tested the ability of Senior Social Care Practitioners, utilising Assessment Technology to objectively identify early changes indicative of pressure damage and make safe Care decisions in a Home Care setting.

**Methods:** Using Healthcare Improvement Scotland's screening Tool we identified 28 people in a Home Care setting that were at high risk of developing a PU. All participants identified had the capacity to consent to involvement in the study.

We used a 3 stage PDSA approach to refine methodology as we progressed through the study.

We trained Senior Social Care Practitioners in the following:

- PU identification, risk reduction and prevention factors
- The safe use of Assessment Technology in a Home Care setting. Participants were assessed x 3 weekly.
- To introduce a Social Care intervention where a delta score of  $\geq 0.6$  was indicated e.g. elevate heels; increase mobilisation; consider nutritional and hydration factors: minimise moisture on skin.
- Identify when targeted District Nurse intervention is required.
- We developed a SOP for the use of the Assessment Technology in a Home Care setting and a pocket guide for Home Care Practitioners.

**Results:** We aimed to reduce unnecessary hospital admissions as a result of a PU by 40%. There were no hospital admissions

We aimed to reduce overall PUs by 70%. No-one on the study developed a PU

797 scans, with 41% resulting in a delta score of  $\Rightarrow 0.6$

29% of delta scores of  $\Rightarrow 0.6$  had no skin discoloration

198 changes in Care decisions were made by the Senior Social Care Practitioners which empowered the Care Practitioners and altered the care pathway meaning calls to District Nurses were targeted

53% had changes to hydration/ nutrition

37% had increased turning or mobilisation

79% had heel support/heel elevation introduced

12% had a support surface introduced

74% had a prophylactic dressing or barrier cream used

48% of participants and/or their families, became highly motivated by their own data to improve their own health outcomes.

31% of participants had previously had PUs

**Conclusions:** The use of Assessment Technology by Senior Social Care Practitioners to identify early changes indicative of pressure damage in a Home Care setting enabled effective risk assessment and management and decreased Participants likelihood of developing PU.

**COI:** No conflict of interest to declare

## 7.1 NATIONAL ANALYSES OF THE PREVALENCE OF PRESSURE ULCERS IN PATIENTS WITH SPINAL CORD INJURY AS A BASIS FOR SYSTEMIC CHANGE

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**Introduction:** Patients with spinal cord injuries (SCI) are at higher risk of developing and recurring Pressure ulcers (PUs) with higher mortality risk. Caring for a patient with SCI and PUs is costly, especially if flap surgery is performed. For planning effective care strategies, it is essential to know the burden on the healthcare system in terms of the number of people with SCI and PUs.

**Methods:** We analysed national data from the National Health Information System (NHIS) and national health registries. The main source was the National Register of Covered Health Services (health insurance companies' data for inpatient and outpatient areas, available for the period 01/2010-12/2022) and the Death Certificate of Examination as the primary source of information on each death.

**Results:** We identified patients with dg. G82.0-G82.5 Paraplegia and tetraplegia and PUs (L89), in the position of principal or secondary diagnosis. We are aware of the risk of inaccurate recording in clinical practice and underreporting. We chose a scenario in which we included all patients alive each year who had been reported with a diagnosis of G82 at least once in the past (since 2010). According to this calculation variant, 35.5 thousand people lived with para-/tetraplegia in 2021 (19,523 men, 16,177 women). The average age was 57 years for men and 60 years for women (42.2% of men and 50.4% of women over 65). In 2021, the incidence of PUs was recorded in 2 348 para-/tetraplegics (6.6% of 35 430); the prevalence increases with age. The proportion of patients with G82 who died was also evaluated by age and PU (L89) presence in 2021. 694 patients with G82 and L89 died in 2021 (29.6% of 2,348). In contrast, 2,144 patients with G82 without L89 (6.5% of 33,082) died in the same year. Patients with para/tetraplegia and concomitant PUs have a several-fold higher mortality rate in all age categories.

**Conclusions:** The prevalence of PU is higher in patients with SCI and is associated with higher mortality. Approximately 70% of patients with para/tetraplegia die in an inpatient hospital, 18% at home, and less than 9% in social care facilities. Patients with para/tetraplegia and PU have a lower proportion of deaths at home (13%) and a higher proportion of deaths in social care facilities (15%).

**Acknowledgement:** This work was supported by the Ministry of Health of the Czech Republic under grant no. NU20-09-00094 "Cost analysis of pressure ulcers treatment - determinant of care". All rights reserved.

## 7.2

# PATIENT SAFETY: EDUCATING TO SKIN TONE DIVERSITY IN PRESSURE ULCER PREVENTION

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**Introduction:** In pressure ulcer (PU) prevention is important to recognize not all patients are the same. Health inequities and systemic bias contribute to unequal outcomes and people with dark skin tones have been identified as having a higher prevalence of severe PU<sup>1,2</sup>. Lack of knowledge in assessing dark skin is seen as one of the causes as impacts early damage detection. Education is key to improving outcomes<sup>2</sup>.

Following a considerable increased in the number of patients with hospital-acquired PUs, an investigation identified delays in care among dark skin tone patients whose PUs were undetected by the nursing staff. Gaps in knowledge in assessing dark tone skin were identified.

**Methods:** A multidisciplinary education strategy was commenced. Teaching material on skin assessment in dark skin tone patients was created. Register nurses, health care assistants, medical staff and senior nursing teams were invited to attend teaching sessions addressing skin tone diversity in PU prevention.

Previously made teaching materials by the Tissue Viability Team (TVT), were revised to include photographs and illustrations on skin tone diversity and assessing tips.

Staff clinical induction program was revised to raise awareness on this subject among trust new starters.

Creation of a PU categorization poster focused on Dark Skin Patients, set to include a QR code for data collection and knowledge assessment.

**Results:** Over 6 months, over 150 staff attended the above-mentioned teaching sessions. Most staff reported a gain of knowledge and skills. Revision of the Clinical Induction program was completed, now including a session on skin assessment that highlights skin tone diversity. Revised TVT teaching material is now implemented across all Trust.

Number of undetected skin damage among dark skin tone patients have decreased.

The poster was completed and distributed to most wards. Ongoing data collection via QR code is being analyzed.

**Conclusions:** Effective PU prevention requires thorough skin assessment so care plans can be tailored to the patient's individual needs. Organizations need to address skin tone diversity and implement inclusive practices. A focus educational strategy highlighting skin tone diversity has had a positive impact on staff awareness and led to a more inclusive organization.

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**COI:** Essity Company has assisted in the creating of PU categorization in dark skin tone patients' poster. No direct funding was provided.

### 7.3

## A CLINICAL AUDIT TO DETERMINE COMPLIANCE AGAINST THE ASSKING FRAMEWORK FOR PRESSURE ULCERS

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**Introduction:** Pressure Ulcers are known to represent a burden to the health economy and patients alike. Despite national and international guidelines the incidence and prevalence of pressure ulcers (PUs) across England remains high. The introduction of a care bundle for PUs, initially in the United States of America and known as SKIN, which was then introduced in the United Kingdom and became known as SSKIN before being updated to aSSKING, is designed to guide clinicians and reduce those variations in care.

**Methods:** The main aim of the project was to conduct a clinical audit to determine compliance against the aSSKING framework for PUs. The secondary objective was to determine compliance with the Pressure Ulcer Risk Primary or Secondary Evaluation Tool (PURPOSE-T). A retrospective clinical audit was undertaken whereby clinical records of patients with PUs were audited from questions formulated against the aSSKING framework within an adult community nursing setting.

**Results:** The results of the audit identified poor compliance against the majority of the criterion formulated from the aSSKING framework with only two criterion, referral to Tissue Viability and provision of cushion meeting the set compliance rate. A number of short-, medium- and long-term recommendations were proposed with the number one priority being the introduction of the aSSKING template into the electronic patient record. Following a successful pilot of the aSSKING template trust wide roll out has commenced.

**Conclusions:** The literature highlighted that variations in care, and not following clinical guidelines, were primarily due to lack of knowledge and time constraints due to staffing issues, for example.

The main strength of the project was the insight into community nursing clinical practice around the management of PU. Previous clinical audits (Clarke et al, 2017; Stephenson et al, 2021) focused on acute settings whereas this project was able to expand on the findings of those audits.

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**COI:** There was no funding from industry.

## 7.4

# PRESSURE INJURY PREVENTION GAP ANALYSIS USING KEY STAKEHOLDER PERSPECTIVE

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**Introduction:** The purpose of this study was to examine pressure injury (PI) prevention practices in a United States (US) healthcare organization using gap analysis methodology and key stakeholder engagement.

**Methods:** A mixed method, multi-phase, gap analysis approach examined the current state of PI prevention in a US academic hospital. The phased approach included: 1) development of an interprofessional council of key stakeholders; 2) literature review/appraisal of PI prevention; 3) examination of key stakeholder perspective. Interviews were recorded, transcribed, and analysed using NVIVO software. 4) development and testing of the gap analysis instrument; and, 5) a gap analysis of current PI prevention practice. Quantitative data were summarized using descriptive analysis; qualitative data were analysed using thematic approach. Content validity was tested using content validity index (CVI) and Delphi consensus method.

**Results:** Phase 1: The Council was comprised of three academic nursing faculty with expertise in evidence-based practice, PI prevention, research methods, executive leadership, healthcare systems, and Lean Six Sigma methods. Clinical practice members included the Chief Nursing Officer, nursing manager, medical librarian, clinical nurse leaders representing emergency and critical care areas, advanced practice nurse, and interprofessional healthcare experts. Phase 2: A literature review identified 101 articles, of which 57 articles met the initial inclusion criteria; 32 articles remained for a full-text appraisal. A concept map was developed; themes and relationships were mapped to the Donabedian concepts of structure, process and outcomes. Phase 3: Key stakeholder qualitative interviews were completed (n=26). Themes were categorized into barriers (n=8) and recommendations (n=6). Phase 4: Best practice items (79) were incorporated into the gap analysis instrument and categorized by Donabedian model domains of structure, process, and outcome. Eight PI experts completed a content validity survey of the gap analysis instrument. Total CVI was 0.95. Phase 5: The gap analysis identified: a content present score of 56/79 (71, a level of detail score of 82/237 (35%), ease of use score of 126/237 (53%), and total score of 265/553 (48%). Those best practice items that scored 4 or less (1-7) were identified as a gap. Key stakeholders ranked the "gaps" according to priority (1-4) for action for development of an improvement strategy.

**Conclusions:** This study provides a: 1) model for stakeholder engagement, 2) valid/reliable gap analysis instrument; and 3) method to identify gaps between current PI prevention practice and best practice quality indicators.

**References:** Available upon request

**COI:** Investigator-initiated research funded by Smith & Nephew

## 7.5

# IMPLEMENTATION OF A MULTIDISCIPLINARY AND EVIDENCED BASED, PRE-AND POSTOPERATIVE PRESSURE ULCER RECONSTRUCTIVE SURGERY PROTOCOL.

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<sup>1</sup> UZ Brussel, Nurse specialist woundcare, Brussels, Belgium

**Introduction:** Reconstructive surgery is currently used to treat pressure ulcers (PU) where other treatments have little or no impact.

The complication rate for individuals undergoing surgery for a PU is very high, up to 60%, depending the protocol. Wound dehiscence is the most common complication with infection and necrosis. Complications not only increase the length of stay, it also increase costs.

Looking back on previous cases, the reasons for complications where very divergent. Patients weren't suitable for surgery due to for example their non-compliance in prevention, no postoperative prevention plan, unmanageable incontinence, malnutrition, end of life situation or smoking behavior.

**Methods:** Plastic surgeons, a nurse specialist woundcare, the head nurse of the ward, a woundcare nurse, an infectiologist and a dietician were the main stakeholders for the development of the procedure.

We developed clear guidelines about patient surgery criteria/condition, indications for ostomy and prevention, approved by every discipline.

PU surgery implicates a few weeks of hospital stay, with bedrest and limited mobilization, with discomfort for the patient and an increased workload of the staff due to repositioning. Therefore the use of a post-surgical negative pressure dressing was implemented as well as a new type of alternating mattress where cells can be deflated, to release pressure on the flap.

**Results:** Since the implementation of the new PU surgery protocol (6 patients today) we didn't see any wound dehiscence, maceration or infection of the flap. Because of the use of a post-surgical negative pressure dressing, traction on the flap was reduced and mobilizing the patient from day 1 was possible. Beside the main goal of mobilization we reduced maceration and problems with microclimate. These measures increased the patients comfort and reduced the chance of complications.

Implementing an alternating mattress where cells can be deflated, made it possible for the patient to sit from day one and reduced the workload of the staff due to less repositioning.

**Conclusions:** A multidisciplinary approach and clear guidelines for all team members gives a better selection of patients and make better outcomes. Less complications and less recurrence of the PU. What reduces the length of hospital stay and costs.

### References:

EPUAP guidelines: Pressure Injury Surgery

PRS: Flap Reconstruction for Pressure Ulcers: An Outcomes Analysis, Ravinder Bamba et al., 2017.

**COI:** No funding of the research by industry to declare

**7.6****PREVENTION OF PRESSURE ULCER IN CLINICAL PRACTICE: A DESCRIPTIVE SURVEY USING THE NOVEL PUPS PROTOCOL****Beáta Greš Halász<sup>1</sup>**<sup>1</sup> P.J. Šafárik University in Košice, Medical Faculty, Department of Nursing, Košice, Slovakia

**Introduction:** Pressure Ulcers (PUs) represent a significant burden. The incidence and prevalence of PUs globally is approximately 12 %. Prevention plays an important role in the quality and safety of healthcare, as well as in the patient's quality of life. The aim was to identify which preventive procedures were carried out/not carried out in relation to each PU risk category and compare each risk category.

**Methods:** This quantitative descriptive study investigated the preventive procedures were carried out/not carried out using the newly developed Pressure Ulcer Prevention Strategy (PUPS) protocol of which content is based on the actual EPUAP guidelines. We collected data at two selected wards (surgical and long-term) with 60 patients during September to October 2022. For risk assessment, and due to the sample characteristics, we have used the Waterlow risk assessment tool.

**Results:** From the total, 47% of patients were at the very high risk, 25% at high risk, 20% at medium risk. Nurses on selected wards do not use PU risk assessment tools. Based on their clinical judgement, they place more emphasis on the high-risk patients and in patients who have a history of PU. Nurses perform the fewest procedures in the areas of nutrition, hydration, and supportive surfaces, on the other hand, the most in skin care.

**Conclusions:** This implies that patients at intermediate risk are likely to receive less attention in the prevention of PUs. Further contribution of this work is the presentation of a structured preventive approach, finding, identifying, and specifying gaps in practice by newly developed PUPS protocol. However, when conducting a similar work in the future, related factors such as material, technical and staffing provision, as well as staff knowledge of current PU preventive practices, need to be considered. In the future, it is planned to test and implement PUPS in a large state university hospital in Slovakia to stratify and standardize PU prevention as well as data collection on HAPU and PU incidence and prevalence in the context of quality and safety of nursing care delivery. This work can therefore be considered as a pilot project. PUPS could in the future help to unify standard PU prevention practices and subsequently provide a basis for assessing the quality of care based on the principles of evidence-based practice at the national level in Slovakia.

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**COI:** No funding was involved.

## 8.1

## EFFICACY OF A HEEL OFFLOADING BOOT IN REDUCING HEEL PRESSURE INJURIES IN PATIENTS IN AUSTRALIAN INTENSIVE CARE UNITS: A SINGLE-BLINDED RANDOMISED CONTROLLED TRIAL

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**Introduction:** Patients in the intensive care unit (ICU) are almost four times more likely to develop a pressure ulcer (PU) of any kind than non-ICU patients due to their critical illness and inability to convey sensations of increased pressure and discomfort.<sup>1</sup> One of the most common locations on the body where PUs develop is the heel.<sup>2</sup> The purpose of this study was to compare the effect of a heel offloading boot to standard care (pillows) in preventing heel PUs (PU development rate, incidence, and PU severity). A heel offloading boot was chosen as it has demonstrated in previous studies to be comfortable and easy to apply with less room for error when compared to other heel devices.

**Methods:** A multi-centre, single blinded RCT was conducted in three hospital ICUs (two metropolitan, one regional) from August 2019 to March 2021 (there was 6-month cessation period during April-September 2020 during the COVID-19 pandemic). The study sites had a total of 102 ICU beds: 52, 36 and 14 beds in each respective institution. The study population was patients in the adult ICUs at high risk of developing a PU defined by PU risk assessment scales (Waterlow score  $\geq 15$  or Braden scale  $\leq 12$ ). The heel-offloading boot is a device which supports the foot and ankle and elevates the heel to provide complete offloading at the heel to reduce risk of heel PUs. The boot also holds the foot in position to avoid foot and leg rotation to reduce flexion contracture risk and peroneal nerve damage.

**Results:** Within 28 days of admission, one PU was recorded in the intervention group and 11 in the control group. Hazard of PU incidence within 28 days of admission was significantly lower ( $p = 0.0239$ ) in heels assigned to the intervention (hazard ratio 0.0896 [95% CI 0.0110, 0.727]). Odds of PU incidence within 28 days of admission were significantly lower ( $p = 0.0261$ ) in the intervention group (odds ratio 0.0883 [95% CI 0.0104, 0.749]). The PU in the intervention group was superficial (stage 1) whereas those in the control group were more severe (stage 2 to 4).

**Conclusions:** The heel offloading boot used in this study is an effective pressure relieving device and should be used instead of pillows to prevent the development of heel PUs. It also significantly lowers the hazard and odds of developing heel PUs in critically ill patients and reduces PU severity.

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**COI:** Nil

## 8.2

# A CASE OF PEDIATRIC HARD-TO-HEAL PRESSURE INJURY WITH HIP OSTEOMYELITIS THAT WAS COMPLETELY HEALED BY SURGICAL DEBRIDEMENT AND NPWTI-D.

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**Introduction:** Ischial pressure injuries (PIs) reaching the hip joint space with osteomyelitis in spinal cord injury patients are refractory and cannot be treated with conservative treatment using antibiotics. In adults, invasive surgery such as girdle stone surgery is indicated, however, recurrence is common. Girdlestone surgery and hip arthrotomy are highly invasive and are not indicated for children. In this case, we report a pediatric child case in which the ischial PI was healed by fixing the hip joint with a splint and surgical debridement of the hip joint, and NPWTi-d.

Case: 12 year-old, Female.

She had a history of spinal cord infarction at the age of 7 years and was completely paralyzed below the umbilicus. In July 2017, a PI developed on the left buttock and was infected. In January 2019, the PI pocket was deepened to the point that the ischial tuberosities were palpable. She underwent hospital conservative treatment such as NPWT at the previous hospital for two years, but she was not cured. At the first visit to our hospital, she had a fever of 38. A PI was found in the left ischial region, which had pus retained in the joint, and the femoral head was dislocated and protruded outside the pressure ulcer. After consulting with an orthopedic surgeon, we decided to avoid invasive treatments such as girdle stone surgery because the patient is a child, and to undergo thorough debridement, followed by NPWTi-d. Under general anesthesia, the infected granulation tissue was removed, the acetabulum surface and femoral head cartilage were removed, and the osteomyelitis was removed as much as possible. Postoperatively, the knees and hips were fixed in a 90-degree flexion position with a splint and bandaged and pressure ulcers were managed in the right and supine positions in the general ward. Furthermore, intravenous antibiotics were also started. The wound was reduced while the infection was controlled, and NPWTi-d was continued with the addition of shoe-laces technique 5 weeks after the operation. Eleven weeks after the operation, PI had completely healed and epithelialized.

**Discussion:** Many reports of ischial PIs that reach the hip joint cavity required hip arthroplasty such as girdle stone surgery or local flap surgery to fill the space around the hip joint. In the case that we experienced this time, the dead space was filled with the granulation tissue by NPWTi-d alone and got strict stability without movement of the femoral head by creating a splint after surgery, and healing was obtained.

### 8.3

## A NOVEL EX VIVO PORCINE MODEL OF LOCALISED OEDEMA FOR STUDYING SUB-EPIDERMAL MOISTURE.

**Giulio Brunetti<sup>1</sup>, Juan Carlos Palomeque-Chavez<sup>1</sup>, Zena Moore<sup>1</sup>, Declan Patton<sup>1</sup>, Fergal O'Brien<sup>1</sup>, Colin Boyle<sup>1</sup>**

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**Introduction:** Current best practice in pressure injury detection involves Visual Skin Assessment (VSA)[1], requiring damage to have already occurred – all the more important for dark skin tones, where VSA is less robust[2]. Sub-epidermal moisture (SEM) measurement has been proposed as a method for detecting localised oedema (an early pressure injury indicator) before damage is visible[3]. Lab studies have helped to determine the sensitivity of SEM scanners to moisture using physical tissue phantoms[4]. However, these simplified models cannot capture the distinct structure and composition of human soft tissue.

**Methods:** The adult porcine calcaneus was selected as a bony prominence with anatomical similarities to the human heel. Sub epidermal moisture was controlled using intradermal injection of phosphate-buffered saline via a precision syringe pump. Oedema was inspected using colorimetry. A commercial SEM scanner was used to quantify SEM at the injection site and a control site near the bony prominence. Tests were performed on ten specimens, with ten repetitions within each specimen. SEM, SEM-delta (range of a set of readings; used to indicate damage clinically) and fluid delivered were recorded

**Results:** Moisture was found to remain within 2cm of injection site indicating successful localised oedema. SEM readings increased at the intervention site as moisture content increased, with SEM statistically significantly greater after 1ml injection than baseline ( $p<0.05$ ). SEM values continued to increase as fluid content increased, although the rate of increase reduced, indicating detector saturation at high moisture volumes. SEM-delta increased as sub-epidermal moisture increased, with the clinically-relevant score of 0.6 breached after 1ml injection ( $p<0.05$ ).

**Conclusions:** A SEM scanner successfully detected non-visible variations in sub-epidermal moisture content in ex vivo porcine soft tissue. An injection of 1ml of fluid was sufficient for the scanner to indicate damage. A novel ex vivo clinical model was successfully established for this purpose. Further study is needed to enable finer spatial control of sub-epidermal moisture in the ex vivo model.

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**COI:** This project was funded by Bruin Biometrics Ltd, whose SEM scanner was used in this study.

## 8.4

## THE CORRELATION OF SUB-EPIDERMAL MOISTURE (SEM) MEASUREMENT AND ULTRASOUND FOR ASSESSING THE PRESENCE OF PRESSURE ULCER (PU) DEVELOPMENT IN THE DEEPER TISSUES.

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**Introduction:** Gefen and colleagues argue that strains and stresses nearby bony prominences are much higher than those near the surface, thus can cause damage in these tissues before damage at the skin is visible to the naked eye<sup>1</sup>. Thus, alternate methods over and above visual skin assessment are crucial to detect damage within these deeper tissues. SEM and ultrasound have demonstrated this ability, particularly in the detection of early development of PUs in the deeper tissues<sup>2</sup>, however, are yet to be examined collectively in a clinical population.

**Methods:** A prospective cohort study was undertaken between January-November 2021. Participants undergoing elective surgery with absence of a visual PU were consecutively enrolled following informed consent. Patient assessment was conducted before surgery, and after surgery for three days, at the sacrum, both heels and a control site, using a SEM measurement device and a high frequency ultrasound scanner (5-15 MHz). A SEM PU was defined as two consecutive abnormal SEM delta values that succeeded a normal SEM delta value. Ultrasound abnormalities were placed into four categories to reflect severity. A spearman's correlation (rs) explored the correlation between SEM and ultrasound.

**Results:** A total of 60 participants were included, with a mean age of 58 years (SD: 13.46) and 50% were male. The total SEM PU incidence was 61.8% (n=34), corresponding to 42.9% (n=12), 55.3% (n=21), and 36.7% (n=11) SEM PUs at the sacrum, left heel and right heel respectively. The percentage of ultrasound abnormalities increased across all sites throughout the follow-up period. There were no abnormal SEM or ultrasound assessments at the control site. Spearman's correlation revealed a statistically significant low to moderately positive correlation between SEM and ultrasound across the sacrum (rs range = 0.41-0.54, p<0.05), left heel (rs range = 0.39-0.48, p<0.05) and right heel (rs range = 0.45-0.52, p<0.05). The only exception was a correlation between SEM and ultrasound on day 0 at the right heel (rs = 0.23, p=0.09).

**Conclusions:** SEM and ultrasound both agreed in the presence of injury; however, SEM was able to identify abnormalities prior to ultrasound. SEM demonstrated superiority in terms of its feasibility in clinical practice when compared to ultrasound.

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**COI:** Please declare any funding of the research by industry here, the SEM scanner was provided for use in this study by Bruin Biometrics.

## 8.5

# A SYSTEMATIC REVIEW ON THE IMPACT OF SUB-EPIDERMAL MOISTURE MEASUREMENTS ON PRESSURE ULCER CARE DELIVERY PATHWAYS

**Zena Moore**<sup>1</sup>, **Declan Patton**<sup>1</sup>, **Janet Cuddigan**<sup>2</sup>, **Helen Strapp**<sup>1</sup>, **Pinar Avsar**<sup>1</sup>

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**Introduction:** Elevated Sub-Epidermal Moisture (SEM) has been shown to be an indicator of early-stage pressure ulcer (PU). Early detection of SEM enables healthcare practitioners' to target anatomy-specific PU prevention interventions for at-risk patients<sup>1</sup>. No previous systematic review has investigated whether implementing SEM assessments in PU care pathways and identifying elevated SEM in patients at risk of PUs, prompts objective clinical actions and enables the implementation of enhanced anatomy-specific interventions, and thereby reduces the incidence of PUs.

**Methods:** We undertook a systematic review of the literature, and included original research studies using either a prospective or retrospective study design that report the impact that assessment using SEM measurement has on healthcare practitioners' delivery of PU care pathways in adults at risk of developing PUs. The review protocol was registered on PROSPERO (CRD42023416975). A literature search was conducted in May 2023, using PubMed, CINAHL, Scopus, Cochrane, and EMBASE, Web of Science, and Science Direct databases. Data were extracted using a pre-designed extraction tool and quality appraisal was undertaken using the Evidence-based librarianship (EBL).

**Results:** We identified nine papers published between 2017 and 2022. The majority of these studies were conducted in England (n=6; 67%). Regarding study designs, four of the studies were observational studies (44%), four were interventional studies (22%), four were pilot studies (22%), and one was a case study (11%). The systematic review included studies conducted across multiple care settings including acute care, medical-surgical units, and palliative care, highlighting the importance of pressure ulcer prevention and management across diverse patient populations. The PU care pathways implemented in the studies varied, but commonly included elements such as the application or increased use of pressure-relieving mattresses/cushions, implementation of repositioning plans, management of incontinence and moisture, regular skin inspection, and assessment of patient mobility. Introducing SEM assessments, however, was the only singular change to PU care pathways in individual studies. Out of the nine studies identified, seven reported PU incidence. In all of these studies, implementing PU care pathways informed by SEM assessments resulted in a reduction in the incidence rate.

**Conclusions:** This systematic review provides evidence that implementing SEM assessments in patients at risk of developing PUs prompts anatomy-specific clinical actions. The subsequent implementation of enhanced and targeted skin care interventions leads to consistent and sustained reductions hospital-acquired PU incidence. The findings emphasize the importance of incorporating SEM assessments as part of comprehensive PU prevention strategies in all care settings and patient populations.

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**COI:** No COI.

## 8.6

# RISK FACTORS FOR INTRAOPERATIVELY ACQUIRED PRESSURE INJURIES IN THE PARK-BENCH POSITION ARE REDUCED USING A SOFT SILICONE MULTI-LAYERED FOAM DRESSING AS IN ADDITION TO INTRAOPERATIVE CORE TEMPERATURE MANAGEMENT

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**Introduction:** The park-bench position (PBP) is the surgical position associated with the highest risk of intraoperative acquired pressure injuries (IAPIs). Prophylactic dressings are recommended for patients at risk for pressure injuries in NPUAP/EPUAP/PPPIA guideline 1). However, there no studies have examined the risk factors for IAPIs with sufficient preventive measures (e.g., soft silicone multi-layered foam dressing [SMD]) in the PBP. This prospective study aimed to investigate risk factors for IAPIs in patients who received SMD in the PBP.

**Methods:** The study included patients who underwent neurosurgical operations in the PBP between October 2021 and August 2022 for whom SMD was applied to the lateral thoracic, iliac, and greater trochanteric regions to prevent IAPIs. Intraoperative core temperature management was performed as usual perioperative complication prevention care in this study. Ninety participants were included in the analysis. Patient characteristics (age, sex, BMI, smoking history, medical history, presence of skin dryness, bony prominence or oedema and paralysis, Braden Scale score, American Society of Anesthesiologists [ASA] physical status classification) and blood test data (hemoglobin and albumin) were analyzed. Intraoperative factors included the surgical procedure, operative time, amount of bleeding, diastolic blood pressure <50mmHg (yes/ no), core temperature (baseline value, end value, change value, maximum value), core temperature  $\geq 38.1^{\circ}\text{C}$  (yes/ no) and presence of perspiration.

**Results:** The incidence of IAPIs was 6.7% (6/90). The sites of IAPI onset were the lateral thoracic region in 5 cases and the iliac region in 1 case. Univariate analysis revealed sex (male, n=5; female, n=1; P=0.025) and operative time (P<0.0001) as risk factors for IAPIs. In the multivariate analysis, operative time (every 1 hour: P=0.0001, odds ratio 3.62, 95% confidence interval 1.73-11.42) was significantly associated with the incidence of IAPIs. The threshold of operative time was 6.85 hours. The microclimate (core temperature and perspiration variables) was not identified as a risk factor for IAPIs.

**Conclusions:** In our previous studies, the incidence of IAPIs was 11.0-24.1 % when film dressing was used in the PBP. This decreased to 6.7% in this study. Moreover, the operative time, for which the cut-off value was 6 hours in previous studies, was extended to 6.85 hours (12.4% increase) in this study. SMD and core temperature management could weak the involvement of risk factors for IAPIs. Consequently, it may extend the cut-off value for operative time, which is the strongest risk factor.

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## 9.1

# MULTI-PROFESSIONAL GROUP WORKING ACROSS THREE CARE SETTINGS TO STANDARDISE PRESSURE ULCER PREVENTION STRATEGIES THROUGH DEVELOPMENT OF AN END-OF-LIFE PRESSURE ULCER PREVENTION PATHWAY

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**Introduction:** Patients at End of Life (EOL) can be at higher risk of harm due to compromised nutrition, immobility, sensation, moisture balance along with existing co-morbidities. On review of incidents, an average of 40% of harm develops on patients in their last months of life with the dominant theme being lack of Pressure Relieving Equipment (PRE). Missed opportunities included poor communication between clinicians from Acute, Community and Hospice services and no standardised process for obtaining PRE.

To reduce missed opportunities a multi professional working group was developed. The aims and objective of this working group was to increase interprofessional communication, explore existing barriers and develop a multi-professional network and pathway.

**Methods:** The working group included a variety of specialist services across Community, Hospice and Acute care settings that input on the patient journey. Learning from Incidents was shared with the group and the barriers to care delivery by each stakeholder from the different settings explored.

Several themes were expanded on, including the difference in patients potential care need from an inpatient setting to a community setting. Equipment provision differs across care settings, limiting decision-making by clinicians and impacting on discharge planning for EOL patients (Mertens et al, 2021).

A key theme was patient choice and acceptance of prognosis, limiting what can sensitively be offered or received prior to discharge. The physical impact to the patient on and following discharge can expedite the need to increase PRE due to the rapid deterioration of patient's mobility and overall health.

**Results:** This multi professional working group has increased awareness of the patient journey and the challenges clinicians face while trying to support the progressive needs of EOL patients. The Working group meet monthly to ensure multi professional networking is maintained which has increased channels of communication to facilitate person centered care planning.

EOL Pressure Relieving Pathways have been developed to support clinician decision making, ensuring all patients receive the right equipment for their need, preventing harm development in this high-risk cohort.

Future outcomes include provision of Educational Events supported by multi professional teams across the settings to increase knowledge and skills of all clinicians who support the care of a patient at end of life.

**Conclusions:** Multi professional working improves communication, reduces barriers within services and standardises care for patients. It ensures all patients receive the right care at the right time and that gaps in care are reduced. The long-term objective of the working group is to reduce the number of harms that develop in these high-risk patients and improve multi-professional collaboration and continuity of care.

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Mertens F, Debrulle Z, Lindskog E, Deliens L, Deveugele M, Pype P. (2021). Healthcare professionals' experiences of inter-professional collaboration during patient's transfers between care settings in palliative care: A focus group study. *Palliative Medicine*. 35(2):355-366. doi:10.1177/0269216320968741

## 9.2

## THE USE OF CONTINUOUS PRESSURE MONITORING TO EMPOWER SELF-MANAGEMENT OF PRESSURE ULCER MANAGEMENT AND PREVENTION IN THE COMMUNITY

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**Introduction:** Pressure ulcer prevention and treatment in the community setting has a number of challenges, where empowering self-management is seen as a critical strategy in national health and social care agendas (NHS 2019). The aim of the project was to understand the impact on the patient/carer and multidisciplinary team of using continuous pressure monitoring (CPM) as visual feedback in decision making regarding pressure ulcer management and prevention.

**Methods:** Multi-centre (n=4) community quality improvement project with embedded qualitative interviews. 360-degree interviews were used following a purposeful sample of patients/carers to reflect different experiences of using CPM.

Semi-structured interviews were used to recount the impact of the implementation of CPM on their care and quality of life. Interviews were audio recorded, transcribed verbatim and sent to each participant to verify content and accuracy. Narratives were thematically analysed, and key quotes were selected to illustrate and reinforce the interview findings and develop further questions to achieve saturation.

The interviews were conducted in each of the sites with:

- a patient and /or their carer
- Health Care Practitioner involved in the patient's care
- a representative from a local equipment supplier.

**Results:** A total of 23 interviews were conducted:

The interviews were made up of:

- |                    |                              |
|--------------------|------------------------------|
| 5 Patients         | 3 Other Health Professionals |
| 4 Carers           | 4 Equipment providers        |
| 7 Study Clinicians |                              |

Patients were aged 34-73 years with a history of recurrent or non-healing Category 2 or 3 pressure ulcers/pressure damage. Patients, carers and clinicians recounted the strong visual impact of the image on the monitor which resulted in increased engagement, insights and understanding with changes in behaviour.

Key themes were identified as:

- |                       |                     |
|-----------------------|---------------------|
| Assessment            | Posture/Positioning |
| Bio feedback          | Quality of life     |
| Equipment selection   | Referral reason     |
| Joint decision making | Technology          |

There were reports of an increased sense of empowerment, feeling listened to, supported and understood. Equipment suppliers recognised the value of CPM as a clinical and equipment procurement tool.

**Conclusions:** The key benefits of CPM were improved access to effective equipment solutions and better mutual understanding and concordance between patients and clinicians.

The interviews showed improved collaborative multi-disciplinary working and understanding of the needs of the patients and carers to aid patient empowerment and patient-centered care.

### References:

<http://www.longtermplan.nhs.uk/>

**COI:** I have nothing to declare

### 9.3

## BARRIERS TO ENGAGING WITH PRESSURE ULCER PREVENTION BEHAVIOURS FOR COMMUNITY-DWELLING OLDER PEOPLE AND THEIR LAY CARERS

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**Introduction:** International PU prevention guidelines recommend behaviours to reduce the risk. Increasingly community-dwelling patients and their lay carers are having to take responsibility for adopting PU prevention behaviours. We know that behaviour change theory is effective in supporting adoption of desired behaviours particularly when tailored to pre-assessed determinants (barriers and facilitators). This study was informed by the Theoretical Domains Framework (TDF), which offers an evidence-based comprehensive framework of all potential determinants of behaviour.

**Methods:** Recorded interviews were undertaken with ten community-dwelling older (>65) people who were at risk of or have (had) a PU and their lay carers (n=10). Following transcription, interviews were analysed according to the TDF and barriers to PU prevention behaviours identified.

**Results:** Barriers existed in the following key domains: Knowledge, Social and Professional Role, Motivation, Goals and Priorities, Emotion, and Environment.

Patients had good knowledge of PU prevention behaviours, however, this was usually acquired after a PU had developed. Knowledge was frequently gained from observing what practitioners did to prevent and treat pressure ulcers, often whilst in hospital. Participants indicated that PUs were a 'taboo' topic, due to the perceived intimate nature of these wounds. Understanding of nutrition and hydration was limited, particularly in regard to PU prevention.

Nearly all participants spoke of the emotional burden of being a patient or carer generally, irrespective of the presence of a PU, or the need for PU prevention. Exhaustion and isolation was indirectly linked with PU prevention and was a problem expressed by all carers and all but two patients (one of whom did not have a lay carer). Patient participants spoke about feelings of malaise, low energy and low mood due to illness or life-style restrictions caused by illness which impacted on PU prevention behaviours.

The key environmental barrier related to human resources, and particularly the work that goes into making and changing healthcare appointments. Accessing care out of hours was challenging, and participants considered practitioners to be overworked and short of time. Pressure relieving equipment was usually in place but was sometimes delayed, inappropriate or provided without the necessary support or information.

The next phase of this project involves co-designing interventions to support PU prevention behaviours.

**Conclusions:** This research has identified barriers to pressure ulcer prevention for older people living in the community, and their lay carers. Numerous practical and emotional barriers hampered day-to-day engagement with PU prevention behaviours. By fostering an open dialogue about pressure ulcers and how to prevent these, HCPs can facilitate engagement with prevention strategies in this hard-to-reach group.

## 9.4

## EFFECTIVENESS OF FLAPS CONTROLLING INFLAMMATION FOR SEVERE PRESSURE SORES IN OLDER PATIENTS WITH MULTIPLE CORMORBIDITIES

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**Introduction:** Older patients with pressure sores secondary to medical problems generally are not likely to become physically active again and are therefore rarely considered candidates for flap surgery. When surgeons decide whether to perform surgery in older individuals with multiple morbidities, they must weigh the risks of prolonged general anesthesia and the burdens of flap surgery against the benefits of the flap.

**Methods:** This retrospective study included patients over 65 years of age who were treated at our clinic from May 2010 to August 2018 for grade III or IV pressure sores. They underwent either general wound care without flap coverage (debridement only) or complete flap coverage of the sore (debridement plus flap group). We compared changes in laboratory blood tests from pre-operation to post-operation

**Results:** A total of 63 patients were included, with 53 in the flap coverage group and 10 in the control group. Age, sex, and flap size were statistically similar between groups ( $P>0.05$ ). The control group exhibited no significant laboratory changes after debridement. The flap coverage group exhibited statistically significant improvements in neutrophil percentage and C-reactive protein level postoperatively ( $P<0.05$ , paired t-test). Serum hemoglobin, albumin and electrolyte levels did not differ with statistical significance from pre-operation to post-operation in either group ( $P>0.05$ , Wilcoxon signed-rank test and paired t-test)(Table 1).

**Conclusions:** As pressure sore coverage with flaps may have a positive effect on controlling inflammation, flap surgery could be a viable option for older patients with severe pressure sores.

## References:

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Table 1. Comparison between general wound care (debridement only) and Flap surgery (debridement and flap surgery) treatment for pressure ulcers

	General wound care			Flap		
	Pre	Post	P-value	Pre	Post	P-value
Hemoglobin (g/dL)	9.39±1.53	8.89±1.87	0.13	10.41±1.41	10.62±1.10	0.29
Neutrophil fraction(%)	73.23±12.65	66.58±21.87	0.19	72.25±9.67	67.22±11.31	0.001*
Albumin(g/dL)	2.84±0.40	3.02±0.67	0.38	3.21±0.51	3.21±0.36	1.0
Sodium(mmol/L)	136±2.50	121.64±42.38	0.30	136±4.86	136.49±4.77	0.5
Potassium(mmol/L)	4.08±0.65	4.15±13.90	0.78	4.08±0.60	4.04±0.55	0.72
CRP(mg/L)	54.99±22.42	42.02±33.94	0.26	43.79±47.36	23.99±25.72	0.004*

## 9.5

## EXPLORING BARRIERS IN THE IDENTIFICATION, MANAGEMENT AND PREVENTION OF MUCOSAL MEMBRANE INJURY (MMI) SUSTAINED IN PATIENTS WITH A URETHRAL CATHETER WITHIN HEALTHCARE COMMUNITIES

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**Introduction:** Pressure Ulcer prevention and management focusses on cause of harm. This becomes more challenging when the sources of harm are medical devices which are necessary for patients' health. National guidance (NHSI, 2018) recommended harm from devices be reported and distinguished by the addition of a (d) following the category, to address under reporting of medical device damage. These recommendations were implemented within the organisation. Analysis demonstrated the highest numbers of device related harm was attributed to urethral catheters, damaging the meatus, resulting in Mucosal Membrane Injury (MMI). However, in the case of mucosal harm, the anatomical structure of mucosal tissue, prevents categorisation using the existing guidance (NHSI, 2019, and NPUAP, 2008). Therefore, an additional subcategory of MMI was reported with harm levels to ensure patient safety and learning.

The impact of this harm, which is often severe, causes lifelong cosmetic and functional changes to the urethral meatus, negatively impacting a patient's quality of life and self-image and may necessitate surgical intervention.

**Methods:** An audit of MMI incidents and care plans was undertaken, highlighting insufficient information in patient records. The previous SSKIN bundle /care plans /assessments that clinicians used did not prompt assessment for MMI or provide guidance on preventative interventions. This was identified as the primary contributing factor to effective pressure ulcer prevention in this patient population. A project group with key stakeholders was implemented with the aim to review best practice and evidence on MMI prevention. Evidence was limited; however, recommendations included the use of appropriate catheter equipment and the increase of clinician knowledge to reduce the risk of harm.

**Results:** From this working group, educational sessions were developed and implemented to increase awareness. The local SSKIN bundle was update to aSSKINg to reflect The National Wound Care Strategies, the additional (a) 'assess' component prompting skin assessment of the body where medical devices were in contact (NHS England, 2018). The (I) Incontinence component was expanded, prompting assessment of catheter equipment preventing MMI's. This enabled staff to document MMI and offered guidance on appropriate intervention. Additionally, catheter care plans for clinicians, carers and patients were implemented increasing awareness.

**Conclusions:** There is now a greater understanding of the risks of this specific harm and required preventative interventions which is demonstrated in the successful completion of risk assessment tools and care plans. However, an area that requires further investigation and exploration is the potential barrier and social taboo in assessing and managing this at-risk area for both patient, clinician, and carers, which may impact on reporting and appropriate intervention strategies.

#### References:

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## 9.6

## TAKING PATIENT INVOLVEMENT TO A NEW LEVEL

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**Introduction:** Management of pressure ulcers/pressure injuries (PUs/PIs) in people with spinal cord injuries (SCI) is a complex task that should involve a multidisciplinary team, including people with SCI – both on an individual, an organizational- and on a strategic level, and in research.

**Methods:** We established a user-initiated National Pressure Ulcer Alliance in May 2022 to improve the multidisciplinary and cross-sectoral effort to prevent, treat and rehabilitate PUs in people with SCI.

**Results:** The National Pressure Ulcer Alliance has arranged two online theme days, created a flyer with information about handling a PU/PI, and is a quick-responding clinical network. Furthermore, the alliance is involved in an ongoing research project and preparing another PhD project. The National Pressure Ulcer Alliance members are in all the processes from defining the subject, writing a protocol, performing the research, to applying for funding and publishing results.

**Conclusions:** We established a National Pressure Ulcer Alliance that supports multidisciplinary collaboration nationwide and secures a very high level of service-user involvement in all projects and processes.

We want to present this example of a high level of service user involvement, how we established the alliance, the purpose and aim of the alliance, and the former and future activities. We hope that one of the service users are able to participate in this presentation and at the conference.

**COI:** No funding to declare.

## 9.7

## THE IMPORTANCE OF PATIENT ORGANIZATION IN THE SYSTEM OF NON-HEALING WOUND CARE

**Adela Holubova**<sup>1</sup><sup>1</sup> Zahojíme, z.s., Sezimovo Ústí, Czech Republic

**Introduction:** The treatment of non-healing wounds requires a multidisciplinary approach. However, the patient and their loved ones are the most important. Without the cooperation and help of the patient, the treatment of these wounds would not be successful. In order to cooperate fully, the patient needs correct and understandable information. Information about how the wound is caused, what causes it, how the healing process will proceed, how to apply the correct wound healing materials and, last but not least, information about where to seek the specialised, guaranteed and comprehensive care that is provided in the specialised wound treatment centres.

**Methods:** Based on the facts described above, an organization for non-healing wound patients called ZAHOJÍME, z.s was founded in December 2022. Patient organizations are non-profit organizations whose activities are patient-oriented, and in which patients and/or their caregivers (if patients are unable to represent themselves for whatever reason) represent a majority of the members on the governing bodies. In January 2023, the Scientific Board of ZAHOJÍME, z.s. was formed and is composed of leading experts in the field of non-healing wounds and related disciplines. The Scientific Board serves as a control mechanism for the materials produced by the ZAHOJÍME, z.s. Committee, thus guaranteeing the quality and validity of the materials produced.

**Results:** The goal of our organization is a professional, patient-oriented organization with the support of professional societies and a broad patient base. Our aim is to follow new developments in the field of wound healing, legislation, to monitor the needs of patients with non-healing wounds, to listen to them, to provide them with sufficient and understandable information. On the basis of this knowledge, to establish close cooperation between the patient organisation, the individual wound healing centres and other disciplines that belong to the multidisciplinary team and, last but not least, the Ministry of Health of the Czech Republic. Cooperation with home care agencies is also an integral part of this. In 2022, ZAHOJÍME, z.s. participated in the development of nursing practices and recommendations in oncology (skin and mucous membrane care, prevention and treatment of skin involvement during radiotherapy). These recommended practices are available from health care providers for the treatment of oncological diseases. Recommendations for hygiene of the wound, its surroundings and dressing area during dressings performed in the home environment are currently being developed.

**Conclusions:** The patient organization ZAHOJÍME, z.s. is a non-profit organization that aims to listen, help patients, caregivers and health care providers on the issue of non-healing wounds. An integral part of the organization is to try to improve the quality of life with a non-healing wound. The patient organization is primarily focused on helping lay people, but the specifics of ZAHOJÍME, z.s. include supporting the professional community.

## 10.1

## PRESSURE MONITORING TECHNOLOGIES FOR PRESSURE ULCER PREVENTION: CAN HIGH-RESOLUTION PRESSURE SENSING ARRAYS BE OPTIMISED IN THEIR SPATIAL AND TEMPORAL CONFIGURATION?

Silvia Caggiari<sup>1</sup>, Nicci Aylward-Wotton<sup>1</sup>, Peter Worsley<sup>1</sup>

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**Introduction:** Commercial pressure monitoring technologies have been developed to assess the interface pressure distribution to optimize individual repositioning in sitting or lying and prescribe effective cushions and mattresses [1]. These systems are typically high-resolution sensing arrays sampling data more than once per second (>1Hz). This results in expensive systems that produce a large volume of data, much of which may be redundant [2]. The present study aims to evaluate a minimum number of sensors and acquisition frequency that accurately predict postural and mobility events to support pressure ulcer prevention.

**Methods:** Two data sets were used in the study. These involved the pressure distribution of healthy volunteers (n=20) who performed pre-determined sagittal and lateral lying postures on a foam and air mattress, respectively. A high-resolution continuous pressure monitor (ForeSite PT, Xsensor, Canada) was used to assess interface pressures. This data was subsequently down sampled in the number of sensors and frequency of acquisition, through an off-line optimization process (Fig.1). For each spatial and temporal resolution, parameters including center of pressure, contact area, peak pressure, and peak pressure gradient, were estimated from the pressure distribution. Receiver Operating Characteristic (ROC) analysis was performed and the area under the ROC curve (AuC) used to determine the ability of the parameters in discriminating between the presence and absence of postural events. Convolutional Neural Network (CNN) was also employed to predict postures.

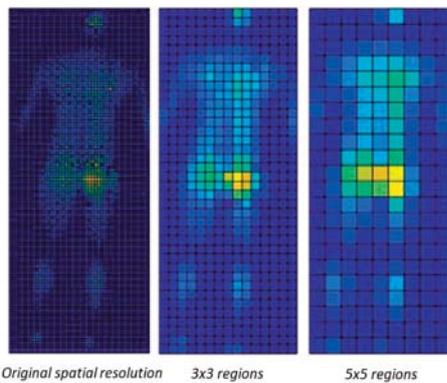


Figure 1: A depiction of a lying posture using different spatial resolutions, represented through the raw pressure readings, aggregated into 3x3 and 5x5 regions.

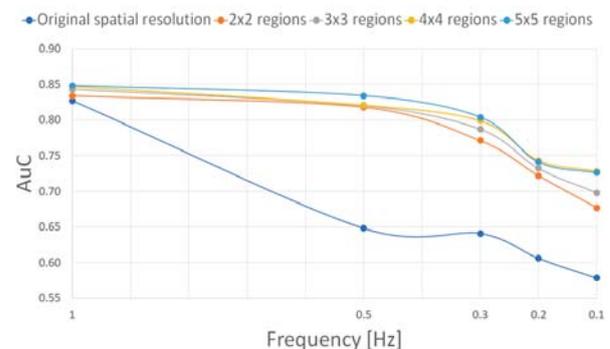


Fig 2: AuC values (y-axis) at different sampling frequencies (x-axis) and spatial resolution. Different colours indicate a different spatial resolution. Each marker indicates a AuC value at sampling frequency of 1, 0.5, 0.3, 0.2 and 0.1Hz

**Results:** AuC showed similar trends when parameters associated to both mattresses were compared, with air mattress showing a higher predictive ability in discriminating postural events. For all the spatial configurations, parameters showed AuC values approximately similar at a sampling frequency ranging 1-0.3Hz, which declined for values >0.3Hz, for both mattresses. For some parameters e.g., pressure gradient, the lower the number of sensors the higher the AuC values (Fig.2). Posture prediction with CNN at different spatial resolutions resulted in similar accuracies of 69-71% and 85-86% for foam and air mattress, respectively, when compared to the commercial configuration.

**Conclusions:** There is a critical need to optimize the commercial systems, and reduce their cost, redundancy, and complexity of the data to support clinical utility in a variety of clinical settings, e.g., community. Indeed, the present study demonstrated that an optimum number of sensors and acquisition frequency can result in equivalent performance to high-resolution pressure sensing arrays in predicting posture and mobility events.

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**10.2****THE INFRARED THERMOGRAPHY AS A PREDICTIVE TOOL IN THE ASSESSMENT OF CHRONIC WOUND HEALING – RESULTS OF A PROSPECTIVE 12-WEEK RANDOMIZED STUDY**

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**Introduction:** The wound healing process is characterized by phasicity and changing dynamics of inflammatory and vascular processes. Not all of them can be assessed visually. But some affect heat emission and can be seen in infrared thermography (IRT). In this study, we evaluated the usefulness of IRT in the diagnosis of chronic wounds and in predicting the course of the healing process. We assume, the method could be useful also for PUs in the future.

**Methods:** We performed a secondary analysis of data collected in a prospective 12-week randomized trial in which we evaluated the effectiveness of collagen gel in patients with VLUs. We qualified 53 patients with wounds of 5-50 cm<sup>2</sup>. Wounds were assessed every 2 weeks, resulting in a total of 368 observations. We assessed the wound surface and the temperature distribution on the tissue surface using a high-resolution mobile infrared thermography camera (640×480 pixels). The preparation of the subjects was in accordance with the guidelines of the International Academy of Clinical Thermology. We compared temperature distributions from 3 areas: the periwound skin, wound area and control point on healthy skin. We used panel data regression analysis to investigate the association between wound characteristics and the three temperature difference measurements.

**Results:** We have shown that changes in temperature distribution on the surface of tissues usually precede clinical changes in the wound (symptoms of disorders). The observed change was small (0.04°C per 1 cm<sup>2</sup>) but statistically significant. The increase in the temperature difference in the compared areas resulted from the presence of local disturbances - it predicted deterioration or inhibition of wound healing. An increase in the range of 0.4-0.95°C was a symptom of developing wound infection and allowed to recognize it at the subclinical stage. A greater increase in temperature above 1.6-2.0°C was associated with full-blown infection or synergism of multiple (≥4) bacterial species. We also observed the correlation of temperature distribution with superficial vein insufficiency and thrombosis, the age of the subjects and the presence of alert pathogens.

**Conclusions:** It has been shown that changes in temperature distribution usually precede clinical changes in the wound. Therefore, infrared thermography can be a valuable diagnostic tool, supplementing the prevention and standard diagnosis of pressure injury by: early warning of the development of pressure injury (before visual diagnosis), warning of wound deterioration and complications (infection) and prediction of the healing process

**References:**

DOI: 10.1111/wrr.12781

**COI:** NCBIR No. PBS3/B7/28/2015

## 10.3

THE USE OF THE FLUORESCENCE IMAGING METHOD FOR  
MICROBIOLOGICAL DIAGNOSIS OF PRESSURE ULCER.  
DESCRIPTION OF TWO CLINICAL CASES.

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**Introduction:** Infection in a chronic wound is one of the factors that slows down the healing process and at the same time increases health care costs. The identification of a wound with bacterial colonization poses a considerable challenge since infection may occur even in asymptomatic patients. Apart from biopsy, which is recommended in diagnostic microbiology, bacterial wound culture remains a routine part of standard care. Fluorescence imaging enables quick diagnostics to determine both the type and location of pathogens residing in the wound and on the skin. The images obtained in this way allow for a quick assessment and documentation of their presence, location and range of fluorescent bacteria.

**Methods:** This study presents the method of microbiological fluorescent imaging and two case studies of patients with pressure ulcers. In both cases, the sample for microbiological testing was obtained by means of a swab stick.

**Results:** The paper presents a description of two clinical cases with pressure ulcers. In each patient, during the first visit, material for microbiological examination was collected from the wound bed and images were taken simultaneously with the fluorescence camera. The fluorescence imaging results showed moderate to severe bacterial loads and were consistent with the results from the microbiology laboratory.

**Conclusions:** Thanks to the rapid diagnostics using the Fluorescence imaging, it was possible to immediately implement targeted local measures, such as: wound hygiene, antiseptics, selection of the optimal dressing and causal treatment.

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## 10.4

ENHANCED SKIN ASSESSMENT METHODOLOGY TO EQUITABLE  
DETECT EARLY TISSUE DAMAGE AND PRESSURE INJURIES IN  
ADULT PATIENTS IN THE ACUTE CARE SETTING

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**Introduction:** Racial disparities occur when clinicians fail to accurately assess skin in people with dark skin tones. This study examined the use of a sub-epidermal moisture (SEM) device to assess, identify, and prevent pressure injuries (PI) in critical care adults.

**Methods:** Retrospective, descriptive, and comparative study of adult Surgical Trauma Intensive Care Unit (STICU) patients with a SEM delta score from trial of device in 2021. Data were collected through medical record review including patient demographics, clinical information, Braden total/subscale scores, PI prevention interventions (not informed by SEM data), and HAPI presence if developed within 7 days of SEM measurement. A web-based survey was administered to nurses who used the SEM device. Descriptive analysis, fisher's test, and one-sided t test were performed.

**Results:** Study included 69 subjects; mean age  $58.8 \pm 18.1$  years; 40 (58%) male, 29 (42%) Black, and 36 (52%) White. Fifteen (22%) subjects developed a HAPI, 5 (7%) had a POAPI, and 49 (71%) had no PI. Of 15 with HAPI, 6 (40%) were Black, and 7 (47%) were White. Thirty-five (57%) subjects had a sacral SEM delta  $\geq 0.6$ ; of which 14 (40%) were Black; 20 (57%) were White; 11 (31%) had a HAPI or POAPI. Among 14 HAPI and POAPI subjects with SEM sacral delta, 11 (79%) were  $\geq 0.6$ . Among 26 Black subjects with sacral SEM delta, 5 had a HAPI or POAPI; and of those 4 (80%) had sacral SEM delta  $\geq 0.6$ .

SEM sacral delta  $\geq 0.6$  was consistent with lower Braden total scores on all 3 days. A negative correlation was observed between Braden total scores on day 2 and SEM sacral delta ( $p = 0.03$ ) and R heel delta ( $p = 0.03$ ) scores. Of 35 patients with a sacral SEM delta  $\geq 0.6$ , 24 (69%) did not have appropriate PI prevention interventions. Of those 24, 9 (37.5%) were Black and 14 (58%) White. Nurses ( $n = 13$ ) indicated the SEM device was easy to use, helped perform an accurate skin assessment in patients with darker skin tones and helped identify a patient's risk for PI.

**Conclusions:** This study demonstrates SEM technology to address racial disparities, the utility of SEM data to promote appropriate location-specific PI prevention interventions and improve skin assessment accuracy beyond existing PI care.

**References:**

*Upon request*

**COI:** Investigator-initiated research funded by Bruin Biometrics.

## 10.5

## EARLY DETECTION OF PRESSURE ULCERS IN CARDIOVASCULAR ICU PATIENTS UNDERGOING PROLONGED SURGERIES

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**Introduction** Successful pressure ulcer prevention is often measured by the absence of visible skin changes and improving risk scores. Nurses often feel reassured by declining risk scores as they mobilized patients postoperatively. This may offer a false sense of security. The 2019 International Pressure Ulcer/Injury Guideline<sup>1</sup> found sufficient evidence to recommend both subepidermal moisture (SEM) and infrared thermography (IT) scanning for the early detection of pressure-induced damage. Although these devices have been tested separately; no study has investigated the use of both devices concurrently. In CVICU patients, who have undergone a surgery lasting 4 or more hours (P), will IT and SEM identification of early tissue damage, followed by more intensive preventive measures in the presence of early damage (I) compared to usual care (C) prevent visible pressure ulcers (O) during the first five days postoperatively (T)?

**Methods:** One-group prospective study with repeated measures conducted in a 30-bed Cardiovascular Intensive Care Unit (CVICU). The subjects were adults scheduled for a surgery predicted to last > 4 hours with a planned postoperative admission to CVICU. Each participant's sacrum and heels were scanned with IT and SEM scanners before their procedure, 2 hours post-procedure, and then every 24 hours until 96 hours postoperatively. If either scan indicated early damage (i.e., IT of 1.2 Celsius above or below surrounding normal tissue OR a SEM delta equal to or greater than 0.6), additional prevention measures were implemented at the anatomic site.

**Results:** Twenty-three patients enrolled. Two surgeries cancelled; one patient withdrew; leaving data from twenty subjects for analysis. This was a high-risk sample as indicated in Table 1. One patient developed a Category 2 pressure ulcer during study follow-up. Of 360 skin assessments, skin color was normal in 91.9% (331/360), blanchable erythema in 5.6% (20/360) and purple discoloration in 2.5% (9/360). Braden Scores improved postoperatively as patients mobilized. However, both SEM and IT scanning identified areas of early pressure damage. In the absence of scanning, these would be "missed opportunities" for prevention. See Figure 1.

**Conclusions:** Using IT and SEM scanning as an adjunct to the Braden Scale was beneficial in detecting early injury, providing opportunities to implement targeted interventions, and prevent pressure ulcers.

**References:**

European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, & Pan Pacific Pressure Injury Advisory Panel. Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline. 2019; (E. Haesler Ed. Third ed.); EPUAP-NPIAP-PPPIA.

**COI:** The scanning devices were on loan from Bruin Biometrics and Wound Vision. No direct funding was provided.

Risk Factor	Mean (SD)
Age	62.35 (12.94)
Preop Hospital LOS	6 (4.76)
Postop ICU Stay	7.45 (11.16)
ASA Score	3.47 (0.84)
Anesthesia time in minutes	469.50 (137.44)
Minutes MAP < 60 despite vasopressors	52.50 (55.85)
Minutes of vasopressors in OR	236.44 (364.24)
Postop days on vasopressors	2 (1.70)
Postop days on ventilator	2 (0.73)
Body Mass Index	29.19 (5.97)

Table 1. Summary of Risk Factors in Study Cohort

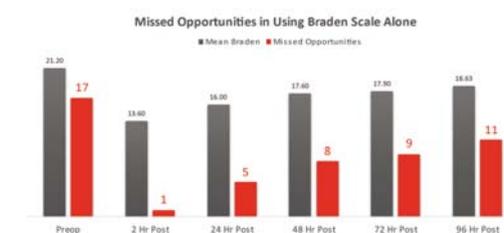


Figure 1. Mean Total Braden Scores &amp; Number of Patients "Missed" by Braden Score but Detected as Having Early Tissue Changes on IT or SEM

## 10.6

## POLYLACTIC AND POLYGLYCOLIC ACIDS: PRELIMINARY DATA OF A NEW TECHNOLOGY TO TREAT PRESSURE INJURIES

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**Introduction:** Among the wound care innovative treatments there's a new material of medication (powder, gel and sheets) that can quickly improve and heal any kind of wound, infected or not. There are no data on pressure injuries and that's why the aim of this work is to demonstrate the effectiveness of this new material in the treatment of this type of lesion, from 2nd to 4th stage.

**Methods:** The work is still in progress. At the moment we have enrolled 13 elderly patients with pressure injuries and 11 of them have already completed the study. The target is 20 patients. Inclusion criteria: age over 75, cleansed and/or critically colonized and/or infected lesions (according to Cutting & Harding criteria [1]), WBP score A-C [2]; exclusion criteria: patients with ischemic lesions, neoplastic or terminal and treated with immunosuppressants. The protocol treatment is to apply dressings containing polylactic and polyglycolic acid in powder or sheet or anhydrous gel formulation; moist gauzes as secondary dressing. Dressing change every 5-10 days according with the exudates excess. Wound Area Reduction (WAR) and the reduction of signs of infection, if present, were evaluated. Study duration 8 weeks or healing or onset of adverse events.

**Results:** All patients achieved significant improvement or complete healing; the mean WAR was 89.1% (6 patients healed within the observation time). The mean weartime was 8.3 days. No adverse events, no allergies, no induced pain.

**Conclusions:** These new materials showed highly significant efficacy in the treatment of pressure injuries, especially in terms of reduction of healing times and dressing frequency. The mean healing time is significantly lower than the one obtainable using advanced dressings[3], but very similar to the one using active dressings[4]. Another important feature of these dressings is the prolonged weartime which allows a significant reduction in the frequency of dressings and the consequent reduction of management costs.

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**COI:** No conflict of interest

## S1.1

## TRANSCUTANEOUS GAS TENSIONS AT THE ISCHIAL TUBEROSITY OF SEATED INDIVIDUALS WITH AND WITHOUT PRESSURE-REGULATING DEVICES: A PRELIMINARY INVESTIGATION

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**Introduction:** Pressure ulcers acquired from prolonged sitting remain a significant concern for immobile or neuropathic patients. Existing technological solutions mainly focus on relieving under-body pressures but have shown limited effectiveness in reducing pressure-ulcer incidence [1]. In this study, we compare the transcutaneous gas tensions of seated individuals with and without an alternating underbody pressure device and a lateral pressure regulating device shown in Figure 1.

**Methods:** We monitored gas tensions (TcPCO<sub>2</sub> and TcPO<sub>2</sub>) at the level of the ischial tuberosity in a healthy volunteer for 30 minutes under the following conditions: (1) standing (control), (2) seated on an armchair, (3) seated with an alternating under-body pressure cushion (current standard of care), and (4) seated with a device applying 55% of lateral to underbody pressure. Three technical repeats were conducted with the same participant. Gas-tension changes were evaluated using the categories defined previously [2].

**Results:** The gas tensions during the 30 minutes of standing served as the control, showing slight fluctuations due to movement but consistently remaining in category 1. Seating resulted in the soft tissue remaining 1 minute (4% of the total time) in category 1, followed by approximately 3 minutes (9%) in category 2 and 26 minutes (88%) in category 3. Sat on the alternating underbody-pressure cushion resulted in the participant being in category 1 for approximately 4 minutes (12%), category 2 for 20 minutes (67%), and category 3 for 5 minutes (20%). The participant remained in category 1 for the entire 30 minutes when lateral pressure was applied; the largest deviation from baseline gas tensions being an 8% decrease in O<sub>2</sub> and a 3% increase in CO<sub>2</sub>. These findings were consistent across the three technical repeats.

**Conclusions:** These preliminary results suggest that a 30-minute sitting duration is adequate to reveal differences in the gas tensions of subcutaneous tissue when in contact with different support surfaces. Data is now being collected using this protocol on a larger sample size to enable meaningful comparisons between pressure-ulcer preventative technologies in the seated patient.



Figure 1 (Top): Schematic of the lateral pressure regulating device [3]

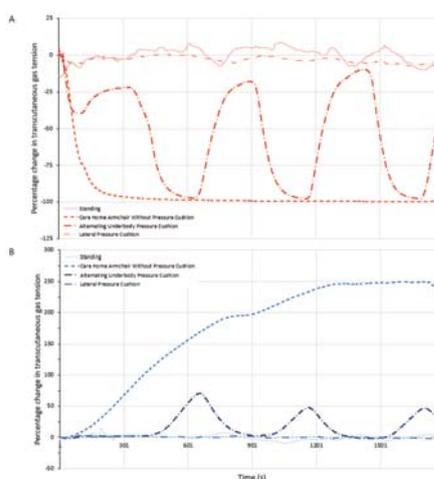


Figure 2 (Right): Percentage change in transcutaneous oxygen and carbon dioxide for a seated participant – A shows oxygen and B carbon dioxide over time.

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## S1.2

EARLY DETECTION OF INFLAMMATORY RESPONSE IN SKIN  
AFTER ORONASAL MASK APPLICATION - USING UNTARGETED  
PROTEOMICS

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**Introduction:** While managing respiratory disorders, non-invasive ventilation (NIV) masks save lives in health care settings but can potentially cause pressure ulcers due to high localized pressure and fractional forces at the nasal bridge that lacking protective adipose tissue (1). Since device-related pressure ulcers seems to develop faster than pressure ulcers from body weight (2), there is a need to identify biomarkers for early tissue damage. We have conducted an explorative and untargeted protein analysis using a multiplex immunoassay technology to explore the inflammatory profile of vulnerable skin sites following non-invasive mask application.

**Methods:** Patients (n=11) from a thoracic intensive care unit underwent routine non-invasive ventilation treatment with oronasal face masks. Cytokines from skin were collected from sebum in skin, using an adhesive tape (3), before and after NIV-therapy. Sampling sites were the nasal bridge under the NIV-mask and from a control area in the forehead. An electrochemiluminescent detection method was used to analyse the concentrations of 71 cytokines. The proteomic data set was analysed by a multivariate data analysis. For protein-protein association network the bioinformatic tool STRING (Search Tool for Retrieval of interacting Genes/Proteins) was used.

**Results:** 11 cytokines were excluded from further analysis due to below limit of detection (>50 percent of the population). The concentration of the remaining 60 proteins from controls and baseline (n=33) and directly after NIV (n=11) showed significant differences between groups. In this model, 21 cytokines contributed most to the separation and were further analysed in the protein network interaction. The pathway analyses showed specific inflammatory or immune response within this network.

**Conclusions:** Multivariate statistical analysis revealed 21 important cytokines that could be potential biomarkers for early skin tissue damage. This results, together with further studies of the refractory period after pressure exposure have potential to be implemented in new prevention strategies, to reduce costs associated with pressure ulcers and to improve the individual's quality of life.

**References:**

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**COI:** The authors report no conflicts of interest.

## S1.3

## 'BED MOBILITY MATTERS': EXPLORING THE IMPACT PRESSURE REDISTRIBUTION MATTRESSES HAVE UPON BED MOBILITY, FUNCTIONAL INDEPENDENCE, AND REHABILITATION.

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**Introduction:** The role of allied health professionals (AHP's) within pressure management is under reported, yet physiotherapists and occupational therapists are vital to ensure mobility and independence, key factors in pressure care. While pressure mattresses aid in the management of pressure ulcers, reports have highlighted negative impacts upon an individual's well-being and mobility (Gorecki et al., 2012; Nixon et al., 2019), with no further exploration in the current literature. This study explored the perceptions of the multi-disciplinary team (MDT), including nurses and AHP's, on the impact pressure mattresses have upon bed mobility, functional independence, and rehabilitation.

**Methods:** An exploratory, sequential, mixed methods study design was used. An online survey with open and closed questions exploring mattress types, associated clinical areas, patient populations, outcome measures, and the impact different mattresses have upon bed mobility was distributed via social media. Semi-structured interviews were developed to explore common survey themes in greater depth, with participants self-selecting from the survey. Any health care professional registered with The Health and Care Professions Council, or Nursing and Midwifery Council were included.

**Results:** 145 participants completed the online survey, 71 physiotherapists, 52 nurses, 20 occupational therapists and 2 moving and handling practitioners.

87.5% reported challenges relating to bed mobility, functional independence and rehabilitation when using pressure mattresses.

16 semi-structured interviews followed, with 6 nurses, 6 physiotherapists and 4 occupational therapists participating.

Findings highlighted:

- Air mattresses are the most common to cause challenges relating to mobility, independence, and rehabilitation. Foam mattresses are least likely to cause challenges.
- A lack of clear outcome measures for AHP's to use for assessment of bed mobility.
- A perceived lack of knowledge, experience, and MDT approach in relation to pressure management, impacting clinical decisions.
- Current pressures in health care are a barrier to effective and timely pressure management.

**Conclusions:** To the authors knowledge this study is the first to explore the perceived impact pressure mattresses have upon bed mobility while incorporating an MDT approach. Participants perceived pressure mattresses to have a detrimental impact upon bed mobility, functional independence, and rehabilitation, most commonly when using air mattresses. Findings from this study will be explored further through an experimental design, with the aim to inform future clinical decisions around pressure redistribution mattresses.

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Nixon, J., Smith, I. L., Brown, S., McGinnis, E., Vargas-Placios, A., Nelson E. A., Coleman, S., Collier, H., Fernandez, C., Gillberts, R., Henderson, V., Muir, D., Stubbs, N., Walker, K., Wilson, L. & Hulme, C. (2019). Pressure Relieving Support Surfaces for Pressure Ulcer Prevention (PRESSURE 2): Clinical and Health Economic Results of a Randomised Controlled Trial. *EClinicalMedicine*, 14, 42-52. <https://doi.org/10.3310/hta23520>.

**COI:** None – part of a PhD project.

## S1.4

# DEVELOPING A TOOL FOR PREVENTING AND MANAGING PRESSURE INJURIES

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**Introduction:** Healthcare complications, such as hospital-acquired pressure injuries, are key performance indicators in the Australian Health Care system (1). Healthcare professionals are responsible for identifying risk-associated pressure injuries and communicating the identified risk and care with patients, carers, and team members. When communicating, there is a need for a tool to facilitate the patient education process. This research aims to develop a tool for preventing and managing pressure injuries.

**Methods:** A modified action research approach, including mixed methods research, was adopted to develop a patient education tool for preventing and managing pressure injuries.

The research objectives of this four-phase study were:

- 1) to explore the effectiveness of patient education tools for preventing and managing pressure injuries,
- 2) to investigate nurses' knowledge and attitudes toward preventing and managing pressure injuries,
- 3) to explore nurses' and patients' educational needs on pressure injuries, and
- 4) to develop an education tool using the Delphi technique.

To address the research objectives:

- 1) A literature review was undertaken to explore the effectiveness of patient education tools.
- 2) A cross-sectional survey (2,3) was distributed between November 2019 and February 2020 to explore nurses' knowledge and attitudes towards pressure injuries.
- 3) Interviews were conducted to explore nurses' and patients' educational needs for pressure injury prevention and management in 2020.
- 4) Delphi technique was implemented to obtain consensus from the panel members on educational content between October 2022 and January 2023.

Data were analysed descriptively and inferentially using SPSS v26 and with thematic analysis.

**Results:** The results were:

- 1) The literature review found little evidence of the effectiveness of patient education tools for patients and nurses' knowledge or satisfaction or pressure injury incidence.
- 2) The cross-sectional survey, with a response rate of 29.2%, showed 71% correct responses for knowledge of prevention/risk, 40% for staging, and 37.5% for wound description. Attitudes toward pressure injuries were positive; most nurses agreed that all patients were at risk of pressure injury.
- 3) Nurses and patients identified gaps in learning to prevent and manage pressure injuries.
- 4) The Delphi panel members suggested various educational contents on admission, hospital stay and before discharge from an acute hospital setting. The mode of delivering the educational content in three points was mixed.

**Conclusions:** Findings supported the need to develop a patient education tool to prevent and manage pressure injuries and assisted with addressing the learning needs on preventing and managing pressure injuries amongst nurses and patients.

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**COI:** I declare that this research has received no funding from industry.

## S1.5

## CORRELATING BIOMECHANICAL PROPERTIES OF MEDICAL DEVICES WITH CLINICAL OUTCOMES IN CRITICALLY ILL ADULTS

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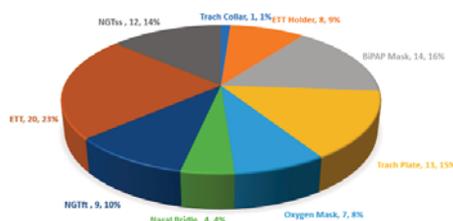
**Introduction:** Medical device related pressure ulcers (MDRPU) are a common adverse event in acute care [1,2]. Despite a well-developed protocol for MDRPU prevention, an urban academic medical centre with 811 adult and paediatric beds was unable to eliminate these harmful occurrences. Twelve oxygen delivery devices, nasogastric tubes, or their holders were frequently implicated in MDRPU occurrences in critically ill adults from January 2016 through October 2022. We hypothesized that devices with greater mechanical stiffness would be associated with a greater number and severity of MDRPU.

**Methods:** A comparative descriptive study exploring the relationship(s) between objective biomechanical tests of medical devices and clinical outcomes. The Institutional Review Board approved this study. Devices in original packaging were sent to a bioengineering laboratory for testing. Using an integrated experimental-computational approach, the compressive elastic moduli (E [MPa]) was measured for each device and compared to the properties of normal skin.

**Results:** Of the total patients with MDRPUs in our database, 68 critically ill adults with 88 MDRPUs were identified (Fig. 1). Using the NPIAP Classification System [3], no Stage 4 injuries were identified. Nasogastric tube and endotracheal (ET) tube MDRPU were the most frequently occurring- accounting for 47% of all MDRPUs. These devices also had the highest elastic modulus (E [MPa] or stiffness) values. Devices associated with the highest number of MDRPUs also had the highest E [MPa] values with a moderate association between E [MPa] values and pressure ulcer severity. When MDRPU were reclassified for severity as partial thickness (i.e., Stage 1 and Stage 2) OR full thickness (i.e., Stage 3, Unstageable or DTPI) OR Mucosal Membrane Pressure Injuries (MMPI), this reclassified scale had a moderate correlation (Spearman correlation = .568,  $p < .001$ ) with the device stiffness (E [MPa]) of the device causing each MDRPU. Partial thickness injuries accounted for 7.8% of all MDRPU; full thickness for 55.7% and MMPI for 36.4%. Figure 2 provides a relationship map depicting these associations. While full-thickness and MMPI MDRPU occurred with devices with the highest elastic modulus (ETT and NGT), devices with much lower stiffness (trach plates) contributed to 15% of all full-thickness MDRPU.

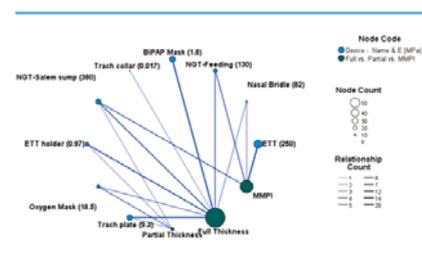
**Conclusions:** The relative mechanical stiffness of a device is an important factor in MDRPU etiology. Device selection incorporating the mechanical stiffness of devices can inform clinical practice. Modification of the material components of devices not compatible with the mechanical stiffness of the skin may ultimately reduce these harmful and potentially disfiguring occurrences.[4] Further exploration of patient and clinical use factors is underway in a larger case-control study involving this clinical cohort.

Figure 1. MDRPI by Device Type



No MDRPUs were reported for soft nasal cannula or prophylactic dressings. ETT = Endotracheal Tube, NGTt = Nasogastric Tube used as a Feeding Tube, NGTss = Nasogastric Tube – Salem Sump for drainage of excess gastric fluids and gas.

Figure 2. Relationship Between Device Stiffness (E [MPa]) and MDRPU Category (Partial vs. Full Thickness vs. MMPI)



Spearman Correlation between Stiffness Values and PI Category = .568 ( $p < .001$ ). MMPI = Mucosal Membrane Pressure Injury.

## S1.6

## DEVELOPMENT OF AN MRI-COMPATIBLE INDENTATION SYSTEM TO CHARACTERIZE THE MECHANICAL RESPONSE OF SACRAL SOFT TISSUES FOR PRESSURE ULCER PREVENTION

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**Introduction:** The prevention of Pressure Ulcers (PU) remains a major health challenge because of its human and financial cost due to prolonged hospitalization and reduced quality of life for the patients. Many subject-specific finite element models have been developed to assess the risk of PU. In particular, the localization of mechanical strain within soft tissues has proved a valuable tool to evaluate soft tissue injury risk [Ceelen et al., 2008]. However, there is a lack of experimental validation of the strain predicted by such models. Based on the methodology developed in a previous study [Trebbi et al, 2022], the objective of this contribution is to experimentally characterize the response of sacral soft tissues under realistic loading (bedrest) using MRI and a custom-made set-up.

**Methods:** One healthy subject (male, 35y.o., BMI=28.1kg/m<sup>2</sup>) participated in the experiment. A custom-made set-up was designed (figure 1) to apply a realistic loading on the sacral area during the MRI. Five positions were recorded: prone, supine unloaded, supine loaded (1kg loading and then 1.5kg) and supine fully loaded (bodyweight). Digital volume correlation was performed with the Elastix library between the supine unloaded and the supine loaded 1kg position. The deformed volume was obtained by applying the displacement field computed to the initial segmented volume.

**Results:** The MRI images in the supine unloaded and loaded position (1kg loading) are given in figures 2(a) and 2(b) respectively. The results of the segmentation of the gluteal muscle are overlaid in both configurations. The gluteal muscle volume in the undeformed configuration was estimated as 1020cm<sup>3</sup>. This is consistent with previous results reported in the literature [Sonnenblum et al., 2014]. Preliminary results show a change of volume of 4.4% for the gluteus maximus in the supine loaded position (1kg loading).

**Conclusions:** This work is important because the evaluation of the internal soft tissues response under realistic loading has never been evaluated experimentally before. The next step is to compute the mechanical strain from the displacement field estimated with Elastix as a surrogate measurement of soft tissue injury risk. Perspective work also include the estimation of the uncertainty of segmentation and the development of methods to alleviate the process.

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Trebbi A., Mukhina E., Rohan P.Y., Connesson N., Baillet M., Perrier A. Payan Y. *MR-based quantitative measurement of human soft tissue internal strains for pressure ulcer prevention*, 2022.

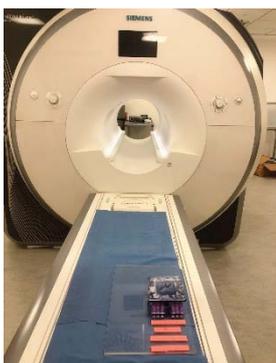


Figure 1) MRI compatible custom-made set-up capable of applying a controllable force on one buttock using weights and pulleys.

## A1

# REDUCING THE RISK OF PATIENT HARM FROM LONG TROLLEY WAITS: RESULTS OF A REVIEW ASSESSING THE USE AND IMPACT OF A TROLLEY MATTRESS OVERLAY.

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**Introduction:** Delayed handover of patients at Emergency Departments (EDs) resulted in patients receiving care for prolonged periods on ambulance trolleys (NHS England 2020). This makes patients vulnerable to pressure ulcers (PUs).

To reduce the risk of patient harm, the acute hospitals and ambulance trust across the south west worked together to trial, then purchase trolley mattress overlays (TMOs). A review was completed in one of the hospital Trusts to assess the benefit of the implementation and identify changes required.

**Methods:** The ED and tissue viability team from the acute hospital worked with the ambulance trust to retrospectively review patient records and procedures to establish:

- Whether a TMO was indicated
- Whether a TMO was utilised
- How this was documented
- Whether any PUs were identified and/or documented
- Any changes in the number of PUs reported in ED since implementation

Records of 30 patients who attended ED by ambulance over 2 months were reviewed.

### Results:

Of the randomly selected 30 patients, 17 (56%) were not transferred onto a TMO. Reasons include:

No handover delay (n = 5)

No documentation about the use of an overlay (n = 4)

No reason recorded (n = 8)

It was unclear whether 11 (36%) of the patients reviewed were transferred onto a TMO. This is due to an anomaly in documentation where an intention to use the TMO is recorded on a paper record (used in the holding area) but with no documentation on the electronic record.

Only 2 (6%) patients were clearly recorded as being transferred onto a TMO, this is likely an under-representation. Both patients for whom a TMO was used and documentation was complete had a frailty score of 5 showing correct use (Moorhouse & Rockwood 2012).

Patients who received a TMO had no PUs reported or recorded during their hospital stay.

Before implementation of the TMOs, 98 PUs were reported by ED. In the 5 months after implementation, this reduced by 30.6%.

**Conclusions:** Paper documentation used in the holding area is not a definitive record, as the clinician completing it is not in charge of the patient's care and circumstances may change.

The TMOs are being utilized. It is not possible to ascertain if they are being used appropriately due to inconsistencies in documentation. However, data suggests a reduction in PUs experienced by patients waiting for a hospital bed. The TMO has been implemented across the south west and results of this review may improve care in other Trusts.

Recommendations include improvement in documentation, clearer assessment identifying need for a TMO and more education on skin assessment.

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Trolley Mattress Overlay (TMO): *Repose Trolley Companion*, Frontier Medical Group. Tredegar South Wales

## A2

# IDENTIFYING PATIENTS AT RISK OF DEVELOPING PRESSURE ULCERS - A COMPARISON BETWEEN PURPOSE T AND THE MODIFIED NORTON SCALE

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**Introduction:** Pressure Risk Primary or Secondary Evaluation Tool (PURPOSE T) is an evidence-based pressure ulcer risk assessment instrument (PU-RAI) that demonstrates good psychometric results, usability, and feasibility<sup>1,2,3,4</sup>. In one region in Sweden, PURPOSE T is used as main risk assessment instrument since May 2021 while the Modified Norton Scale (MNS) is only used when estimating prevalence of pressure ulcer three times a year for nationwide comparison. The aim of this study was to compare two PU-RAIs and evaluate how many patients they identified at risk of developing pressure ulcers.

**Methods:** The design was a quantitative and cross-sectional study. The study was conducted at a university hospital in Sweden. Inclusion criteria for the patients were  $\geq 18$  years of age and risk assessed with both PURPOSE T and MNS. Risk assessment with PURPOSE T had been documented within the same period of care before the prevalence measurement or no longer than three days after. Exclusion criteria were patients who undertook surgery, were away on examinations or was on permit.

Two PU-RAIs were used, PURPOSE T1 and MNS5. The data collection and record review took place in December 2022.

A total of 367 patients from 31 hospital wards were initially screened, and risk assessed according to MNS in the nationwide prevalence measurement. A record review was then conducted on all participants to see if there had been a risk assessment done at the same period of care using PURPOSE T.

**Results:** A total number of 290 patients were risk assessed with both PURPOSE T and MNS. The MNS identified 59 (20,3%) patients "at risk" and PURPOSE T identified 127 (43,8%) patients "at risk". When comparing the total number of patients "at risk" between the two PU-RAIs, PURPOSE T identified 76 (149%) more patients at risk than the MNS.

**Conclusions:** PURPOSE T identifies more inpatients with risk of developing pressure ulcer compared to MNS. Using PURPOSE T as main risk assessment instrument should help healthcare staff identifying more patients at risk of developing pressure ulcers, patients with pressure ulcers, prescribe early prevention and increase patient safety.

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### A3

## EFFECTS OF GLUTEUS MAXIMUS CONTRACTION BY THE ELECTRICAL STIMULATION ON BUTTOCK INTERFACE PRESSURE IN THE SUPINE POSITION

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<sup>2</sup> Kobe University, Kobe, Japan

**Introduction:** The purpose of this study is to examine the effects of gluteus maximus contraction by the electrical stimulation on the interface pressure (IT pressure) on the buttock during the supine position (S position) or 30-degree head elevation position (30 HE position).

**Methods:** The subjects were 20 healthy adults who consented to this study. Participation criteria were defined as a BMI of 20 kg/m<sup>2</sup> or less. The IT pressure at rest was compared with that during ES in the S position and 30 HE position, respectively, and the order of measurements was randomized. Electrodes were placed on each of the left and right gluteus maximus muscles. ES was performed for 3 minutes; ES was set to a pulse width of 300  $\mu$ s, frequency of 50 Hz, and intensity of muscle contraction level confirmed by palpation, during S position or 30 HE position. The differences in IT pressure at rest and during ES were analyzed in both the S position and HE position. In addition, these analyses were stratified by sex.

**Results:** IT pressure in the S position was significantly lower in the ES condition (84.7 $\pm$ 7.0 mmHg) than in the rest condition (87.5 $\pm$ 6.6 mmHg) ( $p$ <0.001). IT pressure in the 30 HE position was also significantly lower in the ES condition (85.0 $\pm$ 7.0 mmHg) than in the resting condition (88.8 $\pm$ 7.4 mmHg) ( $p$ <0.001). Regarding sex-stratified analyses, ES decreased IT pressure in the 30 HE position ( $p$ <0.05) but not decreased in the S position ( $p$ =0.08) in females. Meanwhile, ES decreased IT pressures in both the S position and 30 HE position in males ( $p$ <0.05).

**Conclusions:** ES to the gluteus maximus muscle reduced IT pressures on the buttock in the S position and at 30 HE position. These results suggest that gluteus maximum contraction by ES is an effective intervention to manage the IT pressure on the buttock during both positions. In addition, the difference in the effect by sex suggests the involvement of muscle and/or fat mass in this effect.

## A4

# PRESSURE ULCER KNOWLEDGE AND ATTITUDES OF ASSISTANT NURSES IN CLINICAL PRACTICE

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**Introduction:** Pressure ulcers (PU) are considered as an adverse event causing suffering and pain for patients worldwide. There are international and national guidelines for PU prevention. According to these guidelines, regular surveys should be carried out among healthcare professionals to evaluate which education that is needed in clinic. Knowledge of PU prevention is a crucial factor in preventing PUs (1). Research shows that the assistant nurses often are more bedside to the patient compared to the registered nurses' and that the registered nurse's hand over parts of the risk assessment of pressure ulcers to the assistant nurses such as skin assessment (2,3). Even though they don't know what knowledge the assistant nurses have in pressure ulcers. Therefore, the purpose of this study is to describe the knowledge and attitudes of assistant nurses in clinical practice.

**Methods:** Descriptive design. A convenience sample of approximately 100 assistant nurses were recruited for the study from five different hospital wards at a university hospital in Sweden. Assistant nurses who were on sick leave, vacation or worked night shift were excluded. The PUKAT 2.0, a valid and reliable questionnaire was answered by all the participants to evaluate their knowledge and attitudes about pressure ulcers. The questionnaire contains 28 multiple choice questions, categorized in to six themes: Etiology, Classification and observation, Risk assessment, Nutrition, Prevention of PUs and Specific patient groups (4). After the questionnaire was completed one investigator led discussions and provided opportunity for the assistant nurses to learn the correct answer. This to gain a better understanding of PUs, reflect over their own responses and attitudes in the questionnaire. After the discussion the participants answered two questions about this form of study/education. Data collection; March-May 2023.

Results and **conclusions:** Will be presented at the conference as the result is being processed right now.

### References:

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**COI:** I have no conflict of interest

## A5

# UNDERSTANDING THE COMPLEX PRESSURE ULCER PATIENT, THE PROBLEM OF CONTRACTURES AND THE IMPACT OF THE COVID PANDEMIC

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**Introduction:** The COVID pandemic affected physical and mental health for many, particularly those with complex health needs and at risk of pressure ulcers. The gap in proactive care and backlog in elective intervention also had indirect impact such as increased self-reliance and reduced confidence in health services. 1,2

The Pressure Ulcer Prevention and Intervention Service (PUPIS) in Swansea, UK, is a unique MDT supporting community patients with persistent pressure ulcers. In response to a perceived change in demand, initial assessment data were analysed to determine the demographic of patients requiring specialist input before, during and following the COVID pandemic. A specific hypothesis was that patient complexity increased following COVID.

**Methods:** Data was analysed from assessments of the PUPIS service, as a specialist service referred to support persons in their own home and care homes. Data spanned the years 2015-2022 and included records of 973 patient assessments. Measures chosen to indicate complexity included pressure ulcer category, duration, those with dementia, those with contractures, those with multiple pressure areas, and the interrelation of these factors. Location of pressure ulcers was also analysed for those with contractures compared with the wider population.

**Results:** Descriptive statistics showed that following COVID pandemic, the proportion of patients presenting with a contracture increased, as well as those presenting with more than one pressure ulcer. The proportion of deep wounds also increased, particularly those categorized as unstageable.

Of those with contractures (101 patients), 44% had dementia and 46.5% had more than one pressure ulcer. Common ulcer sites were on the lower limb as opposed to general common sites of sacrum, ischial tuberosity and heel specifically 3. Unsurprisingly, those with contractures were confined to bed more (73%) than those without (38%).

**Conclusions:** Data suggests an increase in complexity for those requiring specialist input for pressure ulcers in the community. A theme was identified with a spike in demographics of dementia, confined to bed, contractures, and multiple, deep, lower limb pressure areas.

The change in landscape has required services to adapt in how they manage patients, prioritise resources and interact between services (engagement with therapist teams, for example). Launch of the pressure ulcer management app 'Offload' is timely to these goals.

Locally, hospitals are also seeing more complex patients coming in with pressure ulcers. The problem is cyclical in that community then receive patients more difficult to manage due to deterioration of mobility or other health deconditioning.

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**COI:** No conflicts of interest.

Data presented in dissertation for BSc Healthcare Science (Rehabilitation Engineer), Swansea University

## A6

# GOING THROUGH RECONSTRUCTIVE SURGERY FOR PRESSURE ULCERS IN THE GLUTEAL AREA - STORIES LIVED AND TOLD

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**Background:** The role of people with complex wounds in wound research is usually limited to being objects of study and beneficiaries of research results. In the field of reconstructive treatment of pressure ulcers, the situation is similar, and studies that measure clinically important outcomes in relation to surgical techniques and treatments dominate. This may be a contributing factor to the fact that existing research has not been able to influence the recurrence rate for pressure ulcers, which has been at approximately the same high level for the past 15 years. The aim of the study was therefore to explore the lived experience of patients with pressure ulcers in the gluteal area and their way through reconstructive surgery treatment and care.

**Method:** Narrative method with in-depth interviews was used and people who had undergone reconstructive surgery for pressure ulcers in the gluteal area since 2020 were contacted and offered to talk about their experiences. The conversations were recorded, transcribed, and then analysed structurally and thematically.

**Results:** Three main themes connected to the aim of the study emerged, and they were: stories about the origin of the wound, stories about living with pressure ulcer and stories about going through reconstructive surgery. Subthemes were also identified that showed general patterns through the different stories and therefore helped to provide a more detailed understanding of the respondents' experiences.

**Conclusions:** The stories show a lack of knowledge about how pressure ulcers can occur. They also show how the time it takes to heal pressure ulcers affects the entire existence of the respondents and how the possibility of surgery is seen as a fast track back to ordinary life. How the care was experienced was, in the stories, strongly linked to the respondents' experiences of being treated as a person or just as a patient with an ulcer.

**Keywords:** Pressure ulcer, reconstructive surgery and care, narratives.

## A7

## NOT EVERY PRESSURE ULCER IS A LIKE PRESSURE SORE - THE RISK OF MDRPU

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**Introduction:** Pressure sores represent a major health issue worldwide and their treatment is very expensive. The formation of a pressure sore leads to ischemia and necrosis. In addition to classic pressure ulcers located on the skin, pressure ulcers occurring on organs can also be encountered in practice.

**Methods:** Percutaneous endoscopic gastrostomy is used for long-term enteral nutrition. The most common indication is swallowing disorder. If the patient starts swallowing, we can easily close the canal soon after insertion of the feeding tube and it heals completely in a few days. The method is relatively safe with low mortality.

We experienced a very unusual complication in the patient after the resumption of the swallowing act. After 12 months following the introduction of PEG, a pressure ulcer formed in the wall of the aorta as a result of prolonged pressure of the gastrostomy probe with subsequent bleeding into the gastrointestinal tract.

This condition was caused by the anatomical conditions of the patient, because the rest of the probe got stuck in the duodenal diverticulum and failed to be spontaneously eliminated. Long-term pressure on the aorta caused necrosis of the arterial wall with subsequent development of aneurysm.

**Results:** The treatment of this patient included removing the remaining part of the PEG with following implantation of a stent in the abdominal aorta. One year after the therapy, the patient is bleeding-free and the stent is freely passable.

The second patient was a woman with chronic constipation who was admitted for acute symptoms of intestinal obstruction. The hard stool in the intestine by its prolonged pressure had created a pressure ulcer on another branch of the intestine. The treatment of the patient with intestinal defect included resection of the bowel with decubitus ulcer and suture and creation of a temporary stoma.

**Conclusions:** Pressure sores arise from long-term pressure on the tissue. This fact must always be kept in mind when treating the patient. Prevention of and proper management of complications are critical to ensuring successful outcome.

**References:**

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## A8

# WOUND AREA REDUCTION OF PRESSURE INJURIES IN ELDERLY PEOPLE WITH AND WITHOUT NUTRITIONAL AMINOACIDIC SUPPLEMENTATION: A COMPARISON BETWEEN TWO DIFFERENT FORMULATIONS AND A CONTROL GROUP

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**Introduction:** Pinchcofsky-Devin in 1986 [1] and Breslow in 1991 [2] demonstrated the importance of the nutritional factor in ulcer patients; 15 years ago our work was published (Cassino, Ricci et al.) which highlighted a significant Wound Area Reduction (WAR) in patients with oral amino acid support [3]. With this work we want to compare three groups of patients: one without supplementation and the other two with two different types of amino acid formulations.

**Methods:** We have enrolled 30 patients with 3rd 4th stage pressure injuries divided into 3 groups. 20 patients (Group A and B) take an amino acidic supplement twice daily: Group A a blend of essential amino acids; Group B the same blend of amino acids enriched with glutamine, proline and succinic, malic and citric acids; the other 10 patients (Group C) had no amino acidic supplement. WAR and serum albumin are evaluated at 4 and 8 weeks.

**Results:** The preliminary analysis confirmed the efficacy of the amino acidic supplementation showing substantial differences between Groups A and B and Group C as shown in the table below.

GROUPS	WAR 4 weeks	WAR 8 weeks	Albumin 4 weeks	Albumin 8 weeks
GROUP A	29.3%	45.8%	+4.9%	+12.1%
GROUP B	48.6%	79.9%	+7.1%	+16.2%
GROUP C	16.2%	26.8%	-4.9%	-7.2%

Statistically significant differences are highlighted between Groups A and B: WAR and albumin improved more in Group B respectively by 74.4% and 33.8%.

**Conclusions:** This work confirms the importance of nutrition in wound care and underlines the difference in efficacy between the two amino acidic formulations used, already evident after 4 weeks of treatment, but highly significant at the end of the study.

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**COI:** No conflict of interest

## A9

# IMPLEMENTATION OF A DYNAMIC AIR IMMERSION MATTRESS IN A SPECIALIST NHS HOSPITAL TRUST FOR THE PREVENTION AND MANAGEMENT OF PRESSURE ULCERS

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**Introduction:** Pressure ulcers continue to pose significant challenges to clinicians, patients, and healthcare providers alike. However, there is a continued focus on their prevention and management with organisations such as the European Pressure Ulcer Advisory Panel (EPUAP) and the National Wound Care Strategy Programme (NWCSP)<sup>1</sup>.

A known risk factor, identified in international guidance<sup>2</sup> and several pressure ulcer risk assessment tools, is any neurological condition where sensory perception and response is altered.

The provision of an appropriate support surface for this patient cohort is an essential part of pressure ulcer preventative care and highlighted in this patient case series.

**Methods:** Within a specialist NHS Hospital Trust dedicated to Neurology and Neurosurgery, four inpatients' journeys were captured. A dynamic air immersion mattress providing reactive therapy was utilised as part of their pressure ulcer prevention pathway.

This is a mixed methods study including clinical data in addition to both staff and patient feedback.

**Results:** Patient 1: Admitted with altered sensation to fingers, hands and arms requiring Intravenous Immunoglobulin treatment. This lady was bedbound with Category 2 pressure ulcers to the sacrum and right buttock, combined with moisture associated skin damage (MASD). Both pressure ulcers healed and MASD resolved during admission.

Patient 2: Gentleman admitted with severe leg weakness requiring emergency thoracic surgery for infective discitis. Category 1 pressure ulcer present to the right buttock and MASD to sacrum. The category 1 pressure ulcer resolved during admission with no further tissue damage occurring.

Patient 3: Admitted with Nutritional Neuropathy secondary to gastric sleeve surgery. High BMI, with MASD present to skin folds which resolved during the patient stay, remained pressure ulcer free during admission.

Patient 4: Admitted with complex multiple sclerosis and restricted mobility. No skin integrity related issues on admission and throughout her stay.

Further patient demographics can be seen in table 1.

Table 1: Patient demographics

Patient	Sex	Age	Waterlow Pressure Ulcer Risk Assessment Score	Length of stay on mattress (days)
1	Female	51	26	62
2	Male	73	18	22
3	Female	31	15	40
4	Female	40	16	121

Overall feedback has been positive with staff stating that the mattress is easy to use. Patients reported to be comfortable and sleeping well.

**Conclusions:** Utilising a clinically effective support surface is imperative in any healthcare setting and the use of a dynamic air immersion therapy mattress within this specialist hospital has contributed to these patients receiving safe, effective harm free care. This mattress continues to be used in the Trust and forms part of the mattress selection pathway.

### References:

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## A10

## PRONE POSITION THERAPY: THE ROLE OF SUPPORT SURFACE DESIGN IN PATIENT MANAGEMENT

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**Introduction:** The prone position is used in medical settings to help patients who are compromised due to certain medical conditions with or without the need to be on mechanical ventilation. Although turning a patient into the prone position is not an invasive procedure, it is complex and has many potential complications.<sup>1</sup>

Amongst these complications is exposure of parts of the body to increased interface pressure (if not positioned correctly).<sup>2</sup> Current evidence suggests that positioning devices to offload pressure points on the face and body are a useful addition within the context of an overall pressure ulcer (PU) prevention strategy.<sup>3</sup>

The study aim is to investigate how the latest support surface technology assists health care professionals as part of a prone positioning PU prevention strategy, in the positioning of various size and weight subjects, in addition to their management whilst in the prone position.

**Methods:** Conscious, healthy adult volunteers will be positioned on the support surface with arms in the swimmers position.<sup>4</sup> Beneath the participant will be a full body pressure mapping sensor mat. Once settled in position a reading of the pressure between the participant and the surface will be captured. The participant will also be asked to rate their comfort and ease of breathing.

After a baseline is established, activation of mattress support features will commence:

- Longitudinal support surface cells to incline the torso
- Individual support surface cells – both partial or full deflation

To measure the effect of the above interventions, pressure mat readings will be recorded and the same questions relating to comfort and ease of breathing rated.

The same methodology will be applied with the participants on other mattress surfaces.

**Results:** The peak pressures from relevant anatomical areas; chest, abdomen, knee, toes will be compared between cell activation modes and different support surfaces.

We will also compare the self-reported feedback from participants surrounding comfort and ease of breathing.

**Conclusions:** Healthcare professionals require flexibility to manage the prone positioned patient as part of a prone positioning PU prevention strategy, and the patient experience. Support surface technology has a role in patient management whilst in the prone position.

**References:**

1. Intensive Care Society (ICS), Faculty of Intensive Care Medicine (FICM). *Guidance For: Prone Positioning in Adult Critical Care*. 2019.
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4. Intensive Care Society *Guidance for prone positioning in adult critical care*. Faculty of Intensive Care Medicine. 2019

**COI:** This study is an industry-initiated research study.

## A11

## EARLY MOBILISATION ELEVATED HEAD OF BED ANGLE: THE IMPACT ON PRESSURE INJURY PREVENTION SURFACES

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**Introduction:** Mechanical ventilation is an essential, life-saving therapy for patients with critical illness and respiratory failure. Ventilator-associated pneumonia (VAP) is a common healthcare-associated infection (HCAI) occurring in 10–20% of patients mechanically ventilated in the ICU.1 Keeping mechanically ventilated patients in a semirecumbent position, as close to 45° as possible should be the goal to prevent the development of VAP.2

This study aims to investigate how an elevated head of bed angle affects the performance of the underlying support surface.

**Methods:** In order to investigate the effect of elevating the head of bed angle on pressure redistribution properties of a surface, two different methods can be used:

- Active, alternating surfaces, which aim to deliver therapy by periodically 'offloading' the tissue, can be compared by measuring the Pressure Redistribution Index (PRI) of the surface at any anatomical site, usually a bony prominence. Comparisons can be made between the performance of a flat bed and that of an incline bed. For this study, the recordings will be taken at the sacrum.
- Reactive or static surfaces, aim to deliver therapy by maintaining a constant low pressure across the entire surface. These surfaces can be compared by measuring the Pressure Area Index (PAI) across the entire patient-surface interface, using a full-body pressure mapping sensor mat. Again, the Index score can be compared between a flat bed and elevated head of bed.

To measure the effect of elevating the head of bed on the microclimate performance of a surface, various methods are available. For this study, the sweating guarded hot plate (SGHP) method from Section 4 of the ANSI / RESNA S3i standard will be utilised. The method will be modified to allow the test indenter to be held at a 45° angle, and results will be compared between this set up and a standard flat bed test.

**Results:** The methods listed in the methodology will be used to characterise the performance for:

- One Alternating Therapy (AP) support surface
- One Constant Low Pressure (CLP) with Low Air Loss (LAL) support surface

Both using a flat bed and 45° head of bed elevation.

**Conclusions:** To encourage early mobilisation of mechanically ventilated patients to prevent VAP, do the surfaces and different methods of pressure redistribution provide uninterrupted therapeutic benefit at head of bed angles of 45°?

#### References:

5. Kollef MH, Chastre J, Fagon JY, François B, Niederman MS, Rello J, Torres A, Vincent JL, Wunderink RG, Go KW, Rehm C. Global prospective epidemiologic and surveillance study of ventilator-associated pneumonia due to *Pseudomonas aeruginosa*. *Crit Care Med*. 2014 Oct;42(10):2178-87.
6. Güner CK, Kutlutürkan S. Role of head-of-bed elevation in preventing ventilator-associated pneumonia bed elevation and pneumonia. *Nurs Crit Care*. 2022 Sep;27(5):635-645.
7. Boltey E, Yakusheva O, Costa DK. 5 Nursing strategies to prevent ventilator-associated pneumonia. *Am Nurse Today*. 2017 Jun;12(6):42-43.

**COI:** This study is an industry-initiated research study.

## A12

# HOW TO CHOOSE AN ANTIDECUBITUS MATTRESS - SIMPLIFIED RISK ASSESSMENT AND PROCUREMENT

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**Introduction:** In a hospital district, one obstacle in prevention of pressure injuries (PIs) was cumbersome risk assessment. Patients did not get appropriate underlays.

**Methods:** A traditional Risk Score Calculation method was replaced by simplified "traffic light model" that has been validated with the Braden Scale. The model is used in choosing antidecubitus mattresses. The efficacy of mattresses is chosen in procurement.

It's also necessary to take care of the patient's basic vital functions, nutrition, moisture balance of skin, hydration, mobilization, repositioning, check skin, use protective dressings, and measure PI prevalences.

A mattress for patients with moderate PI risk consists of several foam layers. A mattress for patients with high risk is an electronically controlled alternating pressure underlay, or a minimum pressure anti-deformation mattress.

Evidence-based information on the clinical efficacy of mattresses is available in scientific articles, meta-analyses, expert panel recommendations, and clinical evaluation reports required by the EU's Medical Device Regulation.

The evidence presented in literature should be reviewed with criticism. Studies may have inadequate sample population, a poor description of a patient group, or they may lack sensitivity analysis. The mattresses are not always tested abreast or using similar group of patients. Very different technologies may be included in meta-analyses rendering the results inconclusive.

A mattress can be selected per technological principle or based on the amount of PI incidences in the patient group. The cost-effectiveness is assessed by comparing the cost of mattresses to benefits gained by preventing the PIs.

Market research, information requests to vendors, and obtaining user experience help to assess available products. Legal requirements, product specifications, and quality management of manufacturers should be considered. The functionality of the mattress should be tested, and its conformity to specifications verified.

The procurement specifications can be defined as minimum requirements of the product, or they can be scored based on type of functions of the mattress and level of evidence on its effectiveness.

**Results:** Prevalence of PIs in our special health care is approximately half of the national average. Various factors may have affected the result.

**Conclusions:** Easier methods can lead to good results.

## References:

Ahtiala, M. et al. (2020). Effect of mattress deployment on pressure ulcer development: a real-world observational cohort experience. *Wounds Int.* 11.1:10-7.

Heikkilä, A., et al. (2022). Validation of the Helsinki University Hospital prevent pressure Injury Risk Assessment Tool: a prospective observational study. *BMC Nurs.* 21(1),18.

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**Table. Simplified risk assessment and examples on costs and QALY**

Example on cost effectiveness:	QALY assessment at an ICU:
- An ICU with 1650 patients per year, 3,42 days in ICU per patient	- During 4 years, 6089 patients, average 3,42 days in the ICU, 423 with PIs
- Mattress A rental costs 10 e/day and 0,52 PIs per 100 patient days	- 63,9 % men and 36,1 % women, average age 61,1 years
- Mattress B rental costs 5 e/day—and 1,83 PIs per 100 patient days	- Mortality 8,4 % without PI, 17,3 % with PI
- Cost of one hospital acquired PI is 6000 euros	- PI possibly an independent factor for mortality
Overall economy of mattresses:	- Acceptable cost of one Quality-adjusted life-year: 20 000 euros
- Mattress A: rental costs 56 430 e/year, PI costs 176 062 e/year → total expenses 232 492 e/year	- Mortality increased by 37,6 patients, each lost 11,4 QALYs = 429 years
- Mattress B: rental costs 28 215 e/year, PI costs 619 601 e/year → total expenses 647 816 e/year	- Cost of lost QALYs: 8 580 000 euros
A cheaper mattress to rent can be more expensive as total.	- Acceptable PI prevention cost for one ICU patient as calculated by QALYs is 8 580 000 euros / 6089 patients = 1409 euros / patient = 412 euros per one patient day



**Table. Specifications for mattresses**

- Purpose of use and adequacy for the patient group	- Fire safety and classifications, evacuation handles
- Patient weight, mattress size	- Wear resistance, change of cover, moisture cover of zipper
- Adequacy for special patients (premature baby, trauma, hemodynamically instable, instable fracture, neurosurgical (elevated ICP), burn, amputated limb, bariatric, ICU, operating theatre)	- Non-sweating cover, permeability for water/air (low air loss)
- Contraindications	- Hygiene properties, washing, disinfection, odourlessness, mold resistance, hypoallergenic properties
- Extreme situations in use, x-ray	- Functionality with beds (change of positions, aisles)
- Mattress for patients in moderate risk: amount and properties of layers, minimum thicknesses, elasticity, density, tensile strength etc.	- Efficiency: incidence/prevalence level in patient group, clinical evidence, quality of evidence
- Mattress for patients in high risk: technical principle, operation modes, noise level, functions (resuscitation, sitting, supine position, firm mode etc.), display and alarms (battery use, low pressure, malfunction, pressure, mode etc.)	- Delivery times, size of mattress storage
- Price, references	- Maintenance, spare parts and their consumption per year, prices
- Standards, CE-marking, MDR declaration of conformity	- Maintenance time, availability of spare mattress
- Size, fixation, weight, storage conditions, battery, location of pipes and wires	- Guarantee, reclamation process, sanctions
- Electrical safety, defibrillation resistance	- Cleaning and checking of mattress between patients
	- Functionality testing: convenience, change of position, risk of falling, getting up, patient transfer and handling, conformity with specifications

## A13

# DYNAMIC AIR MATTRESSES – A CLINICAL CROSS-OVER TRIAL ASSESSING PRESSURE INJURY RISK AND MATTRESS FUNCTIONALITY

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**Introduction:** Persons with spinal cord injury often lack the possibility to adjust their position in bed, thus being dependent on assistance during the night. This may increase the risk for pressure injury, negatively affect the sleep comfort, increase pain and spasticity. Physical strain on the health care providers regarding the position change situation may cause difficulties in the support.

The aim of this study was to compare a self-turning intervention mattress with a dynamic air mattress, in current use at a Norwegian rehabilitation hospital, focusing on pressure-relief, experienced sleep comfort, pain and health related quality of life (HRQoL). In addition, resources needed to assist in position change and physical strain were assessed.

**Methods:** A prospective cross over trial was carried out between September 2021 and December 2022, investigating ten participants with a newly acquired spinal cord injury. Data were collected at baseline, at change of mattress, and at end of the follow-up. Validated questionnaires were used to collect information regarding pressure injury risk, HRQoL, sleep-comfort and pain. Satisfaction was assessed using a Likert scale. A custom made semi-structured questionnaire was used to collect information regarding experienced quality with the mattresses and physical strain in managing the mattresses.

**Results:** The pressure distribution abilities were in favour of the intervention mattress. The participants reported increased sleep comfort with the intervention mattress as compared to the traditional mattress, as there was no need for the staff to perform position changes during the night. The curving position of the intervention mattress was reported to support the participants experience increased safety, as compared to the traditional mattress. The ability to adjust the degree of the turning angle gave the participants the possibility to easily choose one`s own curving position. The continuous, but still leisurely change of position in the intervention mattress was reported to be positive for mild to medium spasms throughout the night, compered to the experiences with the traditional mattress. The nurses experienced less physical strain and less need for assistance in reposition the participants.

**Conclusions:** The intervention mattress ensures pressure distribution throughout the night, provides opportunities for less need for assistance, and provides an opportunity for undisturbed sleep related to the turning situation. For wide persons and those with severe spasms in the legs, the mattress seem to be less suitable.

**COI:** The study is founded by the intervention mattress company, and was carried out in the Testbed department.

## A14

# EVALUATING THE COST EFFECTIVENESS OF SUB-EPIDERMAL MOISTURE (SEM) ASSESSMENT TECHNOLOGY IN SPECIAL CARE POPULATIONS

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**Introduction:** The NHS spends more than £1.4 million every day in treating pressure ulcers (PUs)(1). The occurrence of severe PUs before detection of early damage is higher in specific populations and special care settings. Dark skin tone (DST) patients are twice more likely to develop broken skin PUs while estimates of incidence in intensive care patients range from 10% to 25.9% - reflecting disproportionate and delayed prevention and management of PUs (2,3). Sub-epidermal moisture (SEM) is a biophysical marker for the detection of early and deep pressure-induced tissue damage. Measurement of SEM can detect early pressure ulcers up to five days before visible skin changes occur irrespective of skin tone or patient type. This study aimed at evaluating the cost-effectiveness of SEM assessment technology in special care populations.

**Methods:** A decision-tree model was developed in a representative NHS acute hospital to compare hospital-acquired PU incidence outcomes, quality-adjusted life-years (QALYs) and costs to the UK National Health Service. Standard of care in skin tissue assessment (STA) included risk assessment tools, visual assessment of the skin and clinical judgement. The intervention was measurement of subepidermal moisture (SEM) with a cut-off delta value  $\geq 0.6$  in place of, or as an adjunct to, visual skin assessment (VSA). Cost-effectiveness was assessed against a threshold of £30,000 per QALY gained. Parameter uncertainty was also explored in a probabilistic sensitivity analysis (PSA).

**Results:** Baseline PU incidence was conservatively estimated at 4.69% and 17% respectively for DST cohorts and ICU patient cohorts. In the DST cohort, SEM pathways, SEM alone or SEM as an adjunct resulted in preventing 89 and 105 HAPUs. Incremental costs were cost-saving at £52.71 and £22.48 per patient, respectively. In the ICU cohort, the number of PUs prevented were 321 and 382, and the incremental cost of the intervention were estimated to be cost saving at £168.28pp and £172.00 per patient respectively in SEM and SEM adjunct pathways. Probabilities of cost-savings and improvement in patient QALYs exceeded 85% for both cohorts.

**Conclusions:** Preventing hospital-acquired PUs is an important quality metric which has implications for patient safety and hospital costs. Implementing SEM assessment in existing standards of PU care is expected to be cost effective, will lead to fewer broken skin PUs, lower hospital costs and improve quality of life of patients.

## References:

1. Guest, J. F., Vowden, K. & Vowden, P. 2017. *The health economic burden that acute and chronic wounds impose on an average clinical commissioning group/health board in the UK. J Wound Care, 26, 292-303.*
2. Oozageer Gunowa, N., Hutchinson, M., Brooke, J. & Jackson, D. 2018. *Pressure injuries in people with darker skin tones: A literature review. Journal of Clinical Nursing, 27, 3266-3275.*
4. Chaboyer W, Thalib L, Harbeck EL, et al. *Incidence and prevalence of pressure injuries in adult intensive care patients: A systematic review and meta-analysis. Crit Care Med;46(11):e1074-e1081*

**COI:** Industry Submission

## A15

# PRESSURE INJURIES AND IAD IN INSTITUTIONALIZED ELDERLY: A COST-BENEFIT COMPARISON BETWEEN TRADITIONAL, ADVANCED AND INNOVATIVE TREATMENTS

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**Introduction:** Among the most important expenditure items in Nursing Homes, those relating to dressings and prevention products for pressure injuries (PI) [1] and Incontinence-Associated Dermatitis (IAD) [2] certainly stand out. The purpose of this work is to compare some of the most common treatments for PI and IAD used in Italy with innovative and technological solutions [3].

**Methods:** We enrolled 90 elderly patients in a three-year study divided into two groups, one of 30 (Group 1) and the other of 60 (Group 2); group 1 included patients with pressure injuries and group 2 patients with IAD. Half of the patients in group 1 (1A) were treated with advanced dressings while the other half (1B) with stable ozonide-based dressings. The patients of group 2 were divided into 3 groups of 20 each: group 2A treatment with zinc oxide paste, group 2B treatment with silver spray powder and group 2C with stable ozonides-based barrier cream. We evaluated healing times and costs.

**Results:** All patients treated with stable ozonides achieved much more significant improvements than the other patients: the pressure injuries wound area reduction percentage after one week of treatment with a biological inducer\* was higher than the one achieved in four weeks of advanced dressings, and the healing times of group 1B were 29.1% shorter than those of group 1A; healing times of IAD treated with stable ozonides compared to treatments with zinc oxide paste and silver spray powder were reduced by 77.5% and 24%, respectively. Of course, costs are also significantly reduced: for pressure injuries a cost saving of 16.3%; in the IAD the saving, comparing group 2C with groups 2° and 2B, is respectively 40.2% and 45.7%.

**Conclusions:** This work demonstrated that all the biological inducer\* based dressings help to reduce treatment times and costs, both in comparison to traditional dressings and advanced dressings. About the patients with IAD, the reduction in treatment times using stable ozonides is highly significant and the cost-benefit ratio between the three groups is in any case in favor of the technological treatment with biological inducers\*.

## References:

[1] Frantz RA. Pressure ulcer costs in long term care. *Decubitus*. Aug 1989;2(3):56-57

[2] Doughty D, Junkin J, Kurz P. et al. (2012) Incontinence-associated dermatitis. Consensus statements, evidence-based guidelines for prevention and treatment, current challenges. *J WOCN* 39(3): 303-15

[3] Cassino R. et al. (2021) Creme barriera a confronto: tecnolalternativa all'ossido di zinco. XVI A.I.U.C. (Italian Cutaneous Ulcers Association) National Congress – Rome (Italy)

**COI:** No conflict of interest

\* Ozoile®

## A16

# VASTUS LATERALIS AND VASTUS INTERMEDIUS MYOCUTANEOUS FLAP RECONSTRUCTION FOR COMPLICATED TROCHAENTRIC AND ISCHIAL PRESSURE SORE WITH EXTENDED GIRDLESTONE RESECTION

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**Introduction:** After performing Girdlestone arthroplasty for a trochanteric pressure sore involving the hip joint, reconstruction with the vastus lateralis is the flap of choice. With more extensive defects or combined ischial pressure ulcers, a modified flap is necessary to obliterate the large dead space. This study aims to present a case series of vastus lateralis (VL) and vastus intermedius (VI) myocutaneous flap reconstruction after extended proximal femoral osteotomy in a paraplegic patient and to discuss the background anatomy.

**Methods:** Between March 2017 and December 2021, a total of 8 patients having trochanteric and ischial sore patient with exposed proximal femur with chronic hip joint arthritis who needed the Girdlestone operation were selected for the surgery. The anterolateral thigh (ALT) perforators were located and a skin paddle was designed around them. The VL and VI muscles were dissected and raised together as a unit from the femur. The descending branch of the lateral circumflex femoral artery was not exposed during the procedure. (Figure 1)

**Results:** A total of 9 flaps was elevated and the defect was successfully reconstructed without dead space. After surgery, all patients healed within 1 month; 3 patients experienced minor complications. The average follow-up period was 14.5 months, during which time only one patient with ischial pressure ulcer developed wound disruption and recurrence. The average thickness of the rotated muscle was 51.95mm at 2 to 4 weeks postoperatively and 53.07mm at 6 months postoperatively ( $p = 0.071$ ). (Table 1)

**Conclusions:** For paraplegic patients with muscle atrophy in the legs, vastus lateralis and vastus intermedius myocutaneous flap obtain a sufficient volume to eliminate the dead space of the hip joint socket. This technique offers several advantages: a) it is an anatomically ideal composition which has skin and muscle of the same vascular origin; b) it provides adequate volume; and c) by preserving the rectus femoris, it protects the bare femur with superior structural stability, resulting in reduced donor site morbidity. However, in the ischial area, an increased range of motion of the hip joint may be a drawback in the application of this method.

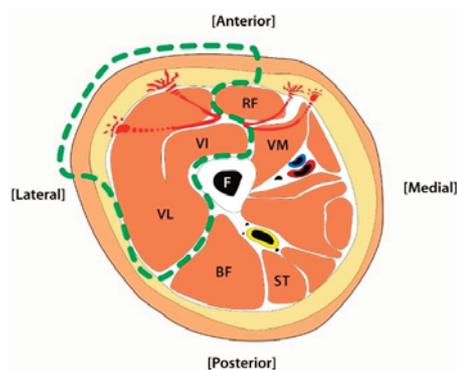


Figure 1. An illustration showing the surgical path and surgical plane in a cross-section of the mid-thigh. The green dotted line represents the dimension of the flap. (F, femur; RF, rectus femoris; VM, vastus medialis; VI, vastus intermedius; VL, vastus lateralis; BF, biceps femoris; ST, semitendinosus)

Table 1. Patient data and results.

Patient	Sex/Age	Reason for being bedridden	Paralytic state	Pressure ulcer location	Defect size	Flap size	Follow-up time, month	Complications	Recurrence	Muscle thickness, cm (1-3 weeks postop)	Muscle thickness, cm (6 months postop)
1	71/M	SCI	Paraplegia	Rt. trochanter	15x10cm	30x7cm	22	None	None	58.39	61.72
2	64/M	SCI	Paraplegia	Lt. trochanter	8x6cm	13x7cm	15	None	None	36.74	39.33
				Rt. ischium	23x15cm	25x11cm	12	Seroma	3 months	41.55	44.25
3	66/M	SCI	Quadriplegia	Rt. ischium	5x3cm	10x4cm	3 *	Minor disruption	None	35.57	-
4	49/M	CVA	Quadriplegia	Rt. trochanter	6x5cm	12x5cm	24	Hematoma	None	43.51	45.05
5	68/M	CVA	Quadriplegia	Rt. trochanter	10x10cm	18x10cm	18	None	None	66.16	70.61
6	65/M	SCI	Paraplegia	Lt. ischium	5x3cm	10x5cm	13	Minor disruption	None	64.38	60.12
7	73/F	SCI	Paraplegia	Rt. ischium	4x4cm	10x4cm	12	None	None	39.28	40.32
8	72/F	CVA	Hemiplegia	Rt. trochanter	22x12cm	24x11cm	12	None	None	65.55	63.17
Average					109.22cm <sup>2</sup>	134.44cm <sup>2</sup>	14.5			51.95	53.07

\* Patient died from COVID pneumonia  $p > 0.05$

Abbreviations: M, male; F, female; SCI, spinal cord injury; CVA, cerebrovascular accident; Rt, Right; Lt, Left; postop, postoperative; COVID, Coronavirus disease

## A17

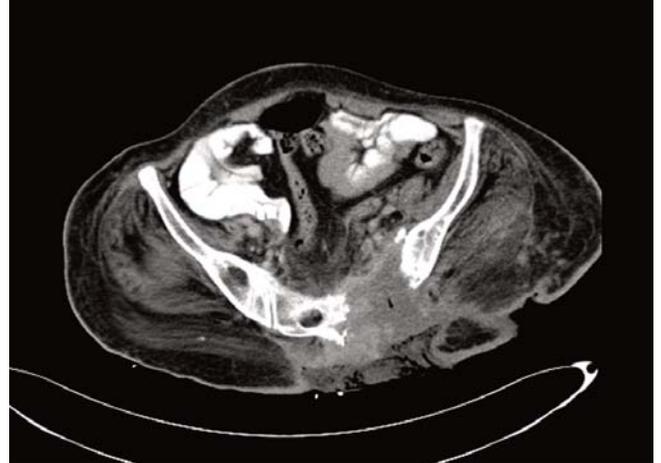
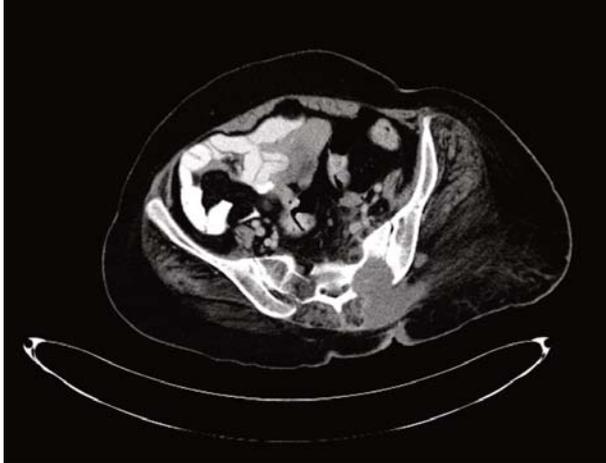
## THE "NATURAL HISTORY" OF INVASIVE MARJOLIN'S ULCER

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**Introduction:** Marjolin's ulcer is a rare cancerous transformation of chronic scar and wounds mainly burns. Usually, but not exclusively, the tumor is squamous cell carcinoma (SCC). Jean Nicolas Marjolin, a French physician, first described a tumor arising from a burn scar, and nowadays his name is a synonym to all cancerous tumors arising from chronic wounds. While most SCC have excellent prognosis following surgical resection, Marjolin's ulcers are aggressive with high mortality rate. We will present a case report of a 54 years old woman with a long-standing sacral pressure ulcer due to paralysis after a car accident 25 years ago. The diagnosis was relatively early, but because she flatly refused any surgical treatment, we unfortunately could only follow the curse of the natural history of malignant carcinoma.

Case report: A 54 years old female with sacral Pressure ulcer, that is wheelchair bound for 25 years after a car accident. Prior to her immigration surgical closure has failed. For 5 years, the ulcer was treated at the community. Recommendation for a surgery was given but she refused and preferred conservative treatment. At first visit at our clinic, there was a 6X4 cm' width and 4 cm' deep sacral ulcer. SPECT Bone scan showed no intake in the pelvis. 14 months later, she came back to the clinic due to a deterioration of the wound for the past month. We noticed bad odor with large "Wild tissue" at the margin of the wound. Four biopsies were taken from wound's margins, all of them showed Squamous cell carcinoma, three well differentiated SCC, and one well to moderately differentiate SCC. CT scan of the region, showed a large soft tissue mass with penetration to the Sacro-Iliac joint at the same side [picture 1]. Since she continued to refuse to any surgical treatment, she was treated with chemotherapy and radiotherapy. Five-month later total body CT scan showed a large mass causing pelvic bone destruction with multiple enlarged lymph nodes at the area [picture 2]. In addition Hypo-dens 2X2 cm' SOL at the left Breast was noticed; with enlarged left axillary lymph nodes. None of this was noted previously on CT, as well as, at Mammography 4 month earlier. Nine months after diagnosis the patient passed away.



**COI:** We declare that we have no conflict of interest

## A18

## IMPLEMENTING CLINICAL GUIDELINES TO EFFICIENTLY PREVENT PRESSURE ULCERS

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**Introduction:** The NHS is facing increasing pressures due to an aging population with chronic and multiple conditions. There are an array of challenges which include longer waiting times in the emergency department (ED) as well as wide spread delayed discharges and lengthier waits for imperative procedures.

Whilst it has been acknowledged that pressure ulcers (PUs) are one of the most commonly occurring complications in hospitalised patients (Gardiner et al. 2016) and with the increased demands on the NHS, the goal of ensuring effective patient care and preventing avoidable PUs has become a greater challenge to the tissue viability service.

**Methods:** The current practice was reviewed, areas of improvement identified which included the development of a series of clinical guidelines.

- Guideline 1 - A Guide to aid equipment selection and management for Pressure Ulcer prevention and management
- Guideline 2 - Pressure ulcer prevention and Management in Critical Care
- Guideline 3 - Pressure Ulcer Prevention & Management in the Emergency Department

The aim of Guideline 1 was to promote a full holistic patient assessment which includes risk assessment, skin inspection and level of mobility or ability to be repositioned. The aim of which was to then support with the appropriate allocation of pressure relieving equipment and patient management.

Guideline 2 focused on patients within critical care, as this cohort of patients are at a greater risk of PUs due to their multiple risk factors aspects such as risk assessment and mobility were not included. The emphasis was in relation to device related PUs and other prevention strategies such as specialist equipment and offloading devices.

Guideline 3 was developed following an increasing concern about the length of time patients were waiting in the emergency department and how this can impact on the development of PUs. Guidance was provided in relation to those patients at greater risk and strategies for the effective assessment and management.

**Results:** Following the introduction of the guidelines there has been positive feedback from all clinical areas with a number of patient benefits which include:

- A reduction in variation and enhanced standardised care.
- Efficient, evidence-based care provided.
- Patient outcomes improved.
- An improvement to care planning.

**Conclusions:** As discussed by the NHS Patient Safety Strategy (NHS England (NHSE), 2019) the point of care is the place where the greatest improvement impact can be achieved and by implementing these guidelines a reduction in patient harm and associated costs was accomplished, as directed by The NHS Long Term Plan (NHS, 2019).

**References:**

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NHS England (2019) *The NHS Patient Safety Strategy: Safer Culture, Safer Systems, Safer Patients*. London: NHSE. <https://www.england.nhs.uk/patient-safety/the-nhs-patient-safety-strategy/>

**COI:** Support was provided by DHG with the development and printing of the guidelines

## A19

# INNOVATIVE PRESSURE AREA CARE IN EMERGENCY MEDICINE TO REDUCE THE RISK OF PRESSURE ULCERS

Anita Morton<sup>1</sup>, Valerie Dowley<sup>1</sup>

<sup>1</sup> Oska, Havant, United Kingdom

**Introduction:** Increasing evidence demonstrates that some patients develop pressure ulcers (PU) during their stay in the Hospital Emergency Department (ED).<sup>1</sup> Research also highlights a correlation between PU incidence and ambulance journey duration or time spent on a trolley.<sup>1</sup> Despite this, few ED's, and even fewer ambulance services operate pressure ulcer prevention protocols.<sup>2</sup>

Placing patients at an elevated risk of pressure ulcers on basic trolley toppers with no pressure redistributing properties, for prolonged periods of time will undoubtedly increase their risk of developing a pressure related tissue injury.

An innovative pressure-redistributing, portable, low-profile powered air overlay capable of following the patient journey from the ambulance, through the ED, is now available.

The aim of this initial evaluation was to determine how the new portable air overlay system compared to a standard foam trolley-topper in terms of pressure-redistribution.

**Methods:** Interface pressure mapping was used to determine the level of pressure redistribution offered by:

- Standard foam trolley-topper
- Standard foam trolley-topper + active therapy powered air overlay system.

Surfaces were placed on a standard, flat bed-base with the pressure mapping mat draped over the top of the surface on test.

Testing was performed using an 85Kg, 50-year-old test subject lying flat in the supine position, arms by their side and feet shoulder width apart. After a ten-minute equilibration period, interface pressures were recorded at 5 second intervals over a ten-minute timeframe.

**Results:** The standard foam trolley topper delivered a constant, unrelieved pressure to the skin, with sacral interface pressures ranging from 23.7mmHg to 30.8mmHg (see Figure 1).

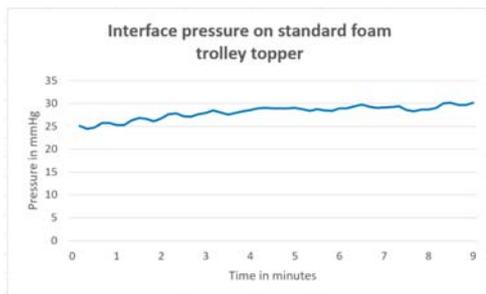


Figure 1. Sacral interface pressure on a standard foam trolley topper.



Figure 2. Sacral interface pressure on the low profile, powered air overlay.

The pressure redistributing, portable, low-profile powered air overlay delivered active pressure redistribution to the skin of the test subject with sacral interface pressure ranging from 2mmHg to 49.5mmHg over the course of a single cycle (see Figure 2). For approximately two-minutes (30%) of the six-minute cycle, sacral interface pressures were below 10mmHg.

**Conclusions:** It is evident from the data that the standard trolley topper delivers a constant, unrelieved pressure to the skin, while the low-profile, powered air overlay gives regular periods of tissue offloading during each cycle.

The ability to deliver active therapy to patients from the point they are placed on the ambulance trolley to the point of in-patient admission has the potential to enhance patients' pressure area care and reduce the risk of pressure related tissue injury for at risk patients entering secondary care via the emergency medicine route.

## References:

1. Fulbrook P, Miles S, Coyer F (2019) Prevalence of pressure injury in adults presenting to the emergency department by ambulance. *Australian Critical Care*. 32, 6, 509-514.
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**COI:** This work has been funded by OSKA.

## A20

# COST-EFFECTIVENESS ANALYSIS OF A SEM ASSESSMENT TECHNOLOGY AS AN ADJUNCT TO ROUTINE CLINICAL ASSESSMENT FOR THE DETECTION OF HOSPITAL-ACQUIRED PRESSURE ULCERS

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**Introduction:** Pressure ulcers (PUs) are the most expensive chronic wound in the National Health Service (NHS), costing an estimated £3.8 million per day and £2.1 billion annually to the UK healthcare system (incremental cost of up to £378 per day) (1, 2). A localised change in subepidermal moisture (SEM) is a biomarker for the development of a PU (3, 4), with early detection offering an opportunity to implement preventive interventions. A test capable of accurately identifying SEM has the potential to result in substantial cost savings for the healthcare service, given the existing financial impact of PUs.

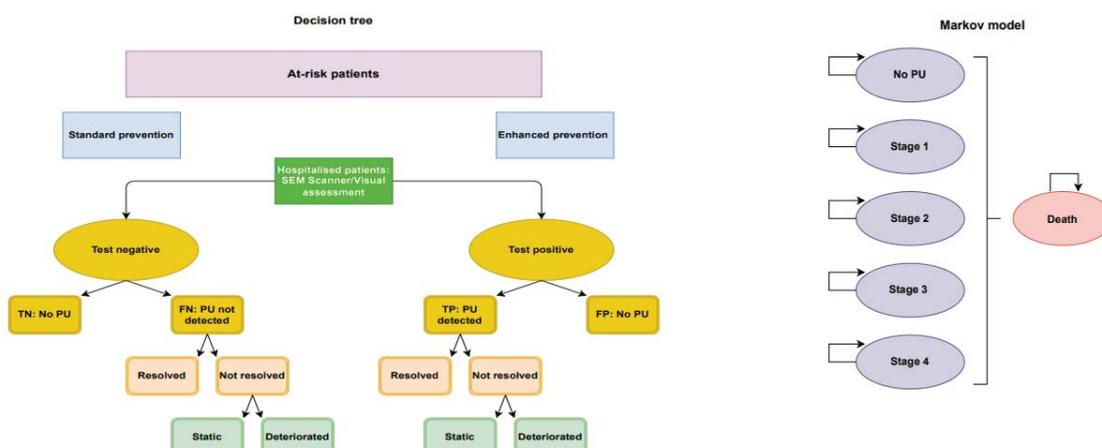
To quantify the costs and health outcomes associated with implementing SEM assessment technology as an adjunct to routine clinical assessment for use amongst patients at risk of PU in the English NHS, a health economic modelling study was performed.

**Methods:** A decision tree, followed by a Markov model, was developed to simulate detection of PUs amongst at-risk adult patients in the acute hospital setting with either visual skin assessment (VSA) alone, or VSA combined with use of SEM assessment technology. The model considered progression of stage 1 PUs (detected and undetected) to more advanced stages, over a one-year time horizon (Figure 1).

Model data included the incidence of hospital-acquired PUs; the sensitivity and specificity of the alternative methods of assessment; costs and resource use associated with introduction of the technology; NHS willingness-to-pay threshold; and utility and mortality data to account for patient quality-of-life and survival. Results of the analysis were presented as cost per quality-adjusted life-years (QALYs) gained, as well as the number of PUs avoided amongst a cohort of 12,421 at-risk annual hospital admissions.

**Results:** Results of the analysis indicated that introduction of the technology would lead to a total cost saving of £205,799 across the overall cohort of at-risk patients over one year (£17 per patient), while increasing QALYs by 3.7. In addition, 91 PUs would be avoided over one year through use of the technology, due to objective, and earlier, detection of PUs and the beneficial impact of subsequent prevention protocols. Probabilistic sensitivity analysis (PSA) results indicated a >81% probability of the technology being cost effective, and a >76% probability of being cost saving, considering base-case input parameters.

**Conclusions:** Introduction of SEM assessment technology as an adjunct to routine clinical assessment for the prevention of PUs amongst at-risk patients in the acute hospital setting, is a cost-effective use of resources for the English NHS and a dominant strategy in improving clinical outcomes amongst this patient population.



## A21

# FLATTENING THE "BULLWHIP" EFFECT OF SEVERE PRESSURE ULCERS VIA SUB-EPIDERMAL MOISTURE (SEM) ASSESSMENTS

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**Introduction:** Early stages of localised persistent edema, when left untreated, develop into more severe stages of broken skin pressure ulcers (PUs) (1). The initial stages of pressure ulcer skin changes and early stage 1 PUs require relatively simpler interventions such as repositioning, offloading pressure, and proper skincare. As PUs progress into more severe stages (Stage 2, 3 and 4), the demand for healthcare resources and costs increases exponentially. This amplification of the disease burden, the bullwhip effect (Figure 1), creates a ripple effect in requiring advanced wound care management, additional staffing hours and extended hospital stays. Sub-epidermal moisture (SEM) assessments detect early-stage PUs, 5 days earlier than visual and tactile skin tissue assessments (3). This study evaluated the impact of implementing SEM assessments in reducing the treatment burden of hospital-acquired PUs.

**Methods:** A decision-tree model was developed to reflect PU associated costs to the UK NHS for a representative 450-bed acute care setting. Aggregated PU incidence (6.65%) data was pooled from real-world implementation sites where SEM assessments were implemented alongside facility standards of PU care. Treatment costs for PUs were adjusted to 2020/21 prices using the NHS cost inflation index; stage 1 £1,536; stage 2 £9,627; stage 3 £10,795; and stage 4 £11,184 per episode. Standard prevention protocols were assumed to require two Band 5 nurses for 10 minutes each, four times daily (£54.67 daily). The cost of enhanced (four-hourly) repositioning was £82.00 daily. The cost of a Band 5 hospital nurse including overheads was £41/hour.

**Results:** Results are for a cohort of 12,421 annual admissions at risk of PUs. Care pathways implementing SEM assessments prevented 149 PUs more than standard pathways. Total nursing time saved in frequent repositioning of patients via SEM pathways was 447 hours. Overall prevention costs for SEM enabled pathways increased by 4.92% from € 3,686,621 to € 3,867,899. Treatment costs for PU reduced by 16.1% from € 6,678,822 to € 5,604,075. Per patient cost was reduced by 10.51% from € 1,208 to € 1,081.

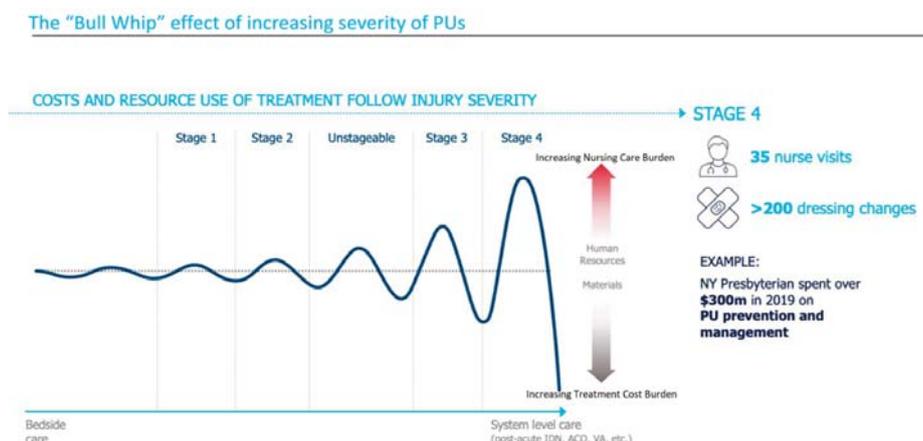
**Conclusions:** Implementing SEM assessments effectively flattens the bullwhip effect by mitigating the need for enhanced PU care associated with severe broken skin PUs. Early and anatomy-specific detection allows for more effective and timely interventions, reducing the progression to severe stages of pressure ulcers. A decrease in hospital-acquired PUs reduces extended hospital stays, lowers the need for additional resources, reduces the overall costs associated with PU management and enables more efficient use of healthcare resources.

## References:

1. Moore, Z., et al. 2022. Measuring subepidermal moisture to detect early pressure ulcer development: a systematic review. *Journal of Wound Care*, 31, 634-647.
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## COI: Industry Submission

Figure 1: The Bull Whip effect of increasing severity of Pressure Ulcers



## A22

## PRESSURE ULCER CHECKLIST

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**Introduction:** North Tees and Hartlepool Foundation Trust Tissue Viability Team, Patient Safety Service and Business Intelligence Department implemented and developed the Pressure ulcer checklist.

Imbedded into incident reporting system the pressure ulcer checklist is designed to support the standardisation of investigation of pressure ulcers when an incident is completed.

The pressure ulcer checklist was designed using the serious incident framework to support clinical areas in identifying any serious incidents and/or omissions in care.

**Methods:** Reviewed the incident reporting systems in place (Datix) to identify gaps in current process.

The gap identified was the Trust had no standard questions to support incident investigation in relation to pressure ulcer assessment and care delivery, which was aligned to the Trust policies and procedures

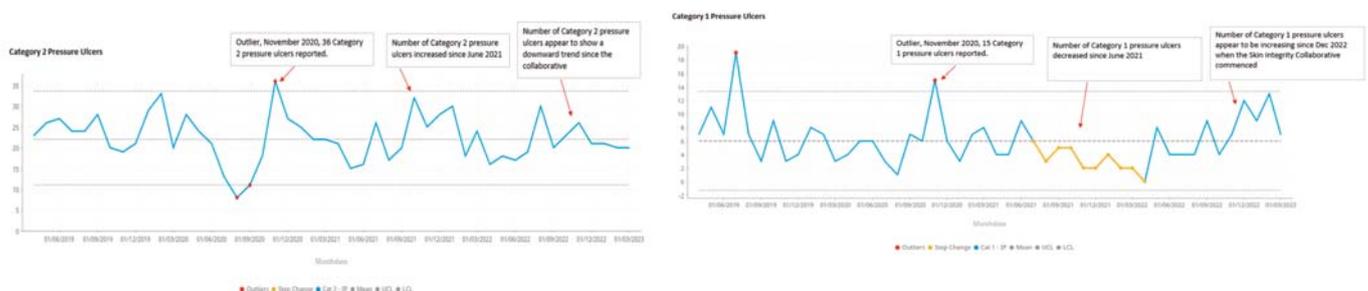
To reduce this gap a tab was created within the incident reporting system in order to create a Pressure ulcer checklist.

Using the Trust data platform, the pressure ulcer checklist data can be presented and analysed to target clinical areas that require improvement and highlight areas of good practice. This enables data to be viewed from a Trust, care group or individual clinical area position in relation to pressure ulcers.

The data collated also feeds into the senior clinical professional huddle each week, which reviews all incident reported in the previous 7 days in order to identify themes, issues and create work streams to support clinical teams. For pressure ulcers, the Skin Integrity Nurse provides a validated position and highlights any concerns regarding reporting and where PU checklists are still outstanding. This data also allows targeted delivery of training and education to areas to improve accurate categorisation of skin damage. Good practice is highlighted, along with targeted improvements identified.

Ward based compliance is reported via the data dashboard. Audits include compliance with risk assessment and SSKIN care plans. The pressure ulcer dashboard allows us to develop a greater numerical and visual picture of all elements which impact upon pressure ulcer development and management.

Validation data position 2019-2023 for hospital acquired category 1 and 2 pressure ulcers:



**Results:** Overall improved compliance of pressure ulcer reporting, validation and investigation across both the acute and community Trust.

**Conclusions:** From analysis of the extrapolated data gathered, targeted training and support is being delivered to ward areas across the Trust to increase category 1 pressure ulcer reporting, increase risk assessment documentation and care implementation. Raising awareness of pressure ulcer reduction and management allows shared practice to be disseminated across the acute and community Trust.

## A23

## SEM SCANNER PILOT ON AN NHS PALLIATIVE UNIT

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**Introduction:** Pressure ulceration poses a huge cost to the NHS. The cost of wound care is increasing, documented as 8.3 billion<sup>1</sup>, the management of pressure ulcers (PUs) is a significant proportion of this ever-growing cost. The global incidence of PUs has increased 42% since COVID<sup>2</sup>. Patients are living longer and presenting much later to with skin changes. The harm free agenda promotes prevention is better than cure.

As part of a Quality Improvement initiative a 6 week pilot study of a sub-epidermal moisture (SEM) scanner technology was undertaken on an NHS palliative unit. Baseline information showed 7.1% (n13) patients developed new HAPUs in a year on the Unit.

The scanner identifies microscopic changes in sub-epidermal moisture 5 days\*3 before visible signs on the skin, regardless of skin tone<sup>4</sup>. There is disparity, deficient knowledge & confidence regarding recognising skin changes from pressure damage<sup>5</sup>. Staff lack confidence in early recognition of pressure damage in darker skin tones<sup>6</sup>. Early detection enables preventive interventions to maintain skin integrity. Daily scanning is intended as an adjunct to skin assessment and does not replace existing pressure damage prevention measures. Registered and non-registered staff were trained.

**Method:** Patients were scanned daily across 4 areas on both heels and 6 on the sacrum. The scanner was only used on dry, intact skin and most often undertaken when supporting personal care needs. The scanner presents a Delta reading; a reading of  $\geq 0.6$  indicated an increase in SEM.

**Results:** Results were captured on patient specific data sheets, 35 patients were scanned with 759 delta readings recorded. 73% of delta readings were  $\geq 0.6$ . In 33% assessments no visual discolouration was noted. In 43% of patients, nurses reported the delta reading had changed their clinical decision making regarding prevention measures. Three patients had dark toned skin with two having increased Delta readings with no skin changes. Ward staff feedback was that the device was easy to use and provides extra clinical evidence of when to implement preventative strategies.

**Conclusions:** A PU incidence reduction of 100% was achieved during the evaluation.

Following this, an increase in PU incidence was noted, 39% for December 2022. The success of the SEM scanner pilot was revisited, a business case put forward and approved for use of the scanner for the next 12 months. This could be rolled out Trust wide.

\*Median

## A24

# EVALUATION AND CHARACTERIZATION OF STIFFNESS, GEOMETRY, AND TISSUE PERFUSION ON THE PLANTAR SURFACE OF THE FEET OF HEALTHY SUBJECTS AND DIABETIC SUBJECTS WITH PERIPHERAL NEUROPATHY.

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<sup>3</sup> Ibhgc/ensam, Paris, France

**Introduction:** Diabetic foot ulcers are a common reason for hospitalization of diabetic patients and frequently result in amputation of lower limbs. The management of diabetic foot ulcers requires an understanding of the clinical factors involved as well as the pathophysiologic components that underlie their impaired healing. Soft tissue deformation leads to the reduction of perfusion, resulting in ischemia direct deformation damage of cells (1). Yet has been reported that there is no single factor accessible in clinical routine can explain pressure ulcer risk; rather, pressure ulcer development, results from a complex interplay of factors (2). The objective of this preliminary study is to evaluate the uncertainty of measurement of a new clinical protocol aiming to investigate the interplay between the morphological (3), mechanical (4; 5; 6; 7), and vascular (8; 9) properties of plantar soft tissue in an at-risk population of diabetic patients with peripheral neuropathy.

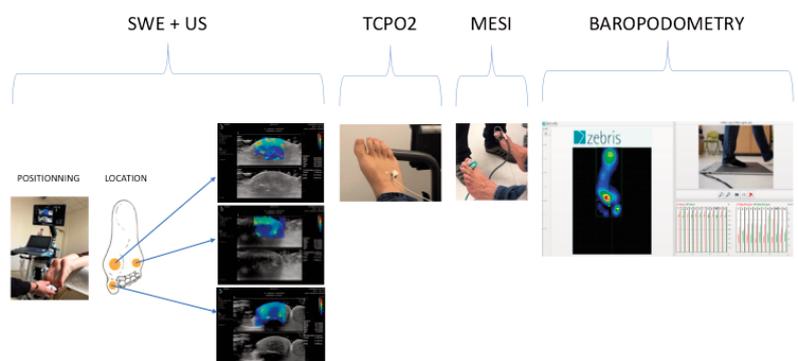
**Methods:** 2 healthy volunteers. In total 7 parameters were quantified (figure1): Shear Wave Speed, dermis, and hypodermis thickness (\*), transcutaneous oxygen pressure (\*\*), Toe-brachial Index (MESI) and peak plantar pressure (\*\*\*, \*\*\*\*). The standard deviation of reproducibility (SDR) for each parameter was computed using the ISO 5725 standard.

**Results:** The SDR of the morphological parameters were 0.2 mm and 1.5 mm for the dermis and hypodermis thickness respectively. The SDR of the mechanical parameters were 9.1 kPa and 45 kPa for the Shear Wave Speed and peak plantar pressure respectively. The SDR of the vascular properties were 1.2 mmHg and 0.58 for the TCPO2 and Toe-Brachial index respectively.

**Conclusions:** To our knowledge, this is the first study investigating the reliability of morphological, mechanical, and vascular properties of plantar soft tissue. Further work is required to standardize the protocol. For the data collection, 15 healthy and 15 diabetic neuropathic volunteers have already been enrolled.

## References:

- Oomens et al. 2015, *Pressure Induced Deep Tissue Injury Explained*.
- Coleman et al. 2014, *A new pressure ulcer conceptual framework*
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- Stess et al. 1997, *The Role of Dynamic Plantar Pressures in Diabetic Foot Ulcers*.
- Cavanagh et Bus 2011, *Off-Loading the Diabetic Foot for Ulcer Prevention and Healing*.
- De Meijer et al. 2008, *Reference value of transcutaneous oxygen measurement in diabetic patients compared with non-diabetic patients*.
- Deng 2014, *Transcutaneous oxygen pressure (TcPO2): A novel diagnostic tool for peripheral neuropathy in type 2 diabetes patients*.



**COI:** This project has received funding from SFD and Entrepreneurs &Go.

\*SupersonicMach30 \*\*Perimed PeriFlux 6000. \*\*\*FDM-S \*\*\*\*Zebris

## B1

# COLLAGEN AND ELASTIN STRUCTURE AND ADIPOSE DISTRIBUTION IN TISSUE UNDER LOAD

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<sup>3</sup> Henry Ford Health, Detroit, United States

**Introduction:** Imaging studies by Sonenblum et al. have demonstrated differences in adipose tissue in at-risk regions near bony prominences in persons with spinal cord injuries with a history of PrI [1]. The aim of this study was to develop hypotheses regarding changes in adipose and collagen and elastin structure in loaded tissue that may explain previous findings and individualization in tissue tolerance.

**Methods:** This study used multiphoton microscopy to analyze post-mortem biopsies from 10 patients at 3 regions: sacrum, center of gluteus medius, and ischial tuberosity. Adipose content, lipid size, and collagen/elastin organization were examined to formulate hypotheses on tissue tolerance to loading.

**Results:** This study analyzed 10 deceased patients, 4 female and 6 male, 4 white and 6 African American, aged 23-86, who were hospitalized for 1-26 days prior to death. Adipose quantity, adipocyte size, and elastin and collagen distribution varied considerably across sample location and participant.

Data from a 23-year-old African American man with a BMI of 27.5 who spent 5 days in the hospital prior to death demonstrated significant differences in the quantity, density, and size of adipocytes (red) at each region, with small, densely packed adipocytes at the mid-gluteus, larger spaced out adipocytes at the sacrum, and small adipocytes distributed sparsely amongst a network of elastin (green) and collagen (blue) at the ischium (Figure 1).

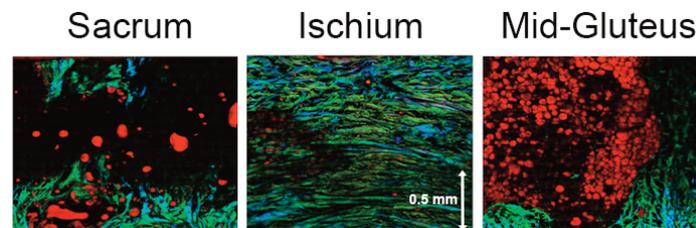


Figure 1. Adipose was measured by coherent Raman scattering (Red), elastin by two-photon fluorescence (Green), and collagen by second harmonic generation (Blue).

In fact, multiple participants demonstrated sparsely distributed, smaller adipocytes at the ischium (Figure 2), suggesting this unique presentation of adipose might be worthy of further investigation considering the unique role of adipose in individuals at risk of sitting acquired PrI. These same participants demonstrated varying distributions of elastin and collagen.

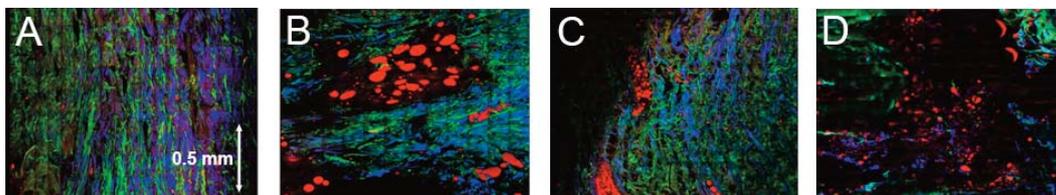


Figure 2. Smaller, sparsely distributed adipocytes (red) were more common at the ischial tuberosity.

**Conclusions:** Biopsies of the tissue underlying the sacrum and ischial tuberosity suggest that further exploration of the adipose, elastin and collagen content and distribution is warranted to help understand individual tissue tolerance.

## References:

1. Sonenblum, S.E., et al, "An Exploratory Analysis of the Role of Adipose Characteristics in Fulltime Wheelchair Users' Pressure Injury History," *Front Bioeng Biotechnol*, 2021. vol 9, no pp. 753897.

## B2

## PERIWOUND MACERATION SKIN MANAGEMENT STRATEGIES USING A SKIN BARRIER FILM ON DIABETIC FOOT ULCERS

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**Introduction:** Moisture-associated skin damage (MASD) is a complex and commonly recognised condition. Overexposure of the skin to bodily fluids can compromise its integrity and barrier function, making it more permeable and susceptible to damage. The impact of maceration on skin integrity, and its traditionally poor management and frequency, make it an obvious contender for inclusion as a risk factor in wound care. However, there is little research on the possible implications of maceration in diabetic foot ulceration. The aims of wound management are to address patient concerns, correct intrinsic and extrinsic factors where possible, and optimise the healing environment. It is also essential to include the periwound margins as an integral part of wound assessment.

**Methods:** Clinical and specialist discussion of best practice advice and guidelines. Discussion on skin management strategies using a skin barrier film for the prevention of periwound maceration on diabetic foot ulcers.

**Results:** Skin protection products should be used to protect the periwound skin. Advanced polymer-based barriers can be used where exudate levels are very high, or where dressing wear time may be extended beyond control. Film-forming barriers may also be considered as part of a treatment regimen where large expanses of adhesive are used and replaced frequently, such as with negative pressure wound therapy.

This reflection discusses how the use of barrier film, additional care time, careful monitoring, and ongoing assessment of both the wound and periwound, skin can aid in identifying skin changes and ensuring early intervention with appropriate and cost-effective treatment options.

**Conclusions:** Diabetes-related foot ulcers represent a major global health concern, affecting up to 25% of people with diabetes mellitus. Assessment and prevention strategies are of key importance in their management.

A key aspect in the management of diabetic foot ulcers (DFUs) is maintaining a wound environment that optimises healing.

Clinicians play an important role in ensuring safe practice standards are observed and that care delivered is evidence-based and that education is one of the key steps in ulcer prevention and that the clinical practice followed by healthcare professionals must be supported by evidence and best practice.

References:

Freitas A (2022) Periwound maceration skin management strategies using a skin barrier film on diabetic foot ulcers. *The Diabetic Foot Journal*.

### B3

## PATHOLOGICAL WOUNDS SEGMENTATION BY CONVOLUTIONAL NEURAL NETWORK AND TRADING EXCHANGE OF GROUND TRUTH DATA USING NFT TECHNOLOGY.

**Norihiko Ohura**<sup>1</sup>, **Kenji Yamada**<sup>2</sup>, **Hirohiko Niioka**<sup>2</sup>, **Nanami Miyanishi**<sup>2</sup>, **Junya Kurahashi**<sup>2</sup>

<sup>1</sup> Kyorin University School of Medicine, Department of Plastic Surgery, Tokyo, Japan

<sup>2</sup> Graduate School of Information Science and Technology, Osaka University, Osaka, Japan

**Aim:** To create a pathologically automatic segmentation model for wounds using CNN, and build a solution for trading exchange ground truth data.

**Methods:** We investigated a digital picture database of wounds and extracted 400 images of pressure ulcer. Two plastic surgeons divided four segments that consisted healthy skin, ulcer, necrosis, and granulation segments one at a time. The ground truth data consist of three pieces of data; the whole ulcer area, the necrotic tissue area, the granulation tissue area. The CNN used U-Net architecture was trained by this supervised data. Finally, we evaluated the accuracy of image segmentation by using U-Net CNN.

**Result:** We randomly split the data into training and testing cases. In testing, we achieved an area-under-the-curve; AUC of 0.9942, specificity was 0.9931, sensitivity was 0.9783. The reason for this was considered to be that the supervised data prepared by plastic surgeons was excellent. This time, we decided to openly distribute the teacher data used in CNN wound segmentation.

**Discussion:** As one of Dx in health care, attempts are being made to generate, exchange, and store health data using blockchain technology. It will have the same characteristics of uniqueness, transparency and interoperability. In the future, it is thought that the use of patient information for research will spread through contracts with patients. The ground truth data to be released this time uses NFT, a blockchain technology, to try to conclude a contract as one of the transactions as a digital asset with multiple researchers (stakeholders) who use it. We considered that this will be one form of data distribution in future research.

## B4

## USE OF MEDICAL-GRADE HONEY IN THE MANAGEMENT OF HEEL PRESSURE ULCERS: A CASE SERIES

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2 *GP Plastic Surgery Private Practice, Ioannina, Greece*

3 *Maastricht University Medical Centre, Department of Gynecology and Obstetrics, Maastricht, Netherlands*

4 *PharmaLife, Ioannina, Greece*

**Introduction:** Management of heel ulcers remains challenging and innovative approaches must be considered. Especially the increasing occurrence of antibiotic-resistant infections complicates and delays the healing process, thereby significantly impacting the patient's quality of life and increasing the socio-economic burden. The aim of this prospective observational study was to present the high effectiveness and safety of medical-grade honey (MGH) for the conservative treatment of clinically infected heel pressure ulcers (HPUs).

**Methods:** Eleven patients (9 / 2 ) developed HPUs (73% unilateral, 27% bilateral) due to permanent immobility (64%) or prolonged immobility post-surgery (36%). HPUs were grade II (9%), grade III (73%), and grade IV (18%). The average age of the patients was 77.6 years (44-94 years) and they all had several comorbidities (e.g. cardiovascular diseases (91%), neurological disorders (82%), and concomitant pressure ulcers elsewhere in the body (45%)). Most wounds were considered chronic (>4 weeks) and often multiple previous treatments were ineffective, including povidone-iodine and topical antibiotic creams. Wound infection was diagnosed by clinical assessment, considering signs and symptoms in and around the HPUs. All wounds were treated with MGH wound gel<sup>1</sup> and MGH-impregnated non-adherent dressing<sup>2</sup> –and dressings were changed every two days.

**Results:** The mean length of the ulcers was 5.07cm (range 3-7cm) and the mean width was 4.14cm (range 3-7cm). The median time to healing was 152 days (range 14-502 days). The MGH products provided a moist wound environment, stimulated autolytic debridement, had anti-inflammatory activity, and promoted angiogenesis and re-epithelialization. Additionally, MGH treatment resolved signs of infection after a mean time of 14 days (range 7-28 days). No complications during the treatment were observed and the quality of life for both the patients and their relatives was markedly improved. Considering the failure of previous treatments and the chronic nature of the wounds, MGH was an effective treatment.

**Conclusions:** MGH-based products<sup>1,2</sup> are safe to use, clinically efficient, and cost-effective for treating hard-to-heal pressure ulcers such as HPUs. Due to its wide-spectrum antimicrobial effects, MGH could resolve the infection independently of the pathogen. Thus, MGH can be recommended as an alternative or complementary therapy for treating hard-to-heal HPUs.

**References:**

1 *L-Mesitran Soft (Triticum Exploitatie BV, Maastricht, the Netherlands)*

2 *L-Mesitran Tulle (Triticum Exploitatie BV, Maastricht, the Netherlands)*

**COI:** This research received no external funding.

## B5 SPINAL INTERBODY FUSION DEVICE RELATED COMPLICATIONS AND RECONSTRUCTIVE MANAGEMENT: A CASE REPORT

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**Introduction:** Various types of implants are used in spinal fixation. We review the therapeutic steps in a case of soft tissue defect caused by deep infection and device malposition, which was treated by using a NPWT and a flap.

**Methods:** A 57-year-old woman presented with necrotic wound on gluteal region. She underwent spinal surgery including T-L interbody fusion 2 years ago. 7\*5 cm open wound with severe infected symptoms was observed. Implant related deep infection was suspected based on the surgical history and imaging findings. The implant was found to be in contact with the wound at initial exploration, and NPWT was first applied to prevent the spread of infection. At the time of flap surgery, the device was removed partially in collaboration with the neurosurgeon and dead space and opening was obliteration and resurfacing with a V-Y patterned fasciocutaneous flap.

**Results:** All inflammation levels and flap have stabilized and have been followed for six months, leading to a good state of daily living

**Conclusions:** If wound problems develop in a patient with spinal fixation, it is important to check whether the symptom is caused by an implant to apply NPWT, modification of implant, and flaps at the appropriate time.

**COI:** In relation to this presentation, the author has no conflict of interest that need to be disclosed

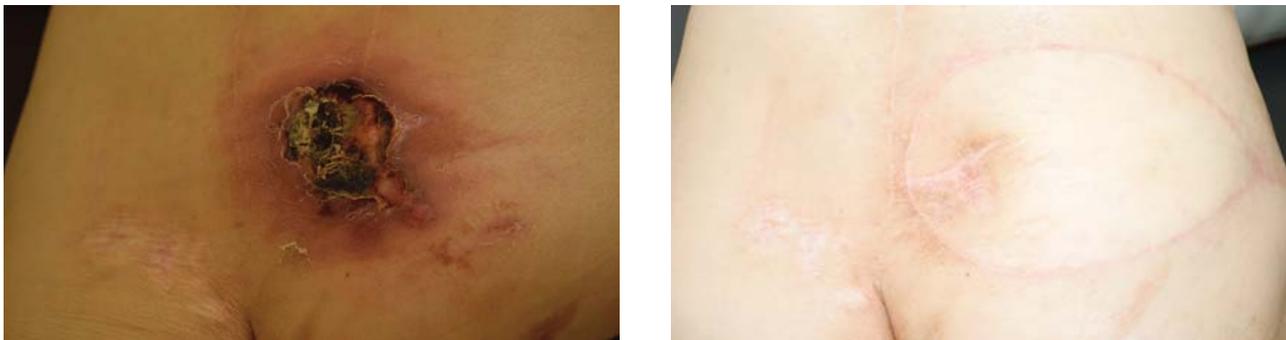


Fig.1 spinal interbody fusion device was the cause of the pressure ulcer and managed by Removal of the rod and screw. Right side picture shows 5 months result of resurfacing by dual perforator gluteal flap

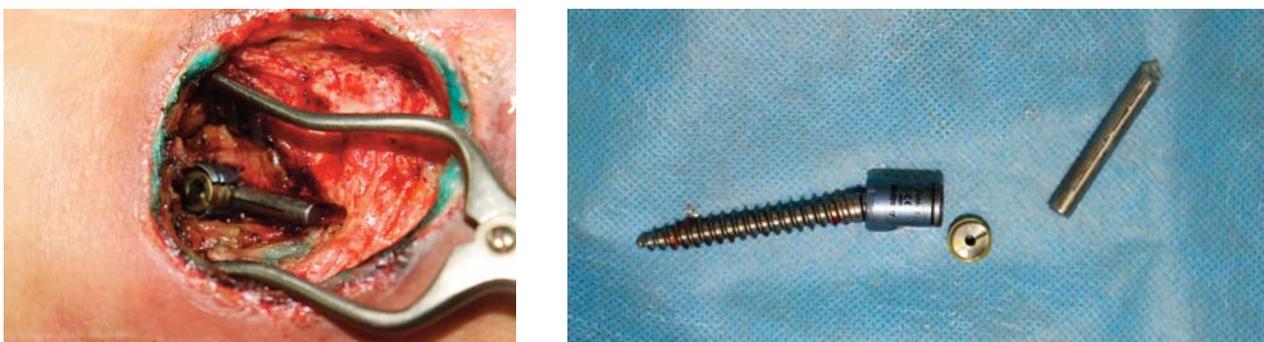


Fig.2 Exposed implant and removed rod and screw devices

## B6

# TOOLS TO MEASURE PRESSURE ULCER KNOWLEDGE, A SCOPING REVIEW.

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1 Royal College of Surgeons Ireland (RCSI) University of Medicine and Health Sciences, Dublin, Dublin, Ireland

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**Introduction:** A pressure ulcer, also known as a pressure sore or bed sore, is a soft tissue injury that occurs when prolonged pressure is applied to the skin causing areas of necrosis and ulceration.(1) It is estimated that approximately 95% of pressure ulcers can be prevented through appropriate preventative measures.(2) The education of healthcare workers play a vital role by increasing awareness and knowledge of the causes, risk factors and prevention strategies for pressure ulcers.(3) Current studies focus on the implementation of educational programmes to improve knowledge, attitudes and practices to preventing pressure ulcers.(3) Psychometric testing of healthcare workers' knowledge of pressure ulcers would provide greater understanding of the actual impact of these educational programmes. This study aimed to identify psychometric tools used to measure the knowledge of healthcare workers with respect to pressure ulcers.

**Methods:** A systematic search of publications using the PubMed and Embase databases was conducted in April 2023, using the search terms (Pressure Ulcers, Bed Sores, Pressure Sores; Psychometric, test, testing; Healthcare workers, Healthcare Personnel; Knowledge, Education). Data was extracted and a scoping review was undertaken. All study types written in English and available in full text were included. No restrictions on the date of publication and study setting were applied.

**Results:** This review identified 12 psychometric tools employed in 16 studies to measure pressure ulcer knowledge. Of the 12 instruments found, 5 were tested for content validity and 7 distinct tools were tested for internal consistency reliability. The most utilized tool, (n=3) studies was the Pieper-Zulkowski Pressure Ulcer Knowledge Test. The tool showing the highest Content Validity Index was the DecubICUs Test, whereas the most reliable tool based on the Cronbach's  $\alpha$  was the Pieper's Pressure Ulcer Knowledge Test.

**Conclusions:** While several instruments were identified, the varying validity and reliability scores of the tools identified in this review, suggest a need for standardization or further refinement of these tools. These findings, nevertheless, serve as a robust foundational platform from which both researchers and healthcare educationists can evolve, underlining the importance of continuous enhancement and optimization of these indispensable tools. The overarching objective of these efforts should be geared towards bolstering the knowledge base and skill set of healthcare practitioners, culminating in improved patient outcomes, and alleviating the significant strain that pressure ulcers inflict upon our healthcare system.

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## B7

## APPLICATION OF HONEY DRESSING FOR PATIENTS WITH INFECTED PRESSURE ULCERS

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**Introduction:** Honey has been known for its various uses in wound healing, as an emollient, and for therapeutic purposes for thousands of years. Glucose oxidase, a component found in honey, maintains an ideal state that is not harmful to normal cells, and the acidic components contained in it create an environment that is difficult for bacteria to thrive in, making it highly effective in wound healing. Therefore, we aimed to investigate the effects of applying honey to pressure ulcers suspected of infection, which may be delaying the healing process.

**Methods:** This case study examines a 66-year-old female patient with a Stage 4 pressure ulcer with signs of infection from September 23, 2022, to November 24, 2022. A dressing product using honey was utilized in this study, which began after obtaining consent from the patient's guardian and consultation with a plastic surgeon. Daily wound cleaning with saline solution was performed on the infected ulcer, followed by the application of a product containing honey and the use of polyurethane foam for daily dressing changes.

**Results:** At the initial diagnosis, the size of the pressure ulcer was measured at 11 x 6 (cm). After 18 days of honey dressing, a visible reduction in infection symptoms and improvement in ulcer cleanliness were observed. On the 39th day, the ulcer size was measured at 10 x 5 cm, and by day 52, it had further decreased to 7 x 4.5 cm, with no signs of infection present. These results suggest that honey-based dressing may be effective in the treatment of pressure ulcers.

**Conclusions:** In Korea, the use of honey-based dressings for pressure ulcer treatment is not widely practiced, and there is a lack of research on the topic. Although some honey-based dressings are available, they are not actively used in hospitals compared to other types of dressings. However, chronic pressure ulcers occur not only in medical institutions but also in households and nursing care facilities, and appropriate medical materials and evidence-based treatment are needed to treat them. Considering this, it is expected that the use of honey as a wound cleansing method, which is readily available, could be helpful in chronic wound care if its safety and standardized use are established. Therefore, research and validation on this topic are needed.

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## B8

## EXPANDING KNOWLEDGE ON PRESSURE INJURIES IN HEALTHCARE: NURSING AND PHYSIOTHERAPY STUDENTS AS KNOWLEDGE AMBASSADORS

Hannele Moisander<sup>1</sup>, Miska Vaara<sup>2</sup>, Lea Pulliainen<sup>3,4</sup>, Aune Isosomppi<sup>5</sup>, Maria Honkala<sup>6</sup>

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3 HUS Helsinki University Hospital, Meilahti Bridge Hospital, Helsinki, Finland

4 Finnish Wound Care Society President, Helsinki, Finland

5 Western Uusimaa Wellbeing Services County, Espoo Hospital, Espoo, Finland

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**Introduction:** Nursing and physiotherapy students, in collaboration with experts from the hospital district's pressure injury working group (PIWG), organized the STOP Pressure Injuries event on November 17, 2022. Additionally, they created an instructional video "Prevent Pressure Injuries - Transfers and Medical Devices".

**Methods:** Preventing pressure injuries (PIs) requires healthcare staff to be able to identify high-risk patients and implement patient-specific preventive measures. Nursing and physiotherapy students are building their professional identities during their education. Education should focus on teaching principles of prevention, identification of risk factors, and treatment of PIs. The goal of education is to enable students to apply researched knowledge in practical nursing care and share their expertise in workplaces.

The STOP Pressure Injury project was implemented using the Learning by Developing model. Students collaborated with the PIWG, implemented, and edited the instructional video "Prevent Pressure Injuries". Additionally, they organized the STOP Pressure Injury event in three hospitals, where the students shared information on the PIs and released the video. Experts supported the students by conducting a workshop on PI prevention and use of medical devices, drafting the script for the instructional video, providing authentic environments for video production, and acting as experts on the PIs. Throughout the project, the students critically reflected on their experiences in collaboration with the experts. The reflection encompassed the entire project as well as the identification and prevention of the PIs, and the utilization of PI prevention models. The students also wrote an article about the project for a professional journal.

Students can act as ambassadors for increasing awareness about PIs in healthcare. The student's competence is focused on future actions, sharing new knowledge, and gaining new experiences that provide insights into the development of work processes, the work community, and the organization. Reflection leads to improving practices in patient care and instructional design. The video produced in the project is available on YouTube to be used as teaching and staff orientation material.

**Results:** The STOP Pressure Injuries project assists students in receiving and sharing information on the prevention and treatment recommendations for PIs, patient transfer ergonomics, and the utilization of assistive devices in healthcare settings and different study modules.

**Summary:** The collaboration between students and professionals has a significant impact on reducing pressure injuries and enhancing the well-being of patients.

### References:

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Picture. Student acting as a patient.



Picture. Students acting in an operating theatre.



## B9

# WHEN TIME IS OF THE ESSENCE: USING AN ENZYME ALGINOGEL TO ACHIEVE HEALING IN A QUADRIPLÉGIC PATIENT WITH PRESSURE DAMAGE

**Maria Rebouco<sup>1</sup>, Lourdes Rivera<sup>1</sup>**

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**Introduction:** The high risk of pressure ulcer (PU) development among patients with spinal cord injury (SCI) is well recognized due to motor paralysis and sensory loss along with other associated comorbidities<sup>3</sup>. Managing PU among SCI patients can be challenging and commonly lead to multiple health complications, affecting their rehabilitation and ultimately their quality of life<sup>2</sup>.

When damage occurs is important to select treatment that best prepares the wound bed for healing. Enzyme alginogels are often used in PU management due to their unique triple mode of action as a hydrogel, alginate and antibacterial<sup>1</sup>.

**Methods:** Patient's case study involved a 50 years old male with quadriplegia post SCI, who acquired a category 3 PU on his right and left buttocks, while waiting to transfer to a rehabilitation unit. The goal was to achieve healing allowing the patient to start his rehabilitation and adapt to his new life post injury.

The Tissue Viability Team decided on the application of enzyme alginogel and a standard silicone border foam, for wound daily dressings.

**Results:** The initial wound dimensions were 7 cm length by 4 cm width, on the right buttock and 4.0 cm length by 2.0 cm width on the left buttock. Wound beds has slough tissue present, no signs of infection and incontinence-associated dermatitis (IAD) to the surrounding skin. Wound application of enzyme alginogel was commenced on first assessment. Photographic evidence was taken.

The gel created a balanced wound bed hydration; the alginate component aided autolytic removal of slough tissue and the antibacterial effect of the enzymes protected the wound bed from infection. We also believe this product aid skin healing from IAD.

Wound healing was achieved after 9 weeks of usage with reported easy application by nursing staff and no negative effects felt by the patient. This allowed the immediate start of patient's rehabilitation therapy.

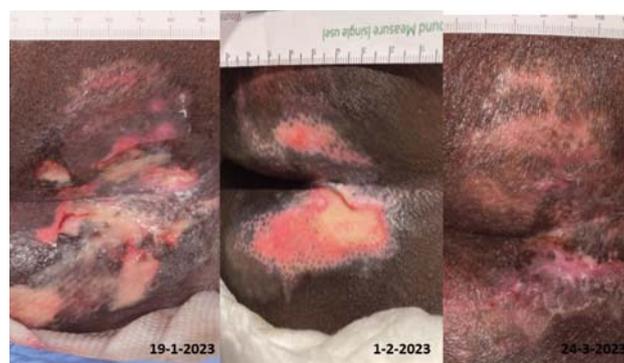
**Conclusions:** Effective PU prevention and management requires tailored care plans, adapted to patient's individual needs and wound bed characteristics. The correct dressing product selection is an important component of wound healing. The usage of enzyme alginogel products was shown to effectively prepare the wound bed for healing, tackling its four main aspects: tissue, infection, moisture and wound edges.

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**COI:** Flen Health Company is assisting with the abstract application but had no influence during the treatment.

Figure 1: Wound evolution to healing.



## B10

## STANDARDIZED PPE-RELATED INJURY ASSESSMENT USING A VALIDATED TOOL

**Susan Solmos<sup>1</sup>, Joyce Black<sup>1</sup>, Janet Cuddigan<sup>1</sup>**

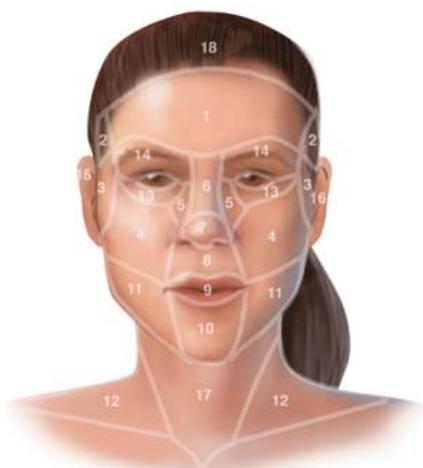
<sup>1</sup> University of Nebraska Medical Center, College of Nursing, PhD program, Omaha

**Introduction:** Unprecedented global personal protective equipment (PPE) shortages during the COVID-19 pandemic prompted extended wear times.[1] As PPE became increasingly scarce, shocking selfies of health care workers (HCWs) with severe facial injuries garnered international attention.[2] Social media posts were leading indicators of the devastating consequences of the pandemic and instantly recognizable as pressure injuries.[3] In fact, pressure injuries due to PPE were later reported in 40% of HCWs; however, self-identification, reporting methods, and single site/country were limitations of most studies.[4] Therefore, we designed and validated a 7-item tool (CVI 0.93) to standardize reporting of PPE-related facial injuries. Inter-rater agreement was 90-95%. We aim to describe the nature, severity, and distribution of PPE-related facial injuries posted to a global Instagram community.

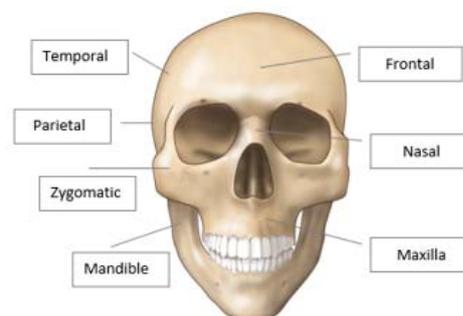
**Methods:** Purposeful sampling of 172 selfies/images with injuries. Images were analyzed using the PPE-Related Facial Injuries Visual Analysis Tool including skin tone, anatomic face and neck landmarks, pattern of injury, corresponding PPE in use, clinical descriptions of injury, likely aetiology, and injury association with a bony prominence. Excluded 27 for poor image quality, black and white, or PPE/dressing obscuring face.

**Results:** 145 posts/images were examined from 24 countries. Demographics n (%): 123 (84.8) females, light skin tone 113 (77.9), in healthcare setting 125 (86.2). Injury pattern n (%): majority of injuries were device-shaped 132 (91) and symmetrical 128 (90.8). Injuries over bony prominences were most often located over the zygomatic (93.1), nasal (91.7), and frontal (53.8) bones. Clinical descriptions of injuries included: erythema, deep red or maroon (possible DTPI), purple (bruise or DTPI), green-yellow (bruise tones). Discerning skin color changes in darker skin tones was challenging. Severe and mild indentations were common, with severe indentations most often on cheek and nose. Severe indentations often had signs of stippling (imprint of PPE surface). Areas of blanching at high pressure points and hyperpigmentation (brown) at edges of PPE were observed. These findings have not been previously described. In this sample, irritant contact dermatitis was less frequent and no skin tears were observed. Further analysis is underway.

**Conclusions:** Assessment of PPE-facial injuries on Instagram by clinical experts using a valid and reliable tool provided additional insights into the pattern and mechanism of PPE-related facial injuries. Mild and severe indentation images were included in a single study[5]; however, no studies to date have described and quantified these injuries. Stippling and blanching are new findings which must be considered in the etiology and prevention of PPE-facial injuries. Clinically, intervening at a pre-injury stage (indentations and stippling) may prevent further pain and injury.



**Figure 1. Anatomic Landmarks for Face and Anterior Neck ©**



**Figure 2. Facial Bony Prominences ©**

## B11

# IS ENOUGH BEING DONE FOR SAFE PATIENT POSITIONING DURING SURGERY?

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<sup>2</sup> Nottingham Trent University, Smart Wearable Research Group, Nottingham, United Kingdom

**Introduction:** Safe patient positioning is a common problem in high-risk surgeries, the choice of position used allows for optimal exposure to the site whilst minimising risk of injury [1]. In prone position, mispositioning can cause serious complications such as perioperative vision loss, peripheral nerve damage and pressure ulcers (PU) [2]. Mispositioning can increase the risk of PU development when body weight isn't evenly distributed on support surfaces [3]. There are multiple strategies, risk assessments and predictive models available that act as guidelines for clinicians to help initial positioning to prevent onset of PUs; these methods are paper/digital based tools that don't allow for intraoperative measurements of pressure during positioning. Literature highlights there needs to be more research conducted/evidenced based upon pressure-reducing surfaces [4]; there is a distinct lack of pressure positioning visual aids used in surgery.

**Methods:** A participant study conducted determined how documented levels of comfort are perceived on a specific spinal frame; participants were placed in prone for a maximum of 5-minutes and asked to document their perceived comfort level using a visual analog scale. The comfort level data was analysed against sensor data collected from the surgical pads (two each on the chest and hips). Data was analysed using logistic regression analysis using the NOMREG procedure in the statistical analysis software.

**Results:** The predicted results will help to answer the themes that this study raises:

- Is enough being done to ensure patient comfort and safety?
- Will the inclusion of a patient positioning device help reduce the risk and onset of PUs.
- How does the perceived comfort levels and sensor matrix align, does it show participants are incorrectly positioned?
- Does incorrect positioning increase the risk to PU development?

**Conclusions:** The findings of this study will help determine whether participants have been positioned correctly on the provided support surfaces and highlighting the need for patient positioning devices used in surgery, specifically spinal surgery.

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**COI:** (declaration) This project is part funded.

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## B12

## THE EFFECT OF NEGATIVE PRESSURE WOUND THERAPY ON THE TREATMENT OF PRESSURE ULCERS IN PATIENTS WITH SPINAL CORD INJURY

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3 University Hospital Brno, Department of Surgery, Brno, Czech Republic

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**Introduction:** Spinal cord injury (SCI) results in motor paralysis and sensory loss, placing individuals at a particularly high risk of pressure ulcers (PUs). Most patients with new SCI develop at least one hospital-acquired pressure ulcer during hospitalization.

**Methods:** A prospective case-control study is being conducted at the Internal department in one of the biggest faculty hospitals in the country. This academic study aims to perform NPWT (introducing the new device for the national market) in patients with SCI who developed category 3 and 4 PUs. The overall aim is to offer patients a more immediate treatment of the wound using NPWT and, if necessary, to close the cleaned wound with a plastic flap surgery in collaboration with a plastic surgeon, which is the situation in the presented case study. The whole study is planned in her first stage for ten patients.

We present one case study of a 69-year-old male, paraplegic (6/2014 fall from a tree - fractured vertebrae, vertebral surgery) who was admitted on 23.02.23 to the hospital with PU (ischiatric PU right, gr. IV.), wound size 8x6x6cm with fistula 1x5 cm for elective treatment with NPWT produced by Egeria Medizintechnik.

**Results:** During the application of NPWT (system changed twice a week, the continual pressure 125 mmHg for 18 days, within 5 redressing and system changes), the wound was reduced to the size 5x4x3 cm with fistula 1x3.5 cm. Initial MRSA was identified in the wound, and debridement (necrectomy) was performed on the 20th day after admission, followed by flap plastic surgery using a fasciocutaneous dorsal thigh flap one week later. We did not experience any postoperative complications.

**Conclusions:** NPWT is a strongly recommended tool in surgery for various indications and we wanted to use this approach in complex patients with high PUs categories treated at the internal medicine department. NPWT was confirmed to accelerate wound healing. The application of NPWT can reduce the size of the wound, which may be beneficial before PU(s) reconstruction.

**Acknowledgement:** This report was written at Masaryk University as part of the "A Comprehensive Approach to Quality Nursing care" project no. MUNI/A/1237/2022 with the support of the Specific University Research Grant, as provided by the Ministry of Education, Youth and Sports of the Czech Republic in the year 2022 and "Supported by Ministry of Health, Czech Republic – conceptual development of research organization (FNBr, 65269705).

**COI:** The study is supported by Egeria Medizintechnik and Leram, who have loaned medical devices but do not influence the study results.

## B13

# A HYDROGEL FOR ANTISEPSIS, DEBRIDEMENT AND HEALING IN INFECTIOUS NECROTIC PRESSURE INJURIES

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**Introduction:** Most of necrotic pressure injuries are also infectious and hydrogel dressings cannot be effective against bacteria [1] so it's necessary to treat infection with antibiotic systemic therapy and/or using antiseptic secondary dressings; very often the debridement action of hydrogels can achieve a complete cleaning of the wound but there's a depth and area increasing. The aim of this work is to demonstrate that not all hydrogels are the same [2] and that it's possible to reduce the treatment time of pressure injuries by debriding necrosis, treating infection and promoting granulation at the same time using another type of hydrogel [3].

**Methods:** We enrolled 30 patients with infectious necrotic pressure injuries (PI). Primary dressing a hydrogel and secondary dressing a moist gauze, both containing biological inducer\*, an olive oil derived stable ozonide. Dressing change three times a week. Observation time two weeks. We evaluated Debridement Rate (DR, as percentage reduction of necrotic tissue), Antiseptic Effectiveness (AE, according with Cutting & Harding Criteria) and Wound Area Reduction (WAR) using portable wound measurement\*\*\* system.

**Results:** All patients completed the study and all treated pressure injuries showed a Debridement Rate of more than 73%, significant Antiseptic Effectiveness with disappearance of signs of infection within the observation time (most within 10 days), and a Wound Area Reduction of approximately 13%. No complications, no allergies, no induced pain.

**Conclusions:** This work demonstrated that this biological inducer\* based dressing allowed us to achieve the intended target: a quick debridement even if there's infection, a significant reduction of the healing time due to the contemporary actions of debridement, antiseptics and promoting granulation and also a good result in terms of cost-benefit.

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[3] Cassino R. et al. An ozonide in hydrogel formulation to debride necrotic infectious wounds and promote granulation at the same time: preliminary results 32nd EWMA (European Wound Management Association) Conference, May 2022 - Paris (France)

**COI:** no conflict of interest

\* Ozoile®

\*\* Visitrak™

## B14

# UTILIZATION OF VARIOUS AUXILIARY MATERIALS FOR EFFECTIVE NEGATIVE PRESSURE WOUND THERAPY

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2 Eulji University, School of Medicine, Plastic and Reconstructive Surgery, Seoul, Korea, Rep. of South

**Introduction:** Negative pressure wound therapy (NPWT) has been widely used since Argenta et al. (1997) introduced the VAC concept. There are cumbersome cases of In this regard, we would like to introduce methods that can be used in combination with negative pressure wound treatment simply and effectively by using auxiliary materials for wound treatment.

**Methods:** First, when preparing skin, wipe it off with an organic solvent and use a hydrocolloid dressing to seal the curved and high-discharge areas. Second, use sterilized adhesive tape. Third, selective use of other dressing materials suitable for wounds when using granufoam. Fourth, reinforcing absorbent cotton on the edge of granufoam when there is too much secretion from the wound itself. Finally, one or more tips for sealing complex areas such as fingers and toes were used.

**Results:** The NPWT replacement cycle was performed between 3 and 6 days, and in the case of complex wounds, it was possible to treat with a small amount of manpower, and it was possible to selectively maintain the part where the granufoam directly touched and the part that did not need to be subjected to strong negative pressure, as a result, within the dressing change period. There was hardly any leakage.

**Conclusions:** By using treatment materials, it was possible to simply and effectively maintain negative pressure at the complicated wound site, and there was no leakage, reducing manpower consumption and preventing wound contamination.

**COI:** In relation to this presentation, the lead author has no conflict of interest that need to be disclosed

Table 1. summary of auxiliary materials and it's effects

Auxiliary materials	Effects
Organic solvents(acetone)	Helps seal by wiping off greased areas of the skin
Various dressing products	Adds selective pressure application in complex wounds and the healing effect of the materials.
Sterilized adhesive tape	Low manpower consumption by using sterile adhesive tape for large or complicated wound.
Absorbent cotton gauze	When there is too much secretion, it is easy to seal by absorbing the exudate generated during dressing.

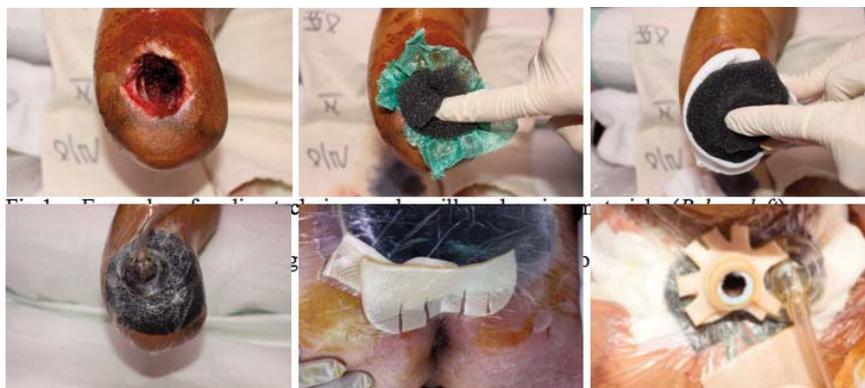


Fig.1. . Examples of sealing technique and auxiliary dressing materials. (Below, left) Amputation stump.

(Below, center) Perianal sealing. (Below, right) Small pharyngocutaneous fistula after PMMC flap for laryngeal cancer.

## B15

# THE MULTIDISCIPLINARY DEVELOPMENTS OF NUTRITION INTERVENTION & NURSING PROGRAM TO PRESSURE ULCER PREVENTION.

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<sup>1</sup> National Cancer Center, Department of Nursing, Kyeonggi-do, Korea, Rep. of South

<sup>2</sup> Kyung Hee University, Department of Medical Nutrition, Graduate School of East-West Medical Scienc, Seoul, Korea, Rep. of South

**Introduction:** Pressure ulcers can reduce the quality of life and can affect complications, length of hospital stay, and increased mortality in hospitalized patients. Also insufficient nutritional intake and malnutrition are the main factors affecting the occurrence, severity, and delay of healing of pressure ulcers. The guidelines for pressure ulcer management of the International Pressure Injury Advisory Committee recommend establishing an individualized treatment plan through accurate diagnosis in the early stage for efficient treatment of pressure ulcers. Along with nursing management, the need for appropriate nutritional interventions is emphasized.

Therefore, it was thought that a standardized nutrition intervention and nursing intervention program are needed for proper treatment and quality of life improvement of patients with pressure ulcers in our hospital.

## Methods:

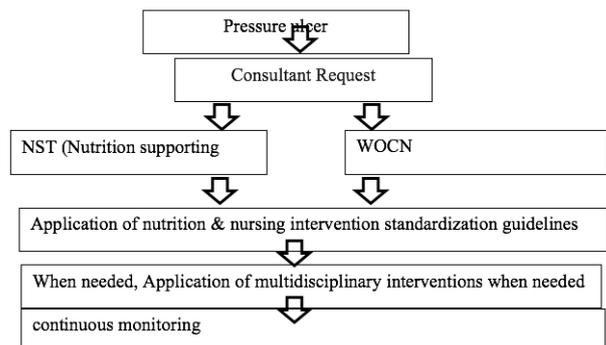
### 1. Collecting date

From 2020.03.12 to 2020.07.06, The following items-pressure Ulcer, Nutrition, data related to quality of life were investigated for patients who developed pressure ulcers of stage 2 or higher during the hospital stay.

### 2. Improvement Plan & activity

### 3. evaluation

- 1) Nutrient intake through application of standardized guidelines
- 2) Pressure ulcer severity and healing period through application of standardized guidelines
- 3) Increase in quality of life through application of standardized guidelines



**Results:** An integrated nutritional intervention and nursing program was developed and applied to shorten the healing period of pressure ulcers and help improve quality of life in cancer patients with pressure ulcers. As a result of providing nutrients in various ways for proper nutrition supply, the intake rate of essential nutrients for pressure ulcer healing increased. In addition, systematic nursing intervention was continued, and the healing period of pressure ulcers was shortened.

**Conclusions:** The risk of pressure ulcer occurrence and malnutrition increased as the hospitalization period passed, and the actual rate of malnutrition among patients with pressure ulcers was higher.

Therefore, it is necessary to select the high-risk group for pressure ulcer occurrence & malnutrition in advance and conduct appropriate interventions to prevent pressure ulcers.

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**COI:** We disclose that I/we have not had any financial or personal relationships with any person, company or organisation that could have inappropriately influenced our work.

## B16

# THE UTILITY OF INTELLIGENT DIGITAL DASHBOARDS TO DIGITIZE THE SEM (Δ) DELTA DATA PATHWAY TO FACILITY EMR SYSTEMS

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**Introduction:** Utilising SEM assessment technology\* is being recognised as routine practice in pressure ulcer (PU) prevention. Clinical data and real-world evidence support the implementation of SEM assessments to achieve consistent PU incidence reductions in multiple care settings.<sup>1,2</sup> Clinical workflows integrated with SEM assessments are skin-tone agnostic and inform healthcare practitioners (HCPs) with early, actionable data to direct anatomy specific interventions to at-risk patients before skin-redness occurs which is even more important in dark skin tone patients and residents.

The aim was to create a digital data pathway for the SEM (✓) Delta readings. Taking it from the bedside point-in-time data on the SEM assessment technology to a digital dashboard that communicates with facility EMR systems, providing all SEM (✓) Delta data into patient records.

**Methods:** A web-based dashboard\*\* was designed to be implemented within facility servers to wirelessly transfer encrypted SEM (✓) Delta data and allow HCPs to visualize patient-level SEM assessment data with the goal of improving service delivery. Visualization features were designed to track patient SEM-delta data throughout the episode of care from admission to discharge. Features at the facility level complemented SEM data with metrics on active users, devices, wards, and total patients scanned by day, week, month, or year.

**Results:** Dashboard analytics illustrate a day-by-day depiction of SEM assessments for individual patients demonstrating the impact SEM (✓) Delta data had on clinical decision-making and subsequent preventative interventions

Linking the SEM (✓) Delta readings to facility EMR systems helps facilitate the macro management of at-risk patients with the data being populated in individual patient progress notes and ward level shift and 24-hour reporting.



Figure 1. Patient level SEM (✓) Delta readings over a week period.

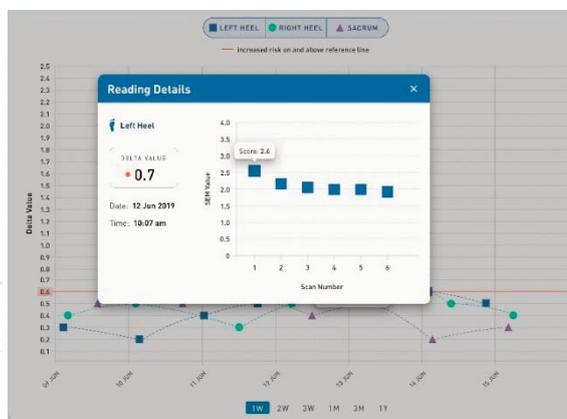


Figure 2. Day specific SEM readings that resulted in a high SEM delta.

**Conclusions:** Digital health dashboards allow real-time monitoring of patient-specific SEM (✓) Delta -data and the impact of subsequent interventions. Monitoring SEM (✓) Delta data has the potential to support implementation of personalised PU care pathways with actionable clinical decisions.

Facility-level insights will ensure health systems are better informed for “never event” investigations, delivering high-quality PU prevention care and realising consistent PU incidence reductions whilst modernising the PU prevention care pathway.

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\*SEM assessment technology – Provizio® SEM Scanner, Bruin Biometrics LLC. \*\*Digital Dashboard – Gateway Dashboard, Bruin Biometrics LLC

## B17

# PYODERMA GANGRENOSUM: CASE-STUDY – CONTRIBUTION OF RESTORATIVE CREAM WITH GROWTH FACTORS IN PERISURROUNDING SKIN

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**Introduction:** 1 • To present the effectiveness of using the Repairing Cream with Growth Factors in the treatment of ulcerated skin abscess within a 2-month interval.

2 • Evaluate the action of the Repairing Cream with Growth Factors in repairing and remodeling the surrounding skin and wound edges.

**Methods:** Observational, multicentric, non-comparative case study of a user with Ulcerated Cutaneous Abscess in Primary Health Care.

## Results:



25.03: Day 0 - 4,5x5,0cm

Lesion with fibrin tissue and devitalized. Started application of Repairing Cream with Growth Factors on the perilesional skin. Local itching and extensive erythema. Presence of intense smell. Pain 4

Note: From 4.04 to 10.04, the user developed erythema, pruritus and extensive redness, so it was decided to suspend the application of the Repairing Cream with Growth Factors and wait 1 week. Application of the cream was restarted on 11.04 and no further negative occurrences were verified.

July 2022 - Complete healing of the wound.



**Conclusions:** User adopted a better life hygiene, assimilated teachings about the importance of having a healthy diet. He complied with the prescribed anti-diabetic therapy and carried out the recommended treatments. A favorable evolution was observed in 2 months.

User continued to apply the Repairing Cream with Growth Factors after complete healing of the wound.

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B18

# THE ROLE OF THE ALLIED HEALTH PROFESSIONAL IN PRESSURE ULCER PREVENTION A LITERATURE REVIEW

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**Introduction:** International and national pressure ulcer guidelines (EPUAP, 2019, NICE, 2014) state that it is the role of a healthcare professional (HCP) to assess and manage a patient's pressure ulcer (PU) risk. However, there is a perception in some healthcare settings that a PU risk assessment and prevention plan is the responsibility of a nurse, rather than the wider multidisciplinary team or the HCP predominantly involved in the individual's care. The aim of the literature review was to explore the role of the Allied Health Professional (AHP) in pressure ulcer prevention (PUP).

**Objectives:**

- Explore AHP's views in pressure ulcer prevention (PUP).
- Explore any barriers with AHP's and pressure ulcer prevention.

**Methods:** Mixed methodology structured literature review. A literature search was undertaken using, British Nursing Index (BNI), Cumulative Index to Nursing and Allied Health Literature (CINAHL), EMCare (nursing and allied health database), Medline (Medical Literature Analysis and Retrieval Online) and Cochrane databases. The initial search retrieved 551 articles, following removal of duplicates, the review of the titles and abstracts a further 543 were excluded. A further article was identified from a reference list, totalling nine studies (Clarkson et al., 2019; Giesbrecht, 2006; Guihan et al., 2009; Macens et al., 2011; Mains et al., 2022; Rose & Mackenzie, 2010; Sterke et al., 2021; Taylor et al., 2021; Worsley et al., 2017) were included in the literature review.

**Results:** Thematic analysis revealed five themes regarding the role of the AHP and PUP.

- Perception of their role in PUP and assessment.
- The education and knowledge
- Multi-disciplinary team (MDT)
- Equipment
- Patient education

**Conclusions:** The aim of this literature review was to explore the role of the AHP in PUP, after reviewing the literature in a systematic approach there is evidence to support that AHPs have a role in PUP. The role of the AHP in PUP has demonstrated to be varied, with the emerging themes, at times these themes are barriers and enables to the role of the AHP in PUP.

## B19

# DO WE STILL NEED TO ASSESS NURSES ATTITUDES TOWARDS PRESSURE ULCERS PREVENTION? AN UPDATED SYSTEMATIC REVIEW

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**Introduction:** Pressure ulcers (PUs) continue to be a major global health problem; despite that they are a condition identified in ancient Egyptian mummies over 5000 years ago.<sup>1</sup> PU prevention is a priority for healthcare professionals and healthcare organisations throughout the world. Although a multidisciplinary team approach plays a key role in the prevention of PUs, nurses remain at the forefront of this endeavour in most healthcare settings.<sup>2</sup> A key consideration argued in the literature is the role that nurses' attitudes play in the success of pressure ulcer prevention strategies.

**Methods:** The systematic review is the first update of Avsar et al. (2019) paper.<sup>3</sup> Using systematic review methodology, we considered published quantitative studies focusing on nurses' attitudes toward pressure ulcer prevention as measured using psychometric tests. The search was conducted in April 2022, using PubMed, CINAHL, Scopus, Cochrane, and EMBASE databases, and returned 454 records, of which 35 met the inclusion criteria. Data were extracted using a pre-designed extraction tool and all included studies were quality appraised using the EBL Appraisal checklist.

**Results:** In most studies, distinct measurement instruments were used for measuring nurses' attitudes toward the prevention of pressure ulcers: The Moore & Price Attitude Scale and the Attitude towards Pressure Ulcer Prevention Instrument. In Avsar et al.<sup>3</sup>, the mean attitude score from all included studies was 73% (SD= 9.2). In this first update, the mean attitude score was 69% (SD= 14). A separate analysis of the new studies alone included in this first update (n=14) indicates a mean attitude score of 62.25% (SD: 17.9), suggesting a 10.75% lower mean attitude score. Furthermore, in this study only 46% (n=16) studies yielded an attitude score  $\geq$  75%. Studies from the Middle East show the lowest mean attitude score (mean 55%; SD: 15), with studies from Europe displaying the highest mean attitude score (mean 79%; SD: 6).

**Conclusions:** The findings suggest that, overall, nurses are relatively positively disposed toward pressure ulcer prevention. However, there are differences across continents. It is important to highlight also that the nurses have difficulties reflecting this positive attitude into actual preventative strategies and there could be an attitude-behaviour inconsistency in terms of PU prevention.

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## B20

# AN 18-YEAR CROSS-SECTIONAL STUDY ON THE MULTIDISCIPLINARY MANAGEMENT OF COMPLEX PRESSURE SORE RECONSTRUCTION AT A SINGLE SPINAL INJURY CENTRE

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**Introduction:** Pressure sores are a complex and debilitating disease which is often difficult and challenging to manage. Since 2005 a Multidisciplinary (MDT) approach was introduced, which evolved to meet the needs of the patient better. During this time, we have continued to publish our surgical outcomes using this team approach. We aim to present our latest cross-sectional outcome study from the last ten years and compare this to prior and published experience in pressure sore management.

**Methods:** Data was collected for a 10-year period using an electronic recording system and cross-reference with the plastics auditing tool and paper notes available at James Cook University Hospital from 2012 to 2022. Data were collected on patients' demographics, reconstructive techniques, surgical outcomes, and complication rates. Statistical analysis using X2 and relative risk was used to correlate patient's comorbidities and surgical outcomes. A comparative study was also performed between the most recent findings and the previously published series of our unit.

**Results:** 113 patients with 138 pressure sores (grade 3 or 4) were reviewed in the pressure sore MDT/clinic between 2012 and 2022. The mean age was 54.6 (range: 17-85). The majority of patients were paraplegic ( 73% ) whilst 16% were tetraplegic. The most common pressure sore was ischial (52%) followed by sacral (18%) then trochanteric (20%). Ischial pressure sores had the highest complication rate 11.9% whilst trochanteric pressure source had the highest recurrence 8.5%. 51% of patients were managed conservatively and 46% required flap reconstruction. Fasciocutaneous flap reconstruction had more complications compared to musculocutaneous (28.57% vs 18.42%) but lower recurrence (14.29% vs 23.68%). Patients were admitted on average 43.5 days and up to 90 days if there were complications (minor wound dehiscence) or requiring prolonged antibiotics for osteomyelitis. Patients were followed up for 9 months after discharge. Compared to previous years, we have demonstrated a reduction in complications from 31% to 23.07% (5.77% major complications and 17.3% minor). Poor compliance was a significant factor RR 2.07 (P>0.02 CI 1.14-5.35). Recurrences were reduced from 22% to 21.1 % with the length of stay remaining at an average of 45 days.

**Conclusions:** The last decade of pressure sore management since the introduction of the MDT approach in 2005 demonstrates an overall improvement in outcomes of pressure sore management, which continues the trend observed over the past 17 years. It can be postulated that this improvement is multi-factorial, perhaps attributed to improved efficiency and efficacy of the MDT approach with dedicated surgeons, physicians, and allied health professionals in a purpose build spinal unit to provide care for these patients.

## B21

# PRESSURE INJURY WITH EMPHASIS ON THE POST-COVID-19 PATIENT EXPERIENCE AND OVERCOME REPORT

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**Introduction:** The pandemic caused by the coronavirus began in Wuhan Province, China at the end of December 2019. The disease is caused by the SARS-CoV-2 virus, or “novel coronavirus”, which is transmitted by infected, asymptomatic people or not, via respiratory droplets resulting from coughing, sneezing, or talking. When the disease is developed in its severe form, the probability of resorting to hospitalization in the Intensive Care Unit (ICU). As a result of prolonged time in the same position and hemodynamic fragility, one of the most frequent interurrences is Pressure Injury (PPI). According to the National Pressure Ulcer Advisory Panel (NPUAP), PI is localized damage to the skin, often over bony prominences. Its etiology is usually related to local pressure, and may be associated with shear, among other extrinsic and intrinsic causes.

**Methods:** A descriptive case study was carried out, with data collection from the medical records and clinical observation during the patient’s outpatient treatment.

**Results:** The patient had an extensive 18x15x0 lesion in the sacrococcygeal region, the result of positioning pressure after 60 days of hospitalization. In the first evaluation, the lesion presented coagulation and liquefaction necrosis, perilesional hyperemia, moderate amount of exudate and fetid odor. A conservative debridement was chosen, removing the necrotic tissue without compromising the underlying structures. In addition, treatment was started with technological gelling fiber dressings, which have absorbent properties and promote a moist environment conducive to healing. After two weeks of treatment, the lesion showed a positive response, with a significant reduction in its size, complete absence of necrotic tissue and unpleasant odor. These encouraging results allowed the patient to begin his rehabilitation and resume his daily activities



**Conclusions:** The treatment of pressure injuries in post-COVID-19 patients can be challenging due to the complexity of the clinical picture. However, the use of technological dressings with gelling fiber proved to be effective in promoting healing. It is important to emphasize the individualization of treatment according to the characteristics of the patient and the lesion. Descriptors: COVID-19, pressure ulcer, case report, treatment.

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## B22

# AUTOLAT ; EVALUATION OF THE USABILITY AND POTENTIAL CONTRIBUTIONS OF AN AUTOMATED LATERALIZATION SYSTEM BY CARE TEAMS IN NURSING HOME.

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**Introduction:** In France, pressure sores' prevalence has been reported as between 5.3% in nursing homes (1). At the same time, dependent elderly people's proportion in care home population is increasing. This tendency leads to increased preventive and curative care for pressure ulcers. Nursing home teams frequently use innovative technological devices like an automated lateral turning system designed to help position patients in a 30° lateral position (2). This device has significant qualities that allow it to assist with the prevention and management of pressure ulcers (3-5). In fact, only six nursing homes used this device in 2022 in Brittany (France).

**Methods:** The AUTOLAT study main objective is to compare the usability of one automated lateral turning system vs. manual repositioning. It also sought to specify the characteristics of the preferred patients and the potential contribution to pressure area care the lateral turning system brings. To this end, a questionnaire was sent to professionals using this device in nursing homes.

**Results:** 81 caregivers took part in this study. Results highlight the innovative device as being as useful as manual repositioning according to the professionals' feedback. The device would improve sleep quality, help in the prevention of pain during mobilization, and therefore patients comfort as well as skin and pressure area management. Furthermore, this device will meet the patients' needs as well as the professionals' physical and organizational constraints. However, adaptations would be necessary to promote optimal use. It seems less suitable for patients with a low BMI or weight and a Braden scale mobility score greater than 2.

**Conclusions:** These results will be clarified and confirmed in future studies, especially about the efficiency of manual repositioning in pressure ulcer prevention and potential contributions to quality of life of the beneficiaries.

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