

# EPUAP

## 2022

The 22<sup>nd</sup> Annual Meeting of the  
European Pressure Ulcer Advisory Panel

14 – 16 September 2022, Prague, Czech Republic

[www.epuap2022.org](http://www.epuap2022.org)



# ABSTRACT BOOK

Partnerships: Masaryk University, Faculty of Medicine, Brno; Institute of Health Information and Statistics;  
Czech Wound Management Association; Ministry of Health of the Czech Republic



Key sessions overview	3
Key sessions	5
EPUAP awards sessions overview	24
EPUAP awards sessions	25
Free paper sessions overview	27
Free paper sessions	29
STINTS symposium overview	75
STINTS symposium	76
Student free paper sessions overview	85
Student free paper sessions	86
Czech symposium overview	94
Czech symposium	95
Poster presentations overview	102
Poster presentations	104

### Plenary Key Session: Navigating the journey from evidence generation to guideline development

*Chairs: Andrea Pokorná, Jane Nixon*

- KS1.1 Guidelines- methodology; *Katrin Balzer, Germany*
- KS1.2 Guidelines for pressure ulcer prevention and treatment: past and present; *Jan Kottner, Germany*
- KS1.3 Credible guidelines need reliable methods: the state of the art; *Holger Schunemann, Canada*

### Key session 2: Pressure ulcer aetiology and the early detection of skin and subdermal damage

*Chairs: Miloslav Klugar, Pierre-Yves Rohan*

- KS2.1 Our contemporary understanding of the aetiology of pressure ulcers/injuries and how to apply it for effective prophylaxis; *Amit Gefen, Israel*
- KS2.2 Linking pressure ulcer aetiology with early pressure ulcer detection – a key to success?; *Zena Moore, Ireland*
- KS2.3 Linking Aetiology with non-invasive measurements to predict skin damage; *Peter Worsley, United Kingdom*

### Key session 3: Why are pressure ulcers associated with quality of care and patient safety?

*Chairs: Jane Nixon, Katrin Balzer*

- KS3.1 The cost-effectiveness of using multi-layer foam dressings in the prevention of pressure ulcers; *Dimitri Beeckman, Belgium*
- KS3.2 Interacting last generation dermal/epidermal substitutes: in search of engraftment rapidity, tissue elasticity, absence of scars and total biodegradability; *Guido Ciprandi, Italy*
- KS3.3 Implementing new standardized workflow at the hospital, as a result of the improvement and patient safety effort regarding pressure ulcer (PU) prevention in the Pandemic COVID19 Intensive Care Unit (ICU); *Camilla Soerensen, Denmark*

### Key session 4: What are recent innovations & advanced interventions in pressure ulcer prevention and treatment?

*Chairs: Andrea Pokorná, Beáta Grešš Halász*

- KS4.1 Skin injuries related with PPE usage among Czech and Slovak health professionals; *Natália Antalová, Czech Republic*
- KS4.2 Costing and cost-effectiveness concerns of the prevention and treatment of pressure ulcer in short term care; *Csaba Dózsa, Hungary*
- KS4.3 Why are pressure ulcers associated with quality of care and patient safety?; *Doris Grinspun, Canada*

### Key session 5: Pressure ulcers in specialist care settings and populations

*Chairs: Andrea Menšíková, Guido Ciprandi*

- KS5.1 Using pressure mapping perioperatively, a quasi-experimental study in Sweden; *Eva Sving, Sweden*
- KS5.2 Double Protection Strategy (DPS): Innovation in preventing PUs in most fragile patients; *Paulo Alves, Portugal*
- KS5.3 PU prevention in acute illness of elderly - strategies in the ER; *Heli Lagus, Finland*

### Key session 6: Preventing and treating pressure ulcers in individuals with long term health conditions

*Chairs: Helen Strapp, Kirsti Ahmajärvi*

- KS6.1 Treating pressure ulcers in individuals with spinal cord injuries; *Marc LeFort, France*
- KS6.2 Pressure ulcer prevention among individuals with spinal cord injuries; *Zena Moore, Ireland*
- KS6.3 Pressure Ulcers in the community; *Pauline Wilson, Ireland*

### Key session 7: Pressure ulcer prevention across the continuum of care – challenges faced in the community

*Chairs: Maarit Ahtiala, Jan Stryja*

- KS7.1 Pressure ulcer prevention in home care - does continuum of care occur?; *Kirsti Ahmajärvi, Finland*
- KS7.2 Patient involvement and understanding of pressure ulcer risk within community settings: shifting the practice paradigm; *Lisa Ledger, United Kingdom*

### Key session 8: How to integrate person centeredness into policy making and practice?

*Chairs: Lucie Charbonneau, Joan-Enric Torra Bou*

- KS8.1 Person-centeredness in policy and practice, what steps can we take?; *Georgina Gethin, Ireland*
- KS8.2 How to integrate a person-centred approach into pressure ulcer prevention practice?; *Lisa Ledger, United Kingdom*
- KS8.3 Innovative approach to involving people with long-term neurological conditions in PU prevention research; *Susanne Coleman, United Kingdom*

### Key session 9: How can e- Health and big data play a role in pressure ulcer prevention and management?

*Chairs: Pierre-Yves Rohan, Jan Kottner*

- KS9.1 How can e- Health and big data play a role in pressure ulcer prevention and management?; *Pierre-Yves Rohan, France*
- KS9.2 Soft tissue biomechanics for pressure ulcer prevention: what challenges for Artificial Intelligence?; *Yohan Payan, France*
- KS9.3 Marrying big databases with machine learning algorithms for artificial intelligence-powered wound care; *Amit Gefen, Israel*

### Key session 10: What are effective strategies for patient, informal carers and non- professional pressure ulcer education?

*Chairs: Beáta Grešš Halász, Andrea Pokorná*

- KS10.1 Patient safety and informal caregivers;  
*Joan-Enric Torra Bou, Spain*
- KS10.2 Evaluating education for pressure ulcer care and prevention: are we measuring the right outcomes?;  
*Tom O' Connor, Ireland*
- KS10.3 What are effective strategies for patient, informal carers and non- professional pressure ulcer education?;  
*Alexandre Rodrigues, Portugal*

### Key session 11: Patients voice

*Chairs: Andrea Pokorná, Maarit Ahtiala*

- KS11.1 The role of the pressure relief cushion in the life of a person with spinal cord injury – patient experience;  
*Věra Kunhartová and Zdeňka Faltýnková, Czech Republic*
- KS11.2 Pressure ulcers in people with spinal cord injury – exploring the patient perspective;  
*Knaerke Soegaard, Denmark*
- KS11.3 Patients and caregivers connect with health professionals in the fight against pressure ulcers;  
*Michaela Tůmová, Czech Republic*

### Key session 12: Hyperbaric oxygen therapy

*Chairs: Amit Gefen, Miloslav Klugar*

- KS12.1 Importance of hyperbaric oxygen therapy in hard-to heal and diabetic foot ulcers;  
*Michal Hájek, Czech Republic*
- KS12.2 Effectiveness of HBOT in hard to-heal ulcers: an umbrella review;  
*Miloslav Klugar, Czech Republic*
- KS12.3 Effectiveness of comprehensive pain management in hard-to heal ulcers: a systematic review;  
*Jitka Klugarová, Czech Republic*



## KS1.1

# Guidelines for pressure ulcer prevention and treatment: past and present

**Jan Kottner<sup>1</sup>**

<sup>1</sup> Charité – Universitätsmedizin Berlin, Berlin, Germany

Clinical Practice Guidelines (CPGs) provide evidence-based recommendations to improve patient care. One of the first CPG about the prevention of pressure ulcers/injuries was published by the Agency for Health Care Policy and Research in the United States in 1992. Since then numerous CPGs have been published and are regularly updated. An international collaboration between the National Pressure Injury Advisory Panel, the Pan Pacific Pressure Injury Alliance, and the European Pressure Ulcer Advisory Panel published the second update of an International GPC of Pressure Ulcer/Injury Prevention and Treatment in 2019, which was widely disseminated. Overall, this indicates an increased interest in evidence-based pressure ulcer/injury management. Current challenges include possible unnecessary duplication efforts, heterogeneous CPG quality, lack of evidence, and implementation problems. Current opportunities include an increasing number of low-risk of bias confirmatory trials and high quality systematic reviews and meta-analysis to be used in future CPGs.

## References

Kottner J, Cuddigan J, Carville K, Balzer K, Berlowitz D, Law S, Litchford M, Mitchell P, Moore Z, Pittman J, Sigauco-Roussel D, Yee CY, Haesler E. Prevention and treatment of pressure ulcers/injuries: The protocol for the second update of the international Clinical Practice Guideline 2019. *J Tissue Viability*. 2019;28(2):51-58.

Kottner J, El Genedy-Kalyoncu M. The uptake of the international pressure ulcer/injury prevention and treatment guidelines in the scientific literature: A systematic analysis of two major citation databases. *J Tissue Viability*. 2022 Aug 7 (Online ahead of print).

U.S. Department of Health and Human Services, Agency for Health Care Policy. *Pressure Ulcers in Adults: Prediction and Prevention – Clinical Practice Guideline Number 3*. Rockville, Maryland, United States of America, 1992.

### KS3.1

## The cost-effectiveness of using multi-layer foam dressings in the prevention of pressure ulcers

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

<sup>1</sup> Ghent University, University Centre for Nursing and Midwifery, Department of Public Health and Primary Care, Ghent, Belgium

There are a growing number of studies that have examined the use of prophylactic dressings and their ability to redistribute pressure and protect the skin from shear and friction damage. The 2021 Belgian study by Beeckman, Fourie et al found that silicone foam dressings reduced the incidence of category 2 or worse pressure ulcers in hospitalised high-risk patients when used in addition to standard care. Results showed a decrease for the sacrum but no statistical difference for the heel and trochanteric areas. In preparation for conducting an economic evaluation for the use of prophylactic dressings in inpatient care in Belgium, a systematic review of the results of other economic evaluations was conducted. The aim was to gain insights into, for example, the structure of the models, the most important variables, missing information, etc. These findings are currently being used to develop the context-specific evaluation. A systematic search was conducted in which various databases were consulted.

Eight studies were included that provided assessments for the United Kingdom (3), United States (3), Australia (2), Germany (1), and Italy (1). Most studies provided results indicating cost savings from the use of multilayer silicone foam dressings. Two studies included a separate analysis for the sacrum, which provided more favourable results compared with the heel. Not surprisingly, the most important variables were the incidence of pressure ulcers and the cost of prevention/dressings. The higher the baseline incidence of pressure ulcers with standard care, the greater the cost savings. Individual studies also identified the number of dressings used, the cost of pressure ulcer treatment, and the frequency and time spent changing dressings as the most influential variables.

In general, all favour the use of multilayer silicone foam dressings. It is important to consider the environment in which these dressings are used. Research is recommended to investigate the criteria for selecting patients for the use of multilayer silicone foam dressings. This is related to pressure ulcer risk, which determines the cost-effectiveness of the intervention. We are addressing this issue in more detail in the ongoing Belgian cost-effectiveness study.

### Reference

Beeckman D, Fourie A, et al.. Silicone adhesive multilayer foam dressings as adjuvant prophylactic therapy to prevent hospital-acquired pressure ulcers: a pragmatic noncommercial multicentre randomized open-label parallel-group medical device trial. *Br J Dermatol*. 2021 Jul;185(1):52-61.

## KS3.2

# Interacting last generation dermal/epidermal substitutes: in search of engraftment rapidity, tissue elasticity, absence of scars, and total biodegradability

**Guido Ciprandi**<sup>1</sup>

<sup>1</sup> Bambino Gesù Children's hospital, Division of Plastic and Maxillofacial Surgery, Rome, Italy

**Background:** During the COVID 19 pandemic, more specific strategies were needed to support children requiring skin grafting because of a lot of complex wounds. Our goal was to identify procedures that reduced operating times, postoperative complications, pain, Family's discomfort and stress and finally the hospital stay. Patient safety, optimal wound bed support, and quick micro debridement with locoregional anesthesia were prioritized. Ultimately a novel acellular fish skin graft (AFSG) derived from north Atlantic Icelandic cod was selected both for the high content of Omega 3-6 with antibacterial properties, and for the rapid integration into the tissues as described in adulthood, but never reported in pediatric ages.

**Methods:** We admitted 15 consecutive pediatric patients with various lesions requiring skin grafting for definitive wound closure. The average age was 8yrs and 9mo (4.1yrs-13.5yrs). All fish skin grafts were applied and bolstered in the operating room following debridement. Twelve patients received negative pressure wound therapy (NPWT) at the same time of the operation, as previously described in association with other skin substitutes..

**Results/Discussion:** Rapid wound healing was observed in all children, with a wound area coverage of 100% and complete healing in 95% of patients (in a 5-year-old patient there was a small leak in a lesional edge). Time until engraftment in NPWT patients was reduced by 50% (12 days instead of 21-25days as previously reported by us). Ten patients received locoregional anesthesia and were discharged after day surgery. The operating time was <60', and no complications or allergic reactions were reported. Excellent pliability of the healed wound was achieved in all children, without signs of itching in the postoperative period. This case series is the first and largest used FSG to treat children with different wound etiology. We attribute the rapid transition to acute wounds status and the new epidermal-dermal complex's good pliability to FSGs' preserved molecular components, including Omega3 and 6.

**Conclusion:** FSG represents an innovative and sustainable solution for pediatric wound care that resulted in shorter surgery time and hospital stay in the COVID-19 pandemic. In addition this tool is an ecofriendly treatment option, biocompatible and fully biodegradable, completely incorporated into the receiving host's structures, with the final result of a wonderful elasticity, both in the coverage of large surfaces and in the case of undermining.

### KS3.3

## Implementing new standardized workflow at the hospital, as a result of the improvement and patient safety effort regarding pressure ulcer (PU) prevention in the Pandemic COVID19 Intensive Care Unit (ICU)

**Camilla Leerskov Sorensen**<sup>1</sup>

<sup>1</sup> Aalborg University Hospital, Department for Quality and Coherence, Aalborg, Denmark

**Introduction:** In the beginning of the pandemic the hospital, I am a pressure ulcer nurse at, established a Pandemic COVID19 ICU. The staff on this ward were gathered from different ICU, different subspecialties, and different located hospitals in the region. They only had their knowledge, in taking care of critically ill patients, in common. The treatment of these patients was different compared to the treatment they were used to provide critical ill patients. Many of the COVID19 patients had to be treated in prone position due to respiratory failure. The staff felt insecure in prone positioning, as it was a relatively unfamiliar procedure. In addition, the equipment, including the type of bed and mattress, was new and the staff had not worked together as a team before.

**Methods:** There was a need in systemizing and building up a structured approach for the pressure ulcer prevention for the COVID19 patient in prone positioning.

- Implemented an air-filled cushion for prone position.
- Established and educated a core of porters with primary function on the pandemic ICU.
- Educational videos about prone positioning, demonstrating the different roles of the professionals in the change of position into prone position.
- Posters showing how to position the patient when in prone, when on the back and in a 30- degree tilt.
- Bags developed in collaboration with the staff in the ICU, prepacked with necessary prophylactic bandages, cushions for prone positioning and printed and laminated posters.
- To support the effort, guideline from Skintghent<sup>1</sup> about prone was implemented.

**Results:** The staff became more secure in handling and nursing the patients in prone position regarding PU prevention, positioning and repositioning. Recognition and use of the different professional skills and competences. Focus on the individual approach in relation to PU prevention. Standard approach regarding the use of protective bandages and relieving cushions. Air-filled cushions and prepacked bags with necessary equipment for prone positioning, became standard at the Pandemic ICU, when prone positioning.

**Conclusions:** The COVID19 ICU is now closed. Implementing prepacked bags succeeded in the specific ICU now located in the same site as the Pandemic ICU ward. It is not yet standard in other ICU's with other subspecialties. Implementation of prepacked bags is successful when developed in collaboration with staff at the ICU where they are to be used. Porters dedicated to specific wards at the hospitals, is being tested widely around wards in the hospital, and is about to become standard.

### References

1: PRONect Practical guidance document: Skin Care Considerations for the Patient in Prone Position - Skint (skintghent.be)



## KS4.1

# Skin injuries related to PPE usage among Czech and Slovak health professionals

Natália Antalová<sup>1</sup>, Abanoub Riad<sup>2</sup>, Andrea Pokorna<sup>1</sup>

<sup>1</sup> Faculty of Medicine, Masaryk University, Department of Health Sciences, Brno, Czech Republic

<sup>2</sup> Faculty of Medicine, Masaryk University, Department of Public Health, Brno, Czech Republic

**Introduction:** The COVID-19 pandemic is a challenge for healthcare systems and healthcare workers. With the increased use of personal protective equipment (PPE), the incidence of device-related pressure ulcers among health professionals has risen starkly. The variety of different types of PPE (face masks, gloves, and respiratory equipment), as well as the extended use of PPE beyond standards in the past, have led to many common dermatologic conditions, including contact/irritant dermatitis, pressure-related skin injury, acneiform eruptions, and moisture-associated skin irritation.

**Methods:** Our cross-sectional questionnaire study aims to evaluate the frequency and duration of PPE usage and the follow-up assessment of the impact of long-term PPE usage on the skin and mucous membrane integrity of healthcare workers in the Czech Republic and Slovakia. The survey was conducted among healthcare staff fighting COVID-19 in the autumn and winter of 2021. The questionnaire items included demographic data, grade of PPE and daily wearing time, skin injury types and preventative measures.

**Results:** A total of 860 respondents answered from the Czech Republic and Slovakia, and 795 responses were valid. The majority were female (729;91.7%), and 64 (8.1%) were males. Among them, 644 (81%) were nursing professionals, 38 (4.8%) physicians and 113 (14.2%) other healthcare professionals (HCPs).

The most frequent prevalence of complications of airway and face protection equipment were postauricular pain/bruises 536 (67.4%), itching of the face, eyelids, lips 354 (44.5%) and acne 293 (36.9%). Pressure ulcers have been noted in 182 (22.9%) cases.

The filtering facepiece 94% (FFP2) was used by 595 (74.8%) HCPs, face-covering by the filtering facepiece 99% (FFP3) was reported in 49 (6.2%) cases, and 421 (53%) respondents have used only one piece of the face protection during the whole working shift. The incidence of complications of the hand protection equipment reported by the HCPs was itching 373 (46.9%), skin redness 246 (30.9%) and skin bleeding 40 (5%).

Majority of Czech and Slovak HCPs (699; 87.9%) reported hyperhidrosis as a PPE-induced complication. The second most often reported PPE-induced complication was a reduced capacity to work (207;26%) more often in 12 hours shift workers (0.016).

**Conclusions:** Our study identified that the skin injuries among healthcare staff are serious, with insufficient prevention and treatment. A comprehensive program will be prepared and implemented.

## References:

*This study was written at Masaryk University as a part of the project "A comprehensive approach to skin and mucosal integrity disorders II." number MUNI/A/1341/2021 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 2021.*

## KS4.2

# Costing and cost-effectiveness concerns of the prevention and treatment of pressure ulcer in short term care

**Csaba Dózsa<sup>1</sup>**

<sup>1</sup> University of Miskolc, Faculty of Health Sciences, Miskolc, Hungary

**Background:** In Hungary, currently, due to the management difficulties and strict budget constraint of publicly funded hospitals, as well as the insufficient number of nurses, the prevention of pressure ulcers (PU, decubitus) does not receive adequate attention and sufficient financial resources. As a consequence, many more wounds and in more severe stages (stage 3 and 4) develop, which causes significant avoidable operational costs and waste of time of human resources in the institutions.

The main objectives of the development of health-economic model (HE model) on PU: Systematization of the costs of decubitus prevention activities, modelling of hospital PU prevention programs, efficiency improvement compared to traditional PU care, and quantification of potential cost savings. Further comprehensive, indirect goal is to gain the attention and support of sectorial and institutional decision-makers in order to introduce and provide adequate financial support for effective decubitus prevention. Provide INPUTs in the development of the national PU prevention and therapy guideline.

**Methodology:** It was conducted a detailed cost data collection in six county hospitals. It also was complemented by in-depth interviews with hospital nursing and economic managers on the issues of wound care, prevention, and framework management within the institutions. Moreover, we reviewed international recommendations, guidelines, and relevant health economics literature in order to systematize cost factors and develop the structure of the Costing and HE model. It consists of Table 1 INPUT table, which collects the health institutions' own cost and other resource data, Table 2 presents the savings results of the calculations, the Table 3 contains the model's "burned-in" probabilities and other constant cost data (decubitus team, preventive and therapeutic details of costs and probabilities), Table 4 contains the decision tree diagram in 3 scenarios.

**Results:** The calculations were developed in 3 scenarios, for one operational year: full prevention model (A), intermediate prevention model (B), therapeutic model without conscious prevention activities (C). According to the HE model we developed, for a typical city or county hospital, in the case of 1,000 patients who underwent a risk assessment and were included in the prevention program within one year, and counting the development or prevention of 2 ulcers on average, the potential savings effect between the C and A scenarios: 70 million HUF, and between the C and B scenarios is: 55 million HUF. A simple ICER calculation was also carried out per each avoided injuries (wounds) in stage III and IV that finally resulting dominant strategies (saving 96,000 HUF and 215.000 HUF consequently). In addition to the above calculations, a multi-level cost structure was developed (direct wound-related costs, patient-level costs, indirect institutional-level costs).

**Discussion:** To follow the scientific literature and other research directions there is a high need for further developments of the HE model with the frequencies of wound types and different locations (such as sacrum, heel), efficiency improvements according to different types of decubitus mattresses, developing a PU prevention model in long-term care facilities (LTC). It also requires to incorporate additional effectiveness indicators into the HE model and calculation of ICER for the avoided hospital staying, and improvements in pain killing and patient satisfaction.

**Conclusion:** Both the Costing and HE model on PU prevention and treatment require further methodological developments. The systematic development of the HC model is necessary because the costs and efficiency issues of PU are quite complex, and newer and newer preventive and therapeutic procedures are appearing, the inclusion of their effects is also indispensable.

## KS5.1

# What effect has intraoperatively pressure mapping on pressure ulcer prevention?

Eva Sving<sup>1,2</sup>, Lena Gunningberg<sup>1</sup>, Carina Bååth<sup>3,4</sup>, Catrine Björn<sup>1,2</sup>

1 Department of Public Health and Caring Sciences, Caring Sciences, Uppsala University, Uppsala, Sweden

2 Centre for Research & Development, Uppsala University/Region Gävleborg, Gävle, Sweden

3 Department of Health Sciences, Faculty of Health, Science and Technology, Karlstad University, Karlstad, Sweden

4 Faculty of Health, Welfare and Organisation, Østfold University College, Fredrikstad, Norway

**Introduction:** Patient undergoing surgery are at high risk of developing a pressure ulcer (1). To position the patient for surgery requires the whole operating room team to work collaboratively. The patient's position must be decided according to the surgical and anaesthetic teams' need for access to the patient, the patient's physical condition, the technical devices used, and the position the patient's tissues can tolerate (2). Continuous pressure mapping allows to in real time see the magnitude of pressure between the patient skin and the bed, called the interface pressure. Can the mapping system be used in an already high technical context? Can the mapping system mapping support and optimize pressure ulcer prevention intraoperatively?

The aim of the studies was to examine the interface pressure intraoperatively, if real-time information intraoperatively reduced the magnitude of pressure and to describe the operating room team member's experiences of having in real-time information of pressure points.

**Methods:** A descriptive study with quantitative and qualitative approach. Included were 49 adult patients. Focus group interviews with operating team members were conducted about their experiences using the system. The data were analyzed with a manifest deductive method.

A quasi-experimental study with an ABA-design. In total, 116 surgical adult patients. Significant tests and a regression model were used to investigate if information in real-time lower the interface pressure.

**Results:** The result shows variations in the interface pressures, from < 50 to 255 mmHg. The interviews ended up in three categories: a) benefits when positioning the patient, b) benefits after surgery and c) need for more knowledge. Preliminary result showed that using information of pressure points affected the interface pressure as well as repositioning's. Further results will be presented during the conference.

**Conclusions:** The pressure mapping system was feasible intraoperatively and could play an important role in preventing pressure ulcers during surgery.

## References:

1. NPIAP/EPUAP/PPPIA. *Prevention and treatment of pressure ulcers: clinical practice guideline*. 3 ed. Perth, Australia: Cambridge Media; 2019.
2. Gefen A, Creehan S, Black J. Critical biomechanical and clinical insights concerning tissue protection when positioning patients in the operating room: a scoping review. *Int Wound J* 2020;17(5):1405–23. <https://doi.org/10.1111/iwj.13408>.
3. Sving E., Bååth C., Gunningberg L & Björn C. 2020. The experiences of operating room teams working with real-time feedback of interface pressure to prevent pressure injuries- A feasibility study. *Perioperative Care and Operating Room Management* 2, 100096

### KS5.3

## PU prevention in acute illness of elderly - strategies in the ER

**Heli Lagus<sup>1</sup>**

*1 Helsinki University Central Hospital, Wound healing center, plastic surgery, Helsinki, Finland*

Busy and crowded emergency department is a challenging environment to identify and to prevent pressure injuries (PI) of the elderly patients at risk of developing PI. The lifesaving interventions are the department priority, and less attention is paid for prevention and basic patient-centered care, but the quality of care should not be neglected.

Due to aging of the population also ERs need to focus more on the specific needs of fragile elderly such as prevention of PIs. In the literature there is increasing evidence that the development of PI worsens the patient outcome (increase morbidity and mortality), increases the length of hospital stay, increases the cost of care, and decreases the quality of care in conjunction with various acute illnesses and trauma of elderly. Older patients with neurological symptoms or reduced general condition may often not be prioritized in ER leading to longer waiting times increasing the risk of PI.

In the past years a few risk assessment tools/ screening tools or their modifications have been introduced for ER use to assess the risk of PIs. Common challenges are that after the implementation their use in practice remains very limited and is not seen important, nor a part of the role of the staff.

As a strategy to change the attitude of the staff, the superiors and influencers should act as opinion leaders and show that preventing pressure injuries is an important part and belongs as an integral part to the work also in the ER. The ER is a part of the chain in the continuum of the care.

Identifying of the patients at high risk of developing pressure injury should be systematic and conducted regularly using a risk assessment tool that is easy to use, and not adding much of the workload and is not too time-consuming. Use of assessment tool should be combined with an operational model or recommended preventative interventions how to prevent pressure injuries in ER on the patients identified at risk of PI. There should also be enough resources available and easy access to pressure relieving equipment, prophylactic dressings, and incontinence pads to follow the local protocol. The use of risk assessment and an operational model should be adopted and implemented in every day working routine and to be part of introduction of every new staff member. There is also a need for ongoing monitoring and informing of staff of the results.



### KS6.3

## Pressure ulcers in the community

**Pauline Wilson<sup>1</sup>**

*1 Royal College of Surgeons in Ireland, St. James Hospital, Dublin, Ireland*

It takes a Village to prevent and manage pressure damage.

This presentation will consider the unique challenges of preventing and managing pressure damage on the lower extremity of people residing in the community using a practical problem-solving approach.

The talk will begin by consider the challenges of preventing and managing pressure damage in the lower extremity. Locations of pressure damage in the lower extremity other than the heel will be presented. The importance of safe yet effective mobility in with the role of footwear will be discussed. Innovative ways to maximise prevention and management practices for those community dwelling individuals both from a practical and evidence-based approach will be presented.

The need for effective communication between care settings and improving the approach to integrated healthcare will be emphasised. The need for educational approaches for all members of the multi-disciplinary team will be highlighted. The need to maximise non-traditional healthcare providers and the role of informal carers will be discussed in both preventative and management practices.

In the 21st century with an ageing population, with multiple co-morbidities, the role of the 'Village' in prevention and management of pressure ulceration needs to be embraced and maximised.

## KS7.1

# Pressure ulcer prevention in home care - does continuum of care occur?

**Kirsti Ahmajärvi<sup>1</sup>**

<sup>1</sup> University of Helsinki and Helsinki University Hospital, Department of general practice and primary health care, Helsinki, Finland

Corner stones of the continuum of care are longitudinal continuity and patient centeredness. Continuity of care can be divided into three categories: Informational continuity, Management continuity and Relational Continuity. Aim of continuity of care is in bridging elements in care pathway – different episodes, interventions by different providers thus bringing the patient consistency and predictable care (1). Length of continuity in GP-patient relationship is associated with lower use of out of office hours- services, fewer acute hospital admissions, and lower mortality (2)

It is known that immobility, perfusion deficiency and skin status are related to pressure ulcers(3). We know that in acute condition and hospital visits the incidence of pressure ulcer is growing (4, 5). Older people spend longer time at emergency department, have more investigations and are more frequently admission to hospital(6). Since mobility and general condition in elderly decreases during hospitalization there is a risk for new pressure ulcers either while hospitalized or after discharged back home.

There has been investigated continuity of care interventions in older people readmission and hospitalization and it seems that those interventions that cover all continuity dimensions are more effective in preventing short term readmissions(7). Phenomenon may be called as transitional care and needed when discharging patient back to home care (8). However, using continuity of care approach in avoiding hospitalization and treating patients by communal care is effective and safe and increases quality of life (9)

Pressure ulcer prevention should start in the very beginning of home care but challenges in home care are in professional, relational, economical and organizational level regarding continuity of care (10).

**Discussion:** There is lack of evidence in pressure ulcer prevention in home care setting(11-13) and how continuity of care is effecting pressure ulcer prevention(14). But we could assume when a person is disabled, because in need of a home care primarily, and has an acute condition with a need of an emergency care and hospitalization, there is a risk for a gap in transitional care. Including individual pressure ulcer treatment and/or prevention care plan while patient is recovering. To assure informational, management and relational continuity in home care it would require stable resources, educating personnel and support from the organization. By improving the transitional care of the elderly, we could improve also pressure ulcer prevention and creating a chance for an implementation strategy for care personnel.

Method: Literature review Ovid Medline, Cochrane Database, Epistemonikos Database for systematic reviews. Keywords: continuity of care, home care, pressure ulcer, prevention

### References:

- Haggerty JL, Reid RJ, Freeman GK, Starfield BH, Adair CE, McKendry R. Continuity of care: a multidisciplinary review. *BMJ*. 2003;327(7425):1219-21.
- Sandvik H, Hetlevik Ø, Blinkenberg J, Hunskaar S. Continuity in general practice as predictor of mortality, acute hospitalisation, and use of out-of-hours care: a registry-based observational study in Norway. *Br J Gen Pract*. 2022;72(715):e84-e90.
- Coleman S, Gorecki C, Nelson EA, Closs SJ, Defloor T, Halfens R, et al. Patient risk factors for pressure ulcer development: systematic review. *Int J Nurs Stud*. 2013;50(7):974-1003.
- Bergquist-Beringer S, Dong L, He J, Dunton N. Pressure ulcers and prevention among acute care hospitals in the United States. *Jt Comm J Qual Patient Saf*. 2013;39(9):404-14.
- Lindgren M, Unosson M, Fredrikson M, Ek AC. Immobility--a major risk factor for development of pressure ulcers among adult hospitalized patients: a prospective study. *Scand J Caring Sci*. 2004;18(1):57-64.
- McCusker J, Bellavance F, Cardin S, Belzile E, Verdon J. Prediction of hospital utilization among elderly patients during the 6 months after an emergency department visit. *Ann Emerg Med*. 2000;36(5):438-45.
- Facchinetti G, D'Angelo D, Piredda M, Petitti T, Matarese M, Oliveti A, et al. Continuity of care interventions for preventing hospital readmission of older people with chronic diseases: A meta-analysis. *Int J Nurs Stud*. 2020;101:103396.
- Coleman EA, Berenson RA. Lost in transition: challenges and opportunities for improving the quality of transitional care. *Ann Intern Med*. 2004;141(7):533-6.
- Crilly J, Chaboyer W, Wallis M. Continuity of care for acutely unwell older adults from nursing homes. *Scand J Caring Sci*. 2006;20(2):122-34.
- Lotfi Fatemi N, Karimi Moonaghi H, Heydari A. Perceived Challenges Faced by Nurses in Home Health Care Setting: A Qualitative Study. *Int J Community Based Nurs Midwifery*. 2019;7(2):118-27.
- Joyce P, Moore ZE, Christie J. Organisation of health services for preventing and treating pressure ulcers. *Cochrane Database Syst Rev*. 2018;12(12):Cd012132.
- Moore ZE, Webster J, Samuriwo R. Wound-care teams for preventing and treating pressure ulcers. *Cochrane Database Syst Rev*. 2015;2015(9):Cd011011.
- Porter-Armstrong AP, Moore ZE, Bradbury I, McDonough S. Education of healthcare professionals for preventing pressure ulcers. *Cochrane Database Syst Rev*. 2018;5(5):Cd011620.
- Coulter A, Entwistle VA, Eccles A, Ryan S, Shepperd S, Perera R. Personalised care planning for adults with chronic or long-term health conditions. *Cochrane Database Syst Rev*. 2015;2015(3):Cd010523.

**KS7.2**

# Patient involvement and understanding of pressure ulcer risk within community settings: shifting the practice paradigm

**Lisa Ledger<sup>1</sup>**<sup>1</sup> University of Derby, Derby, United Kingdom

**Introduction:** Pressure Ulcer (PU) prevention remains a key priority within health and social care settings, with risk assessment and preventative care planning alongside the patient central to prevention. Patient involvement in decision-making has become an increasing focus in recent years, with the governmental shift to personalisation (NHS England, 2020). However, little is known about the involvement of the patient in the PU risk assessment and decision-making process, particularly in community settings. It is important to understand further patient involvement and the potential effect this may have on subsequent adherence to prevention strategies and much of the research to date has largely focused on the professional view rather than the patient own perspective (Ledger et al, 2020). The focus of this research project was to investigate patient involvement and understanding of PU risk and potential factors affecting adherence to advice.

**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, all data was analysed using Thematic Analysis. Purposeful sampling was used to obtain a mix of patients from different age, gender and ethnic groups, living in Birmingham community who were identified and known to the District Nursing Service as 'at risk' of PU with a total of 15 patients recruited to the study.

**Results:** There were 4 key overarching themes to emerge from the study: Patient understanding of risk, Patient related factors, The Nursing Encounter and Nursing Approach. The type of nursing approach employed was found to be critical to active patient involvement and subsequent adherence. These themes will be discussed more fully in the presentation session.

**Conclusion:** This study provides useful insights from a patient perspective around patient understanding of risk and the importance of involvement in decision-making and resultant adherence, which have important implications for healthcare professionals in this sphere of practice.

**References**

NHS England (2020) *Personalised Care Framework* <https://www.england.nhs.uk>

Ledger L, Worsley P, Hope J and Schoonhoven L (2020) *Patient involvement in pressure ulcer prevention and adherence to prevention strategies: An integrative review. International Journal of Nursing Studies* JNS 101 (2020) 103449. Doi.org/10.1016/j.ijnurstu.2019.103449

## KS8.2

# How to integrate a person-centered approach into pressure ulcer prevention practice?

**Lisa Ledger**<sup>1</sup>

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

**Introduction:** Prevention of pressure ulcers 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 a shift toward personalisation and 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). Increased patient involvement is at the centre of contemporary health-care policy in which quality of care improvement is emphasised, with nursing practice evolving and values transforming from biomedical to biopsychosocial aspects. This transformation includes a movement from illness orientation to health that is seen as interdependency of important physical, mental and socio-economic factors. 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 considered PU prevention from the perspective of the patient and provides useful insights into how a person-centred approach can be adopted.

**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 on the importance of the type of nursing approach used in encouraging person-centred practice. The type of nursing approach employed was found to be critical to active patient involvement and subsequent adherence.

**Conclusion:** This study provides useful insights from a patient perspective around patient understanding of risk and the importance of involvement in decision-making and how a person-centred approach can be adopted.

## References

NHS England (2020) *Personalised Care Framework* <https://www.england.nhs.uk>

Ledger L, Worsley P, Hope J and Schoonhoven L (2020) *Patient involvement in pressure ulcer prevention and adherence to prevention strategies: An integrative review. International Journal of Nursing Studies* 101 (2020) 103449. Doi.org/10.1016/j.ijnurstu.2019.103449



### KS8.3

## Innovative approach to involving people with long-term neurological conditions in PU prevention research

**Susanne Coleman**<sup>1</sup>

<sup>1</sup> Clinical Trials Research Unit, University of Leeds, Leeds, United Kingdom

**Introduction:** Improved life expectancy, changes to health/social care organisation, societal changes in attitudes to living with disability and personalised care funding has led to increasing numbers of people with Long-term Neurological Conditions (LTNCs) (e.g. Multiple Sclerosis, Spina Bifida, Spinal Cord Injury and Muscular Dystrophy) living and working while managing complex health needs, as well as fulfilling other roles in the family and society at large [1]. They often self-manage their care needs independently at home, with or without support from informal carers or Paid Personal Assistants (PPAs) or input from health/social services. Despite their high risk of PU development, which leads to major QOL deficits, exposure to professionals with PU expertise is lacking. Therefore, it is vital that people with LTNC and their informal carers or PPAs are able to recognise and react to changes in risk and negotiate care escalation.

**Methods:** We will use a partnership approach based in the participatory research paradigm with extensive input from those whose lives are the focus of the research [2,3] to develop a systems map and Theory of Change (ToC) pathway to underpin a multi-component intervention to support PU risk identification and management. This incorporate 4 work packages:

WP1- Development of two co-operative Inquiry Groups (CIGs) to underpin and support the design, management, data collection, analysis and conclusions of the work and explore their experience of identifying and self-managing PU risk.

WP2- Peer-to-peer Interviews, to explore PU prevention/risk management with other people with LTNCs, informal carers and Paid Personal Assistants.

WP3- Stakeholder engagement to explore the perspectives of professional and strategic partners on PU prevention at home.

WP4- Participatory Systems Mapping and Theory of Change (ToC) Pathway development workshop, to provide a visual representation of the systems associated PU prevention from the perspective of key stakeholders (from WP1 and 3).

Analysis will be conducted by the CIGs, using a framework approach to data co-analysis, which has been used successfully in other research.

**Results:** The study will underpin the required intervention components, preconditions, contextual requirements, long-term outcomes, impacts and explanatory rationale and assumptions.

**Conclusions:** We are using an innovative participatory approach to improve self-management and provide methodological advancement.

### References

[1] Jackson K. *Disability and Rehabilitation*, 2019 41(32)

[2] O’Cathain, et al. *Taxonomy of approaches to developing interventions to improve health: PFS 2019 5*, 41

[3]. Abma, T et al *Participatory Research for Health and Social Well-Being*. Switzerland Singer 2019.

*This study/project is funded by the NIHR HS&DR Project: NIHR134029 - Pressure Ulcer Prevention at Home: Pressure ulcer prevention for people with long-term neurological conditions (LTNCs) who self-manage care and live at home. A participatory intervention development approach. The views expressed are those of the author(s) and not necessarily those of the NIHR or the Department of Health and Social Care.*

### KS10.3

## What are effective strategies for patient, informal carers and non-professional pressure ulcer education?

**Alexandre Rodrigues<sup>1</sup>**

<sup>1</sup> University of Aveiro, Aveiro, Portugal

A person with a chronic wound requires dedicated care not only to the wound itself but also to the overall situation. Ulcer pressure prevention and treatment are directly related to the general care provided to the individual, having the caregiver a leading role in the complete situation evolution.

At the home environment, this type of care is provided by the family caregiver or by a non-formal caregiver who needs specific monitoring, from the specific needs identification until the care guidance.

Caregiver's ability assessment for injured person care must be considered a relevant intervention since it will define the training and guidance in building up knowledge to provide caregiving.

Initial main strategies to involve the caregiver are: wound physiopathology information; wound evolution and caregiving activities organization. After this initial phase, it's important to assure a proper guidance to the caregiver in prioritizing caregiving activities and individual management dedicated time.

In preventing ulcer pressure, it becomes fundamental to prepare family caregivers, by guiding them through the theoretical components regarding preventive caregiving but also by practical training execution.

When the caregiver is not prepared for wound contact, additional teaching strategies become necessary to execute dressing activities without having direct contact with the wound and to learn wound exposure habituation strategies.

For the caregiver quality of life assurance and burnout avoidance it is important to support and guide caregivers for health and social support, the need of a secondary caregiver and task delegation; rest periods strict definition and positive performance focus.

Very often, caregiver needs support from another family or non family member, having this secondary caregiver also the need for preparation and guidance in order to be an effective support for the ulcer pressure caregiving to the one in need.

## KS11.1

# The role of the pressure relief cushion in the life of a person with spinal cord injury - patient experience

**Věra Kunhartová<sup>1</sup>, Zdeňka Faltýnková<sup>2</sup>**

<sup>1</sup> *Zdravý design, Head designer, Praha 10 - Malešice, Czech Republic*

<sup>2</sup> *CZEPA, Praha 9, Czech Republic*

**Introduction:** Improved quality of life for wheelchair users, protection of their health, and unique technologies. The main reasons for which the new anti-decubitus seat was designed.

**Methods:** In collaboration with wheelchair users, occupational therapists, and physiotherapists, testing and developing workshops have been made. At these workshops, a lot of problems with current anti-decubitus wheelchair seats have been named and the main features needed to be included in the seat for good pressure ulcers prevention and the sitting posture correction. For a long period, the role of the product designer has been to focus on the development of health technology and compensatory aids. For the new anti-decubitus seat, an innovative application of FDM 3D print technology has been chosen, thus changing the routine way of producing compensatory aids for wheelchair users.

**Results:** The first fully adjustable anti-decubitus seat on the market works as a set of construction blocks. Upon specialized medical examination, each user obtains an individual setting in accordance with his personal anatomy, along with the possibility of re-adjustment complying with his current state of health. It is possible to replace just single parts, if necessary, and so extend the lifespan of the whole product. The combination of four different material layers, the selection and testing of which has been done with the utmost care, will provide anti-decubitus protection as well as a solution to very complicated cases of postural deformities. Modern technologies such as 3D printing enable financially as well as ecologically user-friendly production and make individual aids more accessible to a larger number of users. The latest materials and individual approaches have in this manner combined into a light, breathable and easily maintainable seat which not only looks well but first and foremost helps its users and makes their life easier.



**Conclusions:** The product is only an example of the way, how important are current technologies and materials of compensatory aids in contributing to an easier life for its users as well as to their better employment possibilities, so helping to reduce costs for the social system.

### References:

[ibelladesign.cz](http://ibelladesign.cz), [zdravydesign.com](http://zdravydesign.com), [czepa.cz](http://czepa.cz)

## KS11.2

# Pressure ulcers in people with spinal cord injury - exploring the patient perspective

***Knaerke Soegaard***<sup>1</sup>

<sup>1</sup> *Odense University Hospital, Department of Plastic Surgery, Odense, Denmark*

**Introduction:** People with spinal cord injuries are in a lifelong increased risk of developing pressure ulcers and up to 95% are having a pressure ulcer during their lifetime. Healing of a deep pressure ulcer is prolong and some wounds never heal. The pressure ulcer treatment and recommended bedrest to relieve the area with wound has a high impact on individuals' life.

**Objective:** To explore the perspectives and experiences of people with spinal cord injuries of having a pressure ulcer.

**Method:** Qualitative individual interviews transcribed and analyzed and interpret with a phenomenological-hermeneutic approach inspired by Ricoeur.

**Results:** Ten individual interviews were conducted. The analysis and interpretation revealed patients' experiences and perspectives on having a pressure ulcer, its impact on life, and the challenges of bedrest.

## KS12.1

# Importance of HBOT in hard to-heal and diabetes foot ulcers

Michal Hajek<sup>1,2</sup>, Jitka Klugarová<sup>3,4</sup>, Dittmar Chmelar<sup>2</sup>, Andrea Pokorna<sup>3,4,5</sup>, Miloslav Klugar<sup>3,4</sup>

1 Ostrava City Hospital, Centre of Hyperbaric Medicine, Ostrava, Czech Republic

2 Faculty of Medicine, Ostrava University, Department of Biomedical Sciences, Ostrava, Czech Republic

3 Faculty of Medicine, Masaryk University, The Czech National Centre for Evidence-Based Healthcare and Knowledge Translation (Cochrane Czech Republic, Czech Republic CEBHC; JBI Centre of Excellence, Masaryk University GRADE Centre), Institute of Biostatistics and Analyses, Brno, Czech Republic

4 Czech Health Research Council, Prague, Czech Republic

5 Faculty of Medicine, Masaryk University, Department of Nursing and Midwifery, Brno, Czech Republic

**Introduction:** Hard to-heal ulcers, especially in diabetes, and critical limb ischemia are the source of major problems and financial costs for both patients and health systems. The amputation occurs in about 20% of cases of diabetic foot ulcers (DFU). The incidence of amputations in this patient population is 15-times higher and make up 50-70% of all non-traumatic amputations. Despite advances in improving diabetes care, there is still a need to identify reserves in the form of new therapeutic strategies and methods. Hyperbaric oxygen therapy (HBOT), according to the current evidence, seems to reduce the need for amputation and increase the number of completely healed wounds.

**Methods:** There are a large number of clinical studies providing the highest level of scientific evidence, clinical and pharmacoeconomic systematic reviews, demonstrating the efficacy of HBOT in hard to-heal ulcers. The aim of the paper is to summarize current recommendations for the treatment of hard to-heal ulcers by HBOT according to the 10th European Consensus Conference which was held in 2016 in Lille.

**Results:** Current selected recommendations for the treatment of hard to-heal ulcers by HBOT according to the 10th European Consensus Conference ECHM (European Commission for Hyperbaric Medicine) 2016 are listed in Table 1.

**Conclusions:** HBOT is involved in accelerating the healing of hard to-heal ulcers. A sufficient number of moderate-quality clinical and economic studies proving the effect of HBOT in the treatment of DFU has been published, as well as the saving of considerable financial resources from the public health insurance and the social system. Despite these results, the HBOT has not yet been accepted by clinicians as much as it deserves.

**Acknowledgments:** The authors have no conflict of interest to disclose. This study was supported by the Ministry of Health of the Czech Republic, grant 20-09-00094 with the title "Cost effectiveness analyses of pressure ulcers treatment – determinants of care", and "Strategic Partnership in Innovation and Development of Evidence-Based Healthcare" (2019-1-CZ01-KA202-061350) project. All rights reserved.

Table 1. Selected recommendations for the treatment of hard to-heal ulcers by HBOT according to the 10th European Consensus Conference ECHM (European Commission for Hyperbaric Medicine) 2016

Clinical situation, condition and procedure	Type of recommendation, level of evidence
The use of HBOT in patients with ulcerations within the DFU is suggested;	Type 2 recommendation, level of evidence B
The use of HBOT in hard to-heal ischemic ulcers is suggested;	Type 2 recommendation, level of evidence C
It is recommended to apply HBOT in hard to-heal ischemic ulcers without the possibility of revascularization or after vascular surgery:	
In patients with diabetes, the use of HBOT in chronic critical ischaemia is recommended if the transcutaneous oxygen (T <sub>cp</sub> O <sub>2</sub> ) in hyperbaric conditions (2.5 ATA, 100% O <sub>2</sub> ) is higher than 100 mm Hg;	Type I recommendation, level of evidence A
In patients with arteriosclerosis, the use of HBOT in chronic critical ischaemia is recommended if the T <sub>cp</sub> O <sub>2</sub> in hyperbaric conditions is higher than 50 mm Hg;	Type 2 recommendation, level of evidence B
Due to the unavailability of the T <sub>cp</sub> O <sub>2</sub> method under hyperbaric conditions in many centers, it is suggested to use HBOT in DFU (Wagner's grade 3 and higher), which does not respond to adequate primary wound care for 4 weeks;	Type 2 recommendation, level of evidence B
The T <sub>cp</sub> O <sub>2</sub> method is recommended as the best technique for monitoring of local oxygen partial pressure and for selecting patients suitable for HBOT;	Type 1 recommendation, level of evidence C

**KS12.2**

# Effectiveness of hyperbaric oxygen therapy in hard-to-heal ulcers: an umbrella review

**Miloslav Klugar**<sup>1,2</sup>, **Andrea Pokorna**<sup>1,3</sup>, **Michal Hajek**<sup>4,5</sup>, **Jitka Klugarová**<sup>1,2</sup>

1 Faculty of Medicine, Masaryk University, The Czech National Centre for Evidence-Based Healthcare and Knowledge Translation (Cochrane Czech Republic, Czech Republic CEBHC; JBI Centre of Excellence, Masaryk University GRADE Centre), Institute of Biostatistics and Analyses, Brno, Czech Republic

2 Czech Health Research Council, Prague, Czech Republic

3 Faculty of Medicine, Masaryk University, Department of Nursing and Midwifery, Brno, Czech Republic

4 Ostrava City Hospital, Centre of Hyperbaric Medicine, Ostrava, Czech Republic

5 Faculty of Medicine, Ostrava University, Department of Biomedical Sciences, Ostrava, Czech Republic

**Introduction:** The objective of this umbrella review was to investigate the effectiveness of hyperbaric oxygen therapy (HBO) in hard-to-heal ulcers. Hard-to-heal ulcers are chronic conditions most commonly caused by venous or arterial insufficiency or a combination which results in inadequate perfusion and low oxygen consumption. Usually, is the prevalence in population approximately 0.16% to 1.42% in the adult population but nearly triples in those over 65 years of age. It is known during HBO that it leads to hyperoxygenation – multiple increases in oxygen partial pressure in both blood and tissues occurs. The supply and availability of oxygen in the tissues is substantially increased. HBO has been successfully used as adjunctive therapy in wound healing.

**Methods:** Umbrella review was developed according to the Joanna Briggs Institute (JBI) methodology. The search using very sensitive search strategy was performed 6. 4. 2020 in ten databases (Cochrane Database of Systematic Reviews, Pubmed, EMBASE, CINAHL, PsycINFO, LILACS, Database of Abstracts of Reviews of Effects, The Campbell Collaboration online library, JBI Evidence Synthesis, EPPI-Centre Evidence Library). Title/abstract analyses, full-text analyses, risk of bias and data extraction was developed independently by two authors MK and JK.

**Results:** Four hundred eighty potentially relevant systematic reviews were retrieved, and only twelve were included into the umbrella review. Most recent work of those above mentioned are publications from 2020, which are both focused on the effectiveness of HBO in the treatment of diabetic ulcers and prevention of amputation. Majority of retrieved systematic reviews are evaluating the effectiveness of HBO in diabetic ulcerations. Risk of bias in retrieved studies varies between moderate and high.

**Conclusions:** Umbrella review shows the potential of HBO as adjuvant therapy for diabetic ulcerations and positive effect is also seen in the prevention of amputations. However, due to the high risk of bias, inconsistency and impression of included studies is the certainty of this results low. More unbiased primary and secondary research with sufficient statistical power is needed to shed light on the effectiveness of HBO not only in diabetic ulcerations but on the whole area of hard-to-heal ulcers.

**Acknowledgement:** This work was supported by the Ministry of Health of the Czech Republic, grant 20-09-00094 with the title “Cost-effectiveness analyses of pressure ulcers treatment – determinants of care”, and supported by projects “Clinical Practice Guidelines” number CZ.03.2.63/0.0/0.0/15\_039/0008221 and “Strategic Partnership in Innovation and Development of Evidence-Based Healthcare” (2019-1-CZ01-KA202-061350). All rights reserved.



### KS12.3

## Effectiveness of comprehensive pain management in hard-to heal ulcers: importance of systematic review in Healthcare

*Jitka Klugarová<sup>1,2</sup>, Andrea Pokorna<sup>1,2,3</sup>, Michal Hajek<sup>4,5</sup>, Miloslav Klugar<sup>1,2</sup>*

*1 Faculty of Medicine, Masaryk University, The Czech National Centre for Evidence-Based Healthcare and Knowledge Translation (Cochrane Czech Republic, Czech Republic CEBHC; JBI Centre of Excellence, Masaryk University GRADE Centre), Institute of Biostatistics and Analyses, Brno, Czech Republic*

*2 Czech Health Research Council, Prague, Czech Republic*

*3 Faculty of Medicine, Masaryk University, Department of Nursing and Midwifery, Brno, Czech Republic*

*4 Faculty of Medicine, Ostrava University, Department of Biomedical Sciences, Ostrava, Czech Republic*

*5 Ostrava City Hospital, Centre of Hyperbaric Medicine, Ostrava, Czech Republic*

**Introduction:** Hard-to heal ulcers are a prevalent problem associated with pain and significant discomfort, which requires timely, comprehensive, and especially systemic solution. According to epidemiological analysis, in the Czech Republic there were hospitalised between 2007 and 2015 in average 70 609 patients per year with hard-to heal ulcers (from total 2 219 898 hospitalised patients). Based on preliminary search in databases Medline, Epistemonikos, Cochrane library, Joanna Briggs Institute database and PROSPERO, in the current literature there is no systematic review dealing with the effectiveness of comprehensive pain management in patients with hard-to-heal ulcers.

The main aim of this presentation is to highlight the necessity of conducting high quality systematic reviews in the area of wound care because there is still high heterogeneity, especially in case of hard-to heal wound care among health care facilities (not only in the Czech Republic).

**Methods:** Systematic review (SR), as a secondary research, synthesizes the best available evidence from primary studies and bringing new and more robust scientific evidence. The essential part of every high quality study including SR is its justification based on preliminary search and ideally on epidemiological analysis; and also a priori published protocol specifying in detail each step of planned research before its beginning. There are lot of approaches and schools how to conduct SR defined by Cochrane Collaboration, Joanna Briggs Institute, etc., however, the standardised minimum for SR conducting is defined in PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis) publication guideline.

**Results:** This SR is being conducted based on PRISMA guideline and a priori published protocol, including; 1. an answerable review question "What is the effectiveness of comprehensive pain management in hospitalised patients with hard-to heal ulcer?"; 2. specified inclusion criteria (see Table 1); 3. a specification of comprehensive three step systematic search aimed to find published and also unpublished literature; 4. description of independent two phase paper screening; 5. assessment of methodological quality of included papers into SR using standardised checklist, 6. extraction of data from primary studies using standardised instrument, and 7. process of pooling data using meta-analysis if possible.

**Conclusions:** Systematic review, if it is done "properly", brings the highest level of evidence and in the best scenario forms the bases of the trustworthy clinical practice guideline improving the clinical practice.

**Acknowledgment:** This work was supported by the Ministry of Health of the Czech Republic, grant 20-09-00094 with the title "Cost effectiveness analyses of pressure ulcers treatment – determinants of care", and supported by projects "Clinical Practice Guidelines" number CZ.03.2.63/0.0/0.0/15\_039/0008221 and "Strategic Partnership in Innovation and Development of Evidence-Based Healthcare" (2019-1-CZ01-KA202-061350). All rights reserved.

Table 1. Inclusion criteria in PICO format

<b>Patient</b>	Adults (≥ 18 let) hospitalised with hard to heal ulcer excluding patients in community or palliative care.
<b>Intervention</b>	Comprehensive pain management including objective assessment, pharmacological and non-pharmacological procedures in pain management.
<b>Comparison</b>	Standard pain management
<b>Outcomes</b>	Primary: pain (assessment of intensity and character using standardised instruments) Secondary: Quality of life, morbidity, mortality, complications (eating disorders, sleep disorders, dysphoria, depression, social isolation, etc.), length of hospitalisation, healing time, quality of care in pain management from the patient's point of view: PROM's and PREM's.
<b>Design of studies</b>	Included: experimental and quasi-experimental studies, analytical observational studies Excluded: descriptonal studies and all types of review



### EPUAP - EWMA joint session: Challenges and benefits for education

*Chairs: Jan Kottner, Beáta Grešš Halász*

EWMA wound curricula for healthcare professionals: achievements and next steps; *Andrea Pokorná, Czech Republic*

Development of the EPUAP pressure ulcer curriculum for professionals responsible for quality and improvement; *Beáta Grešš Halász, Slovak Republic*

### Award session: EPUAP investigator awards

*Chair: Dimitri Beeckman*

A life devoted to children: a novel leadership model in pediatric wound care intensities during changing times; *Guido Ciprandi, Italy*

Developing algorithm based on activity and mobility for pressure ulcer risk among older adult residents: Implications for evidence-based practice; *Pinar Avsar, Ireland*

Understanding risk factors: research, clinical translation and impact; *Jane Nixon, United Kingdom*

Post-Pressure Prevention; *Lisa Tucker-Kellogg, Singapore*

### Awards session: Quality Improvement projects

*Chairs: Zena Moore, Steven Smet*

Development of the PRONect practice guidance document regarding skin care considerations for the patient in the prone position: a gap analysis study and international expert collaboration; *Anika Fourie*

A quality approach to pressure injury/ulcer prevention using SEM Assessments In every day clinical practice; *Vignesh Iyer*

Making proning easy; *Irena Pukiova*

# Development of the Pressure Ulcer Curriculum for Professionals Responsible for Quality and Improvement

**Beáta Greš Halász<sup>1</sup>, Andrea Pokorná<sup>2</sup>**

<sup>1</sup> Pavol Jozef Šafárik University in Košice, Košice, Slovakia

<sup>2</sup> Masaryk University in Brno, Brno, Czech Republic

**Introduction:** Professionals responsible for pressure ulcer (PU) quality improvement and PU monitoring play a key role in supporting and educating clinicians and developing strategies to meet required structural, process, and outcome quality indicators (1). The role, position and competencies of these specialists may vary internationally.

**Methods:** In May 2020, the educational committee of EPUAP started a discussion regarding the possibilities of developing educational material for professionals who focus on quality improvement and data monitoring in the domain of PU prevention and management. A small working group of EPUAP trustees with expertise in clinical practice, education and research was created. Drafts were presented, evaluated and optimized at each trimestral educational committee meeting in 2020 and 2021, and the EPUAP executive board conducted a final review and approval in 2022.

**Results:** The idea for this work were the curriculum for wound management for postgraduate students developed by EWMA (2), and NHS PU core Curriculum (3). The curriculum is designed for experts in PU management following guidelines for curriculum development. Bloom's taxonomy was used for learning outcomes definition in different modules (4). Since the implementation could vary according to the national need (legislation, system of professional education), it is based on the recommendations and good practice statements in the 2019 EPUAP guideline (1).

**Conclusions:** The special recommendations and related knowledge and skills are integrated within the different modules and can be adapted and adjusted to the quality indicators for PU in each country. The curriculum is designed to ensure that specialists have sufficient knowledge and expertise to modify and optimize PU prevention and management protocols in clinical practice, considering the required quality indicators. Specialists will have the necessary skills to transfer their knowledge and experience to the other multidisciplinary teams in different clinical settings.

## References:

- (1) EPUAP/NPIAP/PPPIA. (2019) *Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline. The International Guideline. EPUAP/NPIAP/PPPIA.*
- (2) Holloway S, Pokorná A, Janssen A, Ousey K, Probst S. (2020) *Wound curriculum for nurses: Postregistration qualification wound management – European Qualification Framework level 7. J Wound Care, 29(7 Sup7).*
- (3) *NHS Improvement (2018) Pressure Ulcer Core Curriculum. NHS: London. 58 p.*
- (4) Tractenberg RE, Lindvall JM, Attwood TK, Via A. (2020, April 2) *Preprint. Guidelines for curriculum and course development in higher education and training. Published in the Open Archive of the Social Sciences (SocArXiv), DOI 10.31235/osf.io/7qeht.*

# A life devoted to children: a novel leadership model in pediatric wound care intensities during changing times

**Guido Ciprandi<sup>1</sup>**

1 Bambino Gesù Children's hospital, Division of Plastic and Maxillofacial Surgery, Rome, Italy

How many times, to appear cultured and intelligent in the eyes of others, we have shown off quotes and aphorisms belonging to great authors of the past. There are those who spend whole days on the internet to "plunder" witty phrases of famous personalities.

This is why a title can never be a random choice, it cannot be copied or subtracted from others, because the title must make everyone understand their open-mindedness, that sense of intelligence that helps to be able to see things even from another perspective.

And the title keywords are therefore Life, Children, Leader, Model, Wound Care, Intensity, Changing times. Seven words. Seven steps, like those of a ladder, like the lives of cats, the deadly sins, the colors of the rainbow, the notes, the vowels.

Life is learning to love (Abbe 'Pierre) and it is something that cannot be explained, it is lived (Luigi Pirandello). And when I realized that wounds were a challenge because it meant treating complex, often "special" Children and fighting at the same time with pain, with emotion, with chronic injuries, with infections, with fears and going against the tradition of a medicine that is too universal and conventional and without flashes of light for small patients, I accepted to be the pediatric surgeon of wound care.

So life made me become a Leader but just one step before I was an inventor, at the end of the nineties, and then a voice in the desert, an expert on the subject, an unscrupulous pediatrician, a pioneer but of what when very few in the world talked about injuries in children and pressure ulcers in children and some of you here one day said to me "but why are you almost alone talking about pediatric injuries? But do they really exist?"

Spreading the interest in a Pediatric model for a WOUND CARE has been the leitmotif of my human and professional life and therefore being a Leader and creating a model. Forming a team, joining the guidelines, in dedicated conferences, founding a society for pediatric wound care (ISPeW), forging links with sector specialists and forcing them to insert the vision of this complex world into works done in Team, to make the first book on neonatal and pediatric wound care in just eight months. And for this I thank all the 90 Authors who have worked in the fields of competence.

And I especially thank EPUAP, which is not a company but a world, the one that made me work even from the beginning without any distrust for the arguments I proposed.

The sixth word is Intensity and encompasses many concepts, the difficulty of being intense, profound, of having the attention and constancy in oneself, the power and concentration in looking for a solution, the passion and enthusiasm in studying what is unknown and the vehemence in transmitting everything to every colleague, to every nurse, doctor, professional. The intensity in always involving everyone and teaching to work as a team and in a specific way have given a role to this intensity.

And Times are Changing and today is the time to heal the wounds of micropreemies, to think about precision pediatric wound care, to adopt biodegradable materials, to think about the fourth dimension of children. And we still have to treat extensive injuries, pressure injuries in children with rare diseases and increasingly come to meet all families because times are changing as Bob Dylan said several years ago.

### Free paper session 1: Innovative approaches in clinical research (prevention and treatment)

Chairs: *Ida Marie Bredesen, Marie-Line Gaubert-Dahan*

- 1.1 Core outcome domains for pressure ulcer/injury prevention trials; *Jan Kottner, Germany*
- 1.2 The physiological efficacy of lateral pressure equalisation technology for the prevention of pressure ulcers in seated individuals; *Colin Boyle, Ireland*
- 1.3 Paper device for rapid detection of myeloperoxidase in wound fluids; *Guillem Ferreres Cabanes, Spain*
- 1.4 The relationship between sub-epidermal moisture measurements and inflammatory markers in the early identification of pressure ulcers; *Natalie McEvoy, Ireland*
- 1.5 Comparison of two skin protection regimes for the prevention of incontinence-associated dermatitis in geriatric care: A study protocol for a randomized controlled parallel group exploratory trial; *Monira El Genedy-Kalyoncu, Germany*
- 1.6 Immediate effects after shock wave therapy application in pressure ulcers: a preliminary randomised controlled study; *Robert Dymarek, Poland*

### Free paper session 2: Basic science: Biomechanics, mechanobiology and aetiology

Chairs: *Tom O'Connor, Joan-Enric Torra Bou*

- 2.1 Magnetic Resonance Imaging and computational modelling to predict the soft tissue response of the face when interacting with a respirator; *Bethany Keenan, United Kingdom*
- 2.2 Cell mechanobiology in the context of wound healing; *Daphne Weihs, Israel*
- 2.3 Internal strains reduction in soft tissues surrounding a pressure ulcer using a new bi-layer dressing; *Nolwenn Fougeron, France*
- 2.4 Failure of phagocytosis during the Impaired healing of pressure ulcers; *Lisa Tucker-Kellogg, United States*

### Free paper session 3: Interdisciplinary collaboration and education for pressure ulcer care

Chairs: *Miloslav Klugar, Alison Porter-Armstrong*

- 3.1 A rapid response to preventing healthcare staff facial pressure ulcers in COVID-19 care settings; *Zena Moore, Ireland*
- 3.2 Creation and Evaluation of Face-Specific Measurement Data with Three-Dimensional Imaging Method for Face Masks; *Ayişe Karadağ, Turkey*
- 3.3 Change Management in Pressure Ulcer Nursing Practice; *Abdulaziz Binkanan, Saudi Arabia*

### Free paper session 4: Pressure ulcer prevention and management in specialist care settings

Chairs: *Simona Saibertová, Peter Worsley*

- 4.1 A randomised controlled trial of the effectiveness of multi-layer silicone foam dressings for the prevention of sacral pressure injuries in patients undergoing general surgery; *Hyunjung Yeo, Rep. of South Korea*
- 4.2 The pressure injury evidence in spinal cord injured patients at spinal unit of department of traumatology at University Hospital Brno 2013-2021; *Lia Vašíčková, Czech Republic*
- 4.3 Pressure ulcer risk assessment scales designed for adult intensive care patients - risk factors and predictive validity of the scales: A systematic review; *Maarit Ahtiala, Finland*
- 4.4 Prevention of skin injuries in patients with acute respiratory distress syndrome during the COVID-19 pandemic; *Elizabeth Faust, United States*
- 4.5 The impact of prone positioning on the incidence of pressure injuries in adult intensive care unit patients: A meta review; *Pinar Avsar, Ireland*
- 4.6 Implementation of evidence-based SKIN CARE practices in nursing home residents: Results of a mixed methods process evaluation alongside the SKINCARE trial; *Katrin Balzer, Germany*

### Free paper session 5: Pressure ulcers: Health economics, safety and quality of

Chairs: *Alison Porter-Armstrong, Zena Moore*

- 5.1 Solving the Health Economic Burden of Pressure Ulcers in the United Kingdom Using SEM Assessment Technology; *Martin Burns, United States*
- 5.2 What is the economic impact of pressure ulcers among patients in intensive care units? A systematic review; *Natalie McEvoy, Ireland*
- 5.3 Pressure Injury Prevalence and Practice Improvements in Nursing (PIPPIN study): A realist evaluation of pressure injury prevention practices in an Australian hospital; *Jenny Sim, Australia*
- 5.4 Interventions for maintaining skin integrity in end-of-life care: a systematic review; *Charlotte Raepsaet, Belgium*
- 5.5 What the first National study of pressure ulcer prevalence and incidence in acute inpatient care told us about safety and quality of care?; *Tiina Kortteisto, Finland*

### Free paper session 6: Pressure ulcers: Implementation science and education

*Chairs: Steven Smet, Kirsti Ahmajärvi*

- 6.1 The Use of PURPOSE-T in Clinical Practice;  
*Susanne Coleman, United Kingdom*
- 6.2 Skin hydration measurement and the prediction of the early development of pressure ulcers among at risk adults: A systematic review; *Hannah Wilson, Ireland*
- 6.3 Implementation of carebundle in a clinical setting;  
*Britt Hansen, Denmark*
- 6.4 The Effect of Educational Program on Nurses' Knowledge About Pressure Ulcer; *Abdulaziz Binkanan, Saudi Arabia*

### Free paper session 7: Pressure ulcers: Patient safety, quality of care and policy

*Chairs: Beáta Grešš Halász, Dimitri Beeckman*

- 7.1 I cannot "unhear her cries" or "unsee what I saw." Pressure injuries in Aged Care. A synopsis of the interim report of the Australian Royal Commission into Aged Care Quality and Safety; *Suzanne Kapp, Australia*
- 7.2 Dressings and topical agents for preventing pressure ulcers; *Pinar Avsar, Ireland*
- 7.3 Development of a reporting tool for Medical Device Related Pressure Ulcers: Cognitive pre-testing, usability, and feasibility assessment; *Peter Worsley, United Kingdom*
- 7.4 What is the impact of sub epidermal moisture (SEM) measurement and targeted pressure ulcer prevention, versus visual skin assessment and usual care, on mean SEM delta scores and early pressure ulcer development; *Pinar Avsar, Ireland*
- 7.5 Enhancing pressure injury prevention bundle during COVID 19 pandemic to reduce hospital acquired pressure injury incidence and prevalence rate; *Wilnora Cascolan, Saudi Arabia*
- 7.6 What are the effects of vasopressor agents on the development of pressure ulcers in critically ill patients in intensive care units? a systematic review; *Natalie McEvoy, Ireland*

### Free paper session 8: Technologies for treating and monitoring wounds

*Chairs: Helen Strapp, Jitka Klugarová*

- 8.1 Mini-invasive drainages and irrigation of any infected ulcer recess avoid exudate stasis, reduce recurrence and allow better rehabilitation; *Marco Cavallini, Italy*
- 8.2 The integration of sensor technology in disposable bodyworn: a promising pathway in the prevention and reduction of skin damage; *Charlotte Raepsaet, Belgium*
- 8.3 Subdermal injection of hyaluronate plus amino acids in recalcitrant pressure injuries: preliminary results; *Roberto Cassino, Italy*
- 8.4 PhotoBioModulation in pressure injuries and IAD: a multicentric study in institutionalized elderly people; *Roberto Cassino, Italy*
- 8.5 The use of electronic documentation datasets for the prevention and treatment of decubitus ulcers as an effective tool for education in the differential diagnosis of decubitus ulcers; *Lenka Kolářová, Czech Republic*
- 8.6 Huntington's Disease: a contemporary update of seating, postural support and pressure ulcer prevention; *Rebecca Fleming, United Kingdom*

### Free paper session 9: Pressure ulcer prevention and management in specialist care settings and populations

*Chairs: Camilla Soerensen, Ida Marie Bredesen*

- 9.1 Data from Clinical Practice Demonstrates Pressure Ulcer (PU) Prevention in Long Term Care through the Introduction of Technology into the Care Pathway; *Vignesh Iyer, USA*
- 9.2 Two case reports on pressure injury prevention in patients with COVID-19 associated acute respiratory distress syndrome; *Armin Hauss, Germany*
- 9.3 The Effectiveness of SEM Assessment in Early Identification of Pressure Damage in a Spanish Long Term Care Facility; *Kate Hancock, United Kingdom*
- 9.4 Implementing the high standards for pressure ulcers care: the physician's experience; *Karolína Nováková, Czech Republic*
- 9.5 The assessment of chronic wounds, including pressure ulcers: a review of psychometric properties of instruments and a study of the cognitive process of decision-making; *Steven Smet, Belgium*
- 9.6 Elevated sub-epidermal moisture predicts both pressure ulceration and diabetic foot ulceration; *Pauline Wilson, Ireland*

## 1.1

# Core outcome domains for pressure ulcer/injury prevention trials

Jan Kottner<sup>1</sup>, Anna Lechner<sup>1</sup>, Susanne Coleman<sup>2</sup>, Katrin Balzer<sup>3</sup>, Jamie Kirkham<sup>4</sup>, Jane Nixon<sup>2</sup>

1 Charité-Universitätsmedizin Berlin, Berlin, Germany

2 University of Leeds, Leeds, United Kingdom

3 University of Lübeck, Lübeck, Germany

4 The University of Manchester, Manchester, United Kingdom

**Introduction:** Results of clinical pressure ulcer/injury (PU) prevention trials inform evidence-based PU prevention. Although there are numerous trials in the field of PU prevention the evidence is limited. One major reason is the lack of comparability between the trial outcomes and results. Core Outcome Sets (COS) may help to improve this situation. A COS specifies the essential outcomes that should be measured as a minimum (outcome domains) as well as the measurement methods that should be used (outcome measurement instruments) in a clinical trial of a specified area. The Outcomes for Pressure Ulcers Trials (OUTPUTs) project was set up with the aim to develop a COS for trials investigating the clinical efficacy or effectiveness of PU prevention interventions in adult patients aged  $\geq 18$  years who are at risk of pressure ulceration in all healthcare settings (Lechner et al. 2019).

**Methods:** A scoping review was conducted to map all outcomes reported in the field of PU prevention (Lechner et al. 2021). Based on these results, a three-round international Delphi survey was conducted from December 2020 to June 2021. In October 2021, an online consensus meeting was conducted.

**Results:** In Delphi round 1,  $n = 158$  subjects participated, in round 3 there were  $n = 89$ . Out of 36 outcome domains presented in Delphi round 1, 18 outcome domains were selected as critically important. In the online consensus meeting 14 participants and 5 OUTPUTs project team members participated. After structured discussions and voting, six outcome domains were identified to be of critical importance to form the COS: (1) PU occurrence, (2) PU precursor signs and symptoms, (3) mobility (4), acceptability and comfort of intervention, (5) adherence/compliance, (6) adverse events/safety.

**Conclusions:** For the first time an international agreement was achieved about the outcomes to be measured as a minimum in PU prevention trials. The next steps will be to determine the most appropriate outcome measurement instruments for the defined core outcome domains. However, the six identified core outcome domains should already be considered in future PU prevention trials, as service users, practitioners, industry representatives, and researchers have agreed that they are critically important.

## References

Lechner et al. Outcomes for Pressure Ulcer Trials (OUTPUTs): protocol for the development of a core domain set for trials evaluating the clinical efficacy or effectiveness of pressure ulcer prevention interventions. *Trials*. 2019;20(1):449.

Lechner et al. Outcomes for Pressure Ulcer Trials (OUTPUTs) project: review and classification of outcomes reported in pressure ulcer prevention research. *Br J Dermatol*. 2021;184(4):617-626.

## 1.2

# The physiological efficacy of lateral pressure equalisation technology for the prevention of pressure ulcers in seated individuals

Colin Boyle<sup>1</sup>, Silvia Caggiari<sup>2</sup>, Hana Fox<sup>3</sup>, Peter Worsley<sup>2</sup>, Spyros Masouros<sup>3</sup>

<sup>1</sup> Royal College of Surgeons in Ireland, Dublin, Ireland

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

<sup>3</sup> Imperial College London, Bioengineering, London, United Kingdom

**Introduction:** Seating remains a major factor in pressure-ulcer incidence among immobile or neuropathic patients. Technological solutions for seating-acquired pressure ulcers have not been as successful as those for mattresses and typically focus on relieving under-body pressures [1]. We have developed a novel approach that applies lateral pressure to the pelvis to counteract the tissue deformation that occurs due to under-body pressure and tackle the root cause of pressure ulcers, tissue distortion [2]. Previously, we demonstrated the potential of our approach using computational modelling and MRI [2]. Here, we use transcutaneous tissue monitoring to test the hypothesis that applying controlled lateral pressure to a seated individual improves soft tissue oxygenation, providing further evidence that lateral pressure equalization could protect against pressure ulcers.

**Methods:** Three healthy volunteers, aged 28-35 years and BMI 22.6-27.8 kg/m<sup>2</sup>, adopted an optimal sitting posture in a standard wheelchair incorporating a pressure equalisation device comprising of air filled lateral and underbody cushions (Figure 1). The lateral chambers were inflated sequentially at 20 minute intervals to a prescribed lateral-to-underbody pressure ratio (0%, 30%, 50%, and 70%). Transcutaneous tissue gas levels were monitored at the ischial tuberosities and greater trochanters, and categorized using previously established criteria by Chai and Bader [3].

**Results:** A category 2/3 response at the ischial tuberosity was observed when lateral chambers were inflated to 0% and 30% (Figure 2a), indicating tissue distress. At a lateral-to-underbody pressure ratio of 50%, a partial microvascular recovery of the soft tissues was observed. At the greater trochanter a category 1 response was observed for ratios up to 50%, whereas at 70%, a category 2 response was evident (Figure 2b), indicating tissue distress.

**Conclusions:** This preliminary study supports the hypothesis that controlled lateral pressure exerted around the pelvis of a seated individual could help regulate deep tissue stress. Based on this limited sample size, a ratio of 50% appears to provide tissue relief at the ischial tuberosities without compromising greater trochanter sites.



Figure 1: Schematic of the pressure equalisation device

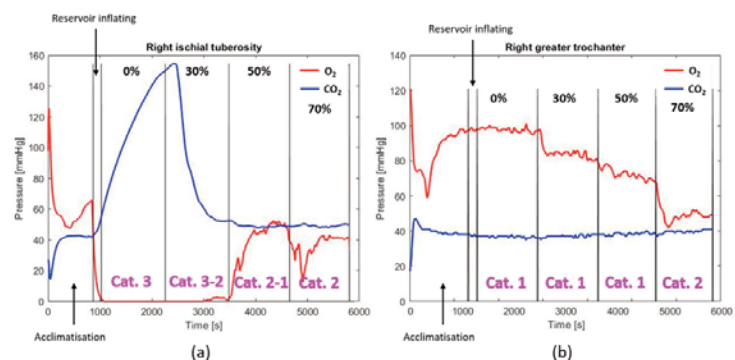


Figure 2: Physiological response at (a) the ischial tuberosity and (b) the greater trochanter

## References:

[1] McInnes, E et al. (2015) *Cochrane Database of Systemic Reviews* (9):CD001735

[2] Boyle, C.J. et al. (2020) *PLoS ONE* 15(1): e0227064

[3] Chai, C.Y. and Bader, D.L. (2013) *Journal of the mechanical behavior of biomedical materials* (28) pp.427-435



## 1.3 Paper device for rapid detection of myeloperoxidase in wound fluids

**Guillem Ferreres Cabanes<sup>1</sup>, Arnau Bassegoda<sup>1</sup>, Javier Hoyo<sup>1</sup>, César Fernández-Sánchez<sup>2</sup>, Tzanko Tzanov<sup>1</sup>**

<sup>1</sup> *Universitat Politècnica de Catalunya, Chemical engineering, Terrassa, Spain*

<sup>2</sup> *Instituto de Microelectronica de Barcelona (IMB-CNM, CSIC), Bellaterra, Spain*

**Introduction:** Bacterial colonisation is a main feature of non-healing chronic wounds. Point of care testing devices allow an early evaluation of infection biomarkers and appropriate treatment to reduce the severity of the disease and avoid the chronicity. Myeloperoxidase (MPO) is an enzyme biomarker detected in fluids of infected wounds, which catalyses the oxidation of a variety of molecules including phenols, quinones and hydrazines whose coloured products can be visually detected.

**Methods:** Paper strips were soaked in with phosphate buffer pH 6.5 containing 0.5 % (w/v) BSA and 0.1 % (w/v) Tween® 20 and dried overnight at 37 °C in order to improve fluidity. Then, a mixture of the substrates 2 mM m-phenylenediamine (mPD), 2 mM glucose, 2mM 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) diammonium salt (ABTS) was applied by drop casting on the centre of the paper strip and dried with air stream. Hydrogen peroxide, the co-substrate of MPO, was generated in the system by the conversion of glucose with glucose oxidase. The MPO (commercial or wound fluid extracts) solution was applied at the tip of the paper strip inducing a liquid flow that encounters the immobilised substrates producing the reaction.

**Results:** mPD combined with the mediator ABTS were oxidized into a purple product<sup>1</sup> (easily distinguishable from the wound fluid colour background), in less than 10 minutes after the flow of the MPO solution. Fast visual detection of MPO levels corresponding to infected wounds<sup>2</sup> was feasible via a distinctive colour change, while avoiding cross-reaction with haemoglobin peroxidase activity<sup>3</sup>. Finally, we engineered a simple fluidic device with a pattern divided into three zones that allows the selective immunocapture of MPO and the production of the purple dye in different steps, preventing undesired reactions. The analytic efficiency of the device was validated ex-vivo with wound fluid extracts.

**Conclusions:** We report on a new infection detection system based on MPO catalysed oxidative synthesis of a bright purple colour dye that can be easily incorporated into paper-based point-of-care devices. The fluidic device was able to detect MPO within the infection range in less than 10 minutes.

### References:

1 – Bassegoda et al. (2019) *Talanta*. Doi: <https://doi.org/10.1016/j.talanta.2018.10.065>

2 – Hasmann et al. (2013) *Ann. Clin. Biochem*. Doi: [10.1258/acb.2011.010249](https://doi.org/10.1258/acb.2011.010249)

3 – Schiffer et al. (2016) *Biotechnol. Bioeng*. Doi: [10.1002/bit.26025](https://doi.org/10.1002/bit.26025)

## 1.4

# The Relationship between Sub-Epidermal Moisture Measurements and Inflammatory Markers in the Early Identification of Pressure Ulcers

**Natalie McEvoy**<sup>1</sup>, **Declan Patton**<sup>1 2 3 4 5</sup>, **Cathal Kearney**<sup>6 7 8 9</sup>, **Gerard Curley**<sup>10 11</sup>, **Zena Moore**<sup>1 2 3 4 12 13 14 15</sup>

1 Royal College of Surgeons in Ireland University of Medicine and Health Sciences, School of Nursing and Midwifery, Dublin, Ireland

2 Royal College of Surgeons in Ireland University of Medicine and Health Sciences, Skin Wounds and Trauma (SWaT) Research Centre, Dublin, Ireland

3 Fakeeh College of Health Sciences, Jeddah, Saudi Arabia

4 Griffith University, School of Nursing and Midwifery, Queensland, Australia

5 University of Wollongong, Australia, Faculty of Science, Medicine and Health, Wollongong, Australia

6 University of Massachusetts, Department of Biomedical Engineering, Amherst, United States

7 Royal College of Surgeons in Ireland University of Medicine and Health Sciences, Kearney Lab, Tissue Engineering Research Group (TERG), Department of Anatomy and Regenerative Medicine, Dublin, Ireland

8 Advanced Materials and Bioengineering Research (AMBER) Centre, Dublin, Ireland

9 Trinity College Dublin, Trinity Centre for Bioengineering, Dublin, Ireland

10 Royal College of Surgeons in Ireland University of Medicine and Health Sciences, Anaesthesia and Critical Care, Dublin, Ireland

11 Beaumont Hospital, Dublin, Ireland

12 Ghent University, Department of Public Health, Faculty of Medicine and Health Sciences, Ghent, Belgium

13 Lida University, Shanghai, China

14 Cardiff University, Cardiff, United Kingdom

15 Ulster University, School of Health Sciences, Faculty of Life and Health Sciences, Derry, Northern Ireland

**Introduction:** Pressure ulcer (PU) prevention in the intensive care unit (ICU) is an important clinical issue as ICU patients are at high risk of developing PUs. The current gold standard of PU detection involves visual skin assessment (VSA). Reliance on VSA as a method of PU detection is problematic given that PUs often develop from within the deeper tissues at a microscopic rather than macroscopic level. Further research into the early methods of PU detection are needed in order to facilitate an objective approach to diagnosis, thus leading to the implementation of prevention strategies.

**Methods:** The aim of this study was to establish the correlation between IL-1 $\alpha$ , total protein (TP) and Sub-Epidermal Moisture (SEM) measurements in the early identification of PUs in ICU patients. This study involved the sampling of sebum using Sebutape and measurement of SEM from skin sites (sacrum, heels and a control site). SEM measurements and Sebutape samples were taken at the same time points, to assess any potential associations between these inflammatory measurement approaches. Five healthy volunteers were recruited to the study. SEM and Sebutape readings were taken at the same anatomical locations as the ICU patients.

**Results:** The study was conducted on 53 participants admitted to ICU in a hospital in Ireland. The mean baseline SEM measurements indicate abnormal SEM readings for all anatomical sites except the control site, where the reading was normal. Mean baseline IL-1 $\alpha$ /TP readings were higher for the sacrum versus both heels. IL-1 $\alpha$ /TP readings were higher for the control site versus all other anatomical locations. There was very weak or weak correlations between SEM measurements and IL-1 $\alpha$ /TP readings on all the study days, for all anatomical locations. These correlations were not statistically significant. In the healthy volunteers, all mean SEM measurements were within normal limits. IL-1 $\alpha$ /TP readings were higher for the sacrum versus both heels. IL-1 $\alpha$ /TP readings were higher for the control site versus all other anatomical locations.

**Conclusions:** This study provides important information on not only the relationship between IL-1 $\alpha$ /TP and SEM measurements as potential biomarkers in the early detection of PUs in ICU patients, but also sheds light on the feasibility of these methods. Results from this study are consistent with findings from previous studies in terms of SEM measurements. It is evident from conducting this study that obtaining SEM measurements, is more practical and feasible than Sebutape sampling to assess for the presence of inflammation.

## 1.5

# Comparison of two skin protection regimes for the prevention of incontinence-associated dermatitis in geriatric care: A study protocol for a randomized controlled parallel group exploratory trial

**Monira El Genedy-Kalyoncu<sup>1</sup>, Alexandra Fastner<sup>1</sup>, Bettina Völzer<sup>1</sup>, Jan Kottner<sup>1</sup>**

<sup>1</sup> Charité – Universitätsmedizin Berlin, Institute of Clinical Nursing Science, Berlin, Germany

**Introduction: Background:** Incontinence-associated dermatitis (IAD) is an inflammatory reaction of the skin caused by prolonged direct contact of the skin with urine and/or stool. It affects nearly one in three persons in geriatric acute and long-term care settings. Skin protection is the cornerstone of IAD prevention and includes mild skin cleansing and the application of skin protecting leave-on products. Applying skin protection products to the vulnerable skin areas can help to prevent IAD development and/or reduce its severity. There is currently no evidence that one specific skin protection product is superior to others. There are a number of expert opinions in the field, but due to the poor quality of evidence, evidence-based recommendations cannot be provided.

**Methods:** The overall aim of this exploratory clinical trial is to compare the effects of two skin protection regimens compared to an untreated control group and to assess the feasibility of a possible subsequent confirmatory clinical trial. An additional objective is to evaluate the feasibility of measuring the five Core Outcome Domains of the recently developed IAD-specific Core Outcome Set (CONSIDER) [1] for the first time in a clinical trial. A three-arm RCT will be performed with n = 210 incontinent geriatric patients and nursing home residents in the state of Berlin (Germany). Participants will be randomly assigned to one of three study groups: (1) Mild skin cleansing and application of a film-forming skin protection product, (2) Mild skin cleansing and application of a hydrophobic skin protection product, (3) Mild skin cleansing without additional application of a skin protection product. Participants will be followed up for 14 days.

**Conclusions: Discussion:** This exploratory clinical trial will be the first with a direct head-to-head comparison of the two most important skin protection categories including the most important outcomes in IAD research. Obtained evidence will be used for designing confirmatory trials.

### References:

[1] Van den Bussche K, Kottner J, Beele H, De Meyer D, Dunk AM, Ersser S, et al. Core outcome domains in incontinence-associated dermatitis research. *Journal of advanced nursing*. 2018;74:1605-17.10.1111/jan.13562.

## 1.6

# Immediate effects after shock wave therapy application in pressure ulcers: a preliminary randomised controlled study.

**Robert Dymarek<sup>1</sup>, Izabela Kuberka<sup>2</sup>, Joanna Rosińczuk<sup>3</sup>, Karolina Walewicz<sup>4</sup>, Jakub Taradaj<sup>5</sup>, Mirosław Sopol<sup>6</sup>**

<sup>1</sup> Wrocław Medical University, Department of Physiotherapy, Wrocław, Poland

<sup>2</sup> Wrocław Medical University, Department of Anaesthetic and Surgical Nursing, Wrocław, Poland

<sup>3</sup> Wrocław Medical University, Department of Internal Medicine Nursing, Wrocław, Poland

<sup>4</sup> University of Opole, Institute of Health Sciences, Opole, Poland

<sup>5</sup> Academy of Physical Education in Katowice, Institute of Physiotherapy and Health Sciences, Katowice, Poland

<sup>6</sup> Wrocław Medical University, Department of Basic Sciences, Wrocław, Poland

**Introduction:** Shock waves (SWT) might be useful for chronic wounds, especially venous and diabetic foot ulcers. However, there is limited evidence of the effects of SWT in the management of pressure ulcers (PUs). Therefore, this preliminary randomized trial aimed to determine an immediate clinical effect following a single SWT procedure in PUs.

**Methods:** In this study, 40 patients with II-III EPUAP class of PUs were qualified: 20 patients received standard SWT therapy (300+100 pulses, 2.5 bars, 0.15 mJ/mm<sup>2</sup>, 5 Hz) and 20 patients received sham SWT therapy (the same parameters with special cover at the applicator blocking the energy). All patients have standard wound care interventions, including wound cleaning, debridement and specialist dressings. The following measures have been taken before (M0) and after (M1) SWT: digital planimetric (DPL) with smartphone application (Swift Medical Inc., Toronto, ON, Canada) and standardized clinimetric using Wound Bed Score (WBS) and Bates-Jansen Wound Assessment Tool (BWAT).

**Results:** We observed a significant improvement after active SWT compared to sham SWT regarding all studied outcomes. According to wound measurements with DPL, there was reduction in: area of 3.42 cm<sup>2</sup> (p<0.001), length of 0.56 cm (p<0.001), and width of 0.66 cm (p<0.0001). In terms of clinical condition, there was a better score in WBS of 5.8 points (p<0.001) and a better score in BWAT of 14.75 points (p<0.001).

**Conclusions:** This preliminary randomized report showed that patients with PUs might benefit from the SWT procedure. Even a single application of SWT therapy can improve clinical conditions of the PUs and might be used as an adjuvant method to standard wound care interventions.

### References:

(1) NPUAP, EPUAP and PPPPIA. *Prevention and Treatment of Pressure Ulcers: Quick Reference Guide*. Emily Haesler (Ed.). Cambridge Media: Osborne Park, Australia; 2014.; (2) Zhang L et al. *Efficacy and safety of extracorporeal shock wave therapy for acute and chronic soft tissue wounds: A systematic review and meta-analysis*. *Int Wound J*. 2018 Aug;15(4):590-599; (3) Dymarek R, et al. *Extracorporeal shock wave therapy as an adjunct wound treatment: a systematic review of the literature*. *Ostomy Wound Manage*. 2014 Jul;60(7):26-39.

## 2.1

# Magnetic Resonance Imaging and computational modelling to predict the soft tissue response of the face when interacting with a respirator

**Bethany Keenan<sup>1</sup>, Sam Evans<sup>1</sup>**

<sup>1</sup> Cardiff University, Medical Engineering Research Group, Cardiff, United Kingdom

**Introduction:** Skin and soft tissue injuries related to the use of respiratory protective equipment (RPE) have been very common, particularly in females or those with smaller face shapes. Current designs for RPE have been based on a white male workforce, providing a limited range of size and geometry [1]. This has meant that many women, men from black and minority ethnic groups and others have experienced problems in finding suitable and comfortable RPE and some have experienced facial soft tissue injuries [2]. Modelling the mechanics at the face-respirator surface is complicated as both can deform substantially making it difficult to measure or predict the tissue strains under the device. To the best of the authors' knowledge there have been no studies to date which have utilized MRI techniques to measure the facial soft tissue deformation with different types of masks.

**Methods:** Ten participants were recruited for this study (mean age 30.8yrs, height 1.70m and weight 72.3kg). A high-resolution 3D MRI sequence was developed to image the face in an unloaded (without a mask) and loaded (with a mask) state for a group of healthy volunteers. All volunteers were quantitatively fit tested prior to MRI examination and each underwent several MRI scans with different FFP3 masks. The supine MRI scan was registered with an optical surface scan of the participant in an upright position to assess the impact of gravity of the facial soft tissue. The loaded and unloaded scans were registered to measure the deformation due to the respirator. A computational model was also created from the subject's MRI scan using a software tool for nonlinear finite element analysis<sup>1</sup>, models of the NIOSH standard head forms were also used (Figure 1).

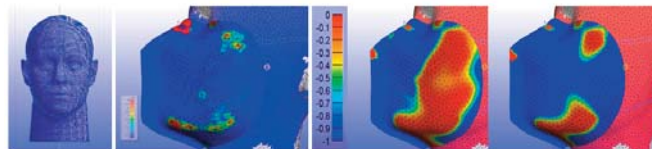


Figure 1: (L-R) Computational model of a GVS respirator on the small NIOSH head form, showing contact pressure distribution and contact gap during inhalation and exhalation.

**Results:** The fit test results showed that the Custom-Fit Respirator Mask2 and Face Mask Valved Respirator3 were a good fit for 60% of participants compared to only 10% successful fit for the folded FFP3 mask4. Larger than expected deformations of the facial soft tissues, up to 10mm, were observed. Gravity flattened the cheek soft tissues up to 3mm in supine during the participants MRI scan (Figure 2).



Figure 2: (L-R) MicroCT image of FFP3 mask on 3D head phantom. MRI scan of participant with corresponding photo of visible soft tissue deformation following MRI examination. Surface scan of participant with inner surface of mask, and registered scan showing effect of gravity on the soft tissue.

**Conclusions:** MRI and optical scanning give valuable insights into soft tissue deformation beneath the respirator. Computational modelling gives valuable insights into the mechanics of device fitting and the causes of leaks and discomfort. It also has the potential to allow simulation and preclinical testing so that the design of masks can be optimized to fit many different faces without expensive, time consuming trial and error testing.

## References:

[1] TUC Report, 2017. PPE and women. [www.tuc.org.uk](http://www.tuc.org.uk); [2] Green at al, 2021. Fit-testing of respiratory protective equipment in the UK during the initial response to the COVID-19 pandemic.

**Acknowledgments:** This project is kindly funded by UKRI / EPSRC (PR/V045563/1).

1. FEBio finite element package ([www.febio.org](http://www.febio.org))
2. Custom-Fit Respirator Mask Easimask FSM18
3. Face Mask Valved Respirator Handanhy 9632
4. Folded FFP3 mask GVS F31000

## 2.2

# Cell Mechanobiology in the Context of Wound Healing

**Daphne Weihs<sup>1</sup>**

<sup>1</sup> Technion - Israel Institute of Technology, Biomedical Engineering, Haifa, Israel

**Introduction:** Closure of small gaps and larger wounds in damaged tissue requires coordination between multiple cell types, which interact with their neighbors and microenvironment. Migratory fibroblasts, immune cells, pre-adipocytes, and myoblasts, for example, will enter the damage site to clean up and regenerate the required tissues. Specifically, cells proliferate, generate extracellular matrix, and also differentiate into cell types required for the different stages of healing; differentiation renders some cell types non-migratory. The mechanical interactions of cells with their microenvironment, during migration and differentiation affect migratory, proliferative, differentiation and other capacities required for wound healing. Hence, we evaluated changes in cell morphology and in adhesive and migratory forces applied by various cell types during migration and differentiation, under varying external conditions.

**Methods:** We used mouse, fibroblasts (3T3), myoblasts (C2C12), embryonic preadipocytes (3T3-L1), and human monocyte (THP-1) cell lines; the latter were also differentiated, respectively, to adipocytes and macrophages. Cell morphology was monitored over time, during migration and differentiation, and under application of external mechanical strains<sup>1</sup>. Concurrently, cells were seeded on physiological stiffness (2.4 kPa), polyacrylamide gels with fluorescent beads as location-markers that facilitated evaluation of cell-applied forces, using traction force microscopy.<sup>2</sup>

**Results:** Fibroblast-like preadipocytes applied a wide range of total traction forces (100-800 nN),<sup>2</sup> especially during migration,<sup>3</sup> typically at the edges of their elongated shape, while adipocytes were smooth-surfaced and round and applied smaller forces (<200 nN) along their perimeters.<sup>2</sup> As forces applied by cells vary, we also evaluated effects of applying force to the cells through the substrate. We show that migration rates of fibroblasts and myoblasts into small gaps are accelerated by external stretching (3-6% strain),<sup>4,5</sup> where the gap shape and size affected migration rate.<sup>4</sup> External stretching also affected the attained macrophage morphology following differentiation and potentially also affected particle internalization reduced, indicating changes to functional phagocytotic uptake, especially under large deformations (10% strain).

**Conclusions:** Mechanical interactions of cells with their microenvironment affect the cell morphology, force application capacity, migratory rate, and other functions, which can affect the progression of different stages of wound healing.

### References:

1. Toume, S., Gefen, A. & Weihs, D. *J. Biomech.* 49, 1336–1339 (2016).
2. Abuhattum, S., Gefen, A. & Weihs, D. *Integr. Biol.* 7, 1212–1217 (2015).
3. Abuhattum, S. & Weihs, D. *Med. Eng. Phys.* 38, 834–838 (2016).
4. Toume, S., Gefen, A. & Weihs, D. *Int. Wound J.* 14, 698–703 (2017).
5. Marom, A., Berkovitch, Y., Toume, S., Alvarez-Elizondo, M. B. & Weihs, D. *Clin. Biomech.* 62, 96–103 (2019).



## 2.3

# Internal strains reduction in soft tissues surrounding a pressure ulcer using a new bi-layer dressing

**Nolwenn Fougeron**<sup>1</sup>, **Nathanael Connesson**<sup>1</sup>, **Grégory Chagnon**<sup>1</sup>, **Thierry Alonso**<sup>1</sup>, **Laurent Pasquinet**<sup>2</sup>, **Manuelle Bahuon**<sup>2</sup>, **Eugénie Guilin**<sup>2</sup>, **Antoine Perrier**<sup>3</sup>, **Yohan Payan**<sup>1</sup>

<sup>1</sup> Laboratory Timc, Biomeca, La Tronche, France

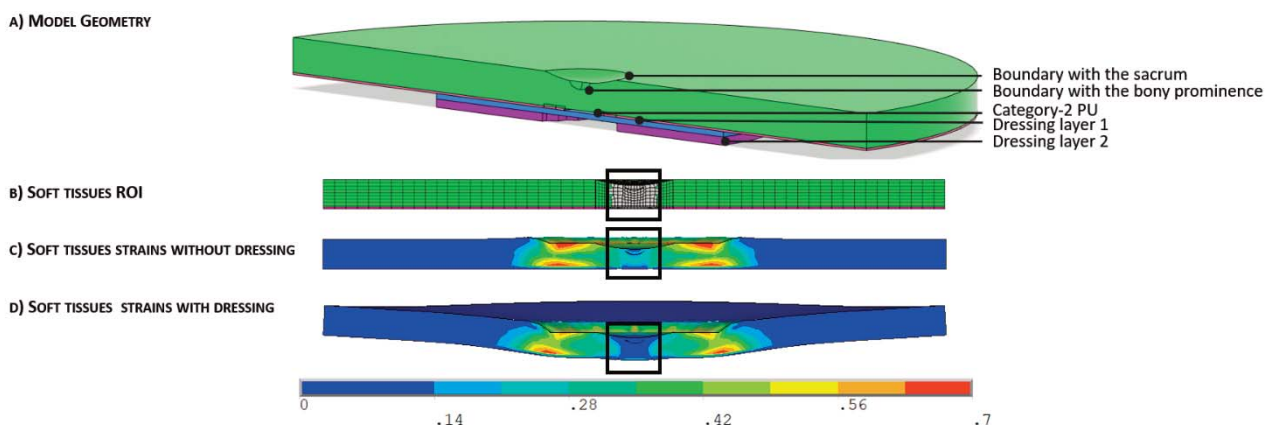
<sup>2</sup> Urgo Research, Innovation & Development, Chenôve, France

<sup>3</sup> AP-HP, Service de Diabétologie, Paris, France

**Introduction:** A new bi-layer dressing was designed to alleviate soft tissue under pressure and improve the healing conditions of category-2 Pressure Ulcers (PU). The aim of this study is to assess the ability of this bi-layer dressing to reduce internal strains in soft tissues using a Finite Element Model (FEM).

**Methods:** A first parametric FEM of the sacral soft tissues (skin and adipose tissues) and the bi-layer dressing was designed. The bone was modeled as a rigid boundary with a simplified spherical geometry and central prominence. A category-2 PU, 1.3 mm deep was added to the model (Figure 1). Hyperelastic constitutive equations were set for soft tissues 1,2 with a stiffening surrounding the PU 3. The dressing first layer, glued with the skin, was modeled as an orthotropic linear elastic compress. The second layer, a compressible honeycombed material with a hole under the PU, was approximated by a compressible Blatz-Ko constitutive material. A rigid plate was added below the dressing to account for a worst-case scenario. A vertical force corresponding to 47 % of a 94 kg subject body weight was applied to the bone. A second parametric FEM without the bi-layer dressing was designed for comparison purpose.

**Results:** Green-Lagrange shear strains in a Region Of Interest (ROI) were extracted. The volume of soft tissues under a threshold set to 30 % was computed for both models. An increase in quantity of healthy tissues (i.e. strains below 30 %) was noticed when the bi-layer dressing was modeled.



**Figure 1:** Parametric FEM of the soft tissues and bi-layer dressing (A). Green-Lagrange shear strains in soft tissues were extracted for both model with and without the bi-layer dressing (C and D). Quantitative comparison of the volume of healthy tissues (with strains below 30 %) was performed in the ROI under de bone boundary (B).

**Conclusions:** The importance of dressings to maintain a proper biochemical environment for the healing of PU is incontestable. New concepts of dressings may also provide local stress and strain reliefs and create mechanical conditions as less damaging as possible for the tissues.

## References:

1. Sommer G, Eder M, Kovacs L, Pathak H, Bonitz L, Mueller C, Regitnig P, Holzapfel GA. 2013. Multiaxial mechanical properties and constitutive modeling of human adipose tissue: A basis for preoperative simulations in plastic and reconstructive surgery. *Acta Biomater* [Internet]. 9(11):9036–9048. doi:10.1016/j.actbio.2013.06.011
2. Ni Annaidh A, Bruyère K, Destrade M, Gilchrist MD, Otténio M. 2012. Characterization of the anisotropic mechanical properties of excised human skin. *J Mech Behav Biomed Mater* [Internet]. 5(1):139–148. doi:10.1016/j.jmbbm.2011.08.016
3. Edsberg LE, Cutway R, Anain S, Natiella JR. 2000. Microstructural and mechanical characterization of human tissue at and adjacent to pressure ulcers. *J Rehabil Res Dev*. 37(4):463–471.
4. Ceelen KK, Stekelenburg A, Loerakker S, Strijkers GJ, Bader DL, Nicolay K, Baijens FPT, Oomens CWJ. 2008. Compression-induced damage and internal tissue strains are related. 41:3399–3404. doi:10.1016/j.jbiomech.2008.09.016



## 2.4

# Failure of Phagocytosis during the Impaired Healing of Pressure Ulcers

*N Jannah M Nasir<sup>1</sup>, Hans Heemskerk<sup>1</sup>, Lisa Tucker-Kellogg<sup>1</sup>*

<sup>1</sup> Duke-NUS Medical School, Singapore, Singapore

**Introduction:** Pressure injuries are classified as chronic wounds but the reasons for poor healing are poorly understood. Would they still heal poorly without bacteria and comorbidities? Although excess inflammation is often blamed the poor healing of chronic wounds, there are important functions that need to be performed by immune cells, and the impact of pressure damage on immune behavior has never been studied under germ-free conditions. We aim to characterize differences between pressure injuries and non-pressure injuries in the absence of infection and comorbidities. A key uncertainty is whether pressure injuries will show any impairment of healing in a germfree facility without diabetes or old age.

**Methods:** In a specific-pathogen-free facility, mice received a pressure injury of skin, adipose, and muscle via magnet pinching of the dorsal skinfold, or a healthy control wound (by injecting the cardiotoxin snake venom into muscle). Tissue sections were analyzed by histopathology. Also, the mice were bred with confetti fluorescent labelling of stem cells to allow newly regenerated tissue to be distinguished from pre-existing tissue.

**Results:** Acute cardiotoxin injuries showed normal wound healing phases -- At 3 days, dead tissue had been cleared; at 10 days, immature muscle fibers filled the wound bed; at 16 days, mature muscle showed near-native morphology. This speed is normal for mice. In contrast, the pressure injury showed a failure of phagocytosis to clear necrosis after 3 days. Histology showed immune infiltration around but not into the compressed region, as if the immune cells could not penetrate. However, immune cell remnants were detected there by immunostaining extracellular traps, which are toxic anti-microbial structures produced by expulsion of nuclear DNA from dying neutrophils/macrophages. Extracellular traps are detrimental to granulation and regeneration. Eventually the dead tissue was extruded to slough at 15 +/- 2 days post-injury, when viable immune cells filled the wound bed. At 40d, immature myofibers filled only the wound margins, and morphology was deranged (wavy, branched fibers). At 90d, unfilled holes remained.

**Conclusions:** In pressure injuries (but not in toxin-induced muscle necrosis) we observed failure of phagocytic clearance, followed by wholesale slough of all layers. Some phagocytic cells did infiltrate the dead tissue of the pressure injury, but they died with markers of extracellular traps. This suggests that in pressure injuries, phagocytic cells get hijacked from the normal program of clearing debris, and instead die creating greater obstacles to clearance. This program does not occur in toxin-injured necrosis, and does not require the presence of microbial pathogens. Future work should identify which aspect of pressure damage is responsible for this misfiring of the immune system. Human pressure injuries are characterized by slough, suggesting they may share a similar mechanism of immune cell dysfunction.

### 3.1

## A rapid response to preventing healthcare staff facial pressure ulcers in COVID-19 care settings

**Zena Moore**<sup>1</sup>, Declan Patton<sup>1</sup>, Tom O'Connor<sup>1</sup>, Natalie McEvoy<sup>2</sup>, Linda Nugent<sup>3</sup>, Simone Walsh<sup>3</sup>, Pinar Avsar<sup>3</sup>, Aglecia Budri<sup>3</sup>, Ger Curley<sup>2</sup>, John Rice<sup>4</sup>, Alison Porter Armstrong<sup>5</sup>, Wendy Chaboyer<sup>6</sup>, David Moore<sup>3</sup>

1 RCSI University of Medicine and Health Sciences, School of Nursing and Midwifery; Skin Wounds and Trauma Research Centre, Dublin, Ireland

2 RCSI University of Medicine and Health Sciences, Department of Anaesthesia and Critical Care, Dublin, Ireland

1 RCSI University of Medicine and Health Sciences, School of Nursing and Midwifery; Skin Wounds and Trauma Research Centre, Dublin, Ireland

4 IREMA Ireland, Limerick, Ireland

5 Edinburgh Napier University, School of Health and Social care, Edinburgh, United Kingdom

6 Griffith University, School of Nursing and Midwifery, Gold Coast, Australia

**Introduction:** Caring for people with COVID-19 in hospital and community settings necessitates the wearing of personal protective equipment (PPE), in particular facemasks. Anecdotal information nationally and internationally suggests that facial pressure injuries (FPIs) occur as result of wearing facemasks and pose a significant challenge to staff safety in COVID areas. In response to the COVID-19 pandemic and its devastating effects on frontline staff, the purpose of this rapid response study was to develop an evidence-based care bundle that would prevent COVID-19 frontline staff from developing a FPI.

**Methods:** This was a pre-posttest observational study of a 5-step skin care bundle based on best practice. The primary outcome of interest was the incidence of FPI. The secondary outcomes of interest were pain and ease of use of the care bundle. This study took place in two large acute hospitals, one COVID-19 testing Centre, one COVID-19 Community Hub and the National Ambulance Service. A population of 224 staff took part in the study. This comprised 120 acute hospital staff, 60 Ambulance staff, 24 Community Hub staff and 20 testing Centre staff. All were COVID facing. All participants were invited to participate and complete the study questionnaire. Judgmental and volunteer sampling was used to select 22 interview participants who used the bundle.

**Results:** The bundle emerged as an all-in-one protector for staff against FPIs. The use of the bundle reduced the incidence of skin injury from 32% to 13%, and staff found the bundle easy to use, safe, and effective. Interview data augmented this with participants paying particular attention to the ease of use of the bundle, specifically how it did not interfere with the protective mask, and how it was not a burden for them. This is of particular importance given the negative impact that FPIs have in terms of the risk of pain, discomfort, and infection, including that of COVID-19 itself.

**Conclusions:** As with evidence from the international literature, this study has identified that when skincare is prioritised, and a systematic prevention care bundle approach is adopted, there are clear benefits for the individuals involved. Further, reaching out to frontline staff to provide support has the added benefit of enhancing wellbeing, this is never more important than today, where our colleagues have faced unprecedented challenges in their day-to-day work.

### 3.2

## Creation and Evaluation of Face-Specific Measurement Data with Three-Dimensional Imaging Method for Face Masks

Vildan Çakar<sup>1</sup>, **Ayişe Karadağ**<sup>2</sup>, Kiran Anwar<sup>3</sup>, Metin Türkay<sup>4</sup>, Selahattin Özmen<sup>5</sup>

1 Koç University, Graduate School of Health Sciences, Istanbul, Turkey

2 Koç University, School of Nursing, Istanbul, Turkey

3 Koç University, Graduate School of Sciences and Engineering, Istanbul, Turkey

4 Koç University, College of Engineering, Industrial Engineering, Istanbul, Turkey

5 Koç University, School of Medicine, Plastic, Reconstructive and Aesthetic Surgery, Istanbul, Turkey

**Introduction:** During the COVID-19 pandemic, high rate of skin injuries (42.8%-88.0%) on the facial area were experienced as a result of the intensive and long-term use of personal protective equipment (PPE) by healthcare workers (HCWs). The main factors deteriorating skin integrity include production materials of PPE, hard edges of the masks, ear straps of masks and constant pressure and friction caused by rigid goggle frames. This situation brought up the improvement of the features of the medical masks, which were used prominently. Therefore, this interdisciplinary study aimed to take face measurements using a three-dimensional (3D) face imaging system and to create mask size groups using machine learning methods.

**Methods:** Participants of the study consisted of HCWs (n=500) working in a foundation university hospital in Turkey. For each participant's age, gender, height, weight, and body mass index (BMI) were obtained as descriptive characteristics. 3D imaging system, which provides sub-millimeter precise information, was used to take images of the participants' facial regions. 3D computer model of the human face was built. 8 different measurements from surrounding nasal bridge, chin, cheek and ear were extracted as Cartesian coordinate to create key dimensions. Then, machine learning methods were applied to cluster the 500 3D measurements into different clusters. We compared the fitness of standard surgical face masks for their comfort and fitness with different medical mask sizes that were determined in this work.

**Results:** The distribution of all measurements (n=500) is 44.6% male and 55.4% female with a mean age of  $32.41 \pm 10.05$ . Also, the mean BMI is  $24.53 \pm 4.58$ . Based on these data, the average values for different facial features including nasal bridge length, face height were calculated. We considered different number of clusters (3, 4, 5 and 6) and evaluated their comfort and fitness computationally. We observed that when the number of clusters is small (such as one standard size and 3 clusters), the comfort and fitness was diminished. On the other hand, large number of clusters (5 and 6) reduce the cluster accuracy indicating that accuracy of assigning HCWs to different mask sizes will be reduced for certain sizes.

**Conclusions:** The results of this study suggest that 4 cluster sizes fulfills the requirement of accommodating as much as possible population. Thus, 4 cluster sizes might suitable for face masks and its measurements will be used to evaluate clusters in fitness test. Also, these findings may guide custom made PPE production in the future.

### 3.3

## Change Management in Pressure Ulcer Nursing Practice.

**Abdulaziz Binkanan**<sup>1</sup>

<sup>1</sup> King Fahad Medical City, Ministry of Health., Wound Care, Riyadh, Saudi Arabia

**Introduction:** As many issues came to nursing practices and judging them as neglecting nurses or poor carers, actions need to be taken to be free blame issues to achieve the desired and ultimate goals. Pressure Ulcer (PU) due to the chronic nature of formation have been linked to some sort of primary nursing care neglect (VanGilder et al, 2017). Moreover, a positive attitude of a nurse determines their compliance at prevention, reporting incidence and management of the PU at early stage before getting developed to advanced and complicated stages (Smit et al, 2016). Furthermore, it was found that nurses had poor motivation to PU management and would often not adhere to PU management guidelines (Aqoulah et al, 2018). In addition, nursing attitude could be influenced by skills level and experience (Roberts et al, 2016).

**Methods:** Kurt Lewin's Change Management Model been used which is containing three simple steps. 1. Unfreezing, 2. Change (transition stage), 3. Refreezing.

**Results:** Lewin's Change Management Model stage one is unfreezing. This involves excessive nurses' education about PU and motivation on the need to accept the changes in PU management and why some routines are being included such as repositioning of patient. That's making them ready and willing to tackle and prevent PU to avoid possible complications caused by neglecting (Qaseem et al, 2015).

Second stage is change, which the real changes start to happen. This stage needs to be implemented step wise with careful planning and behaviour change strategies as there will be some resistance. In this stage, the existing structures, protocols and systems could be changed. Starting nurses training and enhancing skills toward PU.

Third and final stage is refreezing. During this stage the hospital environment, routine and interpersonal relationship style are changed and cemented to the new change. This is sometimes referred to as the state of equilibrium by some scholars (Cummings, Bridgman and Kenneth, 2016). Nurses in this stage have come to accept the new changes as part of their daily routine. Reinforce and confirm the changes into their routine by continuous evaluation and thank those who done it well.

According to Lewin's theory of change management, equilibrium can only be reached if both hindering and driving factors are approximately equally strength.

Finally, the resistance experienced from the nursing staff can be reduced and controlled through effective and efficient communication and involving them in the process through training, coming up with coping and stress management tools, negotiation and appreciating those who put in great effort to accept the change.

**Conclusions:** PU in nursing practice could be blame free and shared responsibility by multidisciplinary team through Lewin's change model and enhancing motivation with avoidable resistance.

**References:** Available

## 4.1

# A randomised controlled trial of the effectiveness of multi-layer silicone foam dressings for the prevention of sacral pressure injuries in patients undergoing general surgery

Hyunjung Yeo<sup>1</sup>, Insil Jang<sup>2</sup>, Ji Hyeon Hwang<sup>1</sup>, Mi Ju Lee<sup>1</sup>, Da Yeong No<sup>1</sup>

<sup>1</sup> Asan Medical Center, SEOUL, Korea, Rep. of South

<sup>2</sup> Chung-Ang University, SEOUL, Korea, Rep. of South

**Introduction:** Hospital acquired pressure injuries are highly related to surgeries with general anesthesia and maintaining immobility before and after surgery. After surgery, semi-fowler's position is taken to prevent postoperative pulmonary complications, which increases the pressure and the shearing force of the sacrum, increasing the occurrence of pressure injuries. Recently, prophylactic dressing is applied to prevent pressure injury, and it is necessary to verify whether this intervention is effective in preventing pressure injuries.

**Methods:** This study is a randomized controlled trial to investigate the effects of prophylactic dressing using multi-layer soft silicone foam on the incidence of pressure injuries after general surgery in patients at risk for pressure injuries. The study period was from June 7 to September 3, 2021, and 144 patients who were hospitalized in the surgical ward and scheduled for surgery were enrolled as study subjects.

For data analysis, the general and clinical characteristics of participants were analysed with descriptive statistics using the SPSS 26.0 program (SPSS Inc., Chicago, IL). The chi-square test was used to test the difference in the incidence of pressure injury and blanching erythema. The factors for pressure injury and blanching erythema were analysed using multivariate logistic regression.

**Results:** Pressure injuries occurred in the sacrum in 5 patients (6.8%) only in the control group ( $p=0.05$ ). A total of 53 cases of blanching erythema occurred, 20 cases in the intervention group and 33 cases in the control group ( $p=0.034$ ). In multivariable logistic regression for patients with pressure injury and blanching erythema, it was found to be related to braden scale and pressure injuries or blanching erythema ( $p=0.019$ ).

**Conclusions:** In previous studies, the effectiveness of prophylactic dressings was mainly conducted for patients in the intensive care unit. In this study, prophylactic dressings were applied to the sacrum for pressure injury high risk patients in general wards after general surgery and found that it was effective in preventing pressure injuries.

## References

Forni, C., D'Alessandro, F., Gallerani, P., Genco, R., Bolzon, A., Bombino, C., ... & Amodeo, A. (2018). Effectiveness of using a new polyurethane foam multi-layer dressing in the sacral area to prevent the onset of pressure ulcer in the elderly with hip fractures: A pragmatic randomised controlled trial. *International wound journal*, 15(3), 383-390.

Fulbrook, P., Mbuji, V., & Miles, S. (2019). Effectiveness of prophylactic sacral protective dressings to prevent pressure injury: a systematic review and meta-analysis. *International journal of nursing studies*, 100, 103400.

## 4.2

# The Pressure Injury Evidence in Spinal Cord Injured Patients at Spinal Unit of Department of Traumatology at University Hospital Brno 2013-2021

**Lia Vašíčková<sup>1</sup>, Michal Mašek<sup>2</sup>, Milan Krticka<sup>2</sup>**

<sup>1</sup> University Hospital, Spinal Unit of Department of Traumatology and Rehabilitation Centre, Brno, Czech Republic

<sup>2</sup> University Hospital, Department of Traumatology, Brno, Czech Republic

**Aim:** Aim is to present an evidence of pressure ulcer (PU), its category, localization and relation to the level and severity of spinal cord injury (SCI) in patients admitted at spinal unit(SU).

**Material and methods:** A set of all 765 patients admitted from acute departments at SU from 2013 to 2021 was analysed. An international classification of SCI ASIA score was used, localization and category of PU at the moment of admission at SU.

**Results:** In a set of 765 patients we verified 94 (12,3%) patients with 144 PU. ASIA Impairment Scale AIS A was found in 168 (22%) patients and 45 (5,9%) of them had PU. AIS B was in 95 (12,4%) patients and 20 (2,6%) with PU; AIS C was in 223 (29,2%) patients and 20 (2,6%) with PU; AIS D, the less disability, was in 226 (29,5%) patients with 5 (0,7%) PU. It was not possible to examine ASIA score in 53 (6,9%) patients with 4 (0,5%) PU. The most severely affected patients with cervical injury were 339 (44,3%) and 48 (6,3%) of them with PU. The most frequent localization of PU was sacrum 68 (47,2%) and heels 44 (30,6%). The most registered were PU of second category - 68 (47,2%).

**Conclusion:** we verified in a set of 765 patients that higher presence of PU is in patients with complete SCI AIS A, in tetraplegics and most frequent localization of PU are sacrum and heels.

### 4.3

## Pressure Ulcer Risk Assessment Scales designed for Adult Intensive Care Patients - Risk Factors and Predictive Validity of the Scales: A Systematic Review

**Maarit Ahtiala**<sup>1</sup>, **Tarja Välimäki**<sup>2</sup>

1 University of Eastern Finland, Turku University Hospital, Turku, Finland

2 University of Eastern Finland, Kuopio, Finland

**Introduction:** Pressure ulcers (PU) are third common burdensome adverse event in healthcare (1). Patients in intensive care units (ICU) are critically ill having several medical or surgical conditions. Frequently health issues involve respiratory, hemodynamics and neurological problems. In a worldwide point prevalence study, PU prevalence in ICUs was 26.6% (2). Both low and high-risk patients need to be identified, that PU prevention methods can be allocated correctly. Aim of systematic review was to provide information of the existing risk assessment scales used in ICUs and their predictive validity.

**Methods:** Data retrieval from CINAHL, PubMed, Scopus and Cochrane database was done through years 1/2010-1/2021 with main search terms: pressure ulcer/injury, intensive care, and risk assessment scale. Overall, 358 publications were identified out of which 231 were rejected based on the initial review of the title and abstract. The articles (N=76) were graded by using critical appraisal tools of Joanna Briggs Institute. This yielded 29 publications for thematic analysis.

**Results:** Cubbin & Jackson, Jackson/Cubbin, CAVE, CALCULATE, COMHON Index, EVARUCI, RAPS-ICU and EFGU risk scales were originally designed to be used in ICUs. Braden scale was commonly used risk scale (N=21). Its most significant risk indicator was the friction and shear and the least was nutrition. The common features among several risk scales were mobility, activity, mental condition, and skin moisture. ICU designed risk scales highlighted oxygenation, hemodynamics, and hygiene related risk indicators. Based on AUROC (60-95%), sensitivity (37.5-97%), specificity (37.4-97%), positive (13.3-69%), negative predictive (80.6-99%) values there is considerable variation among the functionality of the different risk scales for ICUs.

**Conclusions:** PU risk scales are globally used, but the spectrum of the scales is extensive. There is ongoing process of the modification of the scales by editing risk indicators to yield more predictive scales in search for more powerful ways of assessing PU risk. Currently functionality of PU risk assessment scales for ICUs seems promising. There is still a global need for more reliable PU risk assessment the functionality of which needs to be ascertained in multicenter study.

### References

- 1) Slawomirski L, Auraen A, Klazinga N. 2017. *The Economics of Patient Safety: Strengthening a value-based approach to reducing patient harm at national level.* OECD.
- 2) Labeau SO, Afonso E, Benbenishty J, et al. 2021. *Prevalence, Associated Factors and Outcomes of Pressure Injuries in Adult Intensive Care Unit Patients: The DecubiCUs Study.* *Intens Care Med*, doi: 10.1007/s00134-020-06234-9.



## 4.4

# Prevention of Skin Injuries in Patients with Acute Respiratory Distress Syndrome during the COVID-19 Pandemic

**Elizabeth Faust<sup>1</sup>**

<sup>1</sup> Tower Health System, Nursing Administration, West Reading, United States

**Introduction:** During the COVID-19 Pandemic, clinical practices in the acute care setting changed dramatically. Patients with COVID-19 often developed Acute Respiratory Distress Syndrome (ARDS) that is often treated with prone positioning. Bedside clinicians were faced with the challenge to learn how to manually prone patients. A multidisciplinary team was formed to identify best practices in real time for manually proning patients during the COVID-19 pandemic.

**Methods:** A team of clinicians was formed in March 2020 that included a CWOCN, respiratory therapist, critical care clinical nurse specialists, critical care nurses, a pulmonologist, a pharmacist, and a member of supply chain to evaluate products and practices for manually proning patients. Using a PDSA model, it was identified that there was a lack of appropriate supplies and education around the practice of manually prone positioning. The team implemented current best practices and utilized a rapid cycle change to develop best practices across the critical care division. Best practices included supply changes, intense education, and constant monitoring and re-evaluation. A retrospective chart review was performed of patients admitted to ICU and placed in prone position from March 2020-December 2021.

**Results:** Overall, a 40% skin injury rate was found in this population. Facial injuries were found to be the largest skin injury in our health system and across the state. Many patients placed in prone position ultimately died during the hospital stay.

**Conclusions:** A proning toolkit (which included a commercial ETT holder, an educational flier, a fluidized positioner, two flat sheets, wicking pads, and multiple silicone sacral foam bordered dressings) was developed and implemented. This kept the overall HAPI rate to under 30%, below state reported numbers. This prone positioning education is now part of annual competencies within the critical care division. Further evaluation of end-of-life injuries or unavoidable injuries should be examined.

## References

1. Gardner, L.A.(2020) Prone Positioning in Patients With Acute Respiratory Distress Syndrome and Other Respiratory Conditions: Challenges, Complications, and Solutions. *Pennsylvania Safety Authority Journal*; 2,4, pg 11-23. DOI: 10.33940/data/2020.12.1Pennsylvania Safety Authority Journal.
2. Guerin C., Reignier J., Richard J., et al. (2013). Prone positioning in acute respiratory distress syndrome. *N Eng J Med*, 368:2159-68.
3. Langer, T., Brioni, M., Guzzardella, A. et al. Prone position in intubated, mechanically ventilated patients with COVID-19: a multi-centric study of more than 1000 patients. *Crit Care* 25, 128 (2021). <https://doi.org/10.1186/s13054-021-03552-2>
4. Shearer, S.C., Parsa, K.M., Newark, A., Peesay, T., Walsh, A.R., Fernandez, S., Gao, W.Z. and Pierce, M.L. (2021), Facial Pressure Injuries from Prone Positioning in the COVID-19 Era. *The Laryngoscope*, 131: E2139-E2142. <https://doi.org/10.1002/lary.29374>

## 4.5

# The impact of prone positioning on the incidence of pressure injuries in adult intensive care unit patients: A meta review

Declan Patton<sup>1</sup>, Zena Moore<sup>1</sup>, Sharon Latimer<sup>2</sup>, **Pinar Avsar**<sup>3</sup>, Rachel Walker<sup>2</sup>, Brigid Gillespie<sup>2</sup>, Tom O'Connor<sup>1</sup>, Linda Nugent<sup>1</sup>, Aglecia Budri<sup>1</sup>, Niall O'Brien<sup>4</sup>, Wendy Chaboyer<sup>2</sup>

1 RCSI University of Medicine and Health Sciences, School of Nursing and Midwifery; Skin Wounds and Trauma Research Centre, Dublin, Ireland

2 Griffith University, School of Nursing and Midwifery, Gold Coast, Australia

3 RCSI University of Medicine and Health Sciences, School of Nursing and Midwifery; Skin Wounds and Trauma Research Centre, Dublin, Australia

4 RCSI University of Medicine and Health Sciences, Library, Dublin, Ireland

**Introduction:** Intensive care unit patients experience more pressure injuries (PI) than the general hospital population because of the severity of their underlying condition, treatments they receive, and immobility. Although prone positioning is beneficial for respiratory function, it often leads to facial PIs as well as PIs on other weightbearing areas of the body. This is concerning given that over the past decade, prone positioning ventilation has been used more frequently among patients with severe acute respiratory distress syndrome (ARDS), especially during the COVID-19 pandemic. Numerous systematic reviews have examined the impact of prone positioning on outcomes, including PI. For the first time, these were subjected to a meta-review.

**Methods:** This meta-review appraised existing systematic reviews that measured the incidence and prevalence of prone position induced PIs in adult ICU patients. The team followed the standard approach advocated for systematic reviews and used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to guide the conduct and reporting of the meta-review.

**Results:** Ten systematic reviews were synthesised. The cumulative incidence of PI in 15,979 adult patients ranged from 25.7% to 48.5%. One study did not report adult numbers. Only one review reported the secondary outcome of PI location. PIs were identified in 13 locations such as the face, chest, iliac crest, and knees. Using the AMSTAR-2, three reviews were assessed as high quality, six as moderate quality, and one as low quality.

**Conclusions:** The high incidence of PI in the prone position highlights the need for targeted preventative strategies. Care bundles may be one approach, given their beneficial effects for the prevention of PI in other populations. This review highlights the need for proactive approaches to limit unintended consequences of the use of the prone position, especially notable in the current COVID-19 pandemic.

## 4.6

# Implementation of evidence-based SKIN CARE practices in nursing home residents: Results of a mixed methods process evaluation alongside the SKINCARE trial

Janna Sill<sup>1</sup>, Monira El Genedy-Kalyoncu<sup>2</sup>, Alexandra Fastner<sup>2</sup>, Jan Kottner<sup>2</sup>, **Katrin Balzer**<sup>1</sup>

<sup>1</sup> Institute for Social Medicine and Epidemiology, Nursing Research Unit, University of Lübeck, Lübeck, Germany

<sup>2</sup> Institute of Clinical Nursing Science, Charité – Universitätsmedizin Berlin, Berlin, Germany

**Introduction:** Implementing evidence-based skin care in older people in need for care can help to promote skin integrity in this vulnerable population. The cluster-randomized-controlled SKINCARE trial (NCT03824886) evaluated the effects of an evidence-based skin care and prevention strategy in nursing homes [1]. Implementation of this strategy was facilitated by on-site-trainings, a self-learning package and a hotline. A systematic process evaluation was embedded to assess the implementation of the strategy and to identify changes in nursing processes and relevant contextual factors.

**Methods:** The mixed-methods study consisted of surveys with professional nurses, the local SKINCARE teams, and care managers (n=20 nursing homes) at the end of the study (T2, 6 months after randomization) and qualitative data collection in a sample (n=10 nursing homes) at three-time points (T0, T1 (3 months after randomization) and T2). Qualitative data collection comprised non-participatory observations of episodes of nursing assistance with body care, brief interviews with caregivers, and interviews with SKINCARE team members. Based on the Normalization Process Theory, data were collected on following topics: (i) execution of implementation strategies and the skin care program, (ii) mechanisms of change, and (iii) relevant contextual factors. All data were analyzed descriptively.

**Results:** Out of 17 nursing homes, 13 (n=8 IG, n=5 CG) took part in the process evaluation. Fifty-one non-participatory observations were conducted (intervention group n=32, control group n=19) including short interviews with 34 nurses, 13 interviews with SKINCARE team members, and 154 questionnaires completed at T2. Most frequent skin problems of observed nursing home residents were skin dryness (40%) and intertrigo (14%). The majority of the nursing staff in the intervention homes agreed with the use of the strategy, but not all of them knew its contents. Provided skin care products were used by some caregivers, but not always in accordance with the skin care and prevention strategy. Skin assessment, cleansing and care techniques, and product selection were mostly not in line with the strategy. A subjectively perceived high workload and staff shortages, especially due to the Covid-19 pandemic, lacking leadership support and inequities in the access to appropriate products turned out to be main implementation barriers.

**Conclusions:** The evidence-based skin care and prevention strategy was only partially implemented in nursing practice. For a more consistent implementation, more target group-specific strategies are required to facilitate the knowledge uptake. Also, the implementation strategies should be more team-oriented and include needs-based task assignments among nursing staff.

## References

[1] Kottner, J., E. Hahnel, M. El Genedy, K. Neumann, and K. Balzer, *Enhancing SKIN health and safety in aged CARE (SKINCARE Trial): a study protocol for an exploratory cluster-randomized pragmatic trial*. *Trials*, 2019. 20(1): p. 019-3375

## 5.1

# Solving the Health Economic Burden of Pressure Ulcers in the United Kingdom Using SEM Assessment Technology

Vignesh Iyer<sup>1</sup>, John Posnett<sup>2</sup>

<sup>1</sup> Bruin Biometrics, Los Angeles, United States

<sup>2</sup> Health Economic Consultant, England Metropolitan Area, United Kingdom

**Introduction:** Pressure Ulcers (PUs) are complex wounds. If current prevalence rates remain unchecked, the estimated annual treatment costs to the National Health Services (NHS) in the UK exceeds £1.74 billion (1). Despite improvements in the current standard of care that diagnoses PUs using visual skin assessment (VSA), the average treatment costs per patient range from £1,400 to >£8,500 (Category 3, 4 PUs) (1). Localized oedema or sub-epidermal moisture (SEM) is an early biomarker for impending pressure-induced tissue damage. In multiple care settings, implementing SEM assessment technology to detect early non-visible PUs demonstrated a 3-fold reduction in PU incidence (2). This health-economic evaluation describes the cost-effectiveness of implementing SEM assessment technology in the standard of care for PU prevention.

**Methods:** A decision-tree model was developed for a 450-bed representative acute-care NHS hospital. Model parameters including admission rates (83%), length of stay (4.5 days), baseline PU incidence (3.5%), band-5 nurse costs (£41/hour) and diagnostic accuracy of VSA, and SEM technology were obtained from the current literature. SEM assessment costs were obtained from the manufacturer of a commercially approved SEM measurement device\*. The effects of parameter uncertainty were tested in a univariate and probabilistic sensitivity analysis (PSA). Incremental cost-effectiveness (ICER) and Quality-Adjusted Life Year (QALY) were calculated for 10,000 randomly sampled Monte-Carlo simulations.

**Results:** The model demonstrated SEM pathways detecting more patients at risk of developing PUs. Decision tree analysis estimated 879 patients developing a PU of which SEM pathways prevented PUs in 68 patients more than VSA pathways. Economic analysis showed that PU care pathways implementing SEM assessment technology are cost-saving at £56.8 per admission. With a gain of 3.055 QALYs, the probability of SEM being cost-effective at a threshold of £30,000/QALY was 89.76%.

**Conclusions:** Increased detection of patients at high risk of PUs using SEM assessment technology results in preventing more PUs and reduces treatment costs. Implementing SEM assessment technology in PU care pathways is a dominant strategy over and above the current SoC for PU prevention with significant cost savings to the NHS.

## References

1. Guest, Julian F, et al. "Cohort study evaluating pressure ulcer management in clinical practice in the UK following initial presentation in the community: costs and outcomes." *BMJ open* 8.7 (2018): e021769.

2. Ousey, Karen et al. "Sub-epidermal moisture assessment as an adjunct to visual assessment in the reduction of pressure ulcer incidence." *Journal of wound care* vol. 31,3 (2022): 208-216. doi:10.12968/jowc.2022.31.3.208

\*Provizio® SEM Scanner

## 5.2

# What is the economic impact of pressure ulcers among patients in intensive care units? a systematic review.

**Natalie McEvoy<sup>1</sup>, Pinar Avsar<sup>1</sup>, Declan Patton<sup>1</sup>, Gerard Curley<sup>2</sup>, Cathal Kearney<sup>3</sup>, Zena Moore<sup>1</sup>**

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

<sup>2</sup> Royal college of Surgeons in Ireland, Department of Anaesthesia and Critical Care, Dublin, Ireland

<sup>3</sup> Royal college of Surgeons in Ireland, Department of Anatomy and Regenerative Medicine, Dublin, Ireland

**Introduction:** The incidence and prevalence of pressure ulcers in critically ill patients in intensive care units (ICUs) remains high, despite the wealth of knowledge on appropriate prevention strategies currently available. The primary objective of this systematic review was to examine the economic impact of pressure ulcers (PU) among adult intensive care patients.

**Methods:** A systematic review was undertaken, and the following databases were searched; Medline, Embase, CINAHL and The Cochrane Library. Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines were used to formulate the review. Quality appraisal was undertaken using the Consensus on Health Economic Criteria (CHEC)-list. Data were extracted using a pre-designed extraction tool, and a narrative analysis was undertaken.

**Results:** Six studies met the inclusion criteria. Four reported costs associated with prevention of pressure ulcers and three explored costs of treatment strategies. Four main PU prevention cost items were identified: support surfaces, dressing materials, staff costs and costs associated with mobilisation. Seven main PU treatment cost items were reported: dressing materials, support surfaces drugs, surgery, lab tests, imaging, additional stays and nursing care. The overall validities of the studies varied between 37–53%, meaning that there is potential for bias within all the included studies.

**Conclusions:** There was a significant difference in the cost of pressure ulcer prevention and treatment strategies between studies. This is problematic as it becomes difficult to accurately evaluate costs from the existing literature, thereby inhibiting the usefulness of the data to inform practice. Given the methodological heterogeneity among studies, future studies in this area are needed and these should use specific methodological guidelines to generate high quality health economic studies.

### 5.3

## Pressure Injury Prevalence and Practice Improvements in Nursing (PIPPIN study): A realist evaluation of pressure injury prevention practices in an Australian hospital

**Jenny Sim**<sup>1</sup>

<sup>1</sup> University of Newcastle, School of Nursing & Midwifery, Gosford, Australia

**Introduction:** Pressure injuries cause patient harm and place a significant burden on health care systems. Pressure injuries are considered preventable, yet they occur frequently in hospitalized settings. Approximately 7.9% (95% CI, 5.7-10.3%) of patients in Australian hospitals develop a pressure injury while hospitalised (Rodger et al, 2021). The aim of this study was to examine the impact nurses' knowledge, nurses' attitudes, nursing care practices and structured Plan-Do-Study-Act cycles can have on preventing pressure injuries in an acute care hospital.

**Methods:** A mixed methods study using a realist evaluation framework was conducted between November 2021 and April 2022. Data on nurses' knowledge and attitudes towards pressure injury prevention and pressure injury prevalence were collected at baseline and completion of the project. Eleven wards participated in a series of six structured cycles using plan-do-study-act improvement methodology. Qualitative interviews were used to evaluate the project and examine what worked for whom and in what circumstances.

**Results:** Prevalence of pressure injuries at baseline was 12.4% (n=217) and 5.5% were hospital-acquired. Nurses (n=237) at baseline had low levels of knowledge on prevention (32.3%) and aetiology (46.6%) but high levels of knowledge on risk assessment (83.3%) using the Pressure Ulcer Knowledge Assessment Test (PUKAT 2.0). Nurses had positive attitudes towards pressure injury prevention (Mean 43.25, SD 4.43) using the Attitudes to Pressure Ulcer Prevention (APuP) scale. All eleven wards participated in six cycles of plan-do-study-act cycles with focus areas including education, risk assessment, implementation of evidence-based prevention strategies and trialling the PURPOSE T risk assessment tool. At the completion of the project pressure injury prevalence had reduced to 8.9% (n=179) and 3.9% were hospital acquired. Qualitative interviews of key stakeholders were conducted to determine what had worked for whom and in what circumstances.

**Conclusions:** Pressure injury prevention requires nurses to have high levels of knowledge about preventing pressure injuries and for practice improvement activities to be embedded in the ward context.

### References

Rodgers, K, Sim, J & Clifton, R 2021, 'Systematic review of pressure injury prevalence in Australian and New Zealand hospitals', *Collegian*, 28 (2021), 310-323, DOI: 10.1016/j.collegn.2020.08.012

## 5.4

# Interventions for maintaining skin integrity in end-of-life care: a systematic review

Charlotte Raepsaet<sup>1</sup>, Karin Blomberg<sup>2</sup>, Karin Falk-Brynhildsen<sup>2</sup>, Georgina Gethin<sup>3,4</sup>, Dimitri Beeckman<sup>1,2,5,6</sup>

- 1 Skin Integrity Research Group (SKINT), University Centre for Nursing and Midwifery, Department of Public Health and Primary Care, Ghent University, Ghent, Belgium
- 2 Swedish Centre for Skin and Wound Research, Faculty of Health and Medicine, School of Health Sciences, Örebro University, Örebro, Sweden
- 3 Alliance for Research and Innovation in Wounds, School of Nursing and Midwifery, National University of Ireland, Galway, Ireland
- 4 School of Nursing and Midwifery, Monash University, Clayton, VIC., Australia
- 5 Research Unit of Plastic Surgery, Department of Clinical Research, Faculty of Health Sciences, Odense, Denmark
- 6 School of Nursing & Midwifery, Royal College of Surgeons in Ireland (RCSI), Dublin, Ireland

**Introduction:** At the end of life, changes related to a decrease in cutaneous perfusion and local hypoxia at the tissue, cellular, or molecular level reduce the availability of oxygen and the body's ability to utilize vital nutrients. Like other organs, the skin and underlying tissues can fail due to this hypoperfusion. As a result, the integrity of the skin can no longer be maintained.

At the end of life, transition of care with a realistic understanding of what can be achieved is critical. Skin care is one of the cornerstones of professional care and can have a significant impact on patients' end-of-life experiences. Caregivers need to be aware of what they can do to provide safe skin care and how they can contribute to the patient's quality of life. Therefore, the aim of our systematic review was to summarize interventions to optimize skin integrity at the end of life and the associated evidence base.

**Methods:** MEDLINE (PubMed interface), Cumulative Index to Nursing and Allied Health Literature (CINAHL), EMBASE and The Cochrane Library were systematically searched using a combination of key terms including end-of-life care and skin care. The Johns Hopkins Evidence-Based Practice Research Appraisal Tool was used to assess the strength and quality of included articles.

**Results:** Twenty-five articles were included and 21 were rated as low quality evidence-base. The results recommend carers to take a holistic approach that begins with a patient-centered assessment consisting of a general health, skin, wound, and pain assessment. Based on the assessment, any areas of concern can be documented and a patient-centered care plan, including skin and wound care, can be developed to meet the wishes of the patient and family. Realistic goal setting is important, and education and communication play a critical role in preparing the patient and family for the fact that the skin is failing and wound closure may not be possible.

**Conclusions:** This review can help caregivers optimize skin integrity in patients at the end of life. However, the recommendations in this review focus specifically on wound care and wound-related symptoms. Current research is limited to Level V evidence. More research with a high level of evidence in skin care is needed to identify and test strategies to optimize skin integrity in patients at the end of life.

## References

- Proksch E, et al. *The skin: an indispensable barrier. Exp Dermatol*, 2008;17(12):1063-1072.
- Rathert C, et al. *Patient-centered care and outcomes: a systematic review of the literature. Med Care Res Rev*, 2013;70(4):351-379.
- Samuriwo R. *Enhancing end-of-life skin care to prevent pressure ulcers in primary care. Journal of Community Nursing*, 2019;33(3):56-60.
- Sibbald R, et al. *SCALE: Skin changes at life's End. Wounds*, 2009;21:329-336.



## 5.5

## What the first national study of pressure ulcer prevalence and incidence in acute inpatient care told us about safety and quality of care?

**Tiina Kortteisto**<sup>1</sup>, **Anniina Heikkilä**<sup>2</sup>, **Jaana Peltokoski**<sup>3</sup>, **Tuija Ylitörmänen**<sup>4</sup>, **Tarja Tervo-Heikkinen**<sup>5</sup>

1 Tampere University Hospital, General Management Unit, Tampere, Finland

2 Helsinki University Hospital and University of Helsinki, Group Administration (nursing), Helsinki, Finland

3 Central Finland Health Care District, Administration services, Jyväskylä, Finland

4 Finnish institute for health and welfare, Alcohol, Drugs and Tobacco, Helsinki, Finland

5 Kuopio University Hospital, Clinical Development, Education and Research Centre of Nursing, Kuopio, Finland

**Introduction:** Pressure ulcers (PUs) are adverse events of patient care, which should be minimized in safety and qualitative care (OECD 2020). Many countries have implemented national quality programs to reduce number of PUs (Rodríguez-García et al. 2020). In Finland, we have national recommendations to guide PU prevention in nursing practice, but we have no systematic assessment of PU prevalence until this national study.

**Methods:** Multicentered, repeated cross-sectional study conducted in 15 acute care hospitals in Finland on the annual International Prevent Pressure Ulcer Day 2018 and 2019. All patients 18 years or older (N=11252) from somatic inpatient units, emergency follow-up units and rehabilitation units (N=503) were recruited to study. A total of 5902 participants enrolled to the study. Cross-tabulation, Pearson's Chi-square test and a logistic regression were used to analyze associations between variables and PUs.

**Results:** PU prevalence was 13% (all stages) and varied from organization to organization from 7% to 25%. The incidence of hospital acquired pressure ulcer (HAPU) was 10% (all stages) and varied from 4% to 22% by organisations.

Of all participants, 19% had their PU risk assessed and 30% had their skin status assessed within 8 hours after admission. Both assessments were performed in 15% of participants at admission. In the absence of a PU risk assessment and skin status assessment, the odds of having HAPUs increased 6.4-fold higher (CI 95%, 3.9-10.5; p <0.001).

Stages of HAPU/PU	HAPU (n = 591, %)	Medical device related HAPU (n = 119, %)	PU before hospital admission (n = 156, %)
Stage I	389 (65.8)	60 (60.0)	69 (44.2)
Stage II	143 (24.2)	33 (33.0)	53 (34.0)
Stage III	27 (4.6)	2 (2.0)	15 (9.6)
Stage IV	7 (1.2)	1 (1.0)	11 (7.1)
Unstageable	15 (2.5)	1 (1.0)	5 (3.2)
Mucosal membrane	3 (0.5)	3 (3.0)	1 (0.6)
Non-visible	7 (1.2)	0	2 (1.3)

**Conclusions:** According to our results, international and national guidelines of PU prevention have not been implemented successfully in nursing practice. Additionally, more attention should be targeted on PU prevention and systematic monitoring of PUs.

### References

Rodríguez-García, Márquez-Hernández, Belmonte-García, Gutiérrez-Puertas, Granados-Gómez 2020. How Magnet Hospital Status Affects Nurses, Patients, and Organizations: A Systematic Review. *American Journal of Nursing*. 2020;120(7):28-38. doi: 10.1097/01.NAJ.0000681648.48249.16

OECD 2020. *Economics of Patient Safety*. Retrieved from <https://www.oecd.org/health/health-systems/Economics-of-Patient-Safety-October-2020.pdf> (4.4.2022)

## 6.1

# The Use of PURPOSE-T in Clinical Practice

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

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

<sup>2</sup> Hull York Medical School, Heslington, United Kingdom

<sup>3</sup> University Medical Center Utrecht, Utrecht, Netherlands

**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) using adapted 'gold standard' instrument development methods. PURPOSE-T is different to standard RAIs as it includes a screening step to quickly identify those clearly not at risk and considers whether a patient already has a PU to prompt treatment. PURPOSE-T has since been implemented into routine care in 'early adopter' acute and community Trusts.

**Methods:** A realist evaluation was undertaken to facilitate a deeper understanding of 'what works, how, for whom, in what circumstances and to what extent' [1-2]. From a realist perspective PURPOSE-T is a resource to clinicians and its impact on care will be dependent on how they are used in practice, which will differ according to context. This type of evaluation therefore seeks understanding of causality via consideration of programme theories, to clarify how different contexts elicit particular nursing team responses and give rise to different outcomes. The study involved a 3 stage process as detailed below:

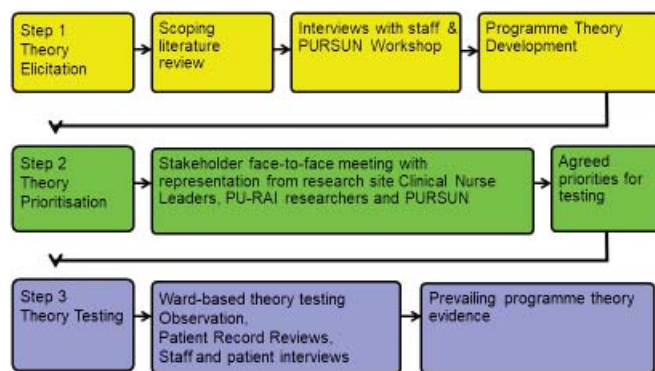


Figure 1: Overview of Realist Evaluation

A combination of methods including a literature review, semi-structured interviews with staff and patients, record review and observation were used. Due to the iterative nature of realist evaluation, analysis is not a distinct phase of the research process, rather it is undertaken on an ongoing basis to inform subsequent phases of the evaluation and maximise exploration of programme theories.

**Results:** Programme theories and supporting evidence relating to the use of PURPOSE-T in informing clinical judgement; prompting care planning and delivery and; facilitating multi-disciplinary and patient communication about pressure ulcer risk will be explored in this presentation.

**Conclusion:** Like other Pressure ulcer Risk Assessment Instruments, PURPOSE-T is a complex intervention as its delivery contains several interacting components [3] including the assessment itself, the potential outcomes and decisions about care interventions set within the delivery context of complex health care environments. Understanding this pathway will facilitate how PURPOSE-T can be used to maximally benefit routine practice 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.

[3] Skivington, K., et al., A new framework for developing and evaluating complex interventions: update of Medical Research Council guidance. *BMJ*, 2021. 374:2061.

**Acknowledgement:** 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.

## 6.2

# Skin hydration measurement and the prediction of the early development of pressure ulcers among at risk adults: A systematic review

Hannah Wilson<sup>1,2,3</sup>, Pinar Avsar<sup>2</sup>, Declan Patton<sup>1,2,4,5,6</sup>, Aglécia Budri<sup>1</sup>, Zena Moore<sup>1,2,4,5,7,8,9,10,11</sup>

- 1 Royal College of Surgeons in Ireland (RCSI), University of Medicine and Health Sciences, School of Nursing and Midwifery, Dublin, Ireland
- 2 Royal College of Surgeons in Ireland (RCSI), University of Medicine and Health Sciences, Skin Wounds and Trauma (SWaT) Research Centre, Dublin, Ireland
- 3 Cardiovascular Research Institute Dublin, Dublin, Ireland
- 4 Fakeeh College of Health Sciences, Jeddah, Saudi Arabia
- 5 Griffith University, School of Nursing and Midwifery, Queensland, Australia
- 6 University of Wollongong, Faculty of Science, Medicine and Health, Wollongong, Australia
- 7 Monash University, Faculty of Medicine, Nursing and Health Sciences, Melbourne, Australia
- 8 Ghent University, Department of Public Health, Faculty of Medicine and Health Sciences, Ghent, Belgium
- 9 Lida Institute, Shanghai, China
- 10 University of Wales, Cardiff, United Kingdom
- 11 Menzies Health Institute Queensland, National Health and Medical Research Council Centre of Research Excellence in Wiser Wound Care, Queensland, Australia

**Introduction:** The outermost layer of the skin's tissue structure is responsible for barrier homeostasis and maintaining hydration levels, which helps to protect the skin from external mechanical forces associated with pressure ulcer (PU) development.

**Methods:** This review aimed to examine skin hydration and determine if this biophysical parameter can predict early signs of PU development in at risk adults. Using a systematic review methodology, all studies within any healthcare setting measuring skin hydration and its association with PU development among at risk adults without a visible injury at baseline were considered for inclusion. The search was conducted in March 2022, using PubMed, CINAHL, SCOPUS, Cochrane, and EMBASE databases. A total of 1,727 records were returned, with 9 studies satisfying the inclusion criteria. Data were extracted using a pre-designed extraction tool and a narrative synthesis of the data was undertaken. The methodological quality of the included articles was assessed using the evidence-based librarianship (EBL) checklist.

**Results:** Included studies were published between 1997 and 2021, with most employing a prospective cohort design (88.9%, n=8). The mean sample size was 74 participants (SD=38.6; median 71). All studies measured skin hydration objectively, with 55.6% (n=5) using the hydration measurement device\* CM825 and 33.3% (n=3) of studies reported a statistically significant association between skin hydration and PU development. The mean EBL percentage was 66.6% (SD: 20.7%), however, only 33.3% (n=3) of studies scored ≥75%, indicating validity.

**Conclusions:** Within the included studies, lower skin hydration was associated with PU development in two studies, whereas higher skin hydration was associated with PU development in one study. On the sacrum, both lower and higher skin hydration was associated with PU development. The quality of included studies, variation of methodologies, and reported results has reduced the homogeneity of outcomes. This review highlights the requirement for future research evidence to ascertain the role of skin hydration in PU development.

## References

- Gefen, A. (2009). "Reswick and Rogers pressure-time curve for pressure ulcer risk. Part 1." *Nurs Stand* 23(45): 64-74.
- Glynn, L. (2006). "A critical appraisal tool for library and information research." *Library Hi Tech* 24(3): 387-399.
- Robinson, M., et al. (2010). "Natural moisturizing factors (NMF) in the stratum corneum (SC). I. Effects of lipid extraction and soaking." *J Cosmet Sci* 61(1): 13-22.
- WoundsUK (2018). "Best Practice Statement Maintaining Skin Integrity." London: Wounds UK: Available to download from: [www.wounds-uk.com](http://www.wounds-uk.com).

\* Corneometer®

## 6.3

# Implementation of carebundle in a clinical setting

**Britt Hansen**<sup>1</sup>, **Aase Fremmelevholm**<sup>2</sup>

1 Odense University Hospital, Department of Plasticsurgery, Odense C, Denmark

2 Odense University Hospital, Department of Plastic Surgery, Odense C, Denmark

**Introduction:** In a structured quality improvement intervention, we managed to decrease pressure ulcer prevalence from 18 percent to less than five percent from year 2012 to 2020 at Odense University Hospital. Unfortunately, the prevalence and severity of pressure ulcers increased at our hospital during Covid-19. This called for action and we decided to revitalize the pressure ulcer prevention at our hospital to ensure quality and patient safety for our patients.

A new national Danish clinical guideline for pressure ulcer prevention recommending the use of carebundle was released in 2020. We decided to revise our local guideline for Odense University Hospital with carebundle as a supplement to the recommendations from the EPUAP guideline, and initiate an implementation initiative at our hospital.

The aim of our initiative was to implement our guideline including the carebundle in clinical practice at our hospital to decrease pressure ulcer prevalence.

**Methods:** The Quality Implementation Framework (QIF) is used in making an implementation plan with four phases as described in the following.

**First phase:** All departments at our hospital has a nurse or nurse assistant dedicated to the work on pressure ulcers prevention. They are the front-line staff in the implementation, which will create stability and be more effective in the process. The leaders of departments are also engaged. The implementation process are initiated by sending an email with information about the process to all departments.

**Second phase:** Two meetings were set up to inform front-line staff about the guideline and the process (completed in March 2022), and one-hour meeting are planned in every department at the hospital (April to May 2022). To support implementation of the local guideline, we created an inspiring video about carebundle. The video is showing how to work with carebundle in clinical practice.

**Third phase:** The active implementation contains local activities and support and supervision in departments.

**Fourth phase:** We are monitoring the pressure ulcers by annual prevalence surveys, and are planning a survey after the implementation period to evaluate the implementation process and the knowledge of the clinical staff.

The survey combined with an evaluation of the implementation process can provide knowledge of pressure ulcer prevalence and implementation process.

**Results:** We will present our inspiring video and data from our prevalence surveys and the evaluation at EPUAP Annual Meeting 2022.

## 6.4

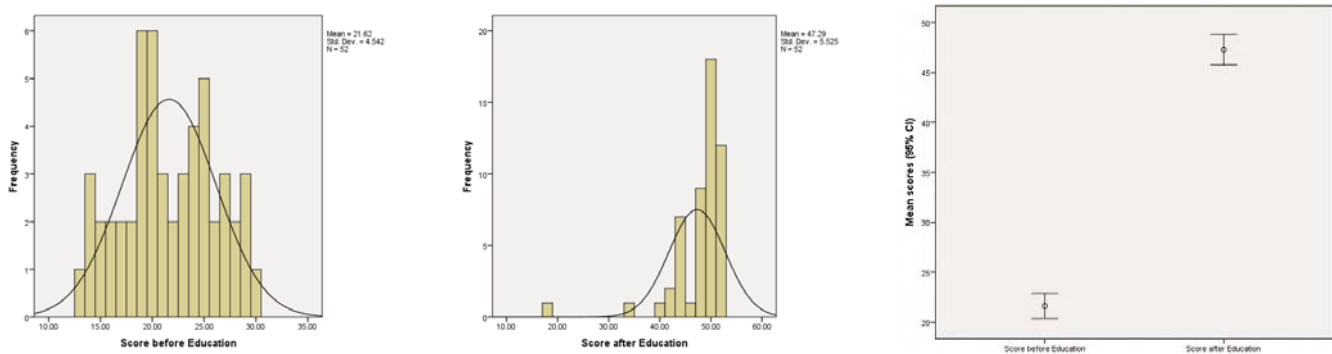
# The Effect of Educational Program on Nurses' Knowledge About Pressure Ulcer.

**Abdulaziz Binkanan**<sup>1</sup>

<sup>1</sup> King Fahad Medical City, Ministry of Health., Wound Care, Riyadh, Saudi Arabia

**Introduction:** Pressure ulcer is a global issue and lack of knowledge about pressure ulcer among nurses been found. Therefore, the aim of this study is to determine the effectiveness of an educational program on nurses' knowledge related to pressure ulcer. Moreover, if they have lack of knowledge related to pressure ulcer or the prevention and care of the pressure ulcer, then the lack of knowledge can be eliminated by the educational program or not.

**Methods:** 52 registered nurses work in a medical city participated in this study and deal with pressure ulcer on daily basis. quasi- experimental design in which the study has two parts (Quantitative). A pre-test and post-test design used. A questionnaire distributed to the nurses to assess their knowledge before conducting the educational program. Then the educational program delivered to them. After that, the same questionnaire given to them for comparison. After the collection of data, the ratio of the correct answers of the pre-test and post-test were compared and processed by Statistical Package for Social Science (SPSS). Ethical approval has been obtained and ethical consideration has been taken.



**Results:** After implementing the educational program, majority of nurses provided the correct answers to the same questionnaire and the lack of knowledge can be eliminated by the educational program. Moreover, around 25% correct answers of the questionnaire while in the pre-test, the nurses gave approximately 97% correct answers.

**Conclusions:** This study showed the lack of knowledge about PU and it can be improved by PU educational program. Among several studies, many of the studies are considered in this study to provide a clear perception that the educational and training program can enhance the knowledge of nurses related to pressure ulcer (Bergman et al., 2015; Qaddumi, J. and Khawaldeh, 2016, p. 6; Monami et al., 2015). Moreover, the study and results show that there is a need of associational and a professional training program in this field.

**References:** Available.

## 7.1

# I cannot "unhear her cries" or "unsee what I saw." Pressure injuries in Aged Care. A synopsis of the interim report of the Australian Royal Commission into Aged Care Quality and Safety.

**Suzanne Kapp**<sup>1</sup>

<sup>1</sup> The University of Melbourne, Nursing, Melbourne, Australia

**Introduction:** In 2018, the Australian Government commenced a Royal Commission into Aged Care Quality and Safety. This landmark enquiry (the highest form of inquiry on matters of public importance in Australia) has been conducted to identify how older people are cared for, what should change, and what can be done to raise the quality and safety of the care provided to people who live in residential aged care and in-home healthcare settings.

**Methods:** A synopsis of the Interim Report of the Australian Royal Commission into Aged Care Quality and Safety (published December 2019) was developed for the purpose of highlighting the issues identified with pressure injury prevention and management in residential aged care and in-home healthcare settings.

**Results:** The very first of the seven quality and safety issues identified in the Interim Report is "inadequate prevention and management of wounds, sometimes leading to septicemia and death." A series of cases are presented which illustrate the poor assessment, care, documentation and follow up of people who developed pressure injuries and subsequently died. The Report suggests that the aged care health system in Australia lacks innovation, flexibility, transparency, accountability and adequate reporting.

**Conclusions:** The Interim Report has highlighted that aged care services in Australia require fundamental reform and redesign so as to meet the basic human rights of people in care and to respect and preserve their dignity and identity. The presentation will conclude with a discussion of the complexities of what will be a complex and challenging healthcare system transformation.

## References

Commonwealth of Australia. (2019). *Royal Commissions into Aged Care Quality and Safety. Interim Report*. Retrieved <https://agedcare.royalcommission.gov.au/publications/Documents/interim-report/interim-report-volume-1.pdf>

## 7.2

# Dressings and topical agents for preventing pressure ulcers

Declan Patton<sup>1,2</sup>, Zena Moore<sup>3,4</sup>, Fiona Boland<sup>5</sup>, Wendy Chaboyer<sup>6</sup>, Sharon Latimor<sup>6</sup>, Rachel Walker<sup>6</sup>, **Pinar Avsar**<sup>2,4</sup>

1 RCSI University of Medicine and Health Sciences, Skin Wounds and Trauma Research Center, Dublin, Ireland

2 RCSI University of Medicine and Health Sciences, School of Nursing and Midwifery, Dublin, Ireland

3 Royal College of Surgeons in Ireland, School of Nursing and Midwifery, Dublin, Ireland

4 Royal College of Surgeons in Ireland, Skin Wounds and Trauma Research Center, Dublin, Ireland

5 Royal College of Surgeons in Ireland, Dublin, Ireland

6 Griffith University G40, Southport, Australia

**Introduction:** Pressure ulcer (PU) prevention strategies often include dressing and topical agents however, it remains unclear which, if any, are most effective. This is the third update of a Cochrane review, which was originally published in 2013 (Moore and Webster 2018).

**Methods:** We included randomised controlled trials that enrolled people at risk of PU. In January 2022 we searched the Cochrane Wounds Specialised Register; the Cochrane Central Register of Controlled Trials (CENTRAL); Ovid MEDLINE (including In-Process & Other Non-Indexed Citations); Ovid Embase and EBSCO CINAHL Plus and clinical trials registries to identify additional studies. There were no restrictions with respect to language, date of publication or study setting.

**Results:** Of the 45 trials (11326 participants; range 37 to 1633 participants) that met the inclusion criteria, 28 involved dressings; 14 involved topical agents; and three included dressings and topical agents. All trials reported the primary outcome of PU incidence. The results for the dressing trials are presented here. There were four different comparison groups; 15 trials (n = 5085) compared a silicone multilayer dressing with no dressing. In the silicone dressing group, 4% (121/2806) of participants developed a PU, in the no dressing group, 11% (246/2279) of participants developed a PU (RR 0.42, 95% CI 0.34 to 0.52). Six trials (n= 1360) compared foam with film/other dressing/other foam. In the foam group 8% (53/662) of participants developed a PU, in film/other dressing/other foam group 8% (58/698) of participants developed a PU (RR 0.92, 95% CI 0.66 to 1.29). Nine trials (n= 1188) compared other dressings with placebo, control or no dressing. In the dressing group 30% (122/403) of participants developed a PU, in the placebo, control or no dressing 29% (119/413) of participants developed a PU (RR 1.06, 95% CI 0.88 to 1.28). Three trials (n = 524) compared fatty acid with foam dressing. In the fatty acid group 8% (22/270) of participants developed a PU, in the foam group 15% (37/254) of participants developed a PU (RR 0.58, 95% CI 0.36-0.92).

**Conclusions:** There are a wide variety of dressings used for PU prevention, overall the evidence is mixed, with silicone multilayer dressings providing the most promising evidence. However, there is a dearth of trials making head to head comparisons, and as such, there is a lack of evidence pertaining to which is the most effective dressing to use for PU prevention.

## References

Moore ZE, Webster J. Dressings and topical agents for preventing pressure ulcers. *Cochrane Database Syst Rev*. 2018 Dec 6;12(12):CD009362. doi: 10.1002/14651858.CD009362.pub3.



### 7.3

## Development of a reporting tool for Medical Device Related Pressure Ulcers: Cognitive pre-testing, usability, and feasibility assessment

Ewa Crunden<sup>1</sup>, Peter Worsley<sup>2</sup>, Lisette Schoonhoven<sup>3</sup>, Susanne Coleman<sup>4</sup>

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

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

<sup>3</sup> Utrecht University, Utrecht, Netherlands

<sup>4</sup> University of Leeds, Leeds, United Kingdom

**Introduction:** Medical Device Related Pressure Ulcers (MDRPU) pose a significant burden on healthcare organisations and patients. Despite international recognition, their reporting is not performed routinely or standardised. This has limited our understanding of the real burden of these wounds and restricts our knowledge about devices that would benefit from safer design. Previously, we undertook an international consensus study to determine a data set for reporting MDRPUs. The aim of the present study was to pilot the reporting tool and assess its feasibility in hospital settings.

**Methods:** Cognitive pre-testing methods, namely think-aloud interviews and focus groups with UK clinicians, were undertaken to improve the reporting tool's understanding, flow, and acceptability. Subsequently, the tool was tested by tissue viability teams in two hospitals in the South of England for three months. We have used a System Usability Scale questionnaire (Brooke, 1986) and focus groups to assess its usability and feasibility of use in practice. Completeness of forms was also assessed.

**Results:** The study was undertaken between January and April 2022. Preliminary results show that the reporting form was easy to follow and clear. However, the nurses felt that the level of detail required was overwhelming and the reporting form challenging to complete in the time during routine reporting. Indeed, it was reported that completing the MDRPU form was taking approx. twenty minutes. The nurses relied mainly on the patient record to complete the form. Data regarding medical devices were challenging to complete. This was due to a lack of record of the medical device application and use in the patient record, the device removal by ward nurses prior to reporting, or the device originating from outside of the Institution. Several items relating to general patient data were found to be irrelevant for the purpose of reporting and practice improvement.

**Conclusions:** The reporting form includes items agreed upon through the international consensus study and was further developed to improve its comprehension and flow. Although the cognitive pre-testing showed that positive changes were made to the layout and order of the reporting form, the number of data items required to be collected was not feasible in clinical practice. The MDRPU reporting form requires further improvements in its usability in clinical practice, integration with electronic patient records to avoid data double-entry, and improved recording of data relating to medical devices.

### References

Brooke, J. (1986) System Usability Scale (SUS). Available at: <https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html> (Accessed: 23rd July 2020).

## 7.4

# What is the impact of sub epidermal moisture (SEM) measurement and targeted pressure ulcer prevention, versus visual skin assessment and usual care, on mean SEM delta scores and early pressure ulcer development

Sorcha Byrne<sup>1</sup>, Zena Moore<sup>2</sup>, **Pinar Avsar**<sup>1</sup>, Tom O'Connor<sup>1</sup>, Declan Patton<sup>2</sup>

<sup>1</sup> RCSI University of Medicine and Health Sciences, School of Nursing and Midwifery, Dublin, Ireland

<sup>2</sup> RCSI University of Medicine and Health Sciences, School of Nursing and Midwifery; Skin Wounds and Trauma Research Centre, Dublin, Ireland

**Introduction:** Decreased mobility/excess movement and the presence of pressure/shear are central to PU formation. However, existing risk assessment dilutes the importance of immobility as a risk factor. Furthermore, visual skin assessment is unable to detect damage which is manifesting beneath the skin, which if left unnoticed can progress to irreversible visible tissue damage. Elevated Sub Epidermal Moisture (SEM) levels have been shown to be an indicator of early-stage PU damage and when detected can enable the targeting of interventions to combat this risk.

**Methods:** The aim was to investigate the impact of SEM measurement and targeted pressure ulcer prevention, versus visual skin assessment and usual care, on mean SEM measurement scores using a CE marked device and early pressure ulcer development (as indicated by a SEM score of  $\geq 0.5$  for 2 or more days consecutively) in acute hospital patients. A quantitative, quasi-experimental observational approach was employed. A total of 149 at risk patients took part and were randomly allocated to study group (78 treatment and 71 control). SEM levels were recorded daily for a maximum of five days on three sites: the sacrum, the right heel, and the left heel in both study groups. Enhanced pressure ulcer prevention was delivered to those with an elevated SEM score in the treatment group. Staff caring for the control group participants were blinded to SEM measurements, and participants in this group received usual care. Intention to treat analysis was used to guide analysis.

**Results:** The mean age of participants was 67.3 years, and 43% were female. Participants in the treatment group had a statistically significant reduction in mean SEM delta scores (MD: 0.49; 95% CI: 0.59, 0.39;  $p < 0.0001$ ), and in the odds of developing a SEM PU (OR: 0.59, 95% CI: 0.24 to 1.00;  $p = 0.05$ ).

**Conclusions:** Knowing the patient's individual responses to pressure and shear forces, using technology, such as SEM measurement, enables the detection of anatomical areas responding adversely. The early detection of tissue damage is beneficial in two different ways. First, it allows practitioners to put interventions into place when the damage is still microscopic and reversible and thus avoids the knock-on effect of inflammation, especially in the presence of tissue deformation. Secondly, cell death can be avoided when the problem is identified before the cell reaches the point when cell death is present, averting the development of a visual pressure ulcer.

## 7.5

# Enhancing Pressure Injury Prevention Bundle During COVID 19 Pandemic to Reduce Hospital Acquired Pressure Injury Incidence and Prevalence Rate

**Wilnora Cascolan<sup>1</sup>**

<sup>1</sup> King Fahd Military Medical Complex - Dhahran, Nursing Administration, Dhahran, Saudi Arabia

**Introduction:** Our hospital successfully sustains the HAPI prevalence rate below 50th percentile (NDNQI benchmark) from 2018 to 2019, however, in the 1st quarter of 2020 at the onset of COVID-19 pandemic, the NDNQI HAPI prevalence rate increased to + 0.32 which is above the mean value - 0.01 (negative indicator) and above the 50th percentile (our benchmark). The increased HAPI prevalence rate has led us to review our current pressure injury prevention bundle and integrate best practice pressure injury (PI) prevention intervention for patients with COVID-19. Our goal is to reduce and sustain HAPI prevalence rate below 50th percentile or better to improve patient's outcome and experience especially with the current pandemic situation.

**Methods:** In collaboration with the multidisciplinary team and skin savers group, the team tested several changes and implemented successful pressure injury prevention bundle. We utilized Lewin's change theory to introduce change in pressure injury prevention bundle and these changes were tested using the Plan-Do-Study-Act methodology. Statistical analysis using the independent test was applied to detect the significance of any difference in the incidence and prevalence of HAPI before and after implementation of changes. Retrospective cross-sectional study was used to identify pressure injury prevalence rates based on NDNQI guideline of data measurement.

**Results:** HAPI/U prevalence rate was sustained below 50th percentile from 2nd quarter 2020 to 4th quarter 2021. The HAPI incidence rate showed reduction and a significant decrease in the severity of the pressure injury from stage two to stage one.

**Conclusions:** In this quality improvement project we explored the importance of preventing pressure injury by implementing evidence-based practice in pressure injury prevention bundle and aligning data measurement with local and international guidelines. Lewin's change theory and the Plan-Do-Study-Act (PDSA) model provided the framework for this pressure injury preventive bundle. Sustaining the result of pressure injury incidence and prevalence rate improved patient care outcomes and overall experience.

### References:

NPIAP 2020, *Unavoidable Pressure Injury during COVID-19 Pandemic: A position paper from the National Pressure Injury Advisory Panel (NPIAP)*, <https://cdn.ymaws.com>, Accessed 12th July 2020

Nursing Database of Quality Nursing Indicators (NDNQI), 2017. *Guidelines for Data Collection and Submission on Pressure Injury Indicator*. Retrieved at [www.ndnqimembersquality.com](http://www.ndnqimembersquality.com), (Accessed 27th August 2020).

*Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline, the International Guideline 2019*. 18.5 Health Research & Educational Trust, 2017 April, *Preventing Hospital Acquired Pressure Ulcers/Injuries (HAPU/I)*, Retrieved at [www.hret-hiin.org/resources.com](http://www.hret-hiin.org/resources.com) (Accessed 1st December 2018).

## 7.6

# What are the effects of vasopressor agents on the development of pressure ulcers in critically ill patients in intensive care units? a systematic review

**Natalie McEvoy<sup>1</sup>, Zena Moore<sup>1</sup>, Declan Patton<sup>1</sup>, Gerard Curley<sup>2</sup>, Cathal Kearney<sup>3</sup>**

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

<sup>2</sup> Royal college of Surgeons in Ireland, Department of Anaesthesia and Critical Care, Dublin, Ireland

<sup>3</sup> Royal college of Surgeons in Ireland, Department of Anatomy and Regenerative Medicine, Dublin, Ireland

**Introduction:** Critically ill patients treated in intensive care units (ICUs) are a unique group of patients that represent the sickest of all those in hospital. The development of a pressure ulcer (PU) in this specific patient group presents an additional threat to their existing critically ill status. PU rates in patients in ICU are reportedly the highest among all hospitalised individuals. This has been attributed to a number of disease-related factors including inadequate tissue perfusion, hemodynamic instability, and the severity of illness. The primary objective of this systematic review was to determine the effect of vasopressor agents on the development of PUs among critically ill patients in ICUs. The secondary outcome of interest was length of stay in ICU.

**Methods:** A systematic review was undertaken using the databases searched: Medline, Embase, CINAHL and The Cochrane Library. Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines were used to formulate the review. Data were extracted using a predesigned data extraction table and analysed as appropriate using RevMan. Quality appraisal was undertaken using the Evidence Based Librarianship (EBL) Critical Appraisal Tool.

**Results:** Ten studies met the inclusion criteria. Two studies provided sufficient data to compare the number of patients who developed a pressure ulcer with and without the use of vasopressors. Within these two studies, being treated with a vasopressor increased the likelihood of PU development. In addition, RevMan analysis identified that shorter duration of administration of vasopressors was associated with less PU development (Mean Difference (MD) 65.97 hours 95% CI: 43.47 to 88.47;  $p=0.0001$ ). Further, a lower dose of vasopressors was also associated with less PU development (MD: 8.76  $\mu\text{g}/\text{min}$  95% CI: 6.06-11.46;  $p < 0.00001$ ). Mean length of stay increased by 8.85 days (95% CI: 4.47-13.24;  $p < 0.00001$ ) for those with a PU. The overall validities of the studies varied between 45–73%, meaning that there is potential for bias within all the included studies.

**Conclusions:** Vasopressor agents can contribute to the development of PUs in critically ill patients in ICUs. Having PU contributed to a prolonged ICU stay in this specific patient group. Given the risk of bias within the included studies, further studies are needed to validate the findings of this review.

## 8.1 Mini-invasive drainages and irrigation of any infected ulcer recess avoid exudate stasis, reduce recurrence and allow better rehabilitation

**Marco Cavallini**<sup>1</sup>

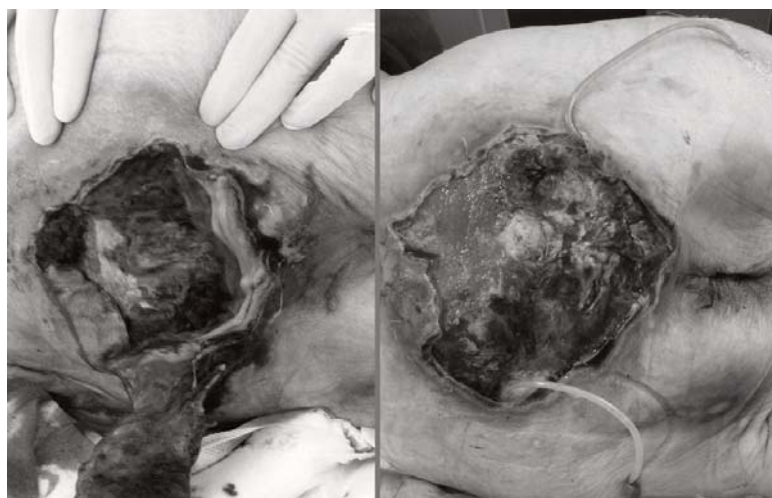
<sup>1</sup> Sapienza University of Rome, Department of medical and surgical sciences and translational medicine, Roma, Italy

**Introduction:** When dealing with deep cutaneous ulcers, after debridement any dead/infected tissue, drainage of any hidden recess is mandatory: stasis is the main responsible for persistent infection, biofilm and wound healing impairment. Surgical drainage of a deep recess could consist in an extended incision of any tract and of the overlying tissues. In these cases healing results in large incision scars, exposing that site to recurrent complications and inadequate rehabilitation. We have, therefore, designed a mini-invasive and easy surgical approach to ulcer's recess drainage which allows an adequate cleansing and facilitates the irrigation of any pierced hidden tract.

**Methods:** This technique has been utilized in 103 ulcers: 72 diabetic foot ulcers (DFU) Wagner 3: toe (n=33), metatarsal (n=29), or Charcot foot (n=10). and in a series of 31 pressure ulcers: 21 presacral, 4 ischiatic and 6 heel, with long recesses along the subcutaneous tissue or deeper. Adequate foot vascularization has been considered in the presence of tibial pulses or with  $ABI > 0,6$  and/or  $TcPO_2 > 30$ mmHg. With a probe we explore any main recess and at the opposite site where the end of the tract become superficial toward the skin, skin and interposed tissues are pierced in order to pass the probe through. A silastic tube is anchored to the probe, is passed backward and two ends are tied together to construct an ulcer piercing ring (UPR). The UPR is designed to keep the tract open and to facilitate the insertion of a syringe into both tissue openings to allow daily irrigation. All patients have been treated with systemic specific antibiotics on the basis of the ulcer's culture results.

**Results:** All ulcers have recovered from their deep infectious status without any further extension of surgical incision.

**Conclusions:** Stalling of ulcer healing, which do not progress beyond the inflammatory phase, has been related to persistent inflammation, biofilm and increase of metalloproteases activities. Any local or systemic treatment finalized to eliminate or reduce prolonged host reaction, revitalizes tissue healing. Ulcer debridement and removal of all infected/dead tissues are mandatory along with drainage and daily irrigation of all recesses and systemic antibiotics. UPR conservative mini-invasive technique should be considered as a first step procedure in treating not well-drained infected ulcer recesses because it could avoid unnecessary extended tissue incisions, extended scar formation, facilitates rehabilitation and reduce recurrence.



## 8.2

# The integration of sensor technology in disposable bodyworn: a promising pathway in the prevention and reduction of skin damage

Charlotte Raepsaet<sup>1</sup>, Brecht Serraes<sup>1</sup>, Sofie Verhaeghe<sup>2,3,4</sup>, Dimitri Beeckman<sup>1,5,6,7</sup>

- 1 Skin Integrity Research Group (SKINT), University Centre for Nursing and Midwifery, Department of Public Health and Primary Care, Ghent University, Ghent, Belgium
- 2 University Centre for Nursing and Midwifery, Department of Public Health and Primary Care, Ghent University, Ghent, Ghent, Belgium
- 3 Department of Nursing, VIVES University College, Belgium, Kortrijk, Belgium
- 4 Faculty of Medicine and Life Sciences, Hasselt University, Hasselt, Belgium
- 5 Swedish Centre for Skin and Wound Research, School of Health Sciences, Örebro University, Örebro, Sweden
- 6 Research Unit of Plastic Surgery, Department of Clinical Research, Faculty of Health Sciences, Odense, Denmark
- 7 School of Nursing & Midwifery, Royal College of Surgeons in Ireland (RCSI), Dublin, Ireland

**Introduction:** Quality of care and control of healthcare spending stimulate the development of innovative interventions and products, such as wearable sensor technology. Such technology can monitor physiological signs such as heart rate in real time and provide feedback to caregivers. The integration of sensor technology in disposable bodyworn, including diapers and underpads, offers a promising pathway in the prevention and reduction of moisture related skin damage, such as incontinence associated dermatitis, which increases the susceptibility to develop pressure ulcers. The integration of sensor technology in disposable bodyworn can increase responsiveness to incontinence events; timely diaper changes, and prevention of soiled linen, and thus minimise the risk of skin damage and improve the residents' wellbeing.

However, technology is often developed from the perspective of engineers who do not necessarily have insight into clinical practice, patient experience, or the cost the technology will bring to the patient and healthcare providers. Therefore, it is recommended to involve the relevant stakeholders in technology development. Our study aimed to define the user profile, (technical) criteria, conditions, and potential benefits of the integration of sensor technology in disposable body-worn according to caregivers, facility managers, and nursing home residents.

**Methods:** A qualitative study was conducted using a frame method. The sample included residents, caregivers, and facility managers in a selection of Belgian nursing homes. Semi-structured interviews were conducted between June and August 2020.

**Results:** The user profile was defined as residents with cognitive impairment and residents who are bedridden or are severely limited in mobility. The following (technical) criteria emerged from the analyses: a small, thin, and oval sensor, a real-time indication of the product's saturation, leakage and liquid stool detection, a durable sensor easy to disinfect, and receiving notifications on a wearable device. Conditions included a stable connection between the wearable device and the sensor, accurate measurements, user-friendly system, comprehensible training, affordability, and data protection. Potential benefits included workload reduction, increased comfort for residents and staff, more person-centred care, increased quality of care, less skin damage, and economic and/or environmental gains.

**Conclusions:** The results of this study demonstrate the importance of involving all relevant stakeholders in the development of sensor technology to ensure that users' needs are met, thereby increasing utilization. Extensive education is recommended to inform stakeholders of the importance and benefits of the technology. The study results also suggest that sensor technology should not be a substitute for, but rather an adjunct to, routine care.

## References

- Gagnon MP, et al. Framework for user involvement in health technology assessment at the local level. *Int J Technol Assess Health Care*. 2015;31(1-2):68-77.
- Yu P, et al. An exploration of the effects of introducing a telemonitoring system for continence assessment in a nursing home. *J Clin Nurs*. 2014;23(21-22):3069-3076.

## 8.3

## Subdermal injection of hyaluronate plus amino acids in recalcitrant pressure injuries: preliminary results

**Roberto Cassino**<sup>1</sup>, **Cristina Galuzzi**<sup>1</sup>, **Gabriela Sofia Barrionuevo Moreno**<sup>1</sup>, **Lorella Bettaglio**<sup>1</sup>, **Irena Cela**<sup>1</sup>, **Federica Maggi**<sup>1</sup>

<sup>1</sup> "Sacra Famiglia" Korian Nursing Home, Geriatrics - Long Term Care, Pieve del Cairo, Italy

**Introduction:** Hyaluronate [1] plus amino acid dressings demonstrated to be effective in the treatment of deep pressure injuries, especially in terms of substance loss filling [2]. The main feature of this treatments is the reduction of healing time [3], but in case of recalcitrant bedsores many times we need a surgical intervention to reactivate wound bed and edge, also using bioengineered tissues. The aim of this work is to suggest a new technique to approach this type of lesions, avoiding surgery.

**Methods:** The study is still ongoing (7 patients completed the protocol); we enrolled 10 elderly patients with recalcitrant pressure ulcers, in stand by situation for 6 weeks at least. Patients with cachexia, neoplasms, immunosuppressive therapies and low life expectance have been excluded. All wounds had an alginate dressing. The protocol of the study was the subdermal injection (under the wound edge) of a mixture of hyaluronic acid and 6 amino acids (lysine, proline, glycine, leucine, valine, alanine) once a week for 2 weeks and then twice a week for 6 weeks. We evaluated the wound area reduction (WAR) and the depth reduction (DR) using the wound measurement system\*.

**Results:** All patients had a significant result within the first two weeks; after the first injection we noted a quick reaction in terms of granulating tissue stimulation and depth reduction. In the patients that concluded the study DR was about 85% and WAR more than 70%. No perilesional skin damages or to the wound edge, nor inflammatory reaction at the injection sites. No adverse reactions/allergies. Patients didn't report any discomfort: only a light burning pain during the injections.

**Conclusions:** This new technique to treat pressure injuries demonstrated to be effective, especially in terms of reactivation of the wound bed and acceleration of the substance loss filling. This could be a new approach to the recalcitrant ulcers to achieve healing quickly without surgical intervention, avoiding the development of deep chronic wounds and saving costs.

**References:**

[1] Neuman MG, Nanau RM, Oruña-Sanchez L, Coto G. (2015) Hyaluronic acid and wound healing. *J Pharm Pharm Sci* 18: 53-60.

[2] De Servi B, Orlandini A, Caviola E, Meloni M. (2016) Amino acids and hyaluronic acid mixtures differentially regulate extra cellular matrix genes in cultured human fibroblast (Ahead of Print)

[3] Cassino R, Ricci E. Topical application of Vulnamin® in the management of chronic wounds: a prospective observational study. *J Wound Care*. 2010 Jan;19(1):29-34.

\* Visitrak™



## 8.4

## PhotoBioModulation in pressure injuries and IAD: a multicentric study in institutionalized elderly people

**Roberto Cassino**<sup>1</sup>, **Agnieszka Kopniak**<sup>2</sup>, **Cristina Galuzzi**<sup>1</sup>, **Gabriela Sofia Barrionuevo Moreno**<sup>1</sup>, **Irena Cela**<sup>1</sup>, **Alina Ilisan**<sup>2</sup>

<sup>1</sup> "Sacra Famiglia" Korian Nursing Home, Geriatrics - Long Term Care, Pieve del Cairo, Italy

<sup>2</sup> "Heliopolis Residences" Korian Nursing Home, Geriatrics - Long Term Care, Binasco, Italy

**Introduction:** Among the wound care treatments that use biophotonics, Blue Light PhotoBioModulation (FBM) is the most recent and has shown its effectiveness on ulcers of the lower limb and diabetic foot[1]. However, there are no validated data on pressure injuries (PI) and Incontinence Associated Dermatitis (IAD). The aim of this work is to demonstrate the effectiveness of Blue Light FBM in the treatment of geriatric lesions (PI & IAD)[2].

**Methods:** We set up a polycentric study involving only Nursing Homes to evaluate the performance of FBM on typically geriatric lesions (PI & IAD). Inclusion criteria: age over 65, cleansed and/or critically colonized lesions (according to Cutting & Harding criteria), WBP score A-B; patients with ischemic and/or infected lesions, neoplastic or terminal and treated with immunosuppressants, were excluded. 10 patients with pressure injuries and 5 patients with IAD were enrolled. Treatment with FBM was 2 minutes for every 25 cm<sup>2</sup> of lesion twice a week for up to 10 weeks. The same dressings for all patients: stable ozonides for PI and ionic silver spray powder for IAD. Wound Area Reduction (WAR) and the reduction of signs of infection, if present, were evaluated. Weekly evaluation using the wound measurement system\*. Study duration 10 weeks or healing or onset of adverse events.

**Results:** All patients achieved significant improvement or complete healing; the mean WAR of the PI was 75.8% (3 patients healed within the observation time); the depth reduction (6 out of 10 patients) was 74.8%. All patients with IAD achieved healing within the observation time (3 in 21 days and 1 in 1 week). No adverse events, no allergies, no induced pain.

**Conclusions:** Blue Light FBM has shown highly significant efficacy in the treatment of pressure injuries and IAD[3]. The mean healing time of IAD (less than 3 weeks) is significantly lower than that of treatment with zinc oxide (about 140 days) and this means a reduction in time, costs and patient suffering.

## References

[1] Dini V et al. Blue light emission in the management of hard-to-heal wounds. *Giornale italiano di dermatologia e Venereologia* 2020;155 doi: 10.23736/S0392-0488.20.06691-2

[2] Cassino R, Kopniak A. (2021) Onde d'urto, Elettrostimolazione e Fotobiomodulazione: microbiota e biofilm. Best Presentation Award at the XVI A.I.U.C. (Italian Cutaneous Ulcers Association) National Congress – Rome Italy)

[3] Cassino R et al. Photobiomodulation in pressure injuries and IAD: preliminary results of a new therapeutic approach. Accepted at the 32nd EWMA (European Wound Management Association) Conference, May 2022 - Paris (France)

\* Visitrak™

## 8.5

# The Use of Electronic Documentation Datasets for the Prevention and Treatment of Decubitus Ulcers as an Effective Tool for Education in the Differential Diagnosis of Decubitus Ulcers

Marie Jouklová<sup>1</sup>, Lenka Kolářová<sup>2</sup>

1 Hospital AGEL Prostějov, management, Prostějov, Czech Republic

2 Hospital AGEL Prostějov, Surgery Dpt., Prostějov, Czech Republic

**Introduction:** Education of non-medical staff in the field of prevention, development and treatment of decubitus ulcers plays an irreplaceable role in the modern nursing system and is an integral part of professional training and professional growth. Part of the training is Differential Diagnostics of Decubitus Ulcers, which has a key role in setting the right nursing care, with a positive impact not only on the patient.

- Supporting the healing process with an appropriately chosen procedure
- Reducing the risk of complications
- Reduction of algic manifestations
- Impact on the patient's psyche and level of self-sufficiency
- Reduction of hospitalisation time
- Legal protection for staff
- Reducing the risk of adverse events
- Cost savings

**Methods:** IT technology – use of database, introduction of remote access for decubitus ulcers assessment and consultation. Use of modern technology – tablet for photographing decubitus ulcers, documentation of care. Collection of statistical data during patient hospitalization. Photo gallery as a supporting educational material, a tool of education. Standardisation of procedures – creation of internal regulations as professional recommendations for prevention, diagnosis and treatment. Introduction of a system of training and knowledge verification through e-learning. Audit activity by a specialist focused on differential diagnosis and nursing care of decubitus ulcers patients.

- Respondent – staff caring for decubitus ulcers patients

Monitored data:

- Number of hospitalised patients
- Number of hospitalised patients with decubitus ulcers
- Number of new decubitus ulcers cases
- % of decubitus ulcers patients with correct classification and treatment procedure

**Results:** Identification of nursing practice mentors for education on decubitus ulcers issues and their involvement in the multidisciplinary wound healing team. Active involvement of staff in education on the prevention and treatment of decubitus ulcers. Effective use of acquired data and photo documentation during hospitalization. The need to focus attention on practical skills, correct dressing technique through practical workshops and rehearsals of model situations.

**Conclusions:** Without systematic education of healthcare professionals, maximum results in decubitus ulcers care cannot be achieved. Emphasis on education of nursing staff not only in theory but also in nursing practice. Incorporation of modern technology for interactive training of decubitus ulcer dressing.

## 8.6

## Huntington's Disease: a contemporary update of seating, postural support and pressure ulcer prevention.

Rebecca Fleming<sup>1</sup>, Linda Lucas<sup>2</sup>, Julie Wilson<sup>3</sup>, Alison Porter-Armstrong<sup>1</sup>

1 Edinburgh Napier University, Edinburgh, Scotland, United Kingdom

2 Scottish Huntington's Association, Adult Clinical Services, Paisley, Scotland, United Kingdom

3 NHS Lothian, Edinburgh Scotland, United Kingdom

**Introduction:** Huntington's disease (HD) is a neurodegenerative condition of genetic origin. Prevalence estimates range from 5.96 to 13.7 cases per 100,000 population in North America, North Western Europe and Australia (Baig et al, 2016). The prevalence in Northern Scotland is higher with 14.6 per 100,000 people (Kounidas et al, 2021). Individuals with HD present with disorders of movement, cognition and behaviour which increase as the disease progresses. Movement disorders such as chorea (involuntary jerking or writhing) may put these individuals at increased risk of pressure ulceration. As a result, specialist seating, postural care and pressure ulcer prevention are key elements of the occupational therapists' role in managing the clinical presentation. In 2012, the European Huntington's Disease Network (EHDN) published best practice guidelines for occupational therapists working with individuals with HD. These included recommendations for seating, postural management and pressure ulcer prevention. However, the evidence used to underpin these recommendations were generic in nature due to a lack of HD specific published literature in the area at the time of the search conducted in 2010. The aim of this study was to update the literature search from 2010 – 2022 and make contemporaneous recommendations for clinical practice based upon the strength of the published evidence in the specific area of HD.

**Methods:** Replication of the search strategy used in the European Network publication was undertaken. Databases MEDLINE, EMBASE, COHARL, AMED, PsychINFO, Cochrane Library were searched from 2010-April 2022. Search terms included Huntington's Disease AND Occupational Therapy; Rehabilitation; Posture; Seating; Wheelchairs; Manual Handling; Pressure Ulceration; Pressure Management were used. Articles published in English and reporting on adults of 18 Year + with HD were included.

**Results:** The study will be completed in June 2022 and submitted as part of the award of MSc in Occupational Therapy from Edinburgh Napier University, UK. The findings of this late breaking study will be presented alongside a clinical commentary on the findings by co-authors occupational therapists from NHS Lothian and HD Scotland.

**Conclusions:** The presentation will be of interest to any healthcare professional in Europe providing seating, postural management and pressure ulcer prevention services to individuals with a diagnosis of HD.

## References

European Huntington's Disease Network (2012). *Occupational therapy for people with Huntington's Disease: best practice guidelines*. [www.euro-hd.net](http://www.euro-hd.net).

Baig, SS, Strong M, Quarrell OWJ. (2016). *The global prevalence of Huntington's Disease: a systematic review and discussion*. *Neurodegenerative Disease Management*, 6 (4). ISSN 1758-2024. [Doi.org/10.2217/nmt-2016-0008](https://doi.org/10.2217/nmt-2016-0008)

Kounidas G, Cruickshank H, Kastora S, Sihlabela S, Miedzybrodzka Z. (2021). *The known burden of Huntington disease in the north of Scotland: prevalence of manifest and identified pre-symptomatic gene expansion carriers in the molecular era*. *Journal of Neurology*, vol 268, pp. 4170-4177.

## 9.1

# Data from Clinical Practice Demonstrates Pressure Ulcer (PU) Prevention in Long Term Care through the Introduction of Technology into the Care Pathway

Zoe Wood<sup>1</sup>, Vignesh Iyer<sup>2</sup>

<sup>1</sup> Bruin Biometrics, Alderley Edge, United Kingdom

<sup>2</sup> Bruin Biometrics, Medical Affairs, Los Angeles, United States

**Introduction:** Globally, in long term care (LTC), the Pressure Ulcer (PU) prevalence rate is reported to be 3.4%-32.4%<sup>1</sup>. This abstract offers a subset analysis of LTC data from a pragmatic real-world evidence (RWE)<sup>2</sup> project conducted to demonstrate reductions in PU when Sub-Epidermal Moisture (SEM) assessment technology\* was implemented into the PU prevention care pathway.

**Methods:** A formal, repeatable, pragmatic design evaluated the impact of implementing SEM assessment technology into existing PU standard of care (SoC) pathways, as an adjunctive device to objectively alert clinicians to the detection of deep and early-stage PU on specific anatomical areas of a patient's body.

The sub-set analysis of the LTC cohort revealed:

- 703 mixed-population subjects at risk for developing PUs
- 11 European, LTC settings
- All patients were scanned daily at sacrum and heels
- Existing SoC remained unchanged apart from the introduction of the technology

Health care practitioners (HCPs) were trained in the use of the technology and clinical interpretation of the technology prompts, that detects specific anatomical areas of a patient's body at increased risk of PU. Preventive interventions were based on clinical judgement, SoC, and technology prompts. The facility's prior PU incidence data were used as a comparator control to compute PU incidence reduction post deployment of the SEM assessment technology.

**Results:** The analysis of this LTC patient cohort identified:

- Reduction PU incidence: 86.8% reduction in HAPU incidence rate compared to prior incidence
- 55% (6/11) of the facilities had ZERO HAPUs during the evaluation period: 100% reduction rate
- 17,729 SEM assessments taken – 59% of had SEM delta  $\geq 0.6$  - In only 24% of the assessments was visual discolouration noted
- The SEM assessment result influenced the HCP decision making for the patient in 69% of cases

After the SEM assessment, additional interventions were put in place for 70% of patients scanned

**Conclusions:** Current risk assessment tools and skin and tissue assessments are subjective and cannot alert HCPs to early, incipient, non-visible pressure induced damage that occurs before visual skin damage, especially in a vulnerable group of patients. Incorporating an objective, reliable, anatomically specific technology, into routine PU care pathways across long term care settings enables HCPs to provide earlier preventive interventions. When used as an adjunct to existing SoC, the technology informs HCPs with subclinical data on early, microscopic skin damage and is an effective tool to support the prevention of PUs.

## References:

1. Anthony D. M. et al. (2019). 'Prevalence of pressure ulcers in long term care: A global review. *Journal of Wound Care*, 28(11), pp. 1-7. DOI: 10.12968/jowc.2019.28.11.702
2. Burns M. (2020). *Reducing Pressure Injury/Ulcer (PI/U) Ulcer through the Introduction of Technology*. Accepted and presented at EWMA, Virtual Conference 2020

\*Provizio® SEM Scanner

## 9.2

## Two case reports on pressure injury prevention in patients with COVID-19 associated acute respiratory distress syndrome

Armin Hauss<sup>1</sup>, Julia Ruhland<sup>2</sup>, Enrico Dähnert<sup>3</sup>, Max Zilezinski<sup>4</sup>

1 Charité – Universitätsmedizin Berlin, Institute of Clinical Nursing Science, Berlin, Germany

2 Charité - Universitätsmedizin Berlin, Campus Benjamin Franklin, Department of Nephrology and Medical Intensive Care, Berlin, Germany

3 Charité – Universitätsmedizin Berlin, Business Division Nursing Directorate – Nursing Science, Berlin, Germany

4 University Medicine Halle (Saale), Health Service Research Working Group | Acute Care, Department for Internal Medicine, Medical Faculty, Halle (Saale), Germany

**Introduction:** During the Covid-19 pandemic, 17% of ventilated patients developed acute respiratory distress syndrome (ARDS) in Germany. According to a German guideline (1), these patients are turned into the prone position (PP) for 16 hours per day to improve oxygenation and reduce mortality (2). This results in a high risk of pressure injuries for the affected patients, preventive measures are limited (3).

**Methods:** We report two patient cases who developed ARDS due to COVID-19 pneumonia and therefore received multiple prone positioning cycles. A standardized pressure injury prevention bundle for PP, consists of skin care, protection of the mammillae with a multi-layer foam dressing, a multi-part position set and micro-positioning's. A 2cm thick mixed-porosity polyurethane foam was added to the prevention bundle in the thoracic and pelvic areas between skin and position set. The heads were positioned on a molded pillow made of open-cell polyurethane in an omega shape.

**Results:** Both patients spent a significant number of hours in prone position. The patient case 1 spent a total of 137 h (9 intervals) in prone position and had a very high risk of pressure injuries throughout. Despite his high-pressure injury risk, no pressure injury developed in the prone position. The patient case 2 spent 99 h in prone position and had also a very high-pressure injury risk. During the prone positioning, a category 2 pressure injury developed on the chin and above the right eye, when the Omega shaped cushion was not used.

**Conclusions:** We found in both patients' good evidence for the efficacy of the additional application of a polyurethane foam to the standard pressure injury prevention bundle (3) who must be placed in prone position due to ARDS. Further quality improvement projects and studies are needed to support the promising evidence.

### References

(1) Deutsche Gesellschaft für Internistische Intensivmedizin und Notfallmedizin (2021) S3-Leitlinie – Empfehlungen zur stationären Therapie von Patienten mit COVID-19 (URL: [https://www.awmf.org/uploads/tx\\_szleitlinien/113-001LG1\\_S3\\_Empfehlungen-zur-stationaeren-Therapie-von-Patienten-mit-COVID-19\\_2022-03.pdf](https://www.awmf.org/uploads/tx_szleitlinien/113-001LG1_S3_Empfehlungen-zur-stationaeren-Therapie-von-Patienten-mit-COVID-19_2022-03.pdf))

(2) Munshi et al. (2017) Prone Position for Acute Respiratory Distress Syndrome. A Systematic Review and Meta-Analysis. *Ann Am Thorac Soc* 14(Supp\_4)280-288.

(3) EPUAP/NPIAP/PPPIA. Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline. The international Guideline. Emily Haesler (Ed.). EPUAP/NPIAP/PPPIA: 2019.

## 9.3

# The Effectiveness of SEM Assessment in Early Identification of Pressure Damage in a Spanish Long Term Care Facility

**Kate Hancock**, Sylvia Sobrin<sup>1</sup>, Juan José Calvo Aguirre<sup>2</sup>

<sup>1</sup> Arjo Spain, Barcelona, Spain

<sup>2</sup> Clinic Zorroaga, San Sebastian, Spain

**Introduction:** The primary objective of this quality improvement study in a long-term care facility in Spain was to evaluate the effectiveness of SEM assessment technology in conjunction with usual skin assessment practices in the early detection of pressure damage compared to standard of care, and secondly, to reduce PU incidence in the study group to zero. The data from this study contributed to a large, international amalgamation of Real-World Data<sup>1</sup>.

**Methods:** Over a 50-day period, 40 patients (n=20 receiving standard of care (SoC), and n=20 receiving SoC plus SEM assessment) were assessed for PU risk.

#### SoC + SEM Assessment Group

- Patients underwent risk assessment using a locally developed risk assessment tool (risk 0-4), visual skin assessment and SEM assessment using SEM assessment technology
- Anatomically specific targeted PU prevention interventions were implemented appropriate to the results as per local policy and protocol

#### SoC Group

- Patients in the SoC group received the same skin assessments but did not undergo SEM assessment
- Patients received usual prevention interventions appropriate to the assessment results as per local policy and protocol

#### Results:

- No patients in the SoC+ SEM assessment group developed a PU during the study period (0% incidence) however, two developed a PU after the study period when SEM assessment was no longer deployed
- Positive (SEM  $\Delta$  Delta > 0.6) SEM assessment technology readings noted in all heel assessments and 45% of sacral assessments
- SEM  $\Delta$  Delta  $\geq$  0.6 was noted in all heels (100%) where visual discoloration was noted (n=28/40)
- Correlation between SEM  $\Delta$  Delta and visual discoloration was 100% in heels; in sacrum correlation was 33%

	Left Heel	Right Heel	Sacrum
Number of patients assessed	20	20	20
Any SEM $\Delta$ Delta ( $\geq$ 0.6) (any time)	20 (100%)	20 (100%)	18 (90%)
Confirmed $\Delta$ Delta* ( $\geq$ 0.6)	20 (100%)	20 (100%)	9 (45%)
Visual discoloration	15 (75%)	13 (65%)	3 (15%)
Additional interventions	6 (30%)	7 (20%)	1 (5%)

- In the SoC group, three patients developed a category 2 ulcer (15% incidence)

**Conclusions:** Use of the SEM assessment technology facilitates earlier anatomically targeted interventions. Although a small study, the results contrast existing standards of care against a technology enabled care pathway. The SoC plus SEM assessment group reported superior clinical results than the SoC group and achieved 0%PU incidence rate.

#### References

1. Burns M. (2020). Reducing Pressure Injury/Ulcer (PI/PU) through the Introduction of Technology. Abstract submitted and presented at EWMA 2020.

\*Provizio® SEM Scanner

## 9.4

# Implementing the high standards for pressure ulcers care: the physician's experience

**Karolína Nováková<sup>1</sup>, Lenka Šeflová<sup>1</sup>**

<sup>1</sup> University Hospital Olomouc, IInd Internal Clinic, Olomouc, Czech Republic

**Introduction:** Opportunity to significantly improve pressure ulcers (PU) prevention and nursing care came in 2018, when our clinic was moved into a new building. The international and national guidelines were implemented in our everyday work, specific procedures and steps were developed. This presentation brings expert physician experience of nearly 4 years of implementing advanced nursing techniques, close physician-nurse collaboration in perpetual pursuit to prevent and heal PU at an internal medicine clinic with non-selective admission.

**Methods:** Retrospective data from 2018-2021 including the age, overall health and nutritional status of patients with PU were collected and analyzed. Final DRG reports were also analyzed.

**Results:** In 2018 138 PU were cared for, in 2019 it was 158 PU, in 2020 the final number was 333 and in 2021 it increased to 448 pressure ulcers. In all those years the majority of PU was brought in - in 2021 from the overall 448 PU, 329 were already present at the admission and only 119 (26,5%) occurred during our care. 100% of admitted patients were laying on anti-decubitus mattresses, 100 % of patients were evaluated for PU risk at the admission and those at risk had in 100% applied multilayer foam dressings. A detailed analysis of patients with PU originating in our care showed that all were in critical state with hepatorenal or cardiac failure or in terminal stage disease, average age 76-80 years. Pressure ulcer was added as final diagnosis in DRG only in 37 cases in 2021.

**Conclusions:** The data shows an increase of the overall number of PU at our clinic, although the nursing care for them is of high importance. Analysis of this discrepancy brought the following possible explanations:

1. Meticulous monitoring and reporting of PU might lead to overdiagnosis - other skin lesions as diabetic ulcer or traumatic injury might get reported wrongly as PU
2. Better expertise in differentiating and diagnosing PU including deep tissue wounds, which were not reported in the past as they were not considered PU

Finally the physicians started to report PU, although this has not readily translated into the DRG. Even though prevention and care for PU has definitely improved at our clinic, there will always be ways to improve in our endeavor to better the nursing and systemic care for PU in hospitalized patients.



## 9.5

# The assessment of chronic wounds, including pressure ulcers: a review of psychometric properties of instruments and a study of the cognitive process of decision-making

Steven Smet<sup>1</sup>, Dimitri Beeckman<sup>2</sup>, Beele Hilde<sup>3</sup>

1 Ghent University Hospital, Wound Care Center, Ghent, Belgium

2 Ghent University, University Centre for Nursing and Midwifery, Ghent, Belgium

3 Ghent University Hospital, Dermatology, Ghent, Belgium

**Introduction:** A wound assessment instrument can help clinicians assess wounds and track wound progression or deterioration. The goal of this project was to identify assessment instruments for chronic wounds, investigate their measurement properties, and summarize the data per assessment instrument. A current follow-up project relates these findings to the process of decision making and problem solving in the assessment and management of chronic wounds by community nurses and general practitioners. The results of both projects will be merged and specific proposals for optimizing wound surveillance and clinical decision support will be developed.

**Methods:** A systematic review of studies reporting on the development and/or assessment of the measurement properties of chronic wound assessment instruments, followed by a scenario-based think-aloud study in the community care setting. The final project will include expert meetings with wound care experts and with key-decision makers in Flemish hospitals and community care organizations.

**Results:** Twenty-seven studies describing the measurement properties of fourteen chronic wound assessment instruments were included in the systematic review. Reported measurement properties included: structural validity, reliability, hypothesis testing for construct validity, and responsiveness. Twenty-six different wound parameters were extracted from the assessment instruments. Preliminary results from the think-aloud interviews are presented.

**Conclusions:** Fourteen assessment instruments for chronic wounds were identified. The following wound parameters were most included in the instruments: size (11x), depth (9x), wound edges (7x), necrotic tissue type (7x) and granulation tissue amount (7x). The construct validity and responsiveness of the Pressure Ulcer Scale for Healing Version 3.0 were supported by sufficient ratings based on moderate to high quality evidence. The reliability of the (Revised) Photographic Wound Assessment instrument was rated as adequate based on moderate quality evidence. High quality research in the domain of assessment of chronic wounds is limited and how these results can be translated into clinical practice requires further investigation.

## References

Smet S, Probst S, Holloway S, Fourie A, Beele H, Beeckman D. The measurement properties of assessment tools for chronic wounds: A systematic review. *Int J Nurs Stud*. 2021 Sep;121:103998. doi: 10.1016/j.ijnurstu.2021.103998. Epub 2021 Jun 7. PMID: 34237439.

Gillespie BM, Chaboyer W, St John W, Morley N, Nieuwenhoven P. Health professionals' decision-making in wound management: a grounded theory. *J Adv Nurs*. 2015 Jun;71(6):1238-48. doi: 10.1111/jan.12598. Epub 2014 Dec 19. PMID: 25522802.

## 9.6

# Elevated sub-epidermal moisture predicts both pressure ulceration and diabetic foot ulceration

**Pauline Wilson**<sup>1,2</sup>, Declan Patten<sup>1</sup>, Tom O'Connor<sup>1</sup>, Zena Moore<sup>1</sup>, Niamh Phelan<sup>2</sup>

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

<sup>2</sup> St James's Hospital, Dublin, Ireland

**Introduction:** It is well established that Pressure Ulcers (PU) are a significant health and safety concern globally. Similarly, Diabetic foot ulcers (DFU) also cause significant morbidity and mortality (1). Many studies have shown that the measurement of sub-epidermal moisture (SEM) identifies increased risk of PU by allowing early identification of cellular oedema (2). Given that PUs and DFUs share some common aetiological factors (3,4) it is postulated that there may also be a role for SEM measurement in the early identification of DFU. This study set out to test this hypothesis.

**Methods:** In this prospective observational study as part of a comprehensive diabetic foot assessment SEM measurements were taken from 216 individuals attending outpatient diabetes clinics. SEM measurements were taken at foot sites commonly associated with ulceration. Those identified at increased risk at baseline had an additional 2 days of SEM measurements within the next 7 days.

**Results:** Of the 216 participants, 22% (n=47) were identified as high risk using standard assessment, 70% (n=152) had suboptimal diabetes control, 23% (n=49) had loss of protective sensation and 2% (n=5) had non-palpable pulses. Elevated SEM deltas were identified in 32% (n=69) and there was agreement between SEM measures and standard risk assessment tools in 62% (n=42) of these cases. Of the 13% (n=9) high risk participants who developed a visual DFU during the 7 day follow up period, 88% (n= 8) had an elevated SEM delta prior to ulceration.

**Conclusions:** Whilst tentative, initial analysis is showing that similar to early-stage PU identification, SEM measurement may also have potential for earlier detection of DFU through identifying cellular oedema and local inflammation.

## References

- 1) Armstrong, D.G., et al (2020). Five-year mortality and direct costs of care for people with diabetic foot complications are comparable to cancer. *Journal of Foot and Ankle Research*, 13(1), 1-4.
1. 4) Musa, L., et al (2021). Clinical impact of a sub-epidermal moisture scanner: what is the real-world use? *Journal of Wound Care*, 30(3), 198-208.
- 2) Jayabal, H., et al (2021). Anatomical variability of sub-epidermal moisture and its clinical implications. *Journal of Tissue Viability*, 30(3), 434-438.
- 3) Mullan, L., et al (2020). Prioritisation of diabetes-related footcare amongst primary care healthcare professionals. *Journal of Clinical Nursing*, 29(23-24), 4653-4673.

## STINTS 1

*Chairs: Amit Gefen, Pierre-Yves Rohan*

Properties of corneocytes in the context of skin health;  
*Ana Evora, United Kingdom*

An optimised method to analyse inflammatory markers from sebum and its role in detecting skin damage;  
*Hemalatha Jayabal, United Kingdom*

A foam dressing is considerably advantageous over a hydrocolloid for prophylaxis of noninvasive ventilation mask-related-pressure ulcers; *Aleksei Orlov, Israel*

Can non-invasive skin parameters reflect changes at grade 1 pressure ulcer skin sites?; *Nkemjika Abiakam, United Kingdom*

Low-frequency ultrasound device for pressure ulcer diagnosis;  
*Elis MarinaSales de Castro, France*

## STINTS 2

*Chair: Peter Worsley*

Contribution of the out-of-plane component in the assessment of sacral soft tissue deformations under compressive loading - Preliminary study on one subject; *Ekaterina Mukhina, France*

Human heel internal tissue displacements and strains calculated from Magnetic Resonance Imaging; *Alessio Trebbi, France*

Molecular dynamics simulation and thermodynamical approaches to predict and model the barrier function of skin lipids; *Nicola Piasentin, United Kingdom*

Characterization of skin integrity by quasi-static mechanical impedance device; *Yisha Chen, France*

## 10.1

## Properties of corneocytes in the context of skin health

Ana Evora<sup>1</sup>, Nkemjika Abiakam<sup>2</sup>, Shabira Abbas<sup>3</sup>, Simon Johnson<sup>1</sup>, Peter Worsley<sup>2</sup>, Michael J. Adams<sup>1</sup>, Dan Bader<sup>2</sup>

<sup>1</sup> University of Birmingham, School of Chemical Engineering, Birmingham, United Kingdom

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

<sup>3</sup> Essity AB, Stockholm, Sweden

**Introduction:** The integrity of the skin can be challenged by constant high normal and shear stresses, which may lead to skin damage in the form of pressure ulcers [1]. Most studies have focused on measures of biophysical markers [2] to assess skin health, overlooking the potential role of corneocytes in maintaining the integrity of the Stratum Corneum (SC). Indeed, these dead cells undergo an active maturation process, which includes the loss of corneodesmosomes and the stiffening of the cornified envelope (CE) [3]. This study was designed to evaluate the role of corneocytes in skin health.

**Methods:** A series of parallel studies have been conducted including the examination of skin response following the prolonged use of respiratory devices and exposure to pressure and moisture on two separate healthy cohorts. Corneocytes were collected via tape stripping from specific anatomical locations following each challenge. The ranked sum of the number of immature CEs (INV+) and the amount of desmoglein-1 (Dsg1) were evaluated using immunostaining techniques and correlated with the biophysical markers of skin health i.e., TEWL and SC hydration.

**Results:** Results revealed that the disruption of the barrier function following prolonged skin exposure to mechanical loads and moisture, as previously evidenced by increased TEWL and SC hydration [2], was correlated with both a relatively lower number of immature CEs and lower levels of Dsg1 (Fig. 1).

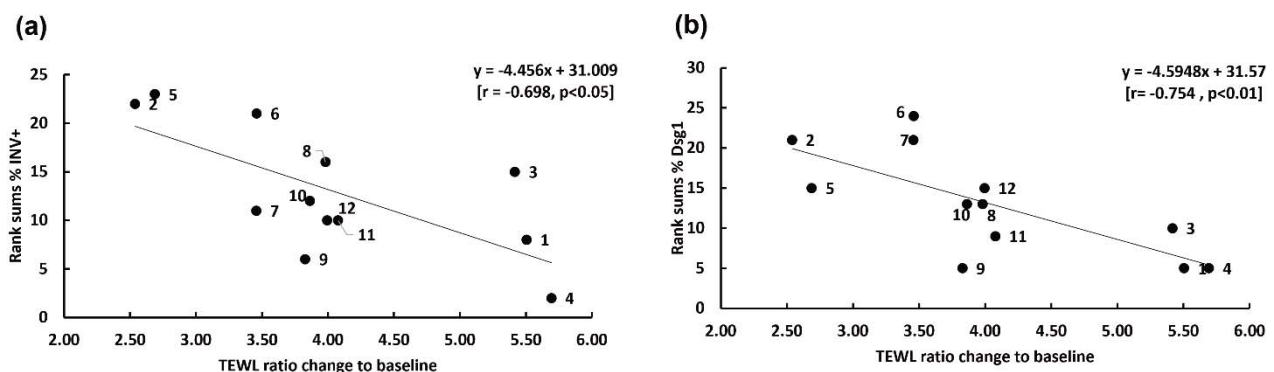


Figure 1. Relationship between the rank-sum of the percentages of (a) INV+ cells and (b) Dsg1 and the TEWL response at the sacrum after exposure to synthetic urine and loading for a total of 120 min.

**Conclusions:** High level of immature CEs and Dsg1 appear to provide the SC with enhanced protection against challenges from mechanical loading and moisture. This might be a direct result of these superficial cells providing a more cohesive, less easy to detach layer. However, additional evidence is required to correlate the properties of corneocytes with subject specific response to insults.

## References:

- [1] Gefen, A, Brienza, DM, Cuddigan, J, Haesler, E, Kottner, J. *Int Wound J.* 2022; 19(3): 692- 704.
- [2] Abiakam N, Jayabal H, Worsley P, Bader D. In: EPUAP 2021 Virtual Meeting.
- [3] Évora AS, Adams MJ, Johnson SA, Zhang Z. *Skin Pharmacol Physiol.* 2021;34(3):146-161.

## 10.2

# AN OPTIMISED METHOD TO ANALYSE INFLAMMATORY MARKERS FROM SEBUM AND ITS ROLE IN DETECTING SKIN DAMAGE

Hemalatha Jayabal<sup>1</sup>, Nkemjika Abiakam<sup>1</sup>, Peter Worsley<sup>1</sup>, Dan Bader<sup>1</sup>

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

**Introduction:** Inflammatory biomarkers are present in varying concentrations in a range of biofluids, with an important signaling role to maintain homeostasis. Commercial tapes have been employed to non-invasively collect these biomarkers in sebum from the skin surface to examine their concentrations in various conditions such as acne, dermatitis and pressure ulcers (PU) [1]. However, the identification of robust biomarker candidates is limited by the low abundance of specific proteins [2]. Therefore, this study aimed at developing an optimized extraction method of protein markers from skin surface and test this on a range of skin damage models.

**Methods:** A systematic study of chemical and mechanical approaches to optimized protein extraction were conducted employing pre-coated commercial tapes with synthetic sebum model. The extraction efficiency of a panel of relevant cytokines was assessed. The optimized approach will then be tested on a range of skin insult models including pressure, moisture induced damage and patients presenting with category 1 PU.

**Results:** The results revealed that the use of surfactant, i.e.  $\beta$ -dodecyl maltoside in addition to the mechanical stimuli, namely sonication and centrifugation resulted in an increased recovery of cytokines, ranging up to 80% for high-abundant cytokines, such as IL-1 $\alpha$  and IL-1RA, and up to 50% for low-abundance cytokines, including TNF-alpha, IL-6 and IL-8.

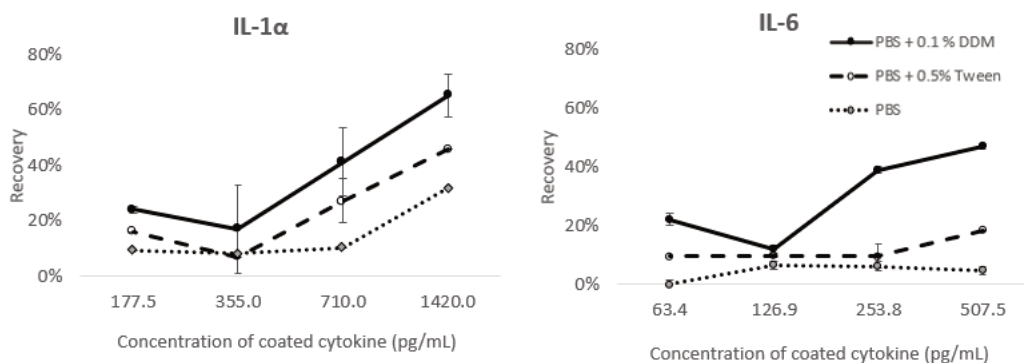


Figure 1: Percentage recovery of high-abundance (IL-1 $\alpha$ ) and low-abundance cytokine (IL-6) for three different extraction buffers

**Conclusions:** The optimized protocol will provide means to identify robust markers from skin surface that could be collected non-invasively in clinical situations involving vulnerable individuals. Indeed, the new protocol will be employed in future studies at the host laboratory involving patients with grade I PUs to identify novel predictive markers of skin health.

## References

- [1] D. Bronneberg et al., "Cytokine and chemokine release upon prolonged mechanical loading of the epidermis," *Exp Dermatol*, vol. 16, no. 7, pp. 567-73, Jul 2007, doi: 10.1111/j.1600-0625.2007.00566.x.
- [2] A. Gramolini, E. Lau, and P. P. Liu, "Identifying Low-Abundance Biomarkers," *Circulation*, vol. 134, no. 4, pp. 286-289, 2016, doi:10.1161/CIRCULATIONAHA.116.022940.

### 10.3

## A foam dressing is considerably advantageous over a hydrocolloid for prophylaxis of noninvasive ventilation mask-related-pressure ulcers

**Aleksei Orlov<sup>1</sup>, Amit Gefen<sup>1</sup>**

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

**Introduction:** Prolonged use of continuous positive airway pressure (CPAP) masks, as often required for noninvasive ventilation during the COVID pandemic time, imposes a risk to facial soft tissue integrity and viability, as these tissues are subjected to sustained deformations caused by tightening of the stiff mask surfaces to the head. The risk of developing CPAP-related pressure ulcers/injuries (CPAP-related-PU) can be reduced through suitable cushioning materials placed at the skin-mask interface, to spread the localised contact forces and disperse the surface and internal tissue stresses.

**Methods:** Using an integrated experimental-computational approach, we compared the biomechanical protective performance of a popular foam dressing material to that of a market-lead hydrocolloid dressing when applied to protect the facial skin under a CPAP mask. We measured the compressive stiffness properties of both dressing materials, and then fed those to an anatomically-realistic finite element model of the head, with an applied (simulated) CPAP mask. Through this process, we calculated the protective efficacy index (PEI) of the above materials in preventing CPAP-related-PU, which indicates the relative contribution of the dressing type to alleviating the facial soft tissue loads with respect to the no-dressing case.

**Results:** We found that the greatest facial tissue stresses occur at the bridge of the nose and the cheeks, followed by the chin, which is in excellent agreement with reported clinical-epidemiological data concerning facial anatomical sites at-risk for CPAP-related-PU. The difference in PEIs between the two material types was dramatic at the cheeks, with PEI=64% for the foam dressing with respect to a poor PEI=9% for the hydrocolloid. At the bridge of the nose that difference was lower, but still substantial, PEI=86% for the foam versus PEI=60% for the hydrocolloid. The mean PEI for the entire face was 70% for the foam dressing, and just 23% for the hydrocolloid, indicating that the foam dressing is considerably advantageous over the hydrocolloid for prophylaxis of CPAP-related-PU.

**Conclusions:** The tested foam dressing demonstrated high protective efficacy at all the studied facial sites, and was considerably superior to a hydrocolloid dressing for prevention of CPAP-related PU.

**Acknowledgement:** Support was received from 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), and from Mölnlycke Health Care (Gothenburg, Sweden).

## 10.4

# Can non-invasive skin parameters reflect changes at grade 1 pressure ulcer skin sites?

Nkemjika Abiakam<sup>1</sup>, Hemalatha Jayabal<sup>1</sup>, Peter Worsley<sup>1</sup>, Dan Bader<sup>1</sup>

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

**Introduction:** When the skin is exposed to prolonged mechanical forces, pressure ulcers (PUs) can occur. This is often observed in the skin of elderly individuals in acute and long-term care facilities who present with impaired mobility. Clinicians register the first signs of localised skin compromise as a category 1 PU, defined by an area of non-blanching erythema. Although there are many studies in relation to PUs, there is still a limited understanding of the temporal and spatial evolution of this condition.

**Methods:** A cohort of inpatients is being recruited for this longitudinal study design following ethical approval. The data from the first ten inpatients aged between 75 and 94 years old, presenting with stage 1 PU, are presented in this abstract. The PU compromised sites, either sacrum or ischial tuberosity, and a control skin site at a distance of 10 cm from the PU were assessed on two consecutive days using biophysical sensors and biochemical markers. Skin parameters were estimated involving transepidermal water loss (TEWL), Stratum Corneum (SC) hydration and inflammatory cytokines sampled from skin sebum.

**Results:** TEWL showed a statistically significant increase ( $p < 0.001$ ) at the PU site compared to the healthy site on the first day of assessment (Figure 1). On day 2, the cohort presented with a similar increase in TEWL relative to the healthy site, although across the cohort individual values varied relative to the day 1 value (from -55% to 187% change). The spatial and temporal differences in skin hydration values were less significant between the two sites with values ranging from 5.8 to 83.4 AUs. Nonetheless, temporal profiles of each participant were repeatable across the assessment days.

**Conclusions:** Preliminary data revealed distinct temporal and spatial differences in TEWL responses between a grade 1 PU compromised site and a healthy adjacent anatomical location. Collected skin samples are to be analysed to examine whether the concentration of inflammatory biomarkers, such as IL-1 $\alpha$  and TNF- $\alpha$  are related to changes evident in the biophysical parameters. Such an approach involving both biophysical parameters and biomarkers can offer the potential to identify early changes in the skin integrity of individuals at risk of developing PUs.

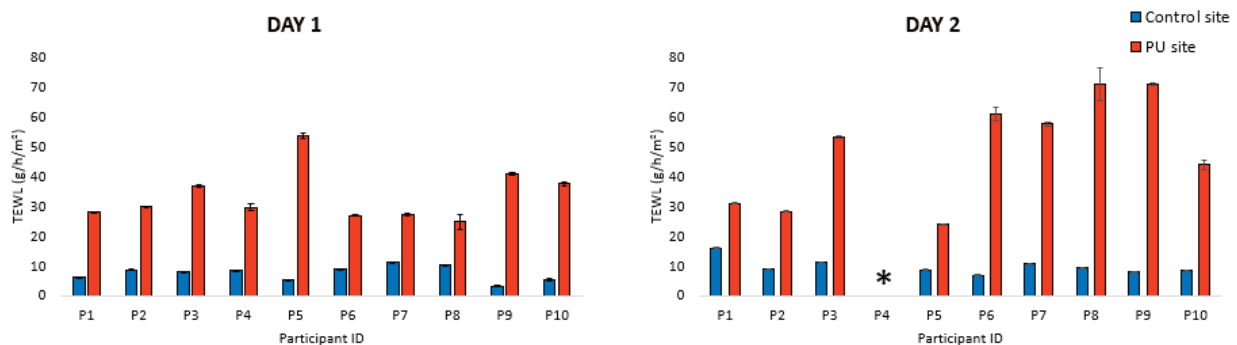


Figure 1. Differences in TEWL responses between an anatomical PU compromise location and a 10 cm adjacent site across two days of data collection. \*Missing data.

**Funding sources:** This work was supported 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).



## 10.5

## Low-frequency ultrasound device for pressure ulcer diagnosis

Elis Marina Sales de Castro<sup>1</sup>, Frédéric Giraud<sup>1</sup>, Betty Lemaire-Semail<sup>1</sup>

<sup>1</sup> University of Lille, L2EP, Villeneuve-d'Ascq, France

**Introduction:** As a result of pressure ulcer (PU), skin mechanical properties vary [1]. In this project, a new technology for PU diagnosis is proposed, the low-frequency ultrasound (LFU) diagnostics tool. Literature indicates LFU as a complement for PU treatment, reducing pain and time for the recovery of patients [2], [3].

The LFU diagnostic tool consists of a Langevin transducer (LT) of 60kHz vibration connected to a host computer and a microcontroller. Initial results of healthy skin are presented below.

**Methods:** The device's set-up is presented on Figure 1. The microcontroller & LFU generation are responsible for the vibration of the LT and the assurance that the waves behave as demanded by the user. The holding structure, containing a force sensor, assures the indentation force of 0.2N during the contact. The host computer provides the interface between user and device.

The experiments taken had a ramp-like vibration over the skin, with a controlled velocity using vector control method [4]. As the vibration is the same in both contact and no-load (no contact with skin) operation, it is possible to calculate skin acoustical force with the difference of electrical effort of the device, reflected on its voltage, as shown below:

$$f_r = N(V_{in-contact} - V_{no-load})$$

In the equation,  $V_{in-contact}$  and  $V_{no-load}$  are the voltages measured in skin tests and no-load operation,  $f_r$  is the acoustical force imposed by the skin and  $N$  is an LT intrinsic constant. Tests based on this measure were taken in 11 participants (5 female, 6 male) with ages ranging from 26 to 67 yo. Results presented in this abstract were obtained with the mechanical reaction force from skin in the morning (AM) and afternoon (PM) and for each assessment, 2 measurements were taken to guarantee the reproducibility of the measurements.

**Results:** The results for acoustic mechanical impedance (AMI), defined as the  $f_r / \bar{u}$ , where  $\bar{u}$  is the velocity [5], are presented in Figure 2, where values of AMI range from 0.0017 to 0.0107 Ns/mm. The standard deviation within the population in different shifts is 0.0028 Ns/mm.

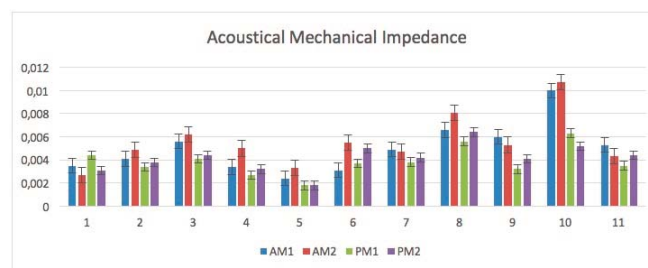


Figure 2. Results of AMI of skin

From the figure, note that the measurements in the same shift (AM or PM) present similar values.

**Conclusions:** The LFU diagnostic tool has shown consistent measurements for the AMI of skin. It is fair to say it can be an objective instrument to characterize skin mechanics and potentially assess early stage PU. For that, tests on damaged skin are foreseen to validate this application.

## References

- [1] H.Yamada,Y.Inoue,Y.Shimokawa,and K.Sakata,Medical & biological engineering & computing,vol.55,no.1,pp.79–88,2017.
- [2] JY.-J.R.Chang,J.Perry,and K.Cross,Plast Surg (Oakv),vol.25,no.1,pp.21–26,feb.2017,doi: 10.1177/2292550317693813.
- [3] N.N.Dedovich,A.F.Romanov,and V.S.Ulashchik,Biomed Eng,vol.51,no.2,pp.138–141,Jul.2017, doi: 10.1007/s10527-017-9701-z.
- [4] F.Giraud and C.Giraud-Audine,Butterworth-Heinemann,2019.
- [5] A.Israr,S.Choi,and H.Z.Tan,2006IEEE/RSJ International Conference on Intelligent Robots and Systems,Oct.2006,pp.472–477,doi: 10.1109/IROS.2006.282353.

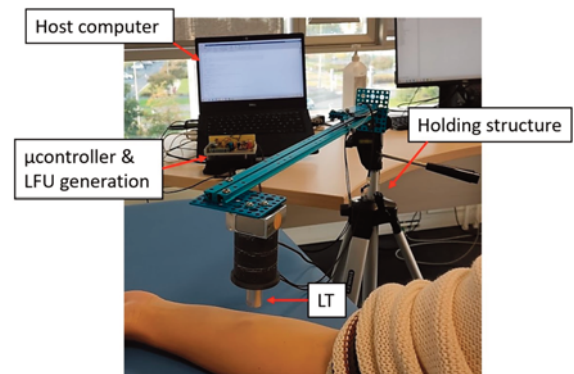


Figure 1. Set-up of the system

## 11.1

# Contribution of the out-of-plane component in the assessment of sacral soft tissue deformations under compressive loading - Preliminary study on one subject.

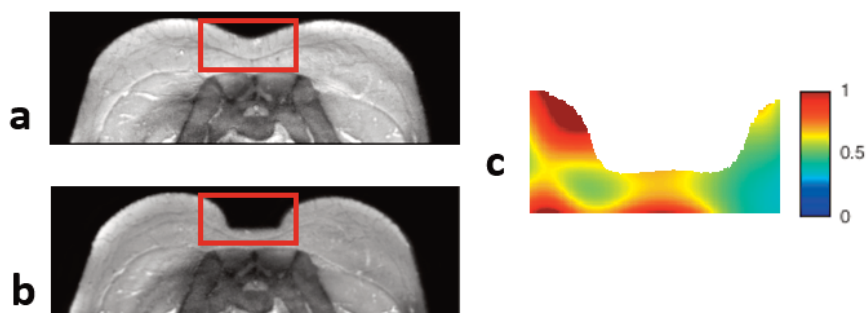
**Ekaterina Mukhina**<sup>1,2</sup>, **Pierre-Yves Rohan**<sup>2</sup>, **Nathanael Connesson**<sup>1</sup>, **Yohan Payan**<sup>1</sup>

<sup>1</sup> Univ. Grenoble Alpes, CNRS, Grenoble INP, TIMC-IMAG, La Tronche, France

<sup>2</sup> Institut de Biomécanique Humaine Georges Charpak, Arts et Métiers ParisTech, Paris, France

**Introduction:** Internal mechanical damage of the soft tissues was previously associated with the personalized risk of pressure ulcer development. 3D MRI is considered to be a golden standard of medical imaging for observing internal tissue deformations. 2D Ultrasound (US) images have been investigated to find a more accessible alternative to MRI. However, a possible downside of using such a 2D modality is disregarding the out-of-plane tissue movements. The objective of this work was to assess the contribution of the out-of-plane component of soft tissue displacements under compressive loadings.

**Methods:** One healthy male volunteer (34 y.o., BMI=27.8 kg/m<sup>2</sup>) was enrolled in the study (MAP-VS protocol N°ID RCB 2012-A00340-43). An MRI-compatible custom-made experimental setup, allowing the application of a vertical controlled load to the sacrum via an indenter, was used with different weights (0-1200 g) in a 3T MRI machine. Four load cases corresponding to the applied weight of 1200 g, 800 g, 600 g, and 400 g respectively were investigated. To evaluate the displacement fields, 3D image registrations (Elastix library) between the unloaded (Figure 1a) and loaded (Figure 1b) MRI configurations were performed. For each voxel of the vertical loading plane, the ratio of the out of plane displacement to combined in-plane displacement was evaluated (Figure 1c).



**Results:** The voxel-wise ratios of the out-of-plane displacement to in-plane displacement were higher than 0.5 for more than half of the voxels in the region of indentation for all investigated load cases. This ratio was also equal to or higher than 1.0 for almost half of the voxels in the region for load cases 2-4.

**Conclusions:** The preliminary results observed on one healthy volunteer suggest that the out-of-plane tissue displacements under compressive loads cannot be ignored. Possible next step is to investigate 3D B-mode US imaging as a way to combine the accessibility of the US technology and the advantage of three-dimension modality.

**Acknowledgements:** This project has received funding from the European Union's Horizon 2020 research and innovation programme under the STINTS Marie Skłodowska-Curie grant agreement No. 811965.

## References

1. Ceelen KK, Stekelenburg A, Loerakker S, et al. Compression-induced damage and internal tissue strains are related. *J Biomech.* 2008;41(16):3399-3404. doi:10.1016/j.jbiomech.2008.09.016
2. Akins JS, Valley JJ, Karg PE, et al. Feasibility of freehand ultrasound to measure anatomical features associated with deep tissue injury risk. *Med Eng Phys.* 2016;38(9):839-844. doi:10.1016/j.medengphy.2016.04.026

## 11.2

# Human heel internal tissue displacements and strains calculated from Magnetic Resonance Imaging

**Alessio Trebbi<sup>1</sup>, Bethany Keenan<sup>2</sup>, Mathieu Bailet<sup>3</sup>, Antoine Perrier<sup>1</sup>, Yohan Payan<sup>1</sup>**

<sup>1</sup> University of Grenoble, Grenoble, France

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

<sup>3</sup> Twinsight, Grenoble, France

**Introduction:** Pressure ulcers are defined as localized areas of damaged skin and underlying soft tissues caused by sustained mechanical loads on the skin surface. They are common in the posterior heel region in bedridden patients. It is still not completely understood how external loads lead to high local internal strains and how these strains cause tissue damage. Finite Element (FE) analysis is a powerful tool to help understanding how such external loads lead to deep internal strains. However, it has been highlighted how this numerical analysis lacks proper validation (Keenan 2021). This abstract aims to describe an in vivo methodology that will be implemented for evaluating the simulations of an FE model of the human heel. This solution is based on applying various loading configurations on the heel while recording Magnetic Resonance (MR) scans.

**Methods:** A healthy male volunteer (aged 30 years) gave his informed consent to be scanned using a 3T MRI platform<sup>1</sup>. A T2 DESS MRI sequence with a 0.6mm isotropic voxel size was used to image the foot in a series of configurations (unloaded, loaded on hard surface, loaded on mattress, loaded with shear, and loaded with an indenter) (Figure 1). The unloaded and loaded MR images were then registered using the registration toolbox<sup>2</sup> to extract the displacement field and strain maps for the soft tissues (Trebbi 2021).

**Results:** The high-resolution MR acquisitions allowed a clear distinction of the tissues that compose the human heel and their displacements due to the application of the various loads (Figure 2). As expected, the implementation of a mattress on the supporting surface reduced the amount of deformation and strains. Conversely, the loading configuration involving the indenter generated the highest levels of max Green Lagrange shear strain.



Figure 1: MR set up with the participant's heel loaded on a soft cushion.

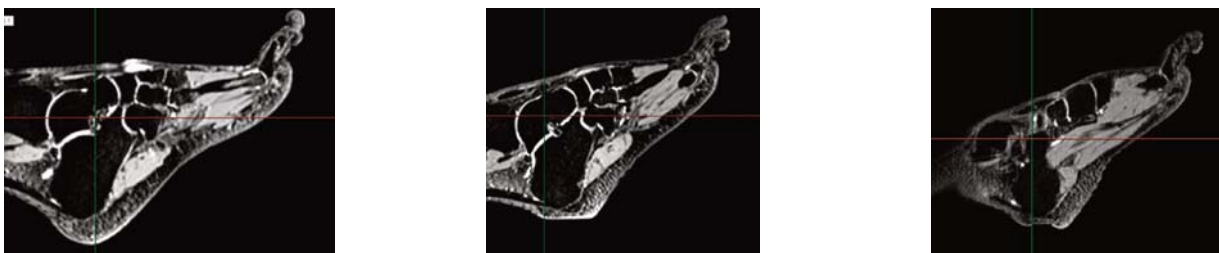


Figure 2: MR images related to the configurations for A unloaded, B loaded on hard surface, C loaded with an indenter.

**Conclusions:** The implemented technique can give insight for several applications. First, it adds a useful tool for better understanding the propagation of deformations in the heel soft tissues that could generate pressure ulcers. Second, this procedure can be used to obtain data on the material properties of the soft tissues to define constitutive laws for FE simulations. Third, image registration offers a promising technique for evaluating FE models. Finally, these outcomes could be implemented to evaluate performances of orthotics and dressings aiming for preventing pressure injuries.

## References

Keenan, B.E., Evans, S.L., & Oomens, C.W.J. (2021). A review of foot finite element modelling for pressure ulcer prevention in bedrest: Current perspectives and future recommendations. *Journal of Tissue Viability*.

Trebbi, A., Perrier, A., Bailet, M., & Payan, Y. (2021). MR-compatible loading device for assessment of heel pad internal tissue displacements under shearing load. *Medical Engineering & Physics*.

<sup>1</sup> 3T Siemens Magnetom Prisma system

<sup>2</sup> Registration toolbox Elastix

### 11.3

## Molecular dynamics simulation and thermodynamical approaches to predict and model the barrier function of skin lipids

**Nicola Piasentin<sup>1</sup>**, Guoping Lian<sup>1</sup>, Qiong Cai<sup>1</sup>

<sup>1</sup> University of Surrey, Chemical and process engineering, Guildford, United Kingdom

**Introduction:** Understanding the barrier properties of the intercellular lipids of stratum corneum (SC) is pivotal to better design of transdermal drugs and skin care products. The current state of the art is that the inter-keratinocyte space is occupied mainly by waxy acids (ceramides), free-fatty acids, and cholesterol, organized geometrically as a series of stacked bilayers in a roughly equal molar ratio<sup>1</sup>. The exposure of skin to dermatological relevant molecules can affect the lipid bilayers' features, consequently altering skin's barrier properties and structural integrity<sup>2</sup>.

Several *in silico* approaches have been developed to investigate the mechanisms underpinning skin barrier hallmarks. Among these, molecular dynamics (MD) simulations have been employed to predict the SC lipid properties<sup>3</sup>. Similarly, a combinations of quantum chemistry and thermodynamical calculations<sup>4</sup> has been developed for fast barrier properties prediction. The aim of this study is to exploit both these tools to investigate and rationalize the effect of selected chemicals on SC lipid bilayer's geometrical and barrier properties.

**Methods:** The systems are being simulated via GROMACS with the CHARMM36 forcefield. Systems containing different concentrations of ethanol, glycerol or urea are simulated to extract their geometrical information. From this information, structural effects are quantified by measuring lipid structural parameters and the corresponding barrier properties are predicted via quantum/thermodynamical approaches.

**Results:** Ethanol is the molecule that majorly disturbs the lipids bilayers, inducing extraction of lipids and partitioning of ethanol molecules into the bilayers. Increasing the temperature lowers the ordering of the lipid bilayers in all cases investigated, gradually compromising the integrity in systems containing ethanol. Barrier properties are not affected by urea and glycerol, while the partitioning of ethanol eases the partitioning of other solutes through lipids.

**Conclusions:** Results show that ethanol disturbs the SC lipid bilayers, enhancing the partition of solutes into the lipid systems, while glycerol and urea have limited effect, suggesting that these molecules affect other SC permeation routes.

### References

1. Van Smeden, J.; Janssens, M.; Gooris, G.; Bouwstra, J., *Biochimica et Biophysica Acta (BBA)-Molecular and Cell Biology of Lipids* 2014, 1841 (3), 295-313.
2. Celleno, L., *Dermatol Ther* 2018, 31 (6), e12690.
3. Lundborg, M.; Wennberg, C. L.; Narangifard, A.; Lindahl, E.; Norlen, L., *J Control Release* 2018, 283, 269-279.
4. Klamt, A.; Huniar, U.; Spycher, S.; Keldenich, J. r., *The Journal of Physical Chemistry B* 2008, 112 (38), 12148-12157.

## 11.4

# Characterization of skin integrity by quasi-static mechanical impedance device

Yisha Chen<sup>1</sup>, Betty Lemaire-Semail<sup>2</sup>, Frédéric Giraud<sup>3</sup>, Vincent Hayward<sup>4</sup>

<sup>1</sup> Université de Lille, Villeneuve d'Ascq, France

<sup>1</sup> Université de Lille, Villeneuve d'Ascq, France

<sup>3</sup> Université de Lille, EEA, Villeneuve d'Ascq, France

<sup>4</sup> Sorbonne Université, CNRS, Institut des Systèmes Intelligents et de Robotique, ISIR, Paris, France

**Introduction:** Early detection of pressure ulcers is essential to reduce treatment costs. Biomechanical characterization of soft tissue/ skin has received increased interest [1]–[3], as they may reveal dysfunction or underlying damage. To better understand how skin biomechanics are related to the risk of pressure ulcers, we developed a portable device to characterise the quasi-static viscoelasticity of skin. To justify the feasibility of the device as a diagnostic tool, we damaged the skin with tape stripping to simulate the presence of a pressure ulcer.

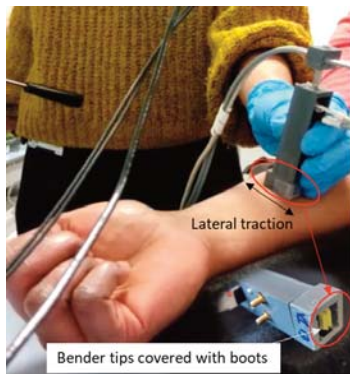


Fig. 1 Skin measurements with the quasi-static mechanical impedance device. The piezoelectric bender tips were insulated by a pair of boots.

**Methods:** To study the influence of tape stripping on skin biomechanics, 8 healthy participants (3 males, 5 females), with an average age of 34 years (27–41 years) were recruited. Skin biomechanics of the forearm were characterized using the quasi-static mechanical impedance device (Fig. 1). The device was composed of a pair of piezoelectric benders, which can deform skin laterally.

To characterize quasi-static viscoelasticity of the skin, a loading pattern of step-hold-sinusoidal was applied [4]. The skin was first stretched laterally to a baseline strain of 4.2% and held for 10 s. Then, a sinusoidal displacement was applied to the skin for 10 periods at 1 Hz, with a strain amplitude of 0.8%. Skin responses before, after insulating (tape stripping 25 times), and after 30 min of recovery were measured.

**Results:** Dynamic modulus analysis was employed to deduce skin parameters. The median complex modulus of the forearm is 165 kPa (78–452 kPa). The median loss tangent value is 0.29 (0.23–0.49).

To study the changes in biomechanics due to insulating, all the data were normalized by their baseline values. As shown in Fig. 2, tape stripping tends to lower the complex modulus, except for participant 6. While loss tangent is increased after, except for participant 8. A recovery time of 30 minutes is insufficient for most of the participants.

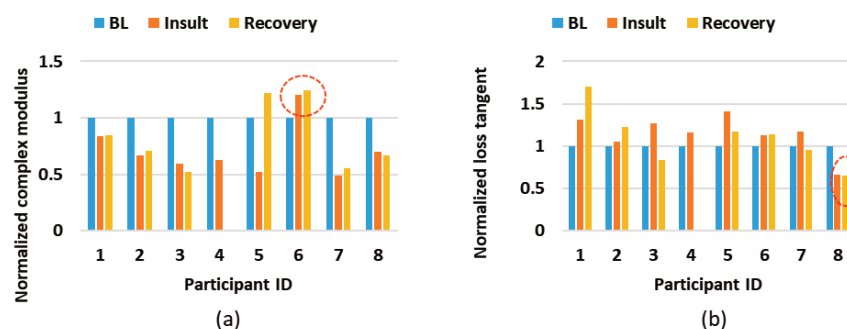


Fig. 2 Dynamic modulus analysis. (a) Normalized complex modulus. (b) Normalized loss tangent. The blue bar ("BL") represents baseline value, the orange bar ("Insult") represents data measured after tape stripping, and the yellow bar ("Recovery") represents data measured after 30 min of recovery time. Data were normalized by the baseline values. Recovery data of participant 4 are missing.

**Conclusions:** Preliminary results show that the quasi-static mechanical impedance device can detect the skin changes after tape stripping, with a decreased complex modulus and an increased loss tangent. Tests on a larger group of participants are required to confirm this conclusion.

## References

[1] Wang et al., doi: 10.1109/IEMBS.2006.260070.

[2] Dagdeviren et al., doi: 10.1038/nmat4289.

[3] Sienkiewicz et al., doi: 10.1109/IECON.2013.6699765.

[4] Babaei et al., doi: 10.1016/j.jmbbm.2016.12.013.

### Student free paper session 1: Basic science

*Chairs: Amit Gefen, Simona Saibertová*

Intelligent sensing to detect posture and mobility in vulnerable individuals: an indicator of pressure ulcer risk;  
*Silvia Caggiari, United Kingdom*

Development of a finite element model for the heterogeneous structure of the calcaneal fat pad to study its loading distribution. Insights for stress-related injuries;  
*Alessio Trebbi, France*

Biomechanical and physiological response of the skin following application of respiratory protective equipment devices;  
*Silvia Caggiari, United Kingdom*

Nano-enabled hyaluronic acid hydrogels target multiple factors governing wound chronicity; *Guillem Ferreres Cabanes, Spain*

Can non-invasive skin parameters reflect changes at grade 1 pressure ulcer skin sites?; *Nkemjika Abiakam, United Kingdom*

### Student free paper session 2: Clinical science

*Chairs: Peter Worsley, Andrea Menšíková*

Prevalence and associations of common adverse skin conditions in aged nursing home residents - a representative prevalence study; *Bettina Völzer, Germany*

Feasibility of PURPOSE T - a mixed method study in Sweden;  
*Lisa Hultin, Sweden*

Old dog, new tricks? Using modern advances in chronic wound management to improve outcomes and patient care; a case report; *Điđi Delalić, Croatia*



## 12.1

# Intelligent Sensing to detect postural changes in Spinal Cord Injured patients

Silvia Caggiari<sup>1</sup>, Peter Worsley<sup>1</sup>, Sarah Fryer<sup>1,2</sup>, Dan Bader<sup>1</sup>

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

<sup>2</sup> Spinal Cord Injury Centre, Duke of Cornwall Spinal Centre, Salisbury NHS Foundation Trust., United Kingdom

**Introduction:** Repositioning represents a primary intervention for pressure ulcer (PU) prevention and is advocated in the current international guidelines, which recommend 2-4 hour intervals depending on the individual level of risk. However, the recommended frequency and magnitude of movements are not regularly followed, and often ineffective movements are performed resulting in inadequate pressure relief, particularly at critical body sites e.g. sacrum [1]. In our latest study, a novel methodology involving intelligent pressure data processing was developed to detect both the frequency and magnitude of lying postures in a cohort of able-bodied individuals [2]. Thus, the present study was designed to assess the combination of pressure monitoring and intelligent processing for the detection of postural changes in vulnerable individuals, and evaluate the frequency of repositioning.

**Methods:** Pressure data were acquired from three spinal cord injured (SCI) patients, who were continuously monitored (Patient Turn System, Intelligent Dynamic Sensing, Canada<sup>1</sup>) during prolonged periods of lying postures (>10 hours) on either a foam or air mattress. Robust pressure parameters involving contact area  $\geq 20\text{mmHg}$  and center of pressure (COP) were estimated. A threshold-based derivative signal was used for prediction of postural changes.

**Results:** A composite derivative calculated by the product of contact area ( $\geq 20\text{mmHg}$ ) and COP proved effective in detecting the postural changes (Fig.1). Two distinct thresholds of 12% and 16% of the maximum value were used depending on the mattress type, namely foam and air mattress, respectively. Perturbations exceeding the corresponding threshold were identified as postural changes and the time interval between two postural changes was examined (Table1). Results showed #SCI 2 was repositioned at regular intervals of approximately 2hours. By contrast, repositioning of #SCI 1 and 3 varied from 1 to 5 hours.

**Conclusions:** In clinical settings, frequency of repositioning is dependent on patient, carers and clinicians, and may not adhere to international guidelines. The present study demonstrated the ability of the derivative of robust pressure parameters in detecting postural change events. It emerged that repositioning did not follow the recommended regular intervals in two patients. The prediction of both frequency and type of postures over prolonged periods has the potential to inform personalized PU prevention strategies. Thus, further analysis is required to automatically detect the magnitude of lying postures.

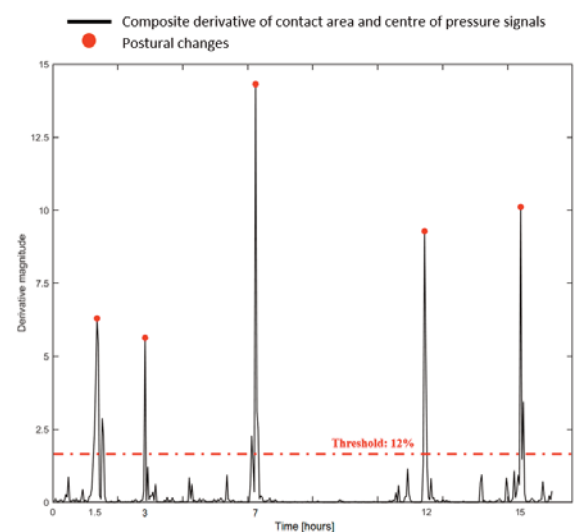
**Acknowledgments:** This work was supported by a UK EPSRC CASE award, Sumed International and Salisbury Spinal Cord Injury Centre.

## References

[1]Woodhouse et al., *Appl Nurs Res* (2019)

[2]Caggiari et al., *Clin Biomech* (2020)

<sup>1</sup> ForeSitePT, Xsensor, Canada



**Fig.1:** Composite derivative calculated as the product of contact area and COP signals for SCI 3, supported on a foam mattress. Perturbations exceeding the threshold of 12% of the maximum value were classified as postural changes.

**Table 1:** Type of mattress, length of the monitoring period, number of the postural changes detected with the threshold-based derivative and maximum time interval between two changes in posture, for the three SCI patients

Patients (mattress)	Monitoring period	Number of events detected as changes in posture	Maximum time interval between postural changes
SCI 1 (air cell)	~17 hours	5	5 hours
SCI 2 (foam)	~11 hours	5	2 hours
SCI 3 (foam)	~17 hours	5	5 hours



## 12.2

# Development of a finite element model for the heterogeneous structure of the calcaneal fat pad to study its loading distribution. Insights for stress-related injuries

**Alessio Trebbi**<sup>1</sup>, **Antoine Perrier**<sup>2</sup>, **Mathieu Bailet**<sup>2</sup>, **Yohan Payan**<sup>1</sup>

<sup>1</sup> Université Grenoble Alpes, Grenoble, France

<sup>2</sup> Taxisense

**Introduction:** The calcaneal heel pad is a heterogeneous structure composed by fat clusters separated by an elastic fibrous-septa. Fat clusters are composed by fully grown adipocytes that bounded together form fat cambers arranged in a honeycomb structure[1]. The fibrous-septa is crucial to maintain the structural integrity and separate the fat clusters. The role of the heel pad is fundamental in the absorption of impact forces during ambulation. Its complex structure is used to distribute the mechanical loads in such a way that the single fat cells can sustain the pressure without permanent damage. A good understanding on the mechanical properties and the loading distribution of the calcaneal fat pad could give insight in stress-related injuries as diabetic ulceration and plantar fasciitis[2].

**Methods:** The objective of the present study is to develop a three-dimensional subject-specific heel pad Finite Element(FE) model that considers the honeycomb structure composed by fat clusters and fibrous-septa and their biomechanical properties. In order to gain insight on the stress propagation inside the fat pad structure an MRI-compatible device was built in order to apply displacements on the human heel sole and measure the corresponding force. The device is capable of applying compression and shear forces independently to analyze the mechanical response for both types of loads. MRI data were acquired in five different scenarios, including a rest position and two loading configurations for the compression and shear respectively(Figure1). The MRI data were then processed in order to generate a FE model of the heel and estimate the soft tissue elasticity parameters by comparison with the different loading situations(Figure2).

**Results:** The heel tissues showed a hyperelastic material behaviour. Under compression and shear loading the calcaneal pad initially has low stiffness, subsequently, increasing the load, the fibrous-septa and the fat clusters come under tension and compression respectively, limiting the deformation.

**Conclusions:** The numerical model developed in this study can be used to define a protocol to establish a set of parameters to describe patient specific material properties of the calcaneal fat pad. This will allow to analyse with multiscale models the amount of load distributed to the single fat cells which is not possible with experimental tests. Finally, this would lead to an optimization in the design of orthotics and shoes to avoid dangerous strains that could generate pressure injuries.

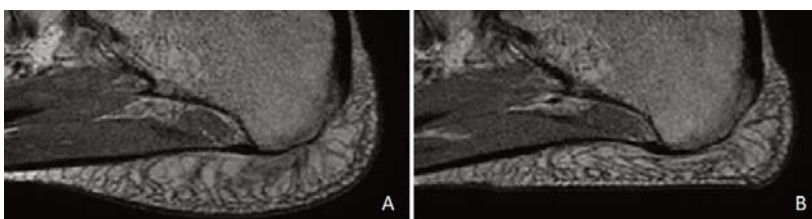


Figure1. The deformation of the internal soft tissues of the calcaneal pad, a comparison between(A) relaxed and(B) vertically loaded configuration.

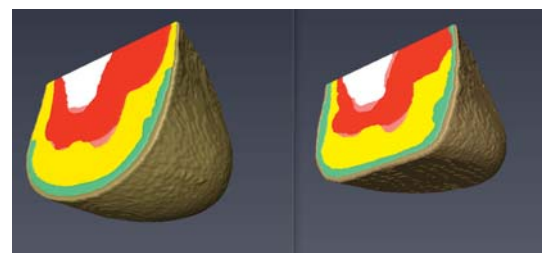


Figure2. Comparison between the segmented surfaces of the heel in relaxed and vertically loaded configuration.

## References

- [1]C.Fontanella(2016).Biomechanical-behavior-of-plantar-fat-pad-in-healthy-and-degenerative-foot-conditions.Medical-and-Biological-Engineering-and-Computing54:653-661.  
[2]A.Gefen(2017).Why-is-the-heel-particularly-vulnerable-to-pressure-ulcers?British-Journal-of-Nursing.Vol.26,No.Sup20

## 12.3

## Biomechanical and physiological response of the skin following application of respiratory protective equipment devices

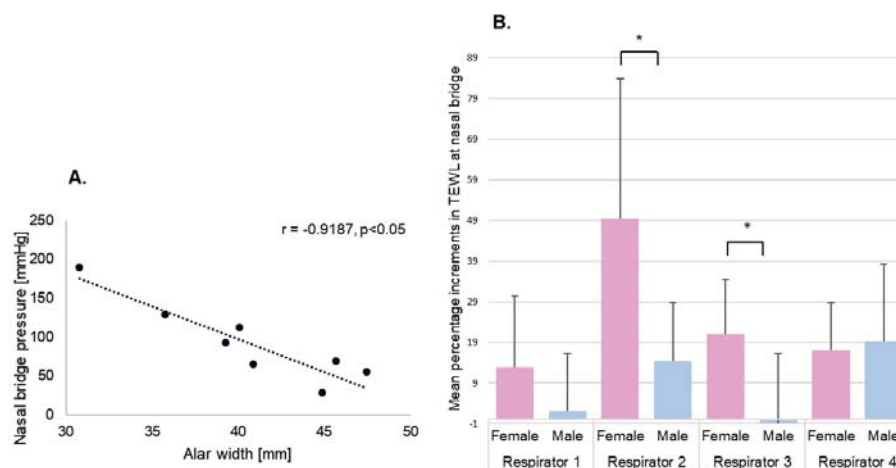
Silvia Caggiari<sup>1</sup>, Dan L. Bader<sup>1</sup>, Finn Foxell<sup>1</sup>, Nicolas Pipe<sup>1</sup>, Seana Couch<sup>1</sup>, Abbie Turner<sup>1</sup>, Peter Worsley<sup>1</sup>

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

**Introduction:** Since the outbreak of COVID-19, healthcare workers have been required to use respiratory protective equipment (RPE) for prolonged periods, for example a 12-hour shift which is often repeated over consecutive days. Although the prolonged use of respirators minimises the risk of transmission of COVID-19 [1], adverse skin reactions including pressure-induced damage, moisture associated dermatitis, skin irritation and itchiness have been reported [2]. There are reports of fitting-related problems in specific sub-groups, with current designs unable to accommodate the variability in face shapes across genders and ethnicities [3]. Accordingly, respirators are regularly overtightened to compensate for a poor fit, resulting in high non-uniform pressures [4]. This motivated the present study which is designed to investigate the biomechanical and thermal challenges during RPE application and the associated changes in local skin physiology at the skin-device interface.

**Methods:** Sixteen volunteers were recruited reflecting a range of gender, ethnicities and facial dimensions, including facial length, alar and bio-ocular width, and dorsal nasal length. Four single use respirators were evaluated representing different geometry, size, and material interfaces. Participants were asked to wear each respirator in a random order while a series of measurements were performed involving interface pressures, temperature and relative humidity. In addition, transepidermal water loss (TEWL) and skin hydration were assessed pre- and post-respirator application, and after 20-min of recovery. Statistical analysis assessed associations between demographics, interface conditions and markers of skin health.

**Results:** Results revealed that the nasal bridge experienced the highest pressures for all respirator designs. A statistically significant negative correlation ( $p < 0.05$ ) between the alar width and interface pressures at the nasal bridge was evident, for three respirator designs (Fig. 1A). Temperature and humidity significantly increased ( $p < 0.05$ ) during each respirator application. Markers of skin health, namely TEWL values revealed statistically significant increases after respirator application, which were most apparent at the nasal bridge. Gender-specific changes were also evident, with females showing higher TEWL values than males ( $p < 0.05$ ) (Fig. 1B).



**Fig. 1:** A. Relationship between interface pressure recorded at the nasal bridge and alar width for one respirator. B. TEWL percentage changes at the nasal bridge for the four respirators with respect to gender.

**Conclusions:** The present study revealed substantive changes in biomechanical, thermal and physiological parameters on application of a range of respirator devices in a cohort of healthy participants. The development of designs that accommodate a diverse range of face shapes and conformity with the skin are required to support the long-term use of these devices among healthcare workers during intense clinical shifts.

**Acknowledgments:** This work was funded by UK Research and Innovation (EP/V045563/1).

## References

[1] Honda et al, *Curr Opin Infect Dis.*, 2016; [2] Abiakam et al, *Int Wound J.*, 2021; [3] Chopra et al, *BMJ Glob Health.*, 2021; [4] Brill et al, *ERJ open research.*, 2018.

## 12.4

## Nano-enabled hyaluronic acid hydrogels target multiple factors governing wound chronicity

Guillem Ferreres Cabanes<sup>1</sup>, Silvia Perez-Rafael<sup>1</sup>, Tzanko Tzanov<sup>1</sup>

<sup>1</sup> Universitat Politècnica de Catalunya, Chemical engineering, Terrassa, Spain

**Introduction:** The majority of commercially available dressing for chronic wounds have been designed mainly to absorb wound exudate and provide moisture environment, and at most to release antimicrobial agents. However, efficient wound repair is only possible if the dressing materials target simultaneously multiple factors involved in wound chronicity, such as deleterious proteolytic and oxidative enzymes and high bacterial load. In this study, we developed a multifunctional hydrogel platform for wound treatment through self-assembling of thiolated hyaluronic acid (THA) and bioactive metal-phenolic network nanoparticles (MPN NPs).

**Methods:** The MPN NPs were formed according to a previously described method using natural phenolic compounds.<sup>1</sup> The hydrogel was synthesized using a proprietary technology,<sup>2</sup> by mixing different NPs concentrations with 1.5 % (w/v) THA, upon which the gelation occurred in less than one hour depending on the NPs concentration.

**Results:** Hybrid epigallocatechin gallate-cobalt (EGCG-Co) NPs were used to form nano-enabled THA hydrogels under physiological conditions. The hydrogel formation was triggered by the self-assembling interaction between the phenolic moieties of the NPs and the polymer's thiol groups.<sup>3</sup> Rheological studies revealed that the THA-EGCG-Co hydrogel was a soft, but resistant nanocomposite material, with self-healing properties making it suitable for wounds subjected to shear stress. The structural role of the EGCG-Co NPs was also rheologically confirmed as a function of NPs' concentration, indicating tuneability of the mechanical properties of the hydrogel depending on the application scenario. The EGCG-Co NPs provided the multifunctionality of the dressing material, targeting simultaneously three main factors that govern wound chronicity: i) the growth of the pathogenic *S. aureus* and *P. aeruginosa*, ii) the activity of the deleterious matrix metalloproteinases and myeloperoxidase, and iii) the generation of reactive oxygen species.

**Conclusions:** The novel self-assembling nano-enabled hydrogels represent a multifunctional skin care platform with antimicrobial and antioxidant properties, and wound enzymes inhibition activities.

### References

- 1 – Li et al. (2019) *Advanced Biosystems*. Doi: <https://doi.org/10.1002/adbi.201800241>
- 2 - EP20383150.8. METHOD TO PRODUCE IN SITU SELF-ASSEMBLED MULTIFUNCTIONAL NANOCOMPOSITE HYDROGEL AND ITS USES THEREOF.
- 3 – Pérez-Rafel et al. (2021) *Acta Biomaterialia*. Doi: <https://doi.org/10.1016/j.actbio.2021.07.020>

## 12.5

## Can non-invasive skin parameters reflect changes at grade 1 pressure ulcer skin sites?

Nkemjika Abiakam<sup>1</sup>, Hemalatha Jayabal<sup>1</sup>, Peter Worsley<sup>1</sup>, Dan Bader<sup>1</sup>

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

**Introduction:** When the skin is exposed to prolonged mechanical forces, pressure ulcers (PUs) can occur. This is often observed in the skin of elderly individuals in acute and long-term care facilities who present with impaired mobility. Clinicians register the first signs of localised skin compromise as a category 1 PU, defined by an area of non-blanching erythema. Although there are many studies in relation to PUs, there is still a limited understanding of the temporal and spatial evolution of this condition.

**Methods:** A cohort of inpatients is being recruited for this longitudinal study design following ethical approval. The data from the first ten inpatients aged between 75 and 94 years old, presenting with stage 1 PU, are presented in this abstract. The PU compromised sites, either sacrum or ischial tuberosity, and a control skin site at a distance of 10 cm from the PU were assessed on two consecutive days using biophysical sensors and biochemical markers. Skin parameters were estimated involving transepidermal water loss (TEWL), Stratum Corneum (SC) hydration and inflammatory cytokines sampled from skin sebum.

**Results:** TEWL showed a statistically significant increase ( $p < 0.001$ ) at the PU site compared to the healthy site on the first day of assessment (Figure 1). On day 2, the cohort presented with a similar increase in TEWL relative to the healthy site, although across the cohort individual values varied relative to the day 1 value (from -55% to 187% change). The spatial and temporal differences in skin hydration values were less significant between the two sites with values ranging from 5.8 to 83.4 AUs. Nonetheless, temporal profiles of each participant were repeatable across the assessment days.

**Conclusions:** Preliminary data revealed distinct temporal and spatial differences in TEWL responses between a grade 1 PU compromised site and a healthy adjacent anatomical location. Collected skin samples are to be analysed to examine whether the concentration of inflammatory biomarkers, such as IL-1 $\alpha$  and TNF- $\alpha$  are related to changes evident in the biophysical parameters. Such an approach involving both biophysical parameters and biomarkers can offer the potential to identify early changes in the skin integrity of individuals at risk of developing PUs.

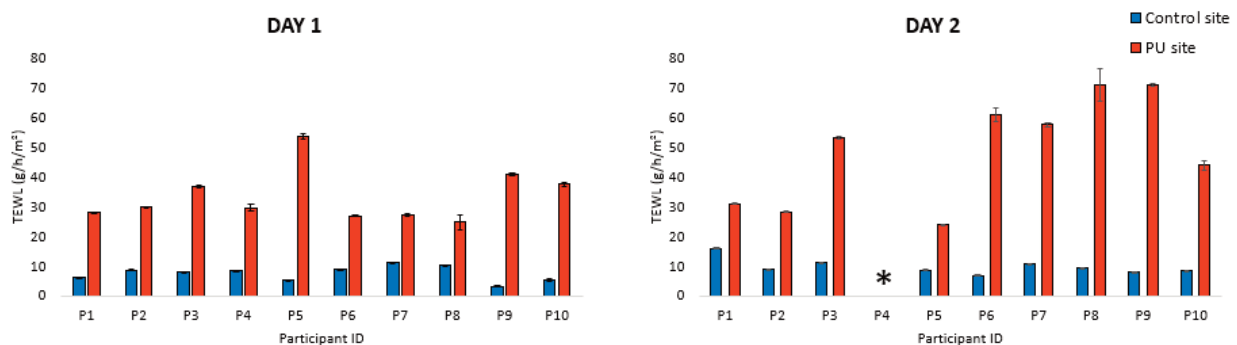


Figure 1. Differences in TEWL responses between an anatomical PU compromise location and a 10 cm adjacent site across two days of data collection. \*Missing data.

**Funding sources:** This work was supported 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).

### 13.1

## Prevalence and associations of common adverse skin conditions in aged nursing home residents - a representative prevalence study

**Bettina Völzer<sup>1</sup>, Monira El Genedy-Kalyoncu<sup>1</sup>, Alexandra Fastner<sup>1</sup>, Jan Kottner<sup>1</sup>**

<sup>1</sup> Charité Universitätsmedizin Berlin, Institute of Clinical Nursing Science, Berlin, Germany

**Introduction:** In Europe, the number of elderly people being dependent on care assistance is nearly 31% and will increase continuously in the upcoming years. Nursing home residents in institutional long-term care are affected by physical and cognitive impairment. Nurses are primarily responsible for daily skin care, prevention and treatment of acute and chronic wounds. However, the prevalence of unwanted skin conditions such as pressure ulcers or skin tears can be high. The evaluation of possible associations and associated factors helps to understand the problem and to develop more effective prevention strategies.

**Methods:** A population-based cross-sectional prevalence study in institutional long-term care facilities as part of an RCT (1) has been conducted and n = 314 subjects aged over 65 years in n = 17 nursing homes were included. A head-to-toe examination by dermatologists was performed, and biographic and functional aspects, as well as cognitive assessment data were collected.

**Results:** Mean age was 85.4 (SD 7.1) years and 68.8% of the participants were female. The majority of nursing home residents was affected by xerosis cutis (95.9%, 95% CI 93.6 to 97.8). The prevalence of incontinence-associated dermatitis was 21% (95% CI 15.6 to 26.3), of skin tears 10.5% (95% CI 7.3 to 13.8), of intertrigo 35% (95% CI 30.0 to 40.1) and of pressure ulcers 8.0% (95% CI 5.1 to 10.8). In the occurrence of severe skin diseases, only few associations were found regarding mobility, care dependency, incontinence or cognitive impairment. No associations were found between the single skin conditions.

**Conclusions:** The prevalence of the investigated skin conditions was high, indicating a substantial burden in this vulnerable population. Results indicate, that xerosis cutis, incontinence-associated dermatitis, skin tears, intertrigo and pressure ulcers are not associated in this population, implying separate aetiologic pathways.

### References

1. 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;20(1):302.

## 13.2

# Feasibility of PURPOSE T - a mixed method study in Sweden

*Lisa Hultin<sup>1</sup>, Ann-Christin Karlsson<sup>1</sup>, Malin Löwenmark<sup>1</sup>, Susanne Coleman<sup>2</sup>, Lena Gunningberg<sup>1</sup>*

<sup>1</sup> Uppsala university, Department of Public Health and Caring Sciences, Uppsala, Sweden

<sup>2</sup> University of Leeds, Leeds Institute of Clinical Trials Research, Leeds, United Kingdom

**Introduction:** Pressure ulcers are considered as adverse events and are often avoidable. Prevention starts with identification of patients at risk of developing a pressure ulcer<sup>1</sup>. PURPOSE T is a relatively new evidence-based risk assessment instrument, developed and psychometrically evaluated in United Kingdom<sup>2</sup>. The psychometric characteristics<sup>3</sup> and the usability<sup>4</sup> have recently been evaluated in Sweden. The next step was to evaluate the feasibility of implementing a translated electronic version of PURPOSE T in a hospital ward.

**Methods:** A mixed-method design. Nurses and assistant nurses received training in PURPOSE T, and a record review was performed (n=30). Thereafter, PURPOSE T replaced the Modified Norton Scale in the electronic health record. After one month, another record review was performed (n=30). Focus groups interviews with nursing staff (n=23) were performed after the implementation. Data collection was conducted between August and December 2020.

**Results:** PURPOSE T showed good clinical feasibility. Patients at risk for pressure ulcers according to PURPOSE T were prescribed significantly more nursing interventions compared to patients who were risk assessed with the Modified Norton Scale. The risk assessment was experienced as taking unaltered time despite a comprehensive assessment, and the nurses were more involved at bedside. It contributed to the nurses' increased reflection and analysis to draw their own conclusions regarding patients' risk status. All the nurses were satisfied and were not interested in going back to the Modified Norton Scale.

**Conclusions:** The implementation of PURPOSE T positively affected the pressure ulcer risk assessments. The study provides evidence that an electronic version of PURPOSE T can replace the outdated risk assessment instruments that are used today. PURPOSE T has now been implemented electronically in one university hospital in Sweden and other regions have shown interest. Implementation of the instrument on a national level in both hospital and community care could be considered.

## References

1. EPUAP/NPIAP/PPPIA (2019). *Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline. The International Guideline.* Emely Heasler (Ed.).
2. Coleman et al. (2018). *Clinical evaluation of a new pressure ulcer risk assessment instrument, the Pressure Ulcer Risk Primary or Secondary Evaluation Tool.* JAN 74(2),407-424.
3. Hultin et al. (2020). *PURPOSE T in Swedish hospital wards and nursing homes: A psychometric evaluation of a new pressure ulcer risk assessment instrument.* J Clin Nurs, 29, 4066-4075.
4. Hultin et al. (2021). *Pressure ulcer risk assessment – registered nurses experiences of using PURPOSE T.* J Clin Nurs, 31, 231-239.

## 13.3

## Old dog, new tricks? Using modern advances in chronic wound management to improve outcomes and patient care; a case report

Điđi Delalić<sup>1</sup>, Robert Roher<sup>2</sup><sup>1</sup> University of Zagreb School of Medicine, Zagreb, Croatia<sup>2</sup> Clinical Hospital Merkur, Zagreb, Croatia

**Introduction:** Chronic wounds are those that have failed to heal after a period of 3 months or have gone through the process of healing without achieving a satisfactory anatomical or functional outcome. There are several factors at play that make chronic wounds a serious problem that is difficult to manage. First of all, in spite of various research, there is still no consensus on the biological background and processes that are responsible for the appearance of chronic wounds. Secondly, there is still no consensus on which specialty should treat those wounds: geriatricians, endocrinologists, general surgeons, vascular surgeons and dermatologists all treat chronic wounds to an extent. The cost of treating chronic wounds is getting higher every year. Luckily for the patients, since chronic wounds have become a significant economic burden on the healthcare system, innovation has started to flourish, with different biomedical companies designing new products in an attempt to facilitate the process of chronic wound healing and provide the definitive solution to a very complex problem. This paper demonstrates how such novel products can have a significant positive impact on patient outcomes and satisfaction.

**Case presentation:** An 89-year-old female patient presented to the Emergency Department with complaints of generalized weakness and pain in the sacral area. On inspection, a large, extensive wound with several layers of purulent contents and necrotic tissue was found on the patient's sacral area, presumed to be a pressure ulcer. An extensive necrectomy and debridement of the wound were performed, and the wound was irrigated with hypochlorous acid. As for the dressing, a specific combination was chosen, comprising of a non-woven PVA dressing that transforms into gel when in contact with exudate, while also transferring exudate to the secondary dressing, keeping the wound bed clean and promoting autolytic wound debridement, and a five-layer sacral foam dressing that absorbs exudate, balances moisture and prevents maceration. After 8 months of the aforementioned treatment plan, the wound had completely healed, without any signs of residuals.

**Conclusions:** While the increasing economic burden of treating chronic wounds has presented a large problem for healthcare administration all around the globe, it has also bred innovation and competition in the research and development sector, leading to the design and production of novel treatments that drastically improve wound healing, patient satisfaction and overall reduce treatment costs by shortening the time necessary for the wounds to heal.



## VI. Sympozium DEKUBITY – SDÍLENÍ ZKUŠENOSTÍ NA MEZINÁRODNÍ ÚROVNI: Daty podložené znalosti, dovednosti a doporučené postupy pro péči o dlouhodobě nemocné pacienty

Strategie prevence a léčby dekubitů na národní úrovni jako reakce na výzvu EPUAP; *Strnadová Alice*

Portál Dekubity.eu – informace na jednom místě;  
*Hofštetrová Knotková Michaela*

Sledování incidence a prevalence dekubitů na národní úrovni – SHNU a jeho rozvoj; *Pokorná Andrea*

Klinické doporučené postupy pro nehojící se rány – česká zkušenost; *Stryja Jan*

Znalosti sester ve vztahu k monitorování výskytu a prevalence tlakových lézí; *Bůžilová Petra*

Problematika diferenciální diagnostiky tlakových lézí a inkontinenční dermatitidy v klinické praxi – dotazníkové šetření; *Saibertová Simona*

Kvalita života pacientů s nehojící se ránou; *Krupová Lenka*

## CS1

# Strategie prevence a léčby dekubitů na národní úrovni jako reakce na výzvu EPUAP

**Alice Strnadová<sup>1</sup>, Michaela Hofstetrova Knotkova<sup>2</sup>, Nina Mullerova<sup>3</sup>, Andrea Pokorna<sup>4</sup>**

1 Ministry of Health of the Czech Republic, Department of Nursing and Non-Medical Professions, Praha, Czech Republic

2 National Centre of Nursing and Other Health Professions, Health Professions Regulatory Department, Brno, Czech Republic

3 University Hospital in Pilsen, Quality Management Center, Plzeň, Czech Republic

4 Faculty of Medicine, Masaryk University, Department of Nursing and Midwifery, Brno, Czech Republic

Ministerstvo zdravotnictví zastoupené Hlavní sestrou České republiky společně s profesní organizací a odbornou společností zahájilo v roce 2013 první jednání u Kulatého stolu, aby společně podpořili akci „Stop dekubitům“, výzvu Evropského poradního panelu pro otázky dekubitů (EPUAP) a navrhli strategii ke snížení výskytu dekubitů v České republice. Ke Kulatému stolu byli pozváni zástupci poskytovatelů zdravotních služeb, zdravotních pojišťoven, Ústavu zdravotnických informací a statistiky, odborných a profesních organizací, výrobců zdravotnických prostředků, ale i patientských organizací, vzdělávatelů a médií. Cílem bylo zvýšit povědomí veřejnosti o problematice dekubitů, jasně definovat problémy vedoucí k jejich vzniku a stanovit strategii ke zlepšení situace. Uskutečnilo se již devět jednání u Kulatého stolu. Definovali jsme několik klíčových bodů, kterými jsme se systematicky každým rokem zabývali a průběžně navrhovali opatření ke zlepšení péče o rizikové skupiny pacientů. Výhodou v zavádění systémových opatření byla velmi silná podpora Ministerstva zdravotnictví, které zajišťovalo překlady EPUAP letáků a doporučení, vydávalo rezortně bezpečnostní cíle, kterými se poskytovatelé zdravotních služeb musí řídit, a upravovalo vzdělávací programy pro zdravotnické pracovníky. Jedním z hlavních cílů bylo získat objektivní data o výskytu dekubitů, to se podařilo díky spolupráci s Ústavem zdravotnických informací a statistiky. Národní centrum ošetřovatelství a nelékařských povolání bylo nápomocné při zpracování dotazníků, analýz vzdělávacích programů, překladů edukačních materiálů a realizaci portálu pro laickou a odbornou veřejnost [www.Dekubity.eu](http://www.Dekubity.eu). Stále sledujeme vývoj ve výskytu dekubitů a hledáme nové možnosti k naplňování výzvy EPUAP „STOP dekubitům“. Povedlo se nám postupně splnit velkou část cílů, které jsme si v roce 2013 stanovili a stále nalézáme nové oblasti, kde je nutné zlepšení – evidence dekubitů v pediatrii a neonatologii nebo informace o výskytu dekubitů v souvislosti s použitými zdravotnickými prostředky. Víme, že se jedná o nekončící proces, který zvládneme jen díky dobře sehranému týmu odborníků podporované nejvyšší zdravotnickou institucí.

## CS2

# Portál Dekubity.eu – informace na jednom místě

**Michaela Hofstetrova Knotkova<sup>1</sup>, Nina Mullerova<sup>2</sup>, Andrea Pokorna<sup>3</sup>**

1 National Centre for Nursing and Non-Medical Professions, Regulation of Non-Medical professions, Brno, Czech Republic

2 University Hospital in Pilsen, Quality Management Center, Plzeň, Czech Republic

3 Faculty of Medicine, Masaryk University, Department of Nursing and Midwifery, Brno, Czech Republic

Vznik portálu Dekubity.eu byl odezvou na osvětovou kampaň pod názvem „Stop dekubitům“, kterou v roce 2013 organizoval Evropský poradní panel pro otázky dekubitů (European Pressure Ulcers Advisory Panel - EPUAP), který se zaměřuje na prevenci a léčbu dekubitů v evropských zemích nebo Evropské unie. Kampaň si kladla za cíl edukovat zdravotníky v moderních přístupech prevence a léčbě dekubitů a zároveň zvýšit povědomí laické veřejnosti o tomto problému. V rámci této kampaně vznikla iniciativa pro podporu prevence a léčbě dekubitů. Česká republika se k této aktivitě přihlásila.

V roce 2014 pořádalo Ministerstvo zdravotnictví s dalšími subjekty dvě diskusní konference u kulatého stolu, které měly přispět ke zlepšení a prohloubení spolupráce při řešení této závažné problematiky. Symbolika kulatého stolu byla vybrána proto, že umožňuje rovnost všech účastníků, pomáhá bourat pomyslné bariéry a vnáší nový rozměr do vzájemných vztahů a současně byla založena tradice pořádání. Problematika prevence vzniku dekubitů u hospitalizovaných pacientů byla schválena mezi rezortní bezpečnostní cíle Ministerstva zdravotnictví. Portál k prevenci proleženin/dekubitů je podporovaný odborem ošetřovatelství a nelékařských zdravotnických povolání Ministerstva zdravotnictví České republiky, Hlavní sestrou České republiky a odborně garantovaný Českou společností pro léčbu ran a Českou asociací sester.

Webový portál je jednou z realizovaných priorit kulatých stolů a zároveň umožňuje naplnění dalších vytyčených cílů, které jsou každým rokem aktualizovány a zohledňují priority dané problematiky v České republice. Prostřednictvím Portálu Dekubity.eu lze získat přístup k celé škále informací. Je otevřený námětům, podnětům a informacím z praxe, které je možné zasílat na email: [dekubity@nconzo.cz](mailto:dekubity@nconzo.cz). Tematicky je webový portál rozdělen do dvou kategorií pro:

- laickou veřejnost
- odbornou veřejnost.

Sekce Informace pro laickou veřejnost obsahuje základní údaje o kůži, charakteristiku proleženin, problematiku prevence, ošetřování a využívání léčebných prostředků. Nedílnou součástí je i velmi opomíjená oblast výživy ve vlastním sociálním prostředí. Cílem je průběžně zvyšovat povědomí o problematice prevence a léčby dekubitů u laické veřejnosti a přinášet informace o nových možnostech. Laická veřejnost může také prostřednictvím emailu [dekubity@nconzo.cz](mailto:dekubity@nconzo.cz) pokládat dotazy. Sekce byla rozšířena o opomíjenou oblast tzv. prosezenin ve spolupráci s odbornou společností Českou asociací paraplegiků.

Sekce Informace pro zdravotníky přináší aktuální novinky z problematiky prevence a léčby dekubitů. Zdravotníci pracovníci získají prostřednictvím portálu aktuální přístup k základním evropským doporučením k prevenci, ošetřování a léčbě dekubitů v českém jazyce a současně k místním doporučením jako je Národní ošetřovatelský postup Prevence vzniku dekubitů a péče o dekubity a informace o výskytu dekubitů v ČR. Velmi důležitou součástí portálu je získání dalších informací nejen o mezinárodních aktivitách, ale i o možnostech vzdělávání a plánovaných akcích k problematice prevence a léčby dekubitů probíhající v rámci celé České republiky.

Portál je spravován a provozován Národním centrem ošetřovatelství a nelékařských zdravotnických oborů Brno a v roce 2020 byla provedena grafická úprava odpovídající moderním trendům.

## Závěr

Za dobu své existence a na základě sledovanosti prokázal webový portál Dekubity.eu svou opodstatněnost. Portál během let prošel odborným vývojem. Každý rok byl věnován určitému tématu - praktickému naplnění resortního bezpečnostního cíle 8 - Prevence vzniku proleženin/dekubitů u hospitalizovaných pacientů, opomíjené problematice výživy a hydratace, bolesti, dekubitům v pediatrii a neonatologii. V letošním roce bude téma věnováno výstupům z mezinárodní konference EPUAP v Praze.

V letošním roce připravujeme pro zdravotnické pracovníky sekci věnovanou novorozencům a dětem. Portál se stal nedílnou a uznávanou součástí kvalifikačního a specializačního vzdělávání, certifikovaných kurzů i národních ošetřovatelských postupů.

## CS3

# Sledování incidence a prevalence dekubitů na národní úrovni – SHNU a jeho rozvoj

**Andrea Pokorná<sup>1,2</sup>, Jana Kučerová<sup>2</sup>, Veronika Štrombachová<sup>2</sup>, Michal Pospíšil<sup>1,2</sup>, Petra Bůřilová<sup>1,2</sup>, Dana Dolanová<sup>1,2</sup>, Jan Mužík<sup>1,2</sup>**

<sup>1</sup> Masaryk University, Department of Nursing and Midwifery, Brno, Czech Republic

<sup>2</sup> Institute for Health Information and Statistics, Quality of Care Assessment, Praha, Czech Republic

**Úvod:** Incidence a prevalence dekubitů na národní úrovni je v České republice sledována prostřednictvím Systému hlášení nežádoucích událostí (SHNU). Hlášení nežádoucích událostí (NU) Dekubitus v klinické praxi je v současnosti povinné pro všechny poskytovatele zdravotních služeb (PZS) lůžkové péče. Metodické dokumenty jsou pravidelně aktualizovány a publikovány na národním online portále SHNU ([www.shnu.uzis.cz](http://www.shnu.uzis.cz)), který slouží jako odborná komunikační platforma pro PZS.

**Metody:** V rámci SHNU jsou formulovány a připraveny na důkazech založená doporučení a pokyny jak pro účinná preventivní opatření, tak pro sběr údajů o prevalenci NU (včetně dekubitů) na národní úrovni. NU jsou na lokální úrovni PZS sledovány a zaznamenávány na základě jednotné metodiky v jednoletém monitorovacím období a data jsou pak jednou ročně předávána do SHNU prostřednictvím výkazu L (MZ) 3-01 – o počtu hlášení nežádoucích událostí pro centrální hodnocení. Následně jsou data analyzována tak, aby bylo možné jejich posouzení jak na úrovni poskytovatele, tak v celonárodním srovnání v anonymizované podobě.

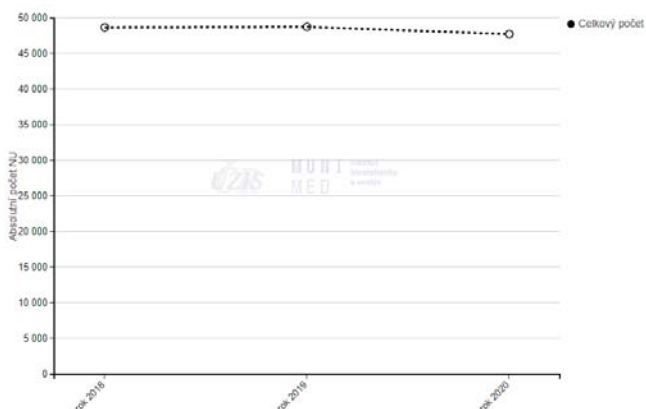
**Výsledky:** V období let 2018–2020 bylo v SHNU celkem sledováno 7 884 203 pacientů a nahlášeno celkem 313 453 NU. V roce 2018 bylo sledováno 2 706 998 pacientů ze 408 PZS; 2 856 355 pacientů ze 430 PZS v roce 2019 a 2 320 850 pacientů ze 435 PZS v roce 2020. Dekubitus byl nejčastěji hlášenou nežádoucí událostí za každé sledované období ( $n = 48\,704/2018$ ;  $n = 48\,779/2019$ ;  $n = 47\,755/2020$ ; podrobněji viz Obrázek 1 a 2).

**Závěr:** SHNU a v něm sledovaná a prezentovaná data slouží zejména ke kultivaci procesů a k podpoře kvality péče na lokální úrovni jednotlivých poskytovatelů zdravotních služeb. Přispívají k procesům sledování rizik péče. Národní online portál je stále rozvíjen. V roce 2016 byly vytvořeny metodické dokumenty k SHNU – obecná metodika sběru dat, Taxonomický slovník a metodické dokumenty k jednotlivým typům NU, které jsou pravidelně aktualizovány. Následně byl vytvořen Národní webový portál SHNU k zajištění komunikační odborně orientované platformy pro PZS. V roce 2019 byly zpřístupněny interaktivní vizualizace dat jednotlivým oprávněným zástupcům PZS. V roce 2020 byly vytvořeny metodické videonávody. V roce 2021 byla zveřejněna sekce jednotlivých analýz dat pro širokou veřejnost. SHNU je vhodným nástrojem pro kontinuální zvyšování kvality péče na národní úrovni, přičemž údaje povinně poskytují všichni poskytovatelé lůžkové zdravotní péče. Zvažováno je zapojení poskytovatelů domácí zdravotní péče.

## Zdroj

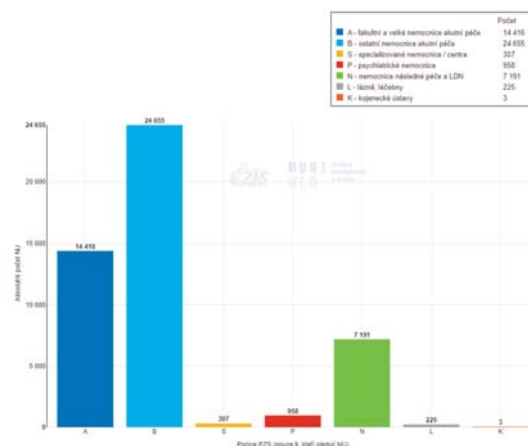
Pokorná A., Štrombachová V., Mužík J., Dolanová D., Bůřilová P., Pospíšil M., Kučerová J., Gregor J., Komenda M., Dušek L. Národní portál Systém hlášení nežádoucích událostí [online]. Praha: Ústav zdravotnických informací ČR, 2016 [cit. 2022-08-29]. Dostupné z: <https://shnu.uzis.cz>.

Dekubity – absolutní počet NU



Obrázek 1. Trend prevalence dekubitů v letech 2018–2020

Dekubity za rok 2020 – absolutní počet NU



Obrázek 2. Prevalence dekubitů u jednotlivých kategorií PZS za období roku 2020

## CS4

# Klinické doporučené postupy pro nehojící se rány – česká zkušenost

**Jan Stryja<sup>1</sup>, Andrea Pokorna<sup>2,3</sup>, Jitka Klugarová<sup>3,4</sup>, Miloslav Klugar<sup>5,6</sup>**

1 *Salvatella s.r.o., Třinec - Staré Město, Czech Republic*

2 *Masaryk University, Department of Nursing and Midwifery, Brno, Czech Republic*

3 *Masaryk University, The Czech National Centre for Evidence-Based Healthcare and Knowledge Translation (Cochrane Czech Republic, Czech Republic CEBHC; JBI Centre of Excellence, Masaryk University GRADE Centre), Institute of Biostatistics and Analyses, Faculty of Medicine, Brno, Czech Republic*

4 *Czech Health Research Council, Praha, Czech Republic*

5 *Masaryk University, The Czech National Centre for Evidence-Based Healthcare and Knowledge Translation (Cochrane Czech Republic, Czech Republic CEBHC; JBI Centre of Excellence, Masaryk University GRADE Centre), Institute of Biostatistics and Analyses, Faculty of Medicine, Brno, Czech Republic*

6 *Czech Health Research Council, Czech Republic, Praha, Czech Republic*

**Úvod:** Velká heterogenita léčby ran je běžná nejen v České republice. Poskytovaná péče o rány se mezi zdravotnickými zařízeními často liší, zejména v případech pacientů s nehojícími se ránami. Aby bylo možné standardizovat péči o rány, začali jsme používat mezinárodní klinické doporučené postupy. Doporučené postupy jsou adoptovány pomocí národního projektu doporučených postupů řízeného Agenturou pro zdravotnický výzkum České republiky společně s Ministerstvem zdravotnictví České republiky a Ústavem zdravotnických informací a statistiky ČR.

**Metodika:** V rámci činnosti projektu jsou adoptovány doporučené postupy zaměřené na prevenci vzniku ran, péči o rány a prevenci ranných komplikací. Adopce klinických doporučených postupů (KDP) se řídí Českou národní metodikou tvorby klinických doporučených postupů, která je založena na přístupu GRADE.

**Výsledky:** V průběhu projektu by mělo být vytvořeno minimálně 40 klinických doporučených postupů. Nejméně tři z nich se zaměřují na péči o rány: Doporučený postup Dekubity (vytvořený EPUAP, NPUAP a PPIAP); KDP zaměřený na infekce v místě chirurgického výkonu a prevenci a léčbu ulcerací syndromu diabetické nohy. Hlavním cílem projektu není přeložit a převzít doporučené postupy. Největší výzvou je překlad znalostí a implementace standardizovaných procesů a intervencí. Těší nás proto podpora Ministerstva zdravotnictví i to, že se nám do projektu podařilo zahrnout další významné instituce. To by mělo mít vliv jak na tvorbu KDP, tak na jejich využití v praxi.

**Závěr:** Standardizace procesů v léčbě ran představuje výzvu, protože pro poskytování adekvátní péče často nejsou dostupné dostatečně silné důkazy. Ve své klinické práci se snažíme vyvarovat rizikům spojených s nesprávnou péčí, s relativně velkým tlakem na zdravotnické pracovníky z oblasti průmyslu a problematickým hodnocením účinnosti a ekonomické účelnosti léčby ran. Domníváme se proto, že KDP jsou nejlepším způsobem, jak dosáhnout zlepšení kvality poskytované péče.

**Poděkování:** Tato práce byla podpořena projektem "Klinické doporučené postupy" číslo CZ.03.2.63/0.0/0.0/15\_039/0008221.

## CS5

# Znalosti sester ve vztahu k monitorování výskytu a prevalence tlakových lézí

Petra Bůřilová<sup>1</sup>, Simona Saibertová<sup>1</sup>, Dana Dolanová<sup>1</sup>, Lenka Krupova<sup>2</sup>, Andrea Pokorna<sup>1</sup>

<sup>1</sup> Masaryk university, Department of Health Sciences, Brno, Czech Republic

<sup>2</sup> University Hospital, Department of Dermatology, Ostrava, Czech Republic

**Úvod:** Cílem tohoto výzkumu bylo zmapovat úroveň znalostí všeobecných sester v oblasti prevence a obecného povědomí o tlakovém poranění paty na jednotkách intenzivní péče zapojených do projektu "Analýza nákladovosti léčby dekubitů - determinanty péče". Druhým cílem bylo zvýšit úroveň znalostí o této problematice prostřednictvím vzdělávacích aktivit.

**Metody:** Byl realizován kvantitativní průzkum. Byl využit standardizovaný dotazník "Pressure Ulcer Knowledge Test - PUKT". V první fázi byl proveden pre-test, aby se zjistila úroveň znalostí před vzděláváním. Ve druhé fázi byla provedena edukace, ale vzhledem k pandemii COVID-19 byly edukační aktivity poskytovány online (edukační videa a prezentace). Po absolvování online vzdělávacích aktivit byly opakovaně vyhodnoceny znalosti sester (n=106). Vzhledem k neuspokojivému výsledku byly všeobecné sestry znovu proškoleny (n=146) kontaktním způsobem a poté byla úroveň znalostí o tlakových poraněních znovu ověřena. Statistická analýza dat byla provedena pomocí Spearmanova korelačního koeficientu a Mannova-Whitneyho rankového testu na statistické hladině  $< 0,05$ .

**Výsledky:** Hraniční hodnotou pro dotazník PUKT je 90 % úspěšnost. Celková míra správných odpovědí v pre-testu byla 74,15 %. Po absolvování online výukových aktivit byl proveden 1. post-test, kde celková míra správných odpovědí činila 74,21 %. Protože online vzdělávání nepřineslo očekávaný efekt, byly všeobecné sestry v další fázi znovu vzdělávány (n=145) formou kontaktních přednášek a o měsíc později byl proveden 2. post-test, kde celková míra správných odpovědí činila 93,1 %.

**Závěry:** Online vzdělávací aktivity během pandemie COVID-19 nezvýšily znalosti všeobecných sester. Významnou překážkou byla nemožnost osobních vzdělávacích aktivit, vysoké pracovní vytížení všeobecných sester a s tím související nízká motivace k samostudiu. Naproti tomu kontaktní vzdělávací aktivity prokázaly zvýšení znalostí všeobecných sester o tlakových poraněních.

**Poděkování:** Tento příspěvek byl podpořen z programového projektu Ministerstva zdravotnictví ČR s reg. č. NU20-09-00094 s názvem: Analýza nákladovosti léčby dekubitů - determinanty péče.

## CS6

# Problematika diferenciální diagnostiky tlakových lézí a inkontinenční dermatitidy v klinické praxi – dotazníkové šetření

**Simona Saibertová<sup>1</sup>, Veronika Šimečková<sup>2</sup>, Andrea Pokorná<sup>2</sup>, Kamila Randová<sup>1</sup>, Tereza Švecová<sup>2</sup>, Marie Garajová<sup>1</sup>, Natália Antalová<sup>1</sup>**

<sup>1</sup> Masaryk university, Department of Health Sciences, Brno, Czech Republic

<sup>1</sup> Masaryk university, Department of Health Sciences, Brno, Czech Republic

**Úvod:** Dekubity i inkontinenční dermatitidy (IAD) představují závažné komplikace pro pacienty i zdravotnické pracovníky. Preventivní a terapeutické zásahy jsou účinné, avšak pouze za předpokladu správné diferenciální diagnózy. IAD a dekubity jsou v klinické praxi často chybně diagnostikovány, a to z důvodu nedostatečných znalostí ošetrovatelského personálu.

**Metody:** Cílem této práce bylo zjistit úroveň znalostí respondentů o diferenciální diagnostice, prevenci a léčbě proleženin a IAD. Kvantitativní dotazníkové šetření (celkem 15 položek, z nichž šest položek bylo zaměřeno na obecné znalosti o IAD, dalších devět položek se týkalo úrovně znalostí preventivních a terapeutických intervencí). Celkem se zúčastnilo 121 zdravotnických pracovníků z různých pracovišť, (anesteziologicko-resuscitační oddělení, interní JIP, chirurgická JIP, standardní jednotky na interním a chirurgickém oddělení a oddělení dlouhodobé péče). Byly provedeny statistické analýzy na hladině významnosti 0,05 (Mannův-Whitneyho U test, chí-kvadrát, Kruskal-Wallisova ANOVA a Lillieforsův test).

**Výsledky:** Úroveň znalostí byla obecně nízká. Nejvyšší úroveň správných odpovědí byla 75,8 % v položkách obecných znalostí. V položkách zaměřených na terapeutické a preventivní zásahy byla úspěšnost 74,7 %. Ověřili jsme, že věk ( $p = 0,414938$ ), pohlaví ( $p = 0,19488$ ), vzdělání ( $p = 0,89980$ ), délka praxe ( $p = 0,258736$ ), specializované vzdělání ( $p = 0,18713$ ) a typ pracoviště ( $p = 0,69948$ ) významně nekorelují se znalostmi respondenta v oblasti diferenciální diagnostiky, prevence a léčby dekubitů a IAD ( $p > 0,05$ ). Respondenti vůbec neznají nástroj GLOBIAD.

**Závěry:** Ve vybraném vzorku zdravotnických pracovníků jsme ověřili nízké znalosti v oblasti identifikace dekubitů a IAD. Byly pořádány vzdělávací akce ke zvýšení povědomí o diferenciální diagnostice. Účinnost edukace bude následně vyhodnocena formou post-testu.

Tento příspěvek vznikl na Masarykově univerzitě v rámci projektu "Komplexní přístup k poruchám integrity kůže a sliznic II." číslo MUNI/A/1341/2021 s podporou dotace na specifický vysokoškolský výzkum, jak ji poskytlo Ministerstvo školství, mládeže a tělovýchovy ČR v roce 2021.



## CS7

## Kvalita života pacientů s nehojící se ránou

**Lenka Krupová<sup>1,2</sup>, Andrea Pokorná<sup>3</sup>**

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

2 *University of Ostrava, Faculty of Medicine, Department of Nursing and Midwifery, Ostrava, Czech Republic*

3 *Masaryk University, Faculty of Medicine, Department of Nursing and Midwifery, Brno, Czech Republic*

**Úvod:** Nehojící se rány mohou mít značný vliv na kvalitu života pacienta, a to bez ohledu na etapu života, v níž rána vznikne. Hodnocení kvality života však není běžnou součástí péče o pacienty s nehojící se ránou.

Cílem studie bylo zhodnotit kvalitu života vybraného souboru pacientů s nehojící se ránou dle dvou dostupných nástrojů: SF-36 a Wound-QoL. Posoudit klinickou využitelnost konkrétního nástroje v populaci pacientů s nehojící se ránou a identifikovat oblasti, v nichž lze uplatnit účelné preventivní nástroje pro ovlivnění kvality života pacientů.

**Metodika:** Prospektivní observační neintervenci studie. Výzkumný soubor tvořili pacienti s nehojící se ránou hospitalizovaní ve Fakultní nemocnici Ostrava. Bylo použito dotazníkové šetření s využitím nástrojů pro hodnocení kvality života (Wound-QoL a SF-36) a objektivizující testy pro hodnocení úrovně sebepéče (ADL), kognitivních funkcí (MMSE), psychického stavu (GDS), intenzity bolesti (numerická škála bolesti a DIBDA) a stavu spodiny rány (WHC). Sběr dat byl prováděn při konzultaci s pacienty při přijetí k hospitalizaci a po sedmi dnech hospitalizace. Data byla statisticky zpracována pomocí statistického software IBM SPSS (hladina významnosti  $\alpha = 0,05$ ).

**Výsledky:** Kvalita života souboru 191 hodnocených pacientů s ránou byla ve srovnání se zdravou populací ovlivněna a snížena. Faktory, které ovlivňují kvalitu života byly úroveň sebepéče dle Barthelové, psychický stav dle škály deprese pro geriatrické pacienty, bolest, typ, velikost a klasifikace spodiny rány ( $p \leq 0,05$ ). Hodnocení kvality života se naopak nelišilo dle pohlaví, věku a délky léčby rány ( $p \geq 0,05$ ).

**Závěr:** Nehojící se rány významně ovlivňují kvalitu života pacienta. Praktické zkušenosti s administrací a vyhodnocením výsledků průzkumu potvrdily, že Wound-QoL je spolehlivým nástrojem vhodným pro hodnocení kvality života pacientů s nehojícími se ranami.

Podpořeno z programového projektu Ministerstva zdravotnictví ČR s reg. č. NU20-09-00094 s názvem: Analýza nákladovosti léčby dekubitů – determinanty péče.

### Poster presentations A

- P1 Implementing S31 Principles into Support Surface Design; *Bill Smith*
- P2 The role of mechanoactivation as a potential mechanism activated in vivo during the pressure ulcer healing under influence of the radial shock waves; *Miroslaw Sopol*
- P3 The use of basic science methods in explaining the biological mechanisms of the pressure ulcer healing process after shock wave treatment; *Miroslaw Sopol*
- P4 Topical insulin gel and hair follicle growth in cutaneous wound; *Maria Helena Melo Lima*
- P5 The knowledge of nurses in caring for a morbidly obese patient in intensive care - a questionnaire survey; *Natália Beharková*
- P6 The Knowledge and practices of nurses in prevention and therapy of skin tears - the questionnaire survey; *Andrea Pokorná*
- P7 What is the impact of prophylactic silicone dressings on the incidence of pressure ulcers among patients in the acute hospital setting?; *Aglecia M. V. Budri*
- P8 The evidence of assessing skin risks and conditions, and non-pharmacological interventions for maintaining skin integrity: a systematic review of systematic reviews; *Alexandra Fastner*
- P9 SCX effectiveness in fungal colonisation as a IAD complication; *Roberto Cassino*
- P10 Using a thin silicone adhesive foam and a care pathway to support device related pressure ulcer prevention for patients requiring the use of orthopaedic devices in an acute trust; *Sarah Charlton*
- P11 The impact of pressure ulcer prevention education on health care assistants' knowledge and skills and pressure ulcer incidence in long-term care settings; *Noreen O'Brien*
- P12 The effect of empathy on pressure ulcer management; *Monika Kubicová*
- P13 Increased risk of pressure ulcer development with delay in transfer to a specialist spinal cord injury rehabilitation unit Ihuoma; *Rosemary Okereke*
- P14 From the prevalence survey in a intensive care unit to the identification of prevention and treatment strategies for pressure injuries in the logic of wound bed preparation; *Francesco Uccelli*
- P15 Perioperative management of pressure injury in plastic surgery patients; *Andrea Menšíková*
- P16 Complex management of atypically located pressure ulcers in oncology patients: a clinical case report; *Izabela Kuberka*
- P17 Pressure ulcer prevention and its challenges in critically ill patients; *Irene Pukiova*
- P18 Pressure ulcer prevention in transition from hospital to home for individuals with spinal cord injury - a scoping review; *Knaerke Soegaard*
- P19 Neonatal skin structure: Pressure injury staging challenges; *Ann Marie Nie*
- P20 Wound healing and Health-related quality of life in patients with pressure ulcers locally treated with TLC-NOSF dressings\* - evidence from a prospective, multicentre real - life study; *Serge Bohbot*
- P21 Analysis of the occurrence of new decubitus ulcers in long-term care patients and the possible forensic impact on nursing staff; *Alice Ručková*
- P22 A survey of 3 nations practice of pressure ulcer care; *Hester Colboc*
- P23 Association of a 2-layer multicomponent compression system and an advanced wound dressing in venous ulcer's treatment; *Thierry Coppin*
- P24 Photobiomodulation in addition to dressing of pressure ulcer stage four, in frail elderly with municipality home healthcare; *Marianne Degerman*
- P25 A prospective, observational study of pressure injury prevention, caregiver protection, and workflow benefits of a novel lift-compatible safe patient handling support surface in U.S. Hospitals; *Philip Davies*
- P26 Clinical decision making in pressure ulcer (PU) prevention as impacted by the use of sub-epidermal moisture (SEM) prompts- the mining of the worlds first PU registry; *Vignesh Iyer*

### Poster presentations B

- P27 WHITE/PRESSURE3: World hip trauma evaluation: Pressure ulcer prevention 3; a randomised clinical trial assessing early use of heel specific adjunct devices for heel pressure ulcer prevention in people with a fractured hip; *Clare Greenwood*
- P28 An exploration of the use of devices for the prevention of heel pressure ulcers: a realist evaluation; *Clare Greenwood*
- P29 Early detection of pressure ulcers on mechanical simulation based on IRM images and the importance of frequent measurement; *Nicolas Gillard*
- P30 Creating continuum of care - prevent pressure injury in ambulance service; *Pia Volmanen*
- P31 Nutrition as part comprehensive decubitus ulcers care; *Kristýna Bechníková*
- P32 Effect of pressure injury on the application of viscoelastic foam overlay in patients with terminal cancer in hospice ward; *Jeong Ran Jeon*
- P33 Decubitus - basic conception of treatment; *Tomáš Jankovič*
- P34 Breaking the cycle of damage: SEM assessment technology as a method for support surface Assessment; *Bill Smith*
- P35 Prevention of pressure ulcers - educational care map for lay caregivers; *Lenka Šeflová*
- P36 Project PRIME: Pressure relief index metric extension - an extended study; *David Newton*

- P37 The importance of pressure mapping system in prevention of pressure ulcers in spinal cord injured patients with wheelchair mobility; *Lia Vasickova*
- P38 Negative consequences and regression in pressure ulcer healing due to the lack of continuity of shock wave treatment - a clinical case report; *Izabela Kuberka*
- P39 incidence and analysis of medical device related pressure injury: Korea acute care hospital; *Jung Yoon Kim*
- P40 The benefit of lateral tilting beds in Intensive Care Unit; *Natália Beharková*
- P41 IAD prevention strategy on Gastroenterology ICU FH Olomouc; *Sylvie Přecechtělová*
- P42 Implementation of the pressure ulcer risk assessment instrument, Purpose T, at a University hospital in Sweden; *Charlotte Bjurbo*
- P43 Analysis of real world data: Impact of technology on nursing interventions for pressure injury/ulcer prevention; *Vignesh Iyer*
- P44 Reducing the adherence of micro-organisms and biofilms on a support surface through a novel surface structure; *Richard Haxby*
- P45 Applying for community reimbursement in the UK national health service for a second-generation technology in pressure ulcer prevention; *Callum Housley*
- P46 Assessment of different type of support surface(s); *Esa Soppi*
- P47 Skin viability and microvascular function under localised applications of heat and pressure; *Alex Robertson*
- P48 Stabilized ozonides as catalyst in the management of elderly people skin lesions with shockwaves and photobiomodulation; *Roberto Cassino*
- P49 Usage of NPWT in a patient with extensive trochanteric pressure ulcer - a case study; *Pavel Kůřil*
- P50 The importance of the differential diagnosis of pressures ulcers and moisture lesions - a case study; *Pavel Kůřil*
- P51 Turn over biceps femoris technique in reconstruction of recurrent ischiadic pressure injuries - our experiences; *Alica Hokynkova*
- P52 Quality of life in informal caregivers in wound care; *Mirna Zulec*

## P1

# Implementing S3I Principles into Support Surface Design

Bill Smith<sup>1</sup>, Craig Jones<sup>1</sup>, Jonathan Busby<sup>2</sup>

<sup>1</sup> Arjo, Research & Development, Cardiff, United Kingdom

<sup>2</sup> Arjo, Medical Affairs, Bedfordshire, United Kingdom

**Introduction:** Can the basic scientific principles of biomechanics and pressure injury aetiology be used in the design and development of a hybrid support surface?

The ANSI RESNA S3i (support surface standard initiative) have developed a comprehensive suite of test methods to quantify the performance of mattresses. In principle, surfaces that perform well under these metrics will help to minimise the risk of pressure injury to the patient.

- Pressure Redistribution – The surface first and foremost should effectively redistribute pressure around the body. This will work to minimise areas of localized high pressures and spread the load more evenly across the body surface.
- Microclimate – The principles of maintaining an optimal moisture and temperature environment at the patient – surface interface is known as microclimate. Lower temperatures and humidity prevent premature breakdown of surface tissue which can lead to accelerated risk of pressure injury. [1]
- Shear Force – The principle of minimizing shear force on the patient is gaining traction in surface design. The physical effect of shear on the patient tissue can trigger the start of a damage cascade. [2]

**Methods:** Surface design can incorporate the following core S3i principles:

- Pressure Redistribution – Using a combination of foam and air to minimise peak pressures and maximize envelopment of the patient, as highlighted in Section 6 of the S3i standard.
- Microclimate – Whilst it is difficult for a hybrid surface itself to bring microclimate properties to the patient – surface interface, it is possible to ensure compatibility with overlay covers. Using these technologies in combination ensures optimal pressure redistribution without compromising the patient microclimate.
- Shear Force – Mattress construction and choice of patient contact materials can help to lower shear forces by minimizing areas of high friction around vulnerable anatomies, e.g. heels.

## Results:

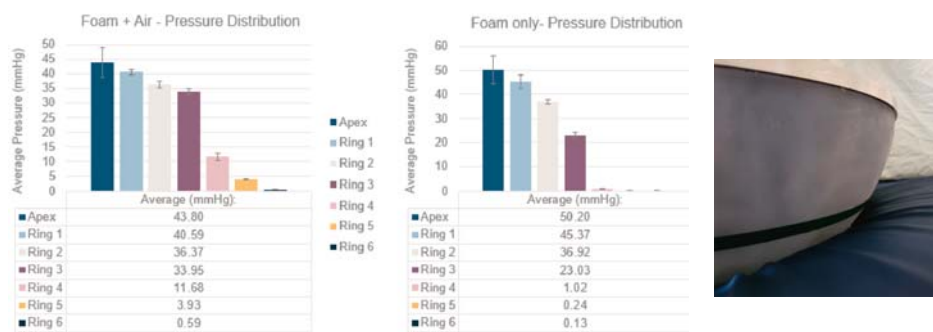


Figure 1 - Hybrid foam and air technology (left) compared to a 'foam only' setup (right)



Figure 2 – Foam only (left), foam + air combination (right)

The contact depth is significantly reduced when air is removed from mattress cells. This is because the air works in combination with the foam to 'wrap around' the irregularities of the applied load. (See Figure 2).

**Conclusions:** Pressure investigation using the S3i methods has shown there is a noticeable difference between a mattress that has been designed with these principles in mind, versus one that does not consider them. Further investigation into other aspects of the surface design principles, such as microclimate and shear, will be undertaken to examine if these same comparisons can be made.

## References

1. Kottner J et al. Microclimate; A critical review 2018  
<https://doi.org/10.1016/j.clinbiomech.2018.09.010>
2. Geffen A; 2020 – Wounds International, Volume 11, Issue 3, Page 22-30

## P2

## The role of mechanoactivation as a potential mechanism activated in vivo during the pressure ulcer healing under influence of the radial shock waves.

**Mirosław Sopol<sup>1</sup>, Izabela Kuberka<sup>2</sup>, Joanna Rosińczuk<sup>3</sup>, Jakub Taradaj<sup>4</sup>, Robert Dymarek<sup>5</sup>**

<sup>1</sup> Wrocław Medical University, Department of Basic Sciences, Wrocław, Poland

<sup>2</sup> Wrocław Medical University, Department of Anaesthetic and Surgical Nursing, Wrocław, Poland

<sup>3</sup> Wrocław Medical University, Department of Internal Medicine Nursing, Wrocław, Poland

<sup>4</sup> Academy of Physical Education, Institute of Physiotherapy and Health Sciences, Katowice, Poland

<sup>5</sup> Wrocław Medical University, Department of Physiotherapy, Wrocław, Poland

**Introduction:** Wound healing involves the coordinated action of many types of cells including epidermal reepithelization, extracellular matrix deposition, connective tissue cell contraction, and angiogenic response. Yes-associated protein (YAP) is a key component of the Hippo pathway. It plays an important role in stem cell proliferation, stem cell self-renewal, apoptosis, organogenesis, epithelial-mesenchymal transition (EMT) and contact inhibition. Numerous studies have shown the important role of YAP in the wound healing process. So far, the mechanisms of extracorporeal shock waves (ESW) activated in vivo are poorly documented. The purpose of this study is to analyze a potential biological mechanism of ESW on human pressure ulcers (PU).

**Methods:** Ten female patients with PU in the sacral localization received three ESW applications (300 + 100/cm<sup>2</sup> pulses, 2.5 bars, 0.15 mJ/mm<sup>2</sup>, 5 Hz). The biopsy specimens were collected from the most contaminated area of the PU at baseline (M0) and 24 hours (M1) after the last ESW. Immunohistochemical staining was performed by a standard immunoperoxidase staining procedure. The results were quantified based on a standard scoring system.

**Results:** YAP was expressed in both nuclear and cytoplasmic locations in the epithelium and connective tissues. In skin before the ESW intervention, YAP was weakly expressed in the stratum basale. After interventions, YAP was mainly expressed in the stratum basale and lower stratum spinosum in the samples. YAP expression in basal cells at the nucleus localization correlates with the expression of proliferation marker Ki67. Results show that increased expression of YAP may cause a higher proliferation of keratinocytes, directly contributing to epithelial regeneration. In pre-intervention wounds, YAP in dermal fibroblasts has mainly cytoplasmic localization, while after the ESW intervention in the wound healing phase it has a high level of expression in the nuclei of fibroblasts in the wound bed. Moreover, the YAP expression level in cytoplasm correlated with an increase in the number of myofibroblasts in the wound bed defined by immunocytochemical expression of smooth muscle actin.

**Conclusions:** YAP may affect wound closure and identify YAP as key regulators of keratinocyte and fibroblast mechanoactivation. It may have pleiotropic effects, influencing wound closure, cell proliferation, and tissue contraction.

### References

[1] Rosińczuk J, et al. *Mechanoregulation of wound healing and skin homeostasis*. *Biomed Res Int*. 2016;2016:3943481. [2] Hatanaka K, et al. *Molecular mechanisms of the angiogenic effects of low-energy shock wave therapy: roles of mechanotransduction*. *Am J Physiol Cell Physiol*. 2016;311(3):378-385. [3] Aschermann I, et al. *Extracorporeal Shock Waves Activate Migration, Proliferation and Inflammatory Pathways in Fibroblasts and Keratinocytes, and Improve Wound Healing in an Open-Label, Single-Arm Study in Patients with Therapy-Refractory Chronic Leg Ulcers*. *Cell Physiol Biochem*. 2017;41(3):890-906.

## P3

## The use of basic science methods in explaining the biological mechanisms of the pressure ulcer healing process after shock wave treatment.

**Mirosław Sopol<sup>1</sup>**, Izabela Szczuka<sup>2</sup>, Izabela Kuberka<sup>3</sup>, Joanna Rosińczuk<sup>3</sup>, Jakub Tarada<sup>4</sup>, Robert Dymarek<sup>5</sup>

1 Wrocław Medical University, Department of Basic Sciences, Wrocław, Poland

2 Wrocław Medical University, Department of Biochemistry and Immunochemistry, Wrocław, Poland

3 Wrocław Medical University, Department of Anaesthetic and Surgical Nursing, Wrocław, Poland

4 Academy of Physical Education in Katowice, Institute of Physiotherapy and Health Sciences, Wrocław, Poland

5 Wrocław Medical University, Department of Physiotherapy, Wrocław, Poland

**Introduction:** Wound healing requires a coordinated interaction of dermis cells, proper extracellular matrix deposition, re-epithelialization and angiogenic response. Increased cell proliferation is a prerequisite for forming new tissue that restores defects following injury. A relatively new therapeutic application for chronic wounds and pressure ulcers (PUs) is shock wave therapy (ESWT).

**Methods:** This study was conducted on PUs patients classified with EPUAP grades II-III, with 7.5 months mean duration of the wound. Enrolled patients underwent two sessions with low-energy ESWT. Histomorphological and immunocytochemical analyses were performed on tissue sections obtained from the PUs' edges before (M0) and after the first (M1) and second ESWT (M2). The proliferation index of keratinocytes and fibroblasts (Ki-67 expression), microvessels density (CD-31 antigen expression) and the number of myofibroblasts ( $\alpha$ SMA activation) were evaluated. Also, the influence of transcriptional cofactor protein YAP1 in sensing mechanical strain and activation of nuclear localization of Yap were investigated.

**Results:** Increased proliferative activity of epidermal cells and skin fibroblasts as well as an increased number of myofibroblasts, often visible as integrated cell bands, were observed after ESWT. The results indicate that the major skin cells keratinocytes, and fibroblasts are mechanosensitive. They intensify proliferation and extracellular matrix remodeling in response to mechanical stress induced by ESWT. A marked increase in the number of vessels in the studied wounds after ESW was shown, which results in better blood supply to the healing process. ESWT increases the expression of nuclear-localized YAP protein in both keratinocytes of the germinal layer of the epidermis as well as in connective tissue cells of the dermis and vascular endothelium.

**Conclusions:** An increased expression of YAP at nuclear localization as a result of ESWT may indicate the important role of mechanical forces in YAP activation, and translocation to the cell nucleus and consequently increase the proliferation of keratinocytes, fibroblasts, and directly contribute to the enhancement of PUs healing processes.

### References

(1) Rosińczuk J, et al. *Mechanoregulation of wound healing and skin homeostasis. Biomed Res Int.* 2016;2016:3943481. (2) Hatanaka K, et al. *Molecular mechanisms of the angiogenic effects of low-energy shock wave therapy: roles of mechanotransduction. Am J Physiol Cell Physiol.* 2016;311(3):378-385. (3) Aschermann I, et al. *Extracorporeal Shock Waves Activate Migration, Proliferation and Inflammatory Pathways in Fibroblasts and Keratinocytes, and Improve Wound Healing in an Open-Label, Single-Arm Study in Patients with Therapy-Refractory Chronic Leg Ulcers. Cell Physiol Biochem.* 2017;41(3):890-906.

## P4

## Topical insulin gel and hair follicle growth in cutaneous wound

Flávia Cristina Zanchetta<sup>1</sup>, Thais Paulino Prado<sup>1</sup>, Beatriz Barbieri<sup>2</sup>, Eliana Pereira Araujo<sup>2</sup>, **Maria Helena Melo Lima**<sup>3</sup>

1 University of Campinas, School of Nursing, Campinas, Brazil

1 University of Campinas, School of Nursing, Campinas, Brazil

1 University of Campinas, School of Nursing, Campinas, Brazil

**Introduction:** Hair follicles are a source of stem cells, characterized by their ability to renew and to give rise to different cell lineages. Under homeostatic conditions, they renew the hair follicle. However, when the skin is injured, they show great plasticity and they are able to give rise to other cell types, contributing to healing.

**Methods:** Hyperglycemia was induced with 5 doses of 50mg/kg of streptozotocin for 5 consecutive days in 6-week-old C57BL/6 mice. The animals were divided into three experimental groups: Saline (SAL), treated with 0.9% saline solution; Control (CTRL), treated with placebo gel and Insulin (INS), treated with insulin gel. Tissues were extracted on the 7th, 14th and 20th days post-injury and histological analysis was performed using Hematoxylin and Eosin (H&E) staining.

**Results:** On the 7th day after injury, the tissue in the INS group showed less inflammation and more organized granulation tissue compared to the CTRL and SAL groups. On the 14th day after the injury, similar tissue characteristics were observed in the three groups. On the 20th day after the injury, there was complete re-epithelialization in the three groups, but there was growth of hair follicles and a smaller scar area in the INS group.

**Conclusions:** After application of insulin gel in lesions of hyperglycemic mice, microscopically, there was an increase in hair at the site and better tissue repair, compared to the other groups. The molecular and cellular mechanisms involved in this process need to be better elucidated to understand the observed phenomenon.

### References

Li B, Hu W, Ma K, Zhang C, Fu X. Are hair follicle stem cells promising candidates for wound healing? *Expert Opin Biol Ther.* 2019;19(2):119-28. 4.

Tadeu AM, Horsley V. Epithelial stem cells in adult skin. *Curr Top Dev Biol.* 2014;107:109-31. 5.

Goldstein J, Horsley V. Home sweet home: skin stem cell niches. *Cell Mol Life Sci.* 2012;69(15):2573-82. 6.

Blanpain C, Fuchs E. Epidermal homeostasis: a balancing act of stem cells in the skin. *Nat Rev Mol Cell Biol.* 2009;10(3):207-17. 7.

Gonzales KAU, Fuchs E. Skin and Its Regenerative Powers: An Alliance between Stem Cells and Their Niche. *Dev Cell.* 2017;43(4):387-401. 8.

Chu GY, Chen YF, Chen HY, Chan MH, Gau CS, Weng SM. Stem cell therapy on skin: Mechanisms, recent advances and drug reviewing issues. *J Food Drug Anal.* 2018;26(1):14-20.



## P5

# The knowledge of nurses in caring for a morbidly obese patient in intensive care -- a questionnaire survey

**Natália Beharková<sup>1</sup>, Martina Mynářová<sup>1</sup>, Andrea Pokorna<sup>1</sup>**

<sup>1</sup> Masaryk University, Faculty of Medicine, Brno, Czech Republic

**Introduction:** Caring for morbidly obese patients is difficult for bedside nurses. Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health (1). WHO data presents the prevalence of obesity among adults, BMI  $\geq 30$  (age-standardized estimate), is 26% in both genders in the Czechia (2). BMI  $>40$  is defined as morbid obesity (3).

**Methods:** The questionnaire survey aims to determine nurses' knowledge and experience in critical care units (CCUs) caring for morbidly obese patients.

**Results:** In total, 117 nurses were involved, of which 2.56% reported the availability of standard nursing guidance. The majority (68.42%) of nurses appreciate an individual approach as always needed, but 9.65% consider caring for a morbidly obese patient usually as improvisation, and 60.68% think caring for a morbidly obese patient to be physically and mentally demanding. According to difficulty, the activities related to the care of a morbidly obese patient were positioning, skin and hygienic care, excretion care, transport, cardiopulmonary resuscitation, wound care. The majority (52.99%) of nurses stated they have beds with a load capacity of  $<200$  kg, and only 12.82% reported beds over 300 kilograms. The level of knowledge was better in nurses with a longer length of practice ( $p=0.0103$ ), and in nurses from CCU than from ICU ( $p=0.0017$ ). Nurses with longer practice reported feelings of the burden from the care of morbidly obese patients more frequently ( $p=0.0000$ ).

**Conclusions:** Although the number of obese patients is increasing, there is a lack of standardized guidance. During the COVID-19 pandemic, the issue of obese patients and the specifics of providing nursing care were significantly emphasized with the special need for pressure ulcers prevention.

### References:

- 1 World Health Organization Obesity and overweight 9 June 2021 [cit. 22.02.2022]. Available from: [Obesity and overweight \(who.int\)](https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight)
- 2 World Health Organization The Global Health Observatory [cit. 22.02.2022]. Available from: [Prevalence of obesity among adults, BMI  \$\geq 30\$  \(age-standardized estimate\) \(%\) \(who.int\)](https://www.who.int/data/datasets/global-health-observatory)
- 3 Czech Medical Society of Jan Evangelista Purkyně How is obesity defined? [cit. 22.02.2022]. Available from: [Jak je definována obezita? | NZIP](https://www.nzip.cz/jak-je-definovana-obezita/)

## P6

## The Knowledge and practices of nurses in prevention and therapy of skin tears - the questionnaire survey

**Andrea Pokorna<sup>1</sup>**, Kamila Randová<sup>2</sup>, Simona Saibertová<sup>2</sup>, Veronika Šimečková<sup>2</sup>, Natália Antalová<sup>2</sup>, Marie Garajová<sup>2</sup>, Tereza Švecová<sup>1</sup>

<sup>1</sup> Masaryk University, Department of Nursing and Midwifery, Brno, Czech Republic

<sup>2</sup> Masaryk University, Department of Nursing and Midwifery, Brno, Czech Republic

**Introduction:** Skin tears are very often seemed like minor wounds generally. However, it presents a significant problem for patients in virtue of decreasing the quality of their life and also for public health in virtue of increasing the costs of health care. The research aims to assess the knowledge and practices of health workers in the prevention and therapy of skin tears and also to give them such a manual or an algorithm for prevention and treatment based on the international skin tear advisory panel (ISTAP) guidelines. As skin tears could be misdiagnosing as pressure ulcers or other wounds, we wanted to identify the knowledge of the skin tears classification also.

**Methods:** A quantitative questionnaire survey focusing on nursing care in the prevention and therapy of skin tears and knowledge regarding them. In total, 120 healthcare workers were involved (bedside personnel – general nurses and paramedics) n= 43 from anesthesiology and resuscitation wards, n= 21 from ICU, and n= 45 from standard units. Data were processed and analyzed using a statistic program Gretl. The method of the smallest squares (a logit and a probit model) for testing the hypothesis were used (at the significance level 0.01).

**Results:** The knowledge of the respondents were verified based on eight items in the quantitative questionnaire survey. The type of workplace ( $p = 0.083$ ) and the highest education ( $p = 0.0493$ ) were two factors most influenced the knowledge of the respondents. Higher education and more specialized type of workplace = more upper bits of expertise in the survey. Preventive and therapeutic procedures used by the respondents were verified based on the kind of workplace, the length of practice, the highest education, and specialization.

**Conclusions:** Despite the fact, skin tears are wounds very often occurring in intensive care units and standard departments, and there is still a lack of information and inadequate application of the preventive and therapeutic material used in „skin tears“. It is always the case that insufficient preventive procedures are applying based on early identification of problems, but rather wounds are treated after their detection.

This study was written at Masaryk University as a part of the project "A comprehensive approach to skin and mucosal integrity disorders II." number MUNI/A/1341/2021 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 2021

## P7

## What is the impact of prophylactic silicone dressings on the incidence of pressure ulcers among patients in the acute hospital setting?

Claire Sugrue<sup>1</sup>, Aglécia Budri<sup>1</sup>, Zena Moore<sup>1</sup>, Declan Patton<sup>1</sup>, Tom O'Connor<sup>1</sup>, Pinar Avsar<sup>1</sup>

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

**Introduction:** Recent guidelines have advocated for the use of prophylactic silicone dressings in conjunction with standard preventative care(1), a systematic search on the effectiveness of silicone dressings in this regard is needed to inform best practice. This review explored the impact of silicone dressings on incidence of PUs in adults in acute care, as it explored the impact according to anatomical location this provides a unique insight compared to a previous review.

**Methods:** A SR following the guidance of PRISMA, the search was undertaken on Jan2021. Data extraction and EBL quality appraisal were undertaken independently by 2 reviewers. Data were analysed using meta-analysis and narrative synthesis.

**Results:** Nine studies were included. Results showed a statistically significant reduction in the incidence of PUs among those using preventative silicone dressings (3%; 74/2264), compared to a control group (8%; 152/1798) receiving only standard care ( $p < 0.000001$ ). Silicone dressings were found to reduce PU incidence statistically significantly at the sacral area, when compared to a control group ( $p < 0.00001$ ), however no statistically significant difference was found in PU incidence on the heels of participants ( $p < 0.07$ ). Four studies concluded that silicone dressings reduced the mean time for pressure ulcer development when compared to a control group(2-5), one study found that silicone dressings reduce pressure ulcer severity when compared to a control group(2), and finally one study found no difference in pressure ulcer incidence between two brands of silicone dressings (6). The mean score for the EBL critical appraisal was 93.2% (min=76.2%, max=100%, SD=8.6%).

**Conclusions:** Recent guidelines have indicated the use of silicone dressings as part of standard PU preventative care in the acute hospital setting. The results of this systematic review provide evidence to support the use of prophylactic silicone dressings in the prevention of PU on the sacral area among adults cared for in the acute hospital setting. However, no evidence of effect was seen for the heels, indicating that further research work is needed in this area.

### References

1. EPUAP, NPUAP, PPPIA. *Prevention and Treatment of Pressure Ulcers/injuries: Clinical Practice Guideline: The International Guideline 2019*:EPUAP,NPIAP,PPPIA;2019.
2. Hahnel Eet al. *The effectiveness of two silicone dressings for sacral and heel pressure ulcer prevention compared with no dressings in high-risk intensive care unit patients: a randomized controlled parallel-group trial*. *Brit Jour Dermatology*.2020;183(2):256-64.
3. OeM, et al. *Effects of Multilayer Silicone Foam Dressings for the Prevention of PUs in High-Risk Patients: A RCT*. *Advances in Wound Care*.2020.
4. Forni C, et al. *Effectiveness of using a new polyurethane foam multi-layer dressing in the sacral area to prevent the onset of PU in the elderly with hip fractures: A pragmatic RCT*. *International Wound Journal*.2018;15(3):383-90.
5. Santamaria N, et al. *A randomised controlled trial of the effectiveness of soft silicone multi-layered foam dressings in the prevention of sacral and heel PU in trauma and critically ill patients: the border trial*. *International Wound Journal*.2015;12(3):302-8.
6. Stankiewicz M, et al. *A cluster-controlled clinical trial of two prophylactic silicone sacral dressings to prevent sacral PU in critically ill patients*. *Wound Practice & Research*.2019;27(1):21-6

## P8

# The evidence of assessing skin risks and conditions, and non-pharmacological interventions for maintaining skin integrity: a systematic review of systematic reviews

**Alexandra Fastner<sup>1</sup>, Armin Hauss<sup>1</sup>, Jan Kottner<sup>2</sup>**

<sup>1</sup> Charité – Universitätsmedizin Berlin, corporate member of Freie Universität Berlin and Humboldt Universität zu Berlin, Institute for Clinical Nursing Science, Berlin, Germany

**Introduction:** Maintaining skin integrity is a major goal in clinical practice. Although conditions such as pressure ulcers/injuries, skin tears, incontinence-associated dermatitis, intertrigo and xerosis cutis are distinct diseases, they share common risk and aetiological factors (1). Skin care interventions include skin cleansing with or without the application of rinse-off and/or leave-on-products (2). The aim of this review is to summarize current evidence to maintain skin integrity and to preventing skin damage.

**Methods:** A systematic review of systematic reviews was conducted (3). The databases MEDLINE and EMBASE via OvidSP, Cochrane Library and Epistemonikos (2010 to 2021), and reference lists were searched without language and age restrictions. Main inclusion criteria were systematic reviews and meta-analysis which include assessments of risk of bias, report skin (risk) assessments, or effects of skin cleansing and/or skin care in general, or regarding xerosis cutis, skin tears, diaper dermatitis/incontinence-associated dermatitis (IAD) and intertrigo. Two reviewers screened titles/abstracts, full-texts, and assessed risk of bias (with AMSTAR 2 or ROBIS) independently. Data extraction was conducted using standardized forms.

**Results:** Out of 2811 articles identified, 87 articles were screened in full text. A risk of bias assessment was conducted for 31 articles, but only 12 systematic reviews showed at least acceptable methodological quality and were included. Because of substantial heterogeneity regarding outcomes, study designs and methods meta-analyses were not conducted. Two articles summarized evidence about measurement properties of assessment instruments regarding erythema associated in incontinence-associated dermatitis and skin tears. There was no difference between skin care programs using water only or using skin cleansers for newborns. In older subjects, no-rinse and “low-irritating” cleansers, and the application of leave-on products seem to have beneficial effects on the skin barrier and integrity in general including improvement of skin dryness and skin tear prevention. Leave-on products are considered beneficial in preventing and treating diaper and incontinence-associated dermatitis. No evidence for the prevention of intertrigo could be identified.

**Conclusions:** The majority of systematic reviews in the field of skin care is at high risk of bias and should not be used for evidence-based practice. Evidence of 12 acceptable systematic reviews indicate, that structured skin care programs containing low-irritating cleansers and application of leave-on products are beneficial to maintain skin integrity and prevent skin damage across a wide range of different skin conditions across the life span.

## References

- (1) EPUAP/NPIAP/PPPIA. *Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline. The international Guideline.* Emily Haesler (Ed.). EPUAP/NPIAP/PPPIA: 2019.
- (2) Kottner J. et al. *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.
- (3) PROSPERO (CRD42022300002)

## P9

## SCX effectiveness in fungal colonisation as a IAD complication

**Roberto Cassino<sup>1</sup>**, Cristina Galuzzi<sup>1</sup>, Irena Cela<sup>1</sup>, Gabriela Sofia Barrionuevo Moreno<sup>1</sup>

<sup>1</sup> "Sacra Famiglia" Korian Nursing Home, Geriatrics - Long Term Care, Pieve del Cairo (Pavia), Italy

**Introduction:** Very often the macerated erythema of the skin caused by IAD (Incontinence Associated Dermatitis) tends to worsen [1] due to a fungal superinfection, frequently by *Candida Albicans* [2], especially in elderly diabetic patients. The aim of this work is to demonstrate that it's possible to avoid and/or eradicate fungal colonisation using a simple procedure that is very effective both in prevention and in treatment.

**Methods:** Twenty elderly patients with IAD have been enrolled; ten with a fungal colonisation, highlighted by a Wood lamp (Group One) and ten without it (Group Two). Every time they had to change the diaper, after careful hygiene with a specific product, they were treated with a spray powder of SCX complex (SiO<sub>2</sub>-Ag+Chlorex: silicon dioxide, ionic silver and chlorexidol), taking care to cover the whole affected area with a thin layer of powder. Patients in systemic antibiotic/antifungal therapy and/or using immunosuppressive drugs, and with cachexia and/or neoplasms have been excluded. After three weeks of observation we evaluated the presence or absence of fungal colonies in both groups of patients.

**Results:** All patients achieved an excellent result with disappearance of IAD-induced skin lesions within the observation time [3]; all patients in Group One eradicated mycotic colonisation within 7-10 days and none of the patients in the Group Two developed fungal colonies. We had no worsening, no allergies, no adverse reactions and patients didn't report any discomfort.

**Conclusions:** The SCX complex has already been shown to be effective not only in treating infected skin lesions, but also in accelerating healing. This work has highlighted a further added value of this molecule, namely the antifungal action.

### References

- [1] Beele H. et al. Incontinence-associated dermatitis: pathogenesis, contributing factors, prevention and management options. (2018) *Drugs & Aging*. 35(1):1-10
- [2] Campbell J.L. et al. *Candida Albicans* colonization, continence status and IAD in the acute care setting: a pilot study. *Int Wound J* 2017; 14:488-495
- [3] Cassino R. et al. Defeating IAD with technomolecular silver. 17th EPUAP Open Meeting (2014) Stockholm, Sweden

**P10**

# Using a thin silicone adhesive foam and a care pathway to support device related pressure ulcer prevention for patients requiring the use of orthopaedic devices in an Acute Trust

**Sarah Charlton**<sup>1</sup>

<sup>1</sup> Mid and South Essex NHS Foundation Trust, Tissue Viability, Southend on sea, United Kingdom

**Introduction:** In 2019 an acute Trust introduced a thin silicone adhesive foam to protect bony prominences under Ventilation systems (NIVs) and nasal cannula for patients requiring long term oxygen therapy. Previous care interventions had been inconsistent. The dressing became part of these patients' device related pressure area care.

The Tissue Viability nurse became aware of similar limited interventions in standard care to protect patients' bony prominences under orthopaedic devices. These devices, like NIVs, are often hard, rigid, tight, and used for extended periods with only minimal repositioning possible.

Although pressure ulcers numbers under orthopaedic devices in the Trust were low, when it occurred damage was often significant, with management challenging due to the devices continued need.

Given the success of using the dressing under NIVs, it was included in a new pathway to protect bony prominences under orthopaedic devices.

**Methods:** The dressing was readily available across the Trust, and clinicians were familiar with it. It can be cut, and the different shapes and sizes makes it amenable to protect bony prominences under different orthopaedic devices.

The Tissue Viability Nurse worked with a wide range of relevant stakeholders on the project. They informed the new pathway, and ensured it took account of the complexities associated with using a large range of orthopaedic devices, and reflected the multi-disciplinary approach to providing pressure area care for these patients.

**Results:** The stakeholders agreed that use the dressing has potential to protect bony prominences under orthopaedic devices. The pathway was approved for use.

The dressing's recommended wear time is up to 7 days, therefore use under plaster and synthetic casts was excluded as they are usually insitu for longer periods.

**Conclusions:** The use of a thin silicone adhesive foam dressing to protect bony prominences under orthopaedic devices arose from a successful project to protect patients from pressure damage whilst using NIVs and nasal cannula.

The dressing will be implemented for use within Orthopaedic departments and Wards and evaluated. Data analysis will establish if it is beneficial as part of a pressure ulcer prevention strategy for patients using orthopaedic devices.

**References**

Fletcher, J. (2012). *Device related pressure ulcers made easy*. Wounds UK. Vol 8 (2).

Foam Lite™ ConvaTec

*In Vitro Performance Characteristics of Foam Lite ConvaTec WHRI 4680 MS132. 25/04/16 Data on File, ConvaTec Inc.*

Vincent Orlandini, Jean-Michel Amici (2018) *A User Evaluation of A Thin Foam Dressing Designed To Manage Low To Non-Exuding Wounds, Surgical, Traumatic And Skin Tears*. Poster presented at EWMA 2018.

## P11

# The impact of pressure ulcer prevention education on health care assistants' knowledge and skills and pressure ulcer incidence in long-term care settings

**Noreen O'Brien<sup>1</sup>, Zena Moore<sup>2</sup>, Pinar Avsar<sup>1</sup>, Declan Patton<sup>3</sup>, Tom O'Connor<sup>4</sup>**

1 Royal College of Surgeons in Ireland University of Medicine and Health Science, Nursing, Dublin, Ireland

2 Royal College of Surgeons in Ireland University of Medicine and Health Science, Head of School of Nursing and Midwifery and Director of the Skin Wound and Trauma Centre (SWaT), Dublin, Ireland

3 Royal College of Surgeons in Ireland University of Medicine and Health Science, Director of Nursing and Midwifery Research Department, Dublin 2, Ireland

4 Royal College of Surgeons in Ireland University of Medicine and Health Science, Deputy Head of School / Director of Academic Affairs, 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.

## References

Glynn, L. (2006) A critical appraisal tool for library and information research. *Library Hi Tech* 24, 387-399.

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}.

Moore, Z., Cowman, S. & Conroy, R.M (2011) A randomised controlled clinical trial of repositioning using the 30 degrees tilt for the prevention of pressure ulcers. *Journal of clinical nursing*, 20, 2633-2644

Ousey, K. (2015) Pressure ulcers: are they a safeguarding issue in care and nursing homes. *Wounds UK*, 11(3), 14-17.



P12

## The effect of empathy on pressure ulcer management

**Monika Kubicová<sup>1</sup>**

<sup>1</sup> Bohumínská městská nemocnice a.s., Chirurgie, Bohumín, Czech Republic

**Introduction:** The treatment of pressure ulcers is a demanding and often very lengthy treatment. The success and the duration of the treatment doesn't solely depend on the correct therapy but is also closely related to the patient's mental condition.

**Methods:** The aim of collecting empirical data was to find out whether an empathic approach can help to heal pressure ulcers faster. Data were collected during 12 months in the department of 'surgery' together with questionnaires, photo documentation, nursing documentation, and mainly observations and interviews with the patients.

**Results:** We treated 46 patients over the 12 month period. Most of them co-operated with us, but 6 of them had a problem with. Nevertheless, we cured pressure ulcers in 38 of these patients. There were 24 patients with grade 4 pressure ulcers, of which 20 patients were healed. There were 16 patients with grade 3 pressure ulcers, of which 12 patients were healed. There were 6 patients with grade 2 pressure ulcers and all 6 patients were healed. Out of the total number of 46 patients, 8 patients were unhealed, and 6 of them were non-cooperating.

**Conclusions:** Our empirical data over 12 months have shown, that the combination of knowledge of the treatment of pressure ulcers and empathy towards the patients, has a positive effect on their treatment. The interviewed patients agreed that the empathic attitude of the medical staff had helped them to cope better and had no further worries when changing the dressing of their pressure ulcers. Therefore, never forget to smile and to touch your patients in a friendly way, because it can help them to manage their treatment much more easily.

### References

- 1 A. Pokorná a spol., *Centrální systém hlášení nežádoucích událostí – Metodika nežádoucí událost decubitus*
- 2 A. Pokorná, R. Mrázová, *Kompendium hojení ran pro sestry*
- 3 E. Zacharová, *Komunikace v ošetrovatelské praxi*

## P13

## Increased risk of pressure ulcer development with delay in transfer to a specialist spinal cord injury rehabilitation unit

**Ihuoma Rosemary Okereke<sup>1</sup>, Hamid Hashemi<sup>1</sup>, Jan Kuiper<sup>1</sup>, Srinivasa Chakravarty Budithi<sup>1</sup>**

<sup>1</sup> Midland Centre for Spinal Injuries, The Robert Jones & Agnes Hunt Orthopaedic Hospital NHS Foundation Trust, Oswestry, United Kingdom

**Introduction:** Pressure ulcers are a common complication in patients with spinal cord injury increasing morbidity and resulting in prolonged rehabilitation. Early admission to a specialist spinal cord injury rehabilitation unit is advised to reduce the risk of complications. The aim of this study was to evaluate the relationship between time to transfer of patients with acute spinal cord injury (SCI) to a specialist spinal cord injury rehabilitation unit and presence of pressure ulcer on admission at the specialist unit.

**Methods:** A three-year (1 January 2016 – 31 December 2018) retrospective study of consecutive patients with acute spinal cord injury admitted to the specialist spinal cord injury rehabilitation unit was conducted. Data was obtained from electronic patient records. Patients with pressure ulcer on admission were identified and duration in referral hospital prior to admission to the specialist rehabilitation unit was evaluated.

**Results:** A total of 378 patients were admitted for acute spinal cord injury rehabilitation. The mean age at injury for these patients was 56.44 years (SD 20.07 years) with a male: female ratio of 4.9:1. Pressure ulcers were found in 59 (15.5%) patients at admission. Of these patients, C4 was the most common level of injury (n=15; 25.4%) and 18 patients (30.5%) had complete spinal cord injury. The most frequent pressure ulcer location was the sacrum seen in 63.5% (40) of patients with pressure ulcer grade 2 being the most common (n=29; 49.2%).

Compared with patients without pressure ulcer, those with pressure ulcers were older (mean age 62.59 vs 55.30 years,  $p = 0.01$ ), male (83.1% vs 16.9%,  $p = 0.005$ ) and had longer stay in the referral hospital prior to admission to the specialist rehabilitation unit (46 days vs 29 days,  $p < 0.001$ ). After adjusting for gender and age in a multivariate analysis, the risk of pressure ulcers was increased with increased time in referral hospital prior to admission to specialist spinal cord injury rehabilitation unit (RR 1.3, 95%CI 1.1 to 1.6,  $p$  value  $< 0.001$ )

**Conclusions:** Pressure ulcers increase the duration of rehabilitation of patients with spinal cord injuries. Delays in admission to a specialist spinal cord injury rehabilitation unit may increase the risk of development of pressure ulcers. Pressure ulcer risk assessment and prevention strategies should be implemented as part of the acute management of patients with SCI prior to transfer to the specialist rehabilitation unit.

## P14

## From the prevalence survey in a intensive care unit to the identification of prevention and treatment strategies for pressure injuries in the logic of Wound Bed Preparation

**Francesco Uccelli**<sup>1</sup>, **Stefania Pesatori**<sup>2</sup>, **Francesco Forfori**<sup>2</sup>, **Massimo Elisei**<sup>2</sup>, **Laura Lorenzetti**<sup>1</sup>, **Monica Scateni**<sup>1</sup>, **Marilena Pradal**<sup>1</sup>, **Katia Nardi**<sup>1</sup>, **Elisabetta Meacci**<sup>2</sup>, **Monia Orsetti**<sup>2</sup>, **Elena Biasci**<sup>2</sup>, **Erika Bufalini**<sup>2</sup>, **Paola Cipriani**<sup>2</sup>

<sup>1</sup> AOUP, Nurse, Pisa, Italy

<sup>2</sup> AOUP, ICU, Pisa, Italy

**Introduction:** Attention towards pressure injuries takes shape annually in X Hospital with a prevalence survey that in 2021 highlighted a prevalence rate of 14.3% (61 patients with pressure injuries on 426) and a rate of 13.1% (8 of 61) in ICU. This data increased significantly compared to previous years (12.7% in 2019).

**Methods:** From analysis of data, a team dedicated to the creation of a specific path was set up. Wound care nurse in X Hospital gave methodological support and specific training to the group. Meetings were held where principles of the Wound Bed Preparation were illustrated; at the end of the meetings, a procedure was drawn up focusing on the methods of prevention and treatment, indicated by the international guidelines. From the evaluation of clinical documentation, a lack of attention of the staff to the mobilization of patients was highlighted; the supplier of anti-decubitus devices was therefore also involved to optimize them use. The involvement of the dietician provided scientific evidence on the right protein intake to be taken by ill patients. Finally, a poster was created on how to manage the wound and the advanced dressings were organized in the logic of Wound Bed Preparation, in such a way as to facilitate the operator in choosing ideal dressing.

**Results:** The changes made to the clinical management of the critically ill patient in ICU have proved to be useful and efficient. The new operating protocol has made possible to make substantial and positive changes to the management of the ICU patient, improving and standardizing preventive and treatment actions against the development of pressure injuries, helping operator in the choice of right dressing and right mobilization to be performed. From a new evaluation of the clinical documentation, a greater use of mobilization as a preventive strategy was appreciated, as well as the more conscious use of advanced dressings.

**Conclusions:** The analysis of data derived from the prevalence survey, conducted annually in X Hospital, is useless if no real improvement action emerges from this criticality. Having actively addressed this problem, implementing various intervention strategies, has allowed a targeted action that has made it possible to significantly reduce unwanted effects.

References: European Wound Management Association (EWMA). Position Document. Wound Bed Preparation in Practice. London: MEP Ltd, 2004  
Bonadeo P, Marazzi M, Masina M, Ricci E, Romanelli M, Wound Bed Preparation: evoluzione della pratica clinica secondo i principi del TIME. 2004, Aretrè

P15

## Perioperative Management of Pressure Injury in Plastic Surgery Patients

**Andrea Menšíková**<sup>1,2</sup>, **Pavel Kůřil**<sup>1,2,3</sup>, **Simona Saibertová**<sup>1</sup>, **Andrea Pokorná**<sup>1</sup>

1 Masaryk University, Faculty of Medicine, Department of Health Sciences, Brno, Czech Republic

2 Masaryk University, Faculty of Medicine, Department of Public Health, Brno, Czech Republic

3 Faculty Hospital, Department of Surgery, Brno, Czech Republic

**Introduction:** Pressure injury (PI) prevention is an essential consideration for patients undergoing lengthy surgery, with reported prevalence rates of 8,5% in surgical patients<sup>1</sup>. PI may be caused by pressure, shear or friction tissue forces, which can occur due to prolonged periods of immobility during an operation, or while the patient is being repositioned or transferred. Prevention is the most effective approach (including repositioning, use of support surfaces and skincare)<sup>2</sup> and these interventions are still underestimated in plastic surgery.

**Methods:** The quality improvement project was carried out. The presented study assesses the current level of practice in the perioperative period: care interventions and documentation on turning in pressure area care for patients at Body Clinic of Plastic Surgery Brno. Consequently, the goal was to improve practice, including care and documentation, by implementing evidence-based practice.

**Results:** Three phases of the quality improvement project were made: baseline audit, design and implementation of strategies leading to improve practice and follow-u audit. A baseline audit on pressure injury prevention was carried out and involved 21 patients. After evaluation of the results of the audit, an implementation strategy was designed. An intervention including PI prevention education, the purchase of new convenient aids, and changes in clinical practice were conducted.

**Conclusions:** This project achieved a distinct improvement of pressure injuries prevention strategies during elective surgery. Clinical audits were proved to promote best practices in healthcare. Focused education, provision, and use of relevant tools and aids can immediately and positively impact clinical practice. Future audits are planned to ensure the sustainability of practice changes.

This report was written at Masaryk University as part of the project "A comprehensive approach to skin and mucosal integrity disorders II." number MUNI/A/1341/2021 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 2021.

### References

1. Huang H, Chen H, XU X. Pressure-redistribution surfaces for prevention of surgery-related pressure ulcers: a meta-analysis. *Ostomy Wound Manage.* 2013;59(4):36-48
2. Mc Innes E, Jammali-Blasi A, Bell-Seyer SE, Dumville JC, Middleton V, Cullum N. Support surfaces for pressure ulcer prevention. *Cochrane Database Syst Rev.* 2015;9.

## P16

## Complex management of atypically located pressure ulcers in oncology patients: a clinical case report.

Izabela Kuberka<sup>1</sup>, Robert Dymarek<sup>2</sup>, Jakub Taradaj<sup>3</sup>, Mirosław Sopol<sup>4</sup>, Joanna Rosińczuk<sup>5</sup>

1 Wrocław Medical University, Department of Anaesthetic and Surgical Nursing, Wrocław, Poland

2 Wrocław Medical University, Department of Physiotherapy, Wrocław, Poland

3 Academy of Physical Education in Katowice, Institute of Physiotherapy and Health Sciences, Katowice, Poland

4 Wrocław Medical University, Department of Basic Sciences, Wrocław, Poland

5 Wrocław Medical University, Department of Internal Medicine Nursing, Wrocław, Poland

**Introduction:** The oncology patient is exposed to several factors that affect overall health status during the treatment process. Oncological treatment has a particularly adverse effect on skin integrity. The toxicity of oncological drugs may cause skin lesions such as drug-induced dermatitis, erythema with crusting, dry skin with pruritus, and bacterial or fungal skin infections. This condition may sensitise the skin which predisposes to development of pressure ulcers (PUs), which worsen the patient's quality of life in the terminal phase of the disease. This study aimed to present a clinical case of an oncology patient and to demonstrate the specialised treatment interventions for the healing of PUs of atypical location.

**Methods:** A 74-year-old woman with Non-Hodgkin lymphoma (NHL) diagnosed 4 years ago and coexisting grade 3 neutropenia was included in the study. The patient has EPUAP grade III PUs for 8 months in an atypical area, i.e. the posterior surfaces of both lower legs. Due to the extent and depth of the wounds, the following management was implemented: surgical wound debridement, specialized dressings including Ag antibacterial absorptive dressing and cleansing dressings with polyhexanide as well as compression bandages with cohesive band. Analysis of medical records and clinical observation of the patient was used to determine treatment progress.

**Results:** Despite the toxic chemotherapy causing periodical deterioration of patient's well-being, the implementation of complex treatment brought beneficial therapeutic effects. A significant improvement in PUs healing conditions was obtained in a surprisingly short time of 4 months. It is worth emphasising that the cytotoxic effect of oncological drugs most often causes inhibition of the healing process. In the case of the treated patient, after the implementation of complex local and systemic treatment, the proper healing process occurred, from the cleansing phase through granulation to epithelisation.

**Conclusions:** In treating PUs in patients undergoing oncological treatment with drugs characterised with cutaneous toxicity, the most important issue is the complexity of prevention and treatment of PUs adjusted to the patient's clinical condition. Furthermore, due to the necessity for the continuation of oncological treatment and the expected adverse effect on the condition of PUs, multi-specialist cooperation supported by the most current medical knowledge is essential.

### References

(1) NPUAP, EPUAP and PPPIA. *Prevention and Treatment of Pressure Ulcers: Quick Reference Guide*. Emily Haesler (Ed.). Cambridge Media: Osborne Park, Australia; 2014. (2) Moore ZE, Patton D. *Risk assessment tools for the prevention of pressure ulcers*. *Cochrane Database Syst Rev*. 2019;1(1):CD006471. (3) Hendrichova I, Castelli M, Mastroianni C, Piredda M, Mirabella F, Surdo L, De Marinis MG, Heath T, Casale G. *Pressure ulcers in cancer palliative care patients*. *Palliat Med*. 2010 Oct;24(7):669-73.

P17

## Pressure ulcer prevention and its challenges in critically ill patients

**Irena Pukiova<sup>1</sup>**

<sup>1</sup> Oxford University Hospitals Foundation Trust, Adult Critical Care Unit, Oxford, United Kingdom

**Introduction:** Pressure ulcer prevention and its challenges in critically ill patients.

There is a little understanding of some conditions amongst critically ill patients and its complexity within tissue viability field. Aim of this presentation is to introduce some of the conditions and feasible preventative measures and outcomes. The presentation will focus on patients in prone position, patients under spinal precautions / fully immobilized, patients with vasopressors use.

**Methods:** This presentation is not a presentation of a formal research, but presentation of experience and data from adult intensive care unit collected in the past few years. The data were collected via Datix reporting system and daily tissue viability ward rounds.

**Results:** Reduction in hospital acquired pressure ulcers if default preventative measures are taken since admission to intensive care unit. Preventative measures are not based on risk assessment but are introduced for every single patient on admission to intensive care unit. Also knowing the pathophysiology some of the conditions in critically ill patients brings question about issues with skin lesions which are classified as pressure ulcers but aren't caused by pressure.

**Conclusions:** Better understanding of pathophysiology in critically ill patients could help tissue viability practitioners in writing policies and preventative documents in terms of feasibility and expected outcomes.

Also, this could open discussions about correct classification of skin lesion caused by vasopressors and other agents.

I have seen many skin lesions diagnosed as pressure ulcers, but they were not caused by pressure or shear, this then leads to unnecessary investigation process. Possible creation of "secondary diagnoses" guide would be beneficial. I feel that more research in this field is required, but MDT approach is needed.

## P18

# Pressure ulcer prevention in transition from hospital to home for individuals with spinal cord injury - a scoping review

**Knaerke Soegaard<sup>1</sup>, Martin Sollie<sup>1</sup>**

<sup>1</sup> Odense University Hospital, Department of Plastic Surgery, Odense C, Denmark

**Introduction:** Individuals suffering from spinal cord injury have a lifelong increased risk of developing pressure ulcers and prevention across sectors is essential. The objective of this scoping review is to identify and describe elements of importance to pressure ulcer prevention in transitional care such as initiatives, organisation and stakeholders' perspectives.

**Methods:** A scoping review. Databases searched: MEDLINE, EMBASE, CINAHL, Cochrane Library, Web of Science and SCOPUS from the year 2000 to present, using the terms: Pressure ulcer, spinal cord injury and transition. Two reviewers conduct all phases of the review. Data extraction and presentation focuses on the important elements identified in the included studies. Critical appraisal of included studies is performed by using validated design-specific quality assessment tools.

**Results:** We have no results, as the review is not yet finished. We expect to obtain knowledge valuable in a following project with the aim to develop a targeted treatment protocol for pressure ulcers in individuals suffering from spinal cord injury in a specialised Danish health care setting.

**Conclusions:** As the review is ongoing, there are no conclusions yet. The clinical impact of the scoping review will be an increased knowledge and awareness of pressure ulcer prevention in transition.

## References

Chhabra HS. *ISCoS Textbook on Comprehensive Management of Spinal Cord Injuries*. Chhabra HS, ed. New Delhi: Wolters Kluwer; 2015.

European Pressure Ulcer Advisory Panel, National Pressure Ulcer Advisory Panel, Pan Pacific Pressure Injury Alliance. *Prevention and treatment of pressure ulcers: quick reference guide*. 2nd edition. 2014.

European Pressure Ulcer Advisory Panel (EPUAP), National Pressure Injury Advisory Panel (NPIAP) and the Pan Pacific Pressure Injury Alliance (PPPIA). *Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline*. 3rd edition 2019.



P19

## Neonatal Skin Structure: Pressure Injury Staging Challenges

Ann Marie Nie<sup>1</sup>, Deanna Johnson<sup>2</sup>, Robyn Reed<sup>3</sup>

1 Children's Minnesota, Wound, ostomy NP Team, Minneapolis, United States

2 Children's Minnesota, Wound, Ostomy NP team, Minneapolis, United States

3 Seattle Children's Hospital, Pathology, Seattle, United States

**Introduction:** To review neonatal pressure injuries (PIs), including clinical features and challenges in evaluation and staging related to the unique anatomic features of preterm neonatal skin, as well as the common sites and mechanisms of injury.

**Methods:** A review of the literature and discussion of clinical experiences at a large children's hospital. Specific topics include the nature and mechanism of PIs, histomorphometric features of skin development in preterm neonates and how these features inform bedside evaluation of PI, and experience-based observations of challenges in evaluating PIs in this vulnerable population.

**Results:** Pressure injury staging in preterm neonates presents unique challenges: (1) The National Pressure Injury Advisory Panel PI staging model is based on visual identification of depth of injury. The immaturity of the preterm neonate, skin lacks many of the visual cues present in adult PIs. Specific qualitative and quantitative differences in skin development impact the macroscopic appearance of skin at different gestational ages. (2) The most common cause of PIs in this population are related to noninvasive respiratory devices. These injuries may be extremely small and difficult to evaluate visually.

**Conclusions:** The National Pressure Injury Advisory Panel staging system can be difficult to implement in the neonatal population. Further study is warranted to determine whether an alternative staging system may provide more accurate information for this population.

### References

1. Fluhr JW, Darlenski R, Taieb A, et al. Functional skin adaptation in infancy—almost complete but not fully competent. *Exp Dermatol* 2010;19:483-92.
2. Sardesai SR, Kornacka MR, Walas W, Ramanathan R. Iatrogenic skin injury in the neonatal intensive care unit. *J Matern Fetal Neonatal Med* 2011;24:197-203.
3. Delmore B, Deppish M, Sylvia C, Luna-Anderson C, Nie AM. Pressure injuries in the pediatric population: a National Pressure Ulcer Advisory Panel white paper. *Adv Skin Wound Care* 2019;32:394-408.
4. National Pressure Injury Advisory Panel. Pressure Injury Stages. [https://cdn.ymaws.com/npiap.com/resource/resmgr/online\\_store/npiap\\_pressure\\_injury\\_stages.pdf](https://cdn.ymaws.com/npiap.com/resource/resmgr/online_store/npiap_pressure_injury_stages.pdf). Last accessed January 5, 2022.
5. Boya V. Pressure injuries of the nose and columella in preterm neonates receiving noninvasive ventilation via a specialized nasal cannula: a retrospective comparison cohort study. *J Wound Ostomy Continence Nurs* 2020;47:111-6.
6. Reed R, Johnson D, Nie AM. Preterm infant skin structure is qualitatively and quantitatively different from that of term newborns. *Pediatr Dev Path* 2021;24:96-102.
7. Visscher MO, Adam R, Brink S, Odio M. Newborn infant skin: physiology, development, and care. *Clin Dermatol* 2015;33:271-80.
8. Eady R, Holbrook K. Embryogenesis of the skin. *Pediatric Dermatology*. 3rd ed. New York, NY: Mosby; 2003:3-13.
9. Black J, Baharestani M, Black S, et al. An overview of tissue types in pressure ulcers: a consensus panel recommendation. *Ostomy Wound Manage* 2010;56:28-44.
10. Yosipovitch G, Maayan-Metzger A, Merlob P, Sirota L. Skin barrier properties in different body areas in neonates. *Pediatrics* 2000;106:105-8.

## P20

## Wound healing and Health-related quality of life in patients with pressure ulcers locally treated with TLC-NOSF dressings\* - Evidence from a prospective, Multicentre real - life study

**Serge Bohbot**<sup>1</sup>

<sup>1</sup> Laboratoires Urgo, Medical Affairs, Paris, France

**Introduction:** Clinical research on pressure ulcer (PU) treatments remains scarce in the literature. This clinical evaluation aimed to assess the performances of TLC-NOSF dressings in the local treatment of chronic wounds in an unselected cohort of patients under real-life settings, and this report focus on the results achieved in patients with PU.

**Methods:** A large, prospective, multicentre observational study was conducted in Germany with general practitioners, internists, surgeons, and dermatologists, between January 2019 and June 2020. Patients with a chronic wound treated with three different TLC-NOSF poly-absorbent dressings\* were followed up during 12 weeks, with a maximum of four documented visits. The main endpoints included wound healing rate and progression, changes in the patient's health-related quality-of-life (HRQoL) (using the validated Wound-QoL questionnaire), and tolerability and acceptability of the dressings.

**Results:** Ninety two patients with PU (mean age 77.9±12.1 years old, 55.4% female, with multiple comorbidities) were treated in 41 centres for a mean duration of 60±32 days. At the initial visit, the PUs (60.9% lasting for ≤ 1 month) had a median area of 9.4 cm<sup>2</sup> covered by 47% of sloughy tissue, with high or moderate level of exudate (76.1%). By the final visit, 45.7% of the ulcers healed, 48.9% improved, 3.3% were stabilized, and 1.1% worsened (1.1% missing). Maceration and malodour were reduced by 74.9% and 86.6%, respectively and periwound skin condition improved in 76.1% of the patients. In PUs ≤1 month duration, wound closure reached 53.6%. The Wound-QoL questionnaire was completed at both initial and final visits by 28 patients. At the final visit, significant improvements in the three dimensions (body, psyche, everyday-life) of the patients' HRQoL was achieved (p<0.001). Substantial improvements were reported by the majority of the patients in all HRQoL parameters, notably regarding pain, disturbing discharge, concerns towards the wound and fear of wound deterioration, unhappy feelings, sleep disturbance, and dependency on help from others. The dressings were 'very well' tolerated (89.1%) and 'very well' accepted (81.5%) by the large majority of the patients.

**Conclusions:** These results show the good performance of these dressings in rapidly improving wound healing and HRQoL of patients with PUs treated in real-life settings. They are consistent with previous clinical evidence on TLC-NOSF dressings, supporting their use, in association with standards of care in the local treatment of PUs and confirming that optimal outcomes are achieved as first-line treatment.

### References

\*UrgoStart Plus Pad, UrgoStart Plus and UrgoStart Plus Border, Laboratoires URGO, France

## P21

# Analysis of the Occurrence of New Decubitus Ulcers in Long-term Care Patients and the Possible Forensic Impact on Nursing Staff

**Alice Ručková<sup>1</sup>**

<sup>1</sup> Hospitals Czech Cieszyn, Board of directors, Český Těšín, Czech Republic

**Introduction:** Decubitus ulcers occur very frequently in patients in long-term care departments. Decubitus ulcer is always a complication that worsens the quality of life and especially prolongs the patient's recovery. The occurrence of decubitus ulcer in a hospital due to improper nursing care can have forensic implications for nursing staff.

Objectives of the analysis:

- Protecting the patient from damage to health due to newly formed decubitus ulcer – minimizing the occurrence of decubitus ulcer
- Protecting medical staff from forensic impact – increasing staff accountability

## Methods:

Data presented – sample size of long-term care patients

Audit activity of the methodology on the patient at risk of decubitus ulcer

Data collection – patients already admitted with decubitus ulcers and their photo documentation

Data collection – newly occurring decubitus ulcers and their subsequent analysis:

- Cause of new decubitus ulcer
- At what stage was the decubitus ulcer reported
- Maintenance of nursing documentation of a new decubitus ulcer patient, including photo documentation
- Patient mobility status
- Risk of malnutrition in patients
- Age of patients
- Development of newly formed decubitus ulcer (healed, improved, worsened, patient died)

Physical control of a patient with newly developed decubitus ulcer at the bedside – checking compliance with the procedures according to the methodology

Present data at department-wide seminars to the nursing team working as a team!

## Results:

Use of modern technology by staff – tablet for photographing decubitus ulcers

Care of patients at risk of decubitus ulcer according to the methodology

Care of patients with decubitus ulcer according to the methodology

Newly occurring decubitus ulcers are reported by nursing staff in a timely manner

Nursing documentation is maintained in accordance with the methodology

Nursing staff are aware of the risk of forensic impact due to the patient's decubitus ulcer injury

The monitored data are presented at university-wide seminars

**Conclusions:** Many years of experience show that data collection, analysis, auditing of operations and subsequent education of nursing staff cannot be done without.

The entire nursing team (nurse-sister-nutritional therapist-physiotherapist) is involved in the prevention of decubitus ulcer, and is also responsible for the care of the patients.

The system of care in place, including photo documentation, has resulted in a positive impact not only on the quality of life of patients, but also on the forensic protection of nursing staff.

## P22

## A survey of 3 nations practice of pressure ulcer care

**Hester Colboc**<sup>1</sup>, **Sylvie Meaume**<sup>2</sup>, **Izabel Freret**<sup>3</sup>, **Serge Bohbot**<sup>4</sup>

1 *Hospital Rothschild, Sorbonne University, Paris, France*

2 *Hopital Rothschild, Paris, France*

3 *A+A research, Paris, France*

4 *Laboratoires Urgo, Paris, France*

**Introduction:** The aim of this survey is to assess General Practitioner's (GPs) and nurse's attitude, knowledge and management of Pressure Ulcer (PU) across three countries in Europe.

**Methods:** A two-part online questionnaire was conducted among GPs and nurses in France, United Kingdom and Germany. First part entailed a survey on knowledge and the second part collected data on healed PU cases recently managed.

**Results:** In France, 60 nurses and 60 GPs were interviewed. For the UK, 130 nurses were interviewed and for Germany 120 GPs.

380 questionnaires were collected for first part and second part included management of 892 PU cases of their 4 last patients with PU stage II or III (France : 302, UK: 298, Germany: 292).

There were on average 41 PU patients currently managed in each country (44 for GPs and 38 for nurses), 54% of PU stage II or III and 29% stage I. 66% of patients are more than 71 years old and 44% have already suffered from a PU. 7/10 patients have 2 PU or more. The 3 main key attributes when choosing a dressing for treatment of PU are "severity of PU", "optimize wound healing", and "comfort for the patient". These are the same for nurses and GPs, the only difference is "Depth of the wound" which is the third main attributes for de GP. About 2/3 of patients had medium, high or very high level of exudates. More than 80% of Health care professionals would like to improve current treatment of PU (95% in UK). Main suggestions are trainings, either practical or specific on PU Care.

**Conclusions:** The analysis of patient's cases is really powerful due to the large number of PU reported. The communication will detail the keys points on each stage of PU management and the differences of care between these 3 countries.

## P23

# Association of a 2-layer multicomponent compression system and an advanced wound dressing in venous ulcer's treatment

**Thierry Coppin<sup>1</sup>**

<sup>1</sup> CH Douai, Vascular surgery, douai, France

A venous ulcer is an open skin lesion effected by venous hypertension. Non infected venous ulcers are usually colonized by multiple micro-organisms and have to be treated without the routine use of topical antimicrobial-containing dressing. The treatment of venous ulcer is debridement, compression and treatment of venous hypertension. We present ours experience with an association of a 2- layer multicomponent compression system and a antibacterial dressing for venous leg's ulcer. Bacteria-binding dressing's\* action is the production of hydrophobic bound between fatty acid of the compress and bacteria. When the dressing is changed it reduces the level of bacteria and improves the healing. Two layer compression system\*\* has been used for therapeutic pressure because compression is important to heal a venous ulcer. This compression system is composed of 2 layers: a short stretch bandage and a long stretch bandage. It aids to obtain the recommended therapeutic pressure of around 40mmHG. Several patients with venous leg ulcer have been treated by coupling bacteria-binding dressing\* and two layer compression system\*\*. The patients presented venous hypertension due to saphenous reflux and were operated except one who refused to be operated ( he was only treated with bacteria-binding dressing\* and two layer compression system\*\*). After the operation, different types of dressing such as foams, alginates and specialty dressings have been used without any ulcer's improvement. We use bacteria-binding dressing\* and two layer compression system\*\* for venous leg ulcers with good results. The synergy between the dressing and the compression has improved the healing of venous ulcer after surgery.

\*Sorbact

\*\*UrgoK2

## P24

## Photobiomodulation in addition to dressing of pressure ulcer stage four, in frail elderly with municipality home healthcare

Marianne Degerman<sup>1</sup>, Micael Öhman<sup>2</sup>

<sup>1</sup> Municipality of Skellefteå, Healthcare Development, Skellefteå, Sweden

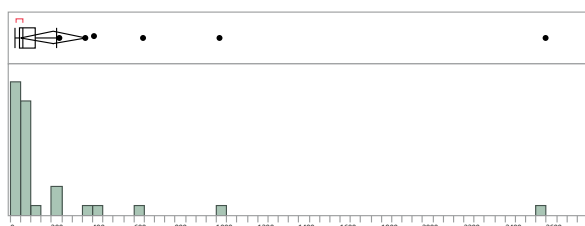
<sup>2</sup> Luleå University of Technology, Skellefteå, Sweden

**Introduction:** Frail elderly are a high-risk population for developing pressure ulcer (PU). Patients treated in municipality home healthcare living in nursing homes or in their home residence are the frailest. Home healthcare include palliative care. Laser Photobiomodulation (PBM) has shown to have effect on wound and tissue healing [1-2]. In the municipality there is an ongoing scientific study of PBM in addition to dressing of PU4. The Swedish registry RiksSår for ulcer treatment present national data from municipality primary home healthcare, primary healthcare and specialist hospital care, general PU data from the registry are presented as one PU group with the stages PU2, PU3 and PU4 together [3].

**Methods:** Home healthcare patients with 35 PU4 were in addition to dressing, treated two times per week, with PBM. Infrared GaAs, 904nm, with effect 60mW and 700Hz, targeting lymphatic area and ulcer area. PBM red visible, GaAlInp, 635nm, 75mW and 250Hz, targeting ulcer area.

### Results:

Duration of the PU4 when PBM started (days)



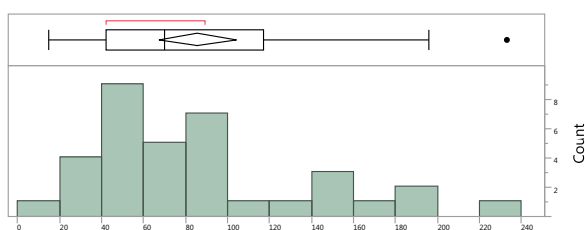
#### Quantiles

100.0%	maximum	2597
0.0%	minimum	21

#### Summary Statistics

Mean	206,6
N	35

Treatment time with PBM



#### Quantiles

100.0%	maximum	233
0.0%	minimum	15

#### Summary Statistics

Mean	85,6
N	35

Median ulcer duration before PBM and median PBM treatment time to heal the PU4 was 133 days.

**Conclusions:** Median total healing time data for 2020 from the registry Rikssår was 167 days for the total group of PU [3]. Median healing time of the 35 PU4 in the PBM group was faster despite the homogeneous severity stage 4. This indicates that PBM may be an effective treatment of PU4.

### References

1. Taradaj J, Shay B, Dymarek R, Sopol M, Walewicz K, Beeckman D, et al. Effect of laser therapy on expression of angio- and fibrogenic factors, and cytokine concentrations during the healing process of human pressure ulcers. *Int. J. Med. Sci.* 2018;15(11):1105-1112.
2. Kuffler. Photobiomodulation in promoting wound healing: a review. *Regen Med.* 2016;11:107-122.
3. RiksSår, the Swedish national quality Registry for Ulcer Treatment ([rikssar.se](http://rikssar.se))

## P25

# A Prospective, Observational Study of Pressure Injury Prevention, Caregiver Protection, and Workflow Benefits of a Novel Lift-Compatible Safe Patient Handling Support Surface in U.S. Hospitals

Rhonda Sullivan<sup>1</sup>, Philip Davies<sup>2</sup>

<sup>1</sup> Molnlycke Healthcare, Jacksonville, United States

<sup>2</sup> Molnlycke Health Care, Gothenburg, Sweden

**Introduction:** Pressure injuries and musculoskeletal injuries are two of the most common and costly preventable harms in healthcare.<sup>1-2</sup> For many healthcare organizations, gains in the mitigation of these preventable harms were lost as the COVID pandemic brought new challenges to safe, high-quality practice, including resource-intensive care, staffing shortages, education paucity, and financial instability.<sup>3-4</sup> The aim of this study was to evaluate exertion, patient- and caregiver-protective capabilities, workflow integration, and the financial benefits of a hybrid lift-compatible safe patient handling support surface.

**Methods:** This step-wedge multi-site prospective observational pilot study was undertaken in eight U.S. hospitals. The experimental product is a lift-compatible safe patient handling and mobility support surface (LC-SPHM-SS). Each facility's standard of care served as the comparator. A standardized data collection form was used. Participants assessed twenty separate data points while using the LC-SPHM-SS to perform safe patient handling and mobility (SPHM) activities. Participants assessed 5 caregiver-centric features, including exertion; 3 patient-centric features, including pressure injury prevention; and 5 product-focused features. Aggregate data were analyzed.

**Results:** Two hundred twenty-nine multi-disciplinary clinicians participated. On average, vertical and bed to chair movements were performed with very light effort, while lateral transfers, turning, and boosting were performed with light effort. Most SPHM tasks were accomplished with 1-2 caregivers. 87.4% to 98.5% of participants rated the LC-SPHM-SS favorably for 5 caregiver-centric and 3 patient-centric features. 93.3% to 96.6% of participants rated the LC-SPHM-SS as 'excellent' or 'good' for 5 product-focused features. Eight SPHM devices were replaced by the one hybrid LC-SPHM-SS in all pilot sites, offering a potential 84.3% reduction in costs or \$1,840 saved per patient. No sacral or ischial pressure injuries developed among included patients.

**Conclusions:** Hybrid technologies allow healthcare organizations to simplify and streamline practice. This study demonstrates that a lift compatible SPHM support surface can alleviate waste, promote consistent care, improve workflow, prevent patient and caregiver harm, and save time and money.

## References

1. Centers for Disease Control. (2020). *Perceived exertion (Borg Rating of Perceived Exertion Scale)*. Accessed on <https://www.cdc.gov/physicalactivity/basics/measuring/exertion.htm>.
2. European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, & Pan Pacific Pressure Injury Alliance. (2019). *Prevention and treatment of pressure ulcers/injuries: Clinical practice guideline. The International Guideline*. Emily Haesler (Ed.), EPUAP/NPIAP/PPPIA
3. Grimm, C.A. (2021). *Hospitals reported that the COVID-19 pandemic has significantly strained health care delivery: Results of a national pulse survey*. Accessed on <https://oig.hhs.gov/oei/reports/OEI-09-21-00140.asp>
4. Occupational Safety and Health Administration. (nd). *Healthcare wide hazards: Hospital eTool*. Accessed on <https://www.osha.gov/SLTC/etools/hospital/hazards/ergo/ergo.html#residenthandlingprogram>



P26

# Clinical Decision Making in Pressure Ulcer (PU) Prevention as Impacted by the Use of Sub-Epidermal Moisture (SEM) Prompts- the Mining of the Worlds First PU Registry

Vignesh Iyer<sup>1</sup>

<sup>1</sup> Bruin Biometrics, Alderley Edge, United Kingdom

**Introduction:** The first unique, Global Pressure Ulcer Registry (GPUR) developed by the worlds leading registry development group\*, is a resource for Real-World Data intended to be used for future clinical research and analysis by capturing a high volume of data points resulting in the production of clearly defined outcomes and outputs<sup>1</sup>. The GPUR provides evidence that informs about the efficacy of care pathways, patient centred care and if the SEM assessment technology, in conjunction with the current Standard of Care, supports PU incidence reduction

This abstract represents an initial interrogation of the data within the GPUR, with an explicit examination of the impact of SEM assessment technology upon clinical decision making.

**Methods:** Data points are captured by participating clinical sites using a data capture template ensuring accuracy and consistency. These data points are submitted and then entered in the GPUR under a quality assured process. Mining of the data took place to answer one specific hypothesis pertaining to clinical utilisation of the SEM assessment technology. Early insights appear to suggest that clinical interventions were prompted by SEM technology readings and contributed to PU incidence reductions.

**Results:** One of the early key findings, substantiated previous RWE publications<sup>2</sup> about SEM assessment, in that clinician's decision making was impacted by SEM assessment readings in 67.81% (n=2215) of cases. Further mining of the data has allowed closer scrutiny and enabled a series of case studies to be developed which demonstrated the impact on the use of preventative interventions. (Fig 1)

This day-by-day depiction of SEM assessments for a specific patient (Fig 2) illustrates the impact the data had on clinical decision making behind the subsequent preventative interventions. Interventions directly correlate to the reduction in SEM value (y axis) where SEM delta ( $\nabla$ ) of <0.6 objectively alerts clinicians to the detection of deep and early-stage PU on specific anatomical areas of a patient's body<sup>3</sup>.

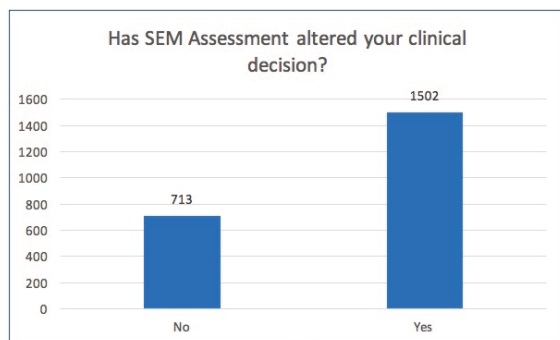


Fig 1- Impact of SEM Assessment on Clinical Decision Making

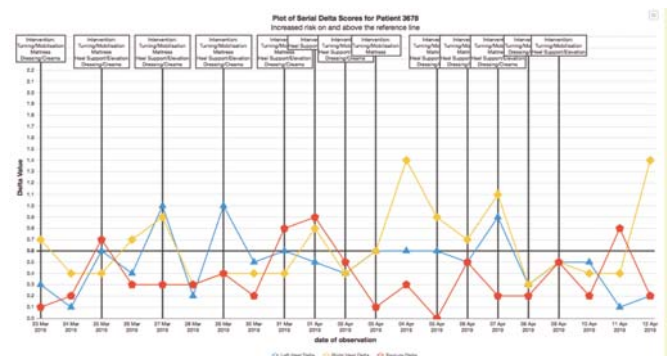


Fig 2. Subject A, Plot SEM Assessments vs Interventions

**Conclusions:** Registries provide stimulation for quality improvement as this initial mining with SEM assessment technology demonstrates<sup>1</sup>

## References

1. Gliklich RE, et al (2018). 21st Century Patient Registries. eBook addendum to Registries for Evaluating Patient Outcomes: A User's Guide, 3rd Ed.
2. Musa L, et al. (2021). Clinical impact of a sub-epidermal moisture scanner: what is the real-world use? *J Wound Care*. 30(3):198-208.
3. Okonkwo H. et al. (2020). A blinded clinical study using subepidermal moisture biocapacitance measurement device for early detection of pressure injuries. *Wound Repair and Reg* 1-11.

SEM Assessment technology – Provizio® SEM Scanner Bruin Biometrics LLC

\*Dendrite Clinical Systems

**P27**

# WHITE/PRESSURE3: World Hip Trauma Evaluation: Pressure ulcer prevention 3; A randomised clinical trial assessing early use of heel specific adjunct devices for heel pressure ulcer prevention in people with a fractured hip

**Clare Greenwood<sup>1</sup>**

<sup>1</sup> Clinical Nurse Specialist, Tissue Viability, , Leeds Teaching Hospitals, Leeds, United Kingdom

**BACKGROUND:** Patients admitted with a fractured hip are at risk of heel pressure ulcers (HPU) which impact upon rehabilitation, recovery, and independence. Whilst available in the NHS, the use of heel specific adjunct devices for HPU prevention is not common even in high-risk patient populations.

**AIM:** to evaluate the clinical and cost-effectiveness of the use of early initiation of heel off-loading devices and constant low-pressure devices for the prevention of Category  $\geq 2$  HPUs in hip fractures patients over the age of 60, recruited within 48 hours of admission.

**DESIGN:** pragmatic, multi-centre, randomised, 3 arm parallel group trial with economic evaluation.

**SETTING:** the trial will be embedded within the World Hip Trauma Evaluation (WHITE) Platform trials framework in 30 pre-established hip fracture centres.

**HEALTH TECHNOLOGIES:** 3102 patients (1034 per group) will be randomised to:

- a) Standard care plus adjunct heel off-loading devices which eliminate heel pressure including heel lift/suspension boots and off-loading wedges
- b) Standard care plus adjunct constant low-pressure device (CLP) which distribute pressure over a larger surface area, reducing the magnitude of the applied pressure, including foam and gel pads and boots
- c) Standard care alone which typically includes the provision of high specification foam or specialised air mattress; an electric profiling bed and repositioning more frequently than 3-hourly.

**ANALYSES:** On an intention to treat basis, proportions of new Category  $\geq 2$  HPUs reported for each group and for the two comparisons: heel offloading versus standard care and CLP versus standard care. Economic assessment methods will align with NICE Reference Case

## P28

# An exploration of the use of devices for the prevention of heel pressure ulcers: a realist evaluation

**Clare Greenwood<sup>1</sup>**

<sup>1</sup> Clinical Nurse Specialist, Tissue Viability, Leeds Teaching Hospitals, Leeds, United Kingdom

**Background:** Heel pressure ulcers (HPUs) are more likely to deteriorate to severe PUs than those elsewhere on the body [1-5], take longer to heal, and less than 50% heal within 18 months/prior to death/amputation[6].

There are numerous different devices designed for the prevention of HPUs, they tend to fall into three categories:

1. Devices that float, or 'offload' the heel so that is free from pressure, e.g. wedges, boots, splints
2. Devices that reduce pressure to the heel (constant low pressure (CLP) devices), e.g. foam and gel boots and heel pads
3. Devices that reduce friction and shear, e.g. booties and dressings.

A comprehensive systematic review found that there could be evidence of a benefit for offloading devices compared to standard care, however the quality of the evidence reduces the certainty of the findings. The relative effectiveness of CLP devices, and devices that reduce friction and shear remains unclear[7]. Some offloading trials reported high levels of withdrawals and protocol violations due to concordance issues.

**Methods:** A realist evaluation was conducted to in the absence of evidence, how, why and when these devices used. This involved in depth interviews with Tissue Viability Nurse Specialists and an epidemiological study of three surgical wards.

**Results:** Perceptions of the devices included:

- o Boots can become a trip hazard in confused/delirious patients
- o Offloading devices are mainly used in bedbound/immobile patients, or reactively for treatment of HPUs.
- o CLP devices were used more proactively for prevention, are easier to use and allow for freer movement in bed

**Conclusions:** CLP devices are often cheaper and perceived to be easier to use, and patients more concordant with compared with offloading devices. This has led us to question, what is more effective, when concordance, patient preferences and staff behaviours are taken into account. These results have informed a HTA funded three-armed RCT to compare the effectiveness of offloading and CLP devices with standard care in the prevention of HPUs.

## References

1. Briggs, M., et al., *The prevalence of pain at pressure areas and pressure ulcers in hospitalised patients. BMC Nursing*, 2013. 12(1): p. 19.
2. McGinnis, E., et al., *Pressure ulcer related pain in community populations: a prevalence survey. BMC Nursing*, 2014. 13(1): p. 16.
3. Smith, I.L., et al., *Exploring the role of pain as an early predictor of category 2 pressure ulcers: a prospective cohort study. BMJ Open*, 2017. 7(1): p. e013623.
4. Nixon, J., et al., *Comparing alternating pressure mattresses and high-specification foam mattresses to prevent pressure ulcers in high-risk patients: the PRESSURE 2 RCT. 2019. 23: p. 52.*
5. Donnelly, J., et al., *An RCT to determine the effect of a heel elevation device in pressure ulcer prevention post-hip fracture. Journal of Wound Care*, 2011. 20(7): p. 309-318.
6. McGinnis, E., et al., *A prospective cohort study of prognostic factors for the healing of heel pressure ulcers. Age Ageing*, 2014. 43(2): p. 267-71
7. Greenwood, C., et al. *Heel Specific Devices for the Prevention of Heel Pressure Ulcers – A Systematic Review. In press. 2022.*

## P29

## Early detection of pressure ulcers on mechanical simulation based on IRM images and the importance of frequent measurement.

**Nicolas Gillard<sup>1</sup>**, Willy Allegre<sup>2,3</sup>, Pauline Coignard<sup>2</sup>, Jacques Kerdraon<sup>2</sup>

1 Capgemini Engineering, Departement R&I, Saint Jacques De La Lande, France

2 Centre Mutualiste de Rééducation et de Réadaptation Fonctionnelles de Kerpape, Ploemeur, France

3 CoWork'HIT, Ploemer, France

**Introduction:** Pressure ulcers are a great handicap for those who develop one. Pressure ulcers can take a long time to heal especially if detected late and are usually not monitored continuously. The time of detection being important for the duration of healing, we consider the use of frequent measurement for an early detection of pressure ulcers

**Methods:** We use a simulation of a prone human buttocks based on 3D IRM to simulate its reaction to pressure. This simulation considers the recent findings about pressure ulcers. In particular, the phenomenon of muscle stiffening (Gefen 2005) when pressure is applied for a long period of time, and the reperfusion phenomenon (Loerakker 2011) have been modelled and implemented in our simulator. The pressure ulcers were simulated for 2 hours of motionless prone positioning by timestep of 15 minutes. We can then simulate pressure captors on the outside interface of the buttocks to use these measurements for detection.

**Results:** We compare different algorithms for the early detection of pressure ulcers and show the need to use frequent measurement for a better detection. We devised new algorithms evaluating the damage on the skin interface, to predict the damages in the deeper tissues. These algorithms are using a dynamic evaluation of damage, thus needing frequent measurements of pressure at the skin interface. With these algorithms, we showed that frequent measurements can help the detection of pressure ulcers compared to one-time measurement.

**Conclusions:** We showed on simulated buttocks, that regular measurement of pressure at the buttocks interface can help detect pressure ulcers early compared to single measurement. This result seems to be caused by the dynamic nature of the pressure ulcers. In particular, the stiffening of the muscle and the reperfusion are both impacting the pressure ulcers formation, being relevant after only a few timesteps.

### References

Gefen A., Gefen N., Linder-Ganz E., Margulies S. S., "In vivo muscle stiffening under bone compression promotes deep pressure sores", *Journal of Biomedical Engineering*, p. 512-524, 2005.

Loerakker S., Manders E., Strijkers G. J., Nicolay K., Baaijens F. P. T., Bader D. L., Oomens C. W. J., "The effects of deformation, ischemia, and reperfusion on the development of muscle damage during prolonged loading", *Journal of Applied Physiology*, p. 1168-1177, 2011.

## P30

## CREATING CONTINUUM OF CARE - PREVENT PRESSURE INJURY IN AMBULANCE SERVICE

**Pia Volmanen**<sup>1</sup>, **Miska Vaara**<sup>2</sup>

1 HUS Helsinki university hospital, Internal medicin, Helsinki, Finland

2 HUS Helsinki University hospital, Ambulance services Helsinki and Uusimaa district, Helsinki, Finland

**Introduction:** The care pathway of a hip fracture patient from the floor of an elderly care home by an ambulance, via an emergency room and an operating theatre to a surgical ward may take hours, even days. Prevention of pressure injuries is not necessarily managed well along the pathway. We needed an operating model to prevent pressure injuries in our interhospital ambulance service. The service transports yearly over 100.000 patients. Transports include also emergency, ICU and NICU patients, and transports to other hospital districts.

**Methods:** An equal-based, multi-professional working group develops operating models and collects information on pressure injury prevalence in our university hospital. A paramedic participated in the group. He created a new operating model for the ambulance service. A validated general model gave principles to the new model. The model was to be employee driven, easy to use in everyday work, and base on scientific evidence. Opinions of the ambulance crew were gathered in various phases of the work in daily Lean stand-up meetings.

**Results:** A new operating model was created. The ambulance crew was educated on the risk factors and formation mechanisms of pressure injuries and their meanings. Three nursing research projects followed. A pilot minimum pressure mattress to ambulance was prepared with a mattress company. The paramedic gave lectures and participated in making an educational video in a local university of applied sciences. He wrote an article for a national magazine. The ambulance service participated in the Stop pressure injuries –day.

**Conclusions:** The prevention of pressure injuries falls easily short in the care pathway. So breaks the information chain on patient's home conditions and observed risk factors. Our ambulance crew is willing to prevent pressure injuries and forward gathered information to the admitting units. Implementation of the operating model caused work. However, the example of the ambulance service was well utilized. We encourage out-of-hospital services to prevent pressure ulcers and reassess patient's needs along the care pathway.

### References

- 1) Vaara, Miska: Painehaava akuuttipotilaan hoitoketjussa. *Haava* 4/2020, s. 29–33.
- 2) HUS Pressure Injury Working Group: *Prevent pressure injury in Ambulance Service* 11/2021.
- 3) Bååth et al: *Prevention of heel pressure ulcers among older patients – from ambulance care to hospital discharge: A multi-centre randomized controlled trial. Applied Nursing Research* 30 (2016) 170 – 175.

## P31

# Nutrition as Part Comprehensive Decubitus Ulcers Care

Andrea Vacová<sup>1</sup>, Kristýna Bečnicková<sup>2</sup>

1 Nemocnice Šternberk, Management, Šternberk, Czech Republic

2 Nemocnice Šternberk, Nutritional Therapy, Šternberk, Czech Republic

**Introduction:** Nutrition is an integral part of decubitus ulcers patient care. It plays a role not only in the healing process of decubitus ulcers but also in its prevention. Wound care is not just a matter of local treatment, but always a total care provided by specialists from several disciplines. A well-functioning nutritional care system enables rapid recognition of an impending or existing nutritional deficiency problem.

**Methods:** Involvement of nutritionists and application of current knowledge to nursing practice as a tool for a comprehensive approach.

- Macronutrients – the basic building material for growth and energy source for tissue remodelling
- Minimizing muscle mass loss and muscle strength
- Reduction of algic manifestations
- Reduction of immobilization syndrome
- Increasing the body's immune response
- Support for recovery, self-sufficiency and return to home environment

Respondent – patients in long-term care with decubitus ulcers and chronic wounds

Monitored data:

- Number of hospitalised patients
- Number of hospitalised patients with decubitus ulcers
- Number of new decubitus ulcers cases
- Number of patients in malnutrition
- Average length of hospital stay

Tools: Assessment and measurement scales, laboratory values, calorie and weight tables, recording of daily intake/output of the patient, photo analysis of decubitus ulcer and accurate determination of lesion size, Nutritional intervention algorithm, Nutritional support algorithm.

Educational materials for practice – examples of commonly available protein-rich foods as substitutes for foods for special purposes.

## Results:

Effective use of the acquired data during the patient's hospitalization.

The need for active patient involvement in planned care.

Deepening staff information on nutritional care.

The need to simplify the presented procedures – creation of nutritional algorithms.

Positive impact on the patient, improvement of physical and psychological condition, positive impact on the length of decubitus ulcer healing and length of hospitalization.

## Conclusions:

Without comprehensive and multidisciplinary care, maximum results in decubitus ulcers and chronic wound care cannot be achieved.

Active patient and family involvement in decubitus ulcers care, introducing nutritional care using simple practical tools.

Emphasis on educating the nursing staff in an understandable way, using modern technology.

## P32

# Effect of pressure injury on the application of viscoelastic foam overlay in patients with terminal cancer in hospice ward

**Jeong Ran Jeon**<sup>1</sup>

<sup>1</sup> Kwandong university international st.mary's hospital, Incheon, Korea, Dem. People's Rep. of

**Introduction:** Application of the support surface is one of effective and important factors in treating and preventing pressure injury by dispersing the concentration of pressure in the protruding areas of the bone and improving the tissue perfusion. EPUAP's recently revised international guideline recommends a high-level rebound foam mattress to be applied to high-risk patients at the evidence level of A. Therefore, we would like to investigate the effect of pressure injury management by applying viscoelastic foam overlay to high-risk group of patients with terminal cancer in the hospice ward

**Methods:** From January 14 to March 9, 2020, viscoelastic foam overlay was applied to 17 terminal cancer patients admitted to the hospice ward of Korea's secondary hospital A for a total of 8 weeks. The study was assess to 12 patients in the skin and pressure injury in sacral area. 5 out of 12 patients who died within a week after application were excluded.

**Results:** 8 out of 12 (66.7%) patients who applied viscoelastic foam overlay showed improvement and no change in pressure injury. On the other hand, 4 out of 12 (33.3%) patients had worsening in pressure injury. For 3 out of 4 patients with deteriorated pressure injury(75%) developed to Deep Tissue Pressure Injury (DTPI). DTPI has occurred 3 days before death.

**Conclusions:** This study suggests that viscoelastic foam overlay can help to lower the incidence of pressure injury progression to late-stage cancer patients admitted in hospice ward. It is also necessary to further study on how effective the application of viscoelastic foam overlay is to the pain of postural change to late cancer patients.

## References

1. National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory panel and Pan Pacific Pressure Injury Alliance. Prevention and treatment of pressure ulcers : International Clinical Practice Guidelines. Korean Association of Wound, Ostomy, Continence Nurse. mindbooks. (2014), p. 128-132.
2. Park KH, (2015) The Support Surface and Its Effect in Preventing Pressure Ulcer. j Korean Wounds Management soc Vol.11, no. 2
3. Kim and Jeong(2012). Optimal time interval for position change for ICU patients using foam mattress against pressure ulcer risk. j Korean Acad Nurs Vol. 42 No. 5, 730-737



P33

## Decubitus- basic conception of treatment

**Tomáš Jankovič<sup>1</sup>**

<sup>1</sup> Faculty Hospital in Nitra, Surgery department, Nitra, Slovakia

**Introduction:** Decubitus is one of the most frequently reason, why surgeon is called in hospital or to retirement home to immobile patient. A pressure ulcer is a localized injury to the skin or underlying tissue, usually over a bony prominence, as a result of unrelieved pressure. Pressure ulcers significantly threaten the well-being of patients with limited mobility. Although 70 percent of ulcers occur in persons older than 65 years, younger patients with neurologic impairment or severe illness are also susceptible. Prevalence rates range from 4.7 to 32.1 percent in hospital settings and from 8.5 to 22 percent in nursing homes or retirement homes. Well-known 4 stages, are today spread to 6 stages.

**Methods:** The aim of the treatment is to reduce the time of healing and also period of hospitalisation, make the treatment more effective with cost benefit. Today, we use „TIMERS„ - concept focused on management of specific, important parameters of the wound. Basic conception of treatment of decubitus is at the first sight very simple. It is necessary to remove causes of ulcer pressure, improvement of patient status and local treatment of wound. Simple? Isn't it? Of course not!

**Conclusions:** The using of adequate methods, techniques, solutions, and dressings is very important and often very difficult. Skills of surgeons, nurses, helpful from family and adequate compliance of patients are necessary for the common aim: healing of decubitus.

## P34

# Breaking the Cycle of Damage: SEM Assessment Technology as a Method for Support Surface Assessment

Bill Smith<sup>1</sup>, Jonathan Busby<sup>2</sup>, Kristina Holst<sup>3</sup>, Vignesh Iyer<sup>4</sup>

<sup>1</sup> Arjo, Research & Development, Cardiff, United Kingdom

<sup>2</sup> Arjo, Medical Affairs, Bedfordshire, United Kingdom

<sup>3</sup> Arjo, Medical Affairs, Malmo, Sweden

<sup>4</sup> Bruin Biometrics, Medical Affairs, Los Angeles, United States

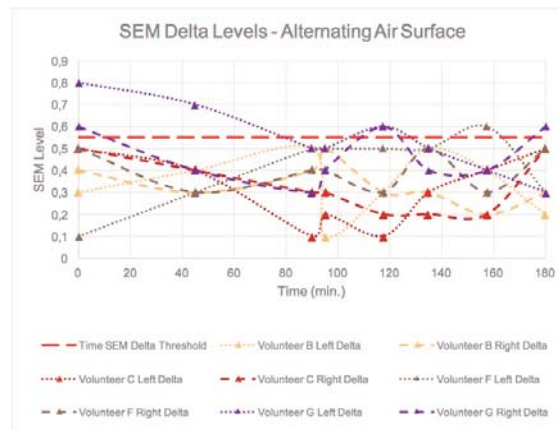
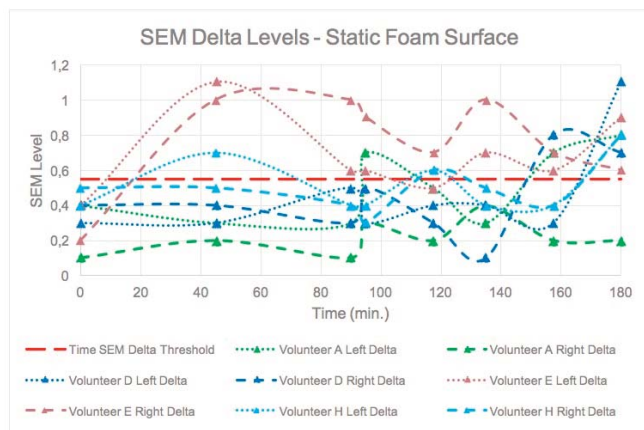
**Introduction:** Inflammation and localized oedema, initiated by sustained mechanical loading in the subcutaneous tissues are associated with the development of pressure ulcers (PUs) [1]. Evidence has confirmed that localized oedema, also called sub epidermal moisture (SEM), is a biomarker for early pressure-induced tissue damage [2]. Once PU risk is identified, support surfaces play a key role in prevention strategies to reduce mechanical loading and breaking the cycle of damage, i.e., persistent oedema and ischemia induced cell death due to sustained tissue deformations [3]

A small pilot experimental study was designed to assess support surface performance at the heel using a commercially available SEM measurement device\*.

**Methods:** Four of eight healthy subjects were placed on a standard foam mattress and the remaining four on an active alternating surface [4], [5].

- Subjects were instructed to lay still for two 90-minute sessions.
  - During the first 90-minute session; SEM-delta ( $\Delta$ ) readings were taken every 45 minutes.
  - SEM- $\Delta$  readings were taken immediately before and after a 5-minute comfort break between the two 90-minute sessions.
- During the second 90-minute session; SEM- $\Delta$  readings were taken every 22.5 minutes.

## Results:



For the volunteers placed on the foam static mattresses, 7 of the 8 heels (100% subjects) showed SEM- $\Delta$  levels  $\geq 0.6$  (high risk of PUs as per device indication) during the 3-hour test window. Comparatively, on the alternating air mattresses, only 3 of the 8 heels (50% subjects) showed SEM- $\Delta$  levels to be above the threshold ( $\geq 0.6$ ) in the same time. Preliminary data show clear differentiation in terms of SEM- $\Delta$  measurements between volunteers placed onto an alternating surface versus those on a static foam surface. These results indicate the possibility of mechanical loading of the tissue impacting SEM levels and the associated risk of developing PUs.

**Conclusions:** There seems to be a possible link between SEM measurements and offloading capabilities of support surfaces. This indicates potential for the use of sub-epidermal moisture measurements to be used as a short term evaluation method for support surface comparisons. Further studies, will be required to investigate the impact of different surface technologies on SEM measurements.

## References

1. Van Damme N et al. *Wound Repair & Regeneration* 2020; 28:242-265
2. Ross G et al. 2019. *Medical Engineering and Physics*. Vol 73:92-99
3. Gefen, A & Ousey, K 2020, *Journal of wound care*, vol. 29, no. 6, pp. 311.
4. Soppi E et al. 1994; 110(4):407-414
5. Soppi E, Lehtiö J, Saarinen H. *OWM* 2015; 61(2):38-46

\*Provizio® SEM scanner

## P35

## Prevention of Pressure Ulcers - Educational care map for lay caregivers

Lenka Šeflová<sup>1</sup>, Adela Kolkova<sup>2</sup>, Marie Kohutova<sup>3</sup>

1 University Hospital Olomouc, Department of Internal Medicine II - Gastroenterology and Geriatrics, Olomouc, Czech Republic

2 University Hospital Olomouc, Director of Nursing Department, Olomouc, Czech Republic

3 University Hospital Olomouc, Department of Medical Nutrition, Olomouc, Czech Republic

**Introduction:** The educational map "Prevention of Pressure Ulcers" is based on the fifth world day "STOP pressure ulcers 2017" with the aim of simplifying the educational process for lay caregivers prior to discharge of patients into their care. In order to improve communication between the nurse educator, patient and caregiver, specific catchment areas have been identified, which require addressing during these sessions.

**Methods:** The educational map is organized into five areas: nutrition, beds, skin care, rehabilitation positions, with the importance of family and other fields drawing particular attention for the prevention of pressure ulcers. For improved orientation within the document, risk factors are circled in red and recommendations in green. A functioning family is of central to homecare, which also provides a motivating factor for patient cooperation. A specialist team comprised from different fields is involved in improving the health of patient's at home, and essential to this team are the general practitioner and home care nurses.

**Results:** The programme was trialled in 2017 at the World Day of Stop Pressure Ulcers. The educational map offered a guide for conversation to the general public and health science students.

An educational map is on display in treatment rooms within the Departments of Internal Medicine II - Gastroenterology and Geriatrics, where visitors are allowed to view, comment and invariably express their interest. For the nurse educator it equally serves as a guide when communicating with patients and their families.

**Conclusions:** An abridged version of the educational map is now available to all nurses at the University Hospital Olomouc and other healthcare facilities within the Czech Republic. 2020 saw the development of an English version of the educational map.

### References

National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific Pressure Injury Alliance. *Prevention and Treatment of Pressure Ulcers: Quick Reference Guide*. Emily Haesler (Ed.). Cambridge Media: Osborne Park, Western Australia; 2014.

## P36

# Project PRIME: Pressure Relief Index Metric Extension - an extended study.

David Newton<sup>1</sup>, Jonathan Busby<sup>2</sup>, Bill Smith<sup>3</sup>

<sup>1</sup> Arjo, Research and Development, San Antonio, United States

<sup>2</sup> Arjo, Medical Affairs, Houghton Regis, United Kingdom

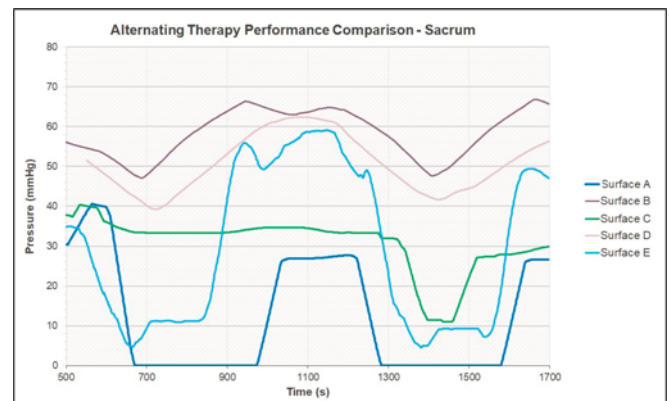
<sup>3</sup> Arjo, Research & Development, Cardiff, United Kingdom

**Introduction:** A previous internal study introduced an alternative approach to analyzing active alternating product performance with air based surfaces. To further validate this approach an extended study was commissioned to include air-foam based surface technologies (hybrids) and to evaluate another key anatomical location prone to pressure ulcer development. Current clinician education of hybrid support surfaces using active pressure redistribution involves comparison using Pressure Relief Index1 (PRI) based on 3 pressure thresholds (30mmHg/20mmHg/10mmHg). These clinically relevant thresholds were selected through association with tissue reperfusion via arterioles, capillaries and venules. An improved education approach is proposed herein. More recent studies<sup>2</sup> indicate that there is no universally safe pressure time threshold for all, hence indicating a 'lower pressure for longer' strategy for offloading is more optimal, particularly for key anatomical areas of concern such as the heel<sup>3</sup> and sacrum. An enhanced set of metrics is proposed focusing on the amount of time truly spent offloading the tissues with current hybrid systems.

**Methods:** An independent laboratory investigative study was performed on 5 commercially available hybrid surfaces with alternating capabilities. Interface pressure was measured over the cycle utilizing an 80kg EPUAP 50th percentile mannequin and a number of additional PRIME parameters were measured, calculated and compared. The first component of the previously published PRIME metrics measures the total percentage time that interface pressure is offloaded, being under a more clinically relevant 1mmHg threshold. The second component is the total interface pressure, in the form of an 'area under the curve' (AUC) calculation. The third component looks at the total applied alternating cell pressure. The final component is the peak interface pressure at any point in the cycle.

## Results

Parameter on Sacrum		Surface A	Surface B	Surface C	Surface D	Surface E
Pressure Relief Index	<10mmHg	59.2	0.0	0.0	0.0	8.4
	<20mmHg	59.6	0.0	6.7	0.0	28.7
	<30mmHg	82.7	0.0	23.1	0.0	31.0
Prime 1 % time under threshold of 1mmHg		59.2	0.0	0.0	0.0	6.6
Prime 2 Area under the Curve (AUC)		22.9	97.1	62.7	30.4	33.4
Prime 3 Total Applied Alternating Cell Pressure		Not measured in external study				
Prime 4 Peak Pressure		40.3	67.2	40.1	63.3	58.7



**Conclusions:** The principle behind the PRIME metrics apply to the hybrid class of products and this correlates with work done previously<sup>4</sup> on air based surfaces. These PRIME metrics provides an additional view beyond the traditional PRI thresholds in indicating the degree of offloading.

Performance depends on many complex factors and issues can often arise interpreting this data when seeking to inform clinical practice and surface selection. The data in the results section demonstrates that more modern hybrid support technologies are more effective at offloading, compared to legacy support surfaces.

As newer more advanced support surfaces are developed, this more sophisticated analysis technique is required to measure these performance improvements. The use of this technique can more clearly highlight areas of innovation that can then benefit patients.

## References

- 1/ Rithalia.S,Kenney.L,"The art and science of evaluating patient support surfaces", *World\_Wide\_Wounds*, Sep:2001.
- 2/ Gefen.A,Clark.M,(2019),"Saving lives through pressure ulcer research:revisiting our decade-old perspective of aetiology",*Wounds International*,10(2):8-9
- 3/ Newton.D et al, EPUAP2019 Conference Abstract Poster P60
- 4/ Newton.D et al, EPUAP2021 Conference Abstract Poster PS2.11
- 5/ "AtmosAir Velaris Adaptable Alternating support surface comparative testing of interface pressure performance",Arjo.A00563.1.0.INT.EN

## P37

# The importance of pressure mapping system in prevention of pressure ulcers in spinal cord injured patients with wheelchair mobility

Lia Vašíčková<sup>1,2</sup>, Jarmila Siegelova<sup>3</sup>, Michal Mašek<sup>4</sup>, Jiri Jarkovsky<sup>5</sup>

1 University Hospital Brno, Spinal Unit, Brno, Czech Republic

2 University Hospital Brno, Department of Rehabilitation, Brno, Czech Republic

3 Masaryk University Brno, Faculty of Medicine, Department of Physiotherapy and Rehabilitation, Brno, Czech Republic

4 University Hospital Brno, Spinal Unit of Department of Traumatic Surgery, Brno, Czech Republic

5 Masaryk University Brno, Faculty of Medicine, Institute of Biostatistics and Analysis, Brno, Czech Republic

**Introduction:** A pressure ulcer (PU) is a serious complication in patients with spinal cord injury (SCI), which fundamentally effects quality of life and can also lead to sepsis and death. Pressure on the seating cushion  $\geq 100\text{mmHg}$  is one of the serious external risk factors for the formation of PU.

**Methods:** A set of 90 SCI patients, 69 (76,7%) men and 21 (23,3%) women with manual wheelchair mobility, was analysed. All older than 18 years, 32 (35,6%) tetraplegics, 58 (64,4%) paraplegics, who lived with SCI from 1 to 42 years. The pressure mapping system Conformat Evolution was used for measurement of pressure on seating cushion. The results were analysed in relation to the presence, localization and severity of PU.

**Results:** The risk pressure for PU formation  $\geq 100\text{mmHg}$  under one or both ischial tuberosities (ITs) was observed in 62 (68.9%) patients. The pressure under the left IT was  $141.1 \pm 35.4\text{mmHg}$  ( $p < 0.001$ ), under the right IT  $134.6\text{mmHg} \pm 32.8$  ( $p < 0.001$ ). PU in the seating compromised area were found in 37 (41,1%) patients. In the entire set of 90 patients were found 69 (100%) PU, from which 47 (68,1%) under ITs ( $p < 0,001$ ). 22 (24,4%) patients with PU had a pressure  $\geq 100\text{mmHg}$  under one or both ITs ( $p < 0.001$ ). 9 (10%) patients had 11 (15.9%) PU in sacrum, 8 (8.9%) patients had 9 (13.2%) PU under trochanters, 1 (1.1%) patient had 2 (2.9%) PU under pubic symphysis. 6 (6,7%) patients had PU in multiple locations. 32 (46,4%) PU were II.grade, 25 (36.2%) III.grade and 12 (17.4%) were IV.grade.

67 (74,4%) patients seated with clinically objectify pelvic obliquity ( $p < 0.001$ ). The pressure  $\geq 100\text{mmHg}$  under one or both ITs was analysed in 49 (54.4%) patients with pelvic obliquity. In 40 (44,4%) patients with obliquity PU was indentified under lower, more loading IT, but in 9 (10%) patients PU was found under higher, less loading IT. 21 (23,3%) patients seated with obliquity experienced 53 (76.8%) PU in the seating compromised area ( $p < 0.001$ ).

**Conclusions:** It was verified the higher number of PU in the seating compromised area. Pathology of pelvic position, especially obliquity, is significant risk element for PU formation. Monitoring of pressure  $\geq 100\text{mmHg}$  under IT on seating cushion and assessment of the pelvic position are an important part of identifying risks and preventing the development of PU in patients with wheelchair mobility. It is also very important feedback for the patients education and compliance.

## P38

# Negative consequences and regression in pressure ulcer healing due to the lack of continuity of shock wave treatment - a clinical case report

Izabela Kuberka<sup>1</sup>, Mirosław Sopeł<sup>2</sup>, Joanna Rosińczuk<sup>3</sup>, Jakub Taradaj<sup>4</sup>, Robert Dymarek<sup>5</sup>

1 Wrocław Medical University, Department of Anaesthetic and Surgical Nursing, Wrocław, Poland

2 Wrocław Medical University, Department of Basic Sciences, Wrocław, Poland

3 Wrocław Medical University, Department of Internal Medicine Nursing, Wrocław, Poland

4 Academy of Physical Education, Institute of Physiotherapy and Health Sciences, Katowice, Poland

5 Wrocław Medical University, Department of Physiotherapy, Wrocław, Poland

**Introduction:** The key role of implementing innovative methods such as shock waves (ESW) in the management of pressure ulcers (PUs) is to intensify and maintain the therapeutic effect. The specialists emphasize that in the management of each chronic wound, it is important to ensure the repeatability of individual actions in line with the TIME strategy and to maintain continuity of treatment. In case of discontinuation of effective procedures, there is a serious risk that the healing process will be stopped or that the clinical condition of the wound will severely regress.

**Methods:** The study was conducted in an inpatient long-term care center based on observation and clinical assessment of PU in sacral area. The presented case shows the effect of discontinuation of therapy with ESW combined with local wound specialist care. The treatment was discontinued due to the necessity of hospitalization in another center, which resulted in the lack of access to previously used methods. The paper points out the need to maintain continuity of treatment using a combination of standard and innovative supporting procedures.

**Results:** It was observed that when ESW treatments were used, the angiogenesis was stimulated and healing process was faster. After 9-month period, PU decreased from 42.9 cm<sup>2</sup> to 6.0 cm<sup>2</sup> (86%). After about one month of discontinuation of the therapy so far, the clinical condition of the PU significantly worsened, with the surface area increasing from 6.0 cm<sup>2</sup> to 23.8 cm<sup>2</sup> (297%). The wound was infected and necrotic tissues appeared and a "pocket" in the upper pole appeared. After re-implementation of the ESW therapy, the PU decreased from 23.8 cm<sup>2</sup> to 6.1 cm<sup>2</sup> (74%). Clinically, the wound was clearly contracted, the inflammatory response was eliminated and proliferation was stimulated.

**Conclusions:** In the process of PU healing, an important factor is the individual choice of the treatment methods, which accelerates the healing process, but also maintaining repeatability without unjustified discontinuation until a complete healing. Discontinuation of therapy when the patient's general condition deteriorates may cause stopping the healing process and worsening of the clinical condition of PU.

## References:

- [1] NPUAP, EPUAP and PPPPIA. *Prevention and Treatment of Pressure Ulcers: Quick Reference Guide*. Emily Haesler (Ed.). Cambridge Media: Osborne Park, Western Australia; 2014. [2] National Clinical Guideline Centre (UK). *The Prevention and Management of Pressure Ulcers in Primary and Secondary Care*. NICE Clinical Guidelines, No. 179. London 2014. [3] Dymarek R. et al. *Extracorporeal shock wave therapy as an adjunct wound treatment: a systematic review of the literature*. *Ostomy Wound Manage*. 2014 Jul;60(7):26-39.

## P39

# Incidence and analysis of medical device related pressure injury: korea acute care hospital

**Jung Yoon Kim**<sup>1</sup>

<sup>1</sup> Seoul National University Bundang Hospital, WOCN, Seongnam-si, Korea, Rep. of South

**Introduction:** Pressure injury (PI) is commonly found in patients with restricted mobility. PI is a localized injury of skin and/or underlying tissue which occurs due to constant pressure on its area and results in constant physical and psychological affliction for patients and their families. Especially, the use of medical devices is associated with developing pressure injury in various patient population. But the incidence rate was still underreported in Korea. The objectives of the study were to identify the incidence rate and characteristics of medical device related pressure injuries (MDRPI) in acute-care patients.

**Methods:** In a cross-sectional, descriptive study, PI incidence was measured from January to December in 2017 using a pressure injury reporting form. Hospital acquired pressure injuries included those that occurred 24 hours after hospitalization.

**Results:** The overall incidence rate of hospital-acquired pressure injuries per 1000 hospital stays and MDRPI was 0.75‰ (350/467,456\*1000) and 0.25‰ (120/467,456\*1000). Incidence rate of intensive care units was 4.85‰ (146/30087\*1000) and general wards was 0.47‰ (204/437369\*1000). MDRPI occurrence rate of intensive care units was 1.60‰ (48/30087\*1000) and general wards was 0.16‰ (72/437369\*1000). Most of MDRPI stage was stage I 20(16.7%), stage II 61(50.8%), Stage III 4(3.3) and suspected deep tissue injury 35(29.2%). The most common location for MDRPI was thigh 48(40.0%), nose 32(26.7%), wrist 20(16.7%), head 4(3.3%), ear 4(3.3%) and heel 12 (10.0%). The most common Medical devices causing pressure injury were treatment aid tools 20(16.7%), anti-embolic stocking 40(33.3%), Levin tube 30(25%), angio catheter (include A-line) 20(16.7%), oxygenations 7(5.8%), and monitoring devices 3(2.5%).

**Conclusions:** Intensive care unit patients had a higher rate of MDRPI compared with other departments. But MDRPI has been underreported, especially pediatric population. It is necessary to perform more frequent skin assessment for patients using medical devices, and collaborate with other health care provider to prevent MDRPI in various clinical setting involving pediatric population.

## References

- 7 Apold, J, Rydrych, D. Preventing device-related pressure ulcers: using data to guide statewide change. *Journal of Nursing Care Quality* 2012;27:28-34
- 7 Black J, Alves P, Brindle CT, Dealey C, Santamaria N, Call E, Clark M. Use of wound dressings to enhance prevention of pressure ulcers caused by medical devices. *International Wound Journal*. 2013: doi: 10.1111/iwj.12111
- 7 Skillman J, Thomas S. An audit of pressure sores caused by intermittent compression devices used to prevent venous thromboembolism. *Journal of Perioperative Practice*. 2011;21(12):418-20



P40

## The benefit of lateral tilting beds in Intensive Care Unit

**Natália Beharková<sup>1</sup>**, **Simona Saibertová<sup>1</sup>**, **Andrea Pokorna<sup>1</sup>**, **Zdeňka Chalabalová<sup>2</sup>**

1 Masaryk University, Faculty of Medicine, Department of Health Sciences, Brno, Czech Republic

2 LINET Group, Slaný, Czech Republic

**Introduction:** The Intensive nursing care is physically and mentally demanding. Many international and national researches have analyzed the factors that contribute to nursing job satisfaction (1). Global shortages of nursing staff have triggered a debate on the working environment and workload the nursing staff are exposed to while performing their duties (2). Lateral tilting beds should reflect the needs of nursing staff and increase patient's safety and comfort (3).

**Methods:** The study aimed to determine the satisfaction of nursing staff with the use of specialized lateral tilting beds, which were lent to the Neuroscience Intensive Care Unit of Southampton University Hospital. Feedback from the staff was determined by performing two audits by a quantitative method of direct questioning about any benefits for staff and patients as well as any disadvantages (1st audit n = 12, 2nd audit n = 89).

**Results:** 1st audit found 91.7% of responses contained mostly positive comments. The benefits noted are reduction in back and other musculoskeletal injuries/aches and pains, more organized teamwork, beds easy to use for, easier to maintain skin integrity, patient comfort, and safer for patients. 2nd audit found that 100% of respondents believe the beds have improved their health and wellbeing at work, and 93 % (n=43) believe that a return of the non-specialist, standard hospital bed will impact their health and wellbeing. The most frequent benefits for staff are physical and mental health, time management, and patient turn time. Benefits for patients are patient safety and positioning of the patient.

**Conclusions:** The investigation proven that special beds that are used in the Intensive Care Unit had positive influence for staff and patients. There was no occurrence of pressure ulcers related to hospital care in the monitored period.

### References

- 1 Hasselhorn HM et al. Contribution of job strain to nurses' consideration of leaving the profession—results from the longitudinal European nurses' early exit study. *SJWEH Supplements* 2008;(No 6):75-82
- 2 Kwiecień K, Wujtewicz M and Medrzycka-Dabrowska W Selected methods of measuring workload among intensive care nursing staff *International Journal of Occupational Medicine and Environmental Health* 2012, 25(3):209-17
- 3 Study result from Southampton University Hospital Neuroscience Intensive Care Unit, LINET UK Ltd.

## P41

## IAD prevention strategy on Gastroenterology ICU FH Olomouc

Sylvie Přecechtělová<sup>1</sup>, Jana Habáňová<sup>1</sup>, Adam Chudoba<sup>1</sup>, Lenka Šeflová<sup>1</sup>, Michaela Valešová<sup>1</sup>, Blanka Drexlerová<sup>1</sup>

1 II.Interní klinika gastroenterologická a geriatrická, Jednotka intenzivní péče, Olomouc, Czech Republic

**Introduction:** An important function of skin is to serve as a protective barrier against adverse effects and irritants (moisture, urine, liquid stool). Skin care management for IAD prevention is essential skill of nursing staff. Implementing the processes of skin care into practice must be supported by the facility management. The proper skin care is directly related to the systematic education and motivation of the staff.

**Methods:** At UH Olomouc, the products containing terpolymer and polymeric cyanoacrylates have been in use since 2016. In 2018, a case study on the treatment and prevention of IAD was conducted. A plan for ICU was set-up. To perform risk assessment to identify patients with increased risk of skin damage. To prepare a plan for IAD prevention, its incidence reduction and treatment of damaged skin. To periodically and systemically educate the nursing team to implement the daily skin care protocol.

**Result:** Our experience revealed that repeated education and motivation of the staff is essential. IAD used to be commonly misdiagnosed as 2nd degree pressure ulcer. Diaper pants used to be overused, skin care products from different manufacturers were used, inappropriate non-transparent dressings were applied preventing objective evaluation of the skin condition. The introduction of the alcohol-free dressings containing terpolymers and polymeric cyanoacrylates proved to be beneficial thanks to their simple and rapid application and transparency. In total, we applied the dressings in 13 patients - 2 with skin maceration and wound secretion and 11 polymorbid patients with IAD, in which the disease course was complicated by urine incontinence and diarrhea. All the patients were classified to be in high risk of skin damage or the skin was damaged already.

**Conclusion:** Prevention is a key aspect in vulnerable skin care. Correct IAD diagnosis and appropriate use of personal care and hygiene products are essential for skin with damaged skin barrier. Our goal was to improve and develop IAD and pressure ulcer prevention and as a result reduce their incidence. We prefer non-irritant alcohol-free dressings containing terpolymers forming transparent protective film on the skin. Nevertheless, individual approach is our main priority, therefore, in some patients according to physician consult different treatment methods and products were used.

## References

- [1] Globiad. Dekubity.eu [cit. 30.9.2019] <http://www.dekubity.eu/informace-pro-odbornou-verejnost/doporuceni/>
- [2] Beeckman, D., et al. Pressure ulcers and incontinence-associated dermatitis: effectiveness of the Pressure Ulcer Classification education tool on classification by nurses. *Qual Saf Health Care*. 2010 Oct;19(5):e3. doi: 10.1136/qshc.2008.028415. Epub 2010 Jul 29 [cit.24.10.2019]
- [3] 3M™ Transforming skin Integrity through science. 3M UK. 2019.
- [4] IAD Expert panel, *Wounds International* 2015, [www.woundsinternational.com](http://www.woundsinternational.com)
- [5] Šeflová, L., et al. Bariérové prostředky k prevenci poškození kůže. *Léčba ran. Ročník VI, číslo 2/2019*, s.31. [cit.23.10.2019] [www.cslr.cz/Vzdelavani/Odborne-casopisy/](http://www.cslr.cz/Vzdelavani/Odborne-casopisy/)

## P42

# Implementation of the pressure ulcer risk assessment instrument, Purpose T, at a University hospital in Sweden.

**Charlotte Bjurbo**<sup>1</sup>, **David Thunborg**<sup>1</sup>, **Lisa Hultin**<sup>2</sup>, **Lena Gunningberg**<sup>2</sup>

<sup>1</sup> Uppsala University Hospital, Department of Quality and Patient safety, Uppsala, Sweden

<sup>2</sup> Uppsala University, Department of Public Health and Caring Sciences, Uppsala, Sweden

**Introduction:** Studies have shown that there is a need of a new upgraded pressure ulcer risk assessment instrument due to new identified risk factors. One assessment instrument that meets these requirements is PURPOSE T which was developed in UK1 and recently studied in Sweden<sup>2,3</sup>.

**Methods:** The aim was to evaluate the implementation of PURPOSE T at a university hospital in Sweden.

The implementation process was initiated and determined in January 2021. Information regarding PURPOSE T was communicated with both verbal and written information to charge nurses and registered nurses responsible for quality improvement regarding pressure ulcer.

A digital education was designed in a visual caption programme aiming to educate registered nurses and assistant nurses how to use the risk assessment instrument.

In May -21, the Modified Norton Scale was replaced by PURPOSE T in the electronic health record with no overlap time to minimize documentation issues caused by different templates.

A questionnaire was sent out to registered nurses and assistant nurses six months after the implementation.

**Results:** The questionnaire showed that the registered nurses and the assistant nurses prefer PURPOSE T instead of the Modified Norton Scale. In addition, the registered nurses reported that more risk factors regarding pressure ulcer were considered with PURPOSE T and that it was more trustworthy compared to the Modified Norton Scale. Output data from the electronic health record showed that PURPOSE T was more frequently used per month compared to the Modified Norton Scale.

**Conclusions:** Good communication is essential for an implementation. A digital education which registered nurses and assistant nurses could take part of both single handed and in group made it easier to spread the knowledge about the new instrument. Using PURPOSE T to identify risk of developing pressure ulcer could hopefully increase patient safety.

## References

1. Coleman et al. (2018). Clinical evaluation of a new pressure ulcer risk assessment instrument, the Pressure Ulcer Risk Primary or Secondary Evaluation Tool. *JAN* 74(2),407-424.
2. Hultin et al. (2020). PURPOSE T in Swedish hospital wards and nursing homes: A psychometric evaluation of a new pressure ulcer risk assessment instrument. *J Clin Nurs*, 29, 4066-4075.
3. Hultin et al. (2021). Pressure ulcer risk assessment – registered nurses experiences of using PURPOSE T. *J Clin Nurs*, 31, 231-239.

## P43

# Analysis of Real World Data: Impact of technology on nursing interventions for pressure injury/ulcer prevention

Vignesh Iyer<sup>3</sup>, Aaron Dane<sup>1</sup>, Zoe Wood<sup>2</sup>

<sup>1</sup> Bioscript, Alderley Edge, United Kingdom

<sup>2</sup> BBI Limited, Alderley Edge, United Kingdom

<sup>3</sup> Bruin Biometrics, Los Angeles, United States

**Introduction:** A pragmatic real-world evidence methodology was used to determine the impact upon Pressure Injury/Ulcer (PI/PU) reduction, clinical decision making and the interventions employed following implementation of a medical device which alerts healthcare practitioners (HCPs) to increased risk of PI/PUs 5 days\* earlier than visual skin assessment<sup>1</sup> as per recommendations in the International Clinical Practice Guidelines (2019)<sup>2</sup>.

**Methods:** Analysis was undertaken on a sub cohort of patients from 26 Acute Care sites who undertook a Pressure Ulcer Reduction Programme (PURP). SEM readings and visual skin assessments were carried out on all patients as per local protocols with particular focus on the analysis of the impact of the clinical interventions that the HCPs implemented for their patients.

### Results:

1952 patients were scanned from the 26 sites

Zero Hospital Acquired Pressure Injury/Ulcer (HAPI/U) reported for 73% of sites

90% (weighted) HAPI reduction

SEM Scanner Information	Data from 26 acute settings
Clinical decision making impacted?	77% of cases saw clinical decision-making changes
Any additional intervention taken?	76% patients received additional interventions which included: <ul style="list-style-type: none"> <li>• Increased turning/mobilisation of the patient</li> <li>• Introduction of specialist surface or mattress</li> <li>• Introduction of heel elevation or heels support</li> <li>• Use of barrier cream or prophylactic dressing</li> </ul>

**Conclusions:** These results identify firstly the role SEM assessments can have in identifying increased risk of PI/PU earlier than VSA. They also importantly demonstrate how HCPs incorporated additional, anatomically targeted clinical interventions when SEM assessment alerted to increased risk of PI/PU damage in patients resulting in an overall reduction in PI/PU incidence of 90%.

### References

- Okonkwo H.et al. (2020) A blinded clinical study using subepidermal moisture biocapacitance measurement device for early detection of pressure injuries. *Wound Repair and Reg*;1-11
- European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel and Pan Pacific Pressure Injury Alliance. (2019). *Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline. The International Guideline.* Emily Haesler (Ed.). EPUAP/NPIAP/PPPIA

## P44

## Reducing the adherence of micro-organisms and biofilms on a support surface through a novel surface structure.

Elizabeth Lakin<sup>1</sup>, **Richard Haxby**<sup>1</sup>, Katie Pearce<sup>1</sup>

<sup>1</sup> Trelleborg, Long Eaton, United Kingdom

**Introduction:** 'The traditional approach to hospital hygiene has been to sterilize surfaces as much as possible, but there is now evidence to suggest that this kill all approach isn't working. ' An innovative medical support surface was designed to 'repel' bacteria through the use of an innovative surface micro-structure. This was compared to a standard medical support surface to establish if it is possible to reduce the number of micro-organisms present to similar levels of normal cleaning regimes.

**Methods:** Four different polyurethane-coated support surfaces were tested:

- The 'repelling' surface in a standard polyurethane
- The 'repelling' surface in a highly breathable polyurethane
- Standard polyurethane-coated surface
- Highly breathable polyurethane-coated surface

All testing was carried out in a laboratory setting, using two micro-organisms and a biofilm.

The study was split into three sections;

- Part 1 evaluated whether it was more difficult to remove the micro-organisms from the standard surfaces as opposed to the 'repelling' surfaces using ISO 20743:2013
- Part 2 investigated the growth rates of micro-organisms and bio-films on all surfaces to see if there were any differences.
- Part 3 investigated the efficacy of different commonly used cleaning materials on the different surfaces to establish if there was a greater kill-rate on the 'repelling' surfaces.

**Results:** The study showed that the micro-organisms were much less well adhered to the 'repelling' surfaces and could be removed more easily from the "repelling' surfaces. It was more difficult for micro-organisms and bio-films to grow on the 'repelling' surfaces. It was seen that the same cleaning effect could be achieved using lower concentrations of cleaning agent on the 'repelling' surfaces compared to the standard surface.

**Conclusions:** Using lower concentrations of cleaning agents combined with the 'repelling' microstructure may help to increase the lifetime of the support surfaces, reducing the risk of strikethrough. This could reduce the exposure of hospital staff to the cleaning chemicals and reduce the amount of chemicals released into the environment.

### References:

1. Mora M, Mahnert A, Koskinen K, Pausan MR, Oberauner-Wappis L, Krause R, Perras AK, Gorkiewicz G, Berg G, Moissl-Eichinger C.. (2016). *Microorganisms in Confined Habitats: Microbial Monitoring and Control of Intensive Care Units, Operating Rooms, Cleanrooms and the International Space Station*. *Front Microbiol.* 7 (1), 1573.

## P45

# Applying for Community Reimbursement in the UK National Health Service for a Second-Generation Technology in Pressure Ulcer Prevention

**Callum Housley**<sup>1</sup>

<sup>1</sup> BBI Limited, Alderley Edge, United Kingdom

**Introduction:** In order to facilitate the use of a 2nd generation technology within the NHS community setting in the UK a different model of market access was developed. The technology utilises a single use sensor head for the new device to complement the new generation device. These sensors will be made available via Part IX of the Drug Tariff (DT) whereby all medical devices are included. The DT requires submission of applications which must meet the following three criteria for inclusion in Part IX of the DT1:

- Products are safe and of good quality
- Appropriate for General Practice and, if relevant, non-medical prescribing
- Cost effective

Considerations:

1. Whether the product should be reimbursed
2. Costs
  1. The cost of using the product in a given treatment regime compared with the cost of the most effective alternative treatment regime (or no treatment regime if there is none currently available).
  2. The price of the product compared with the price of similar products. (Whether or not a product is "similar" to other products may itself be a matter for discussion between NHS Prescription Services and the applicant).

**Methods:** The type of supporting evidence depends on the circumstances of each application. All applications for inclusion of a product onto Part IX of the DT must demonstrate patient benefit as well as appropriateness for NHS prescribing by Doctors or appropriate practitioners. Therefore, a sample cohort of 30 patients will be used to test the user-ability of the device with its single use sensor head. The use of a questionnaire to be completed by the community nurse will question the flexibility, the ergonomics and the ease of use of the new device when interacting with their community patients.

**Results:** The questionnaire has been developed, the clinical site identified, and agreement received from the NHS Trust to commence this user ability study once the NHS landscape settles following COVID19 outbreak. It is anticipated that this study will commence June 2020 and then the results from the 30 patient episodes will be analysed, written into a report and submitted as part of the DT application

**Conclusions:** An evidence-based application for DT inclusion needs to consider both the clinical impact but also the cost of the device

## References

1. NHSBSA. (2019). An introduction to Part IX of the drug tariff. <https://www.nhsbsa.nhs.uk/sites/default/files/2019-04/DT%20Guidance%20v4.9.pdf>

P46

## Assessment of different type of support surface(s)

**Esa Soppi<sup>1</sup>**<sup>1</sup> *Terveystalo, Internal Medicine, Outpatient clinic, KAARINA, Finland*

**Introduction:** Development of pressure ulcer/injury is causing pain and suffering leading to collateral damage and even to increased mortality. The financial consequences are huge and therefore the prevention is the primary objective. In the prevention the correct choice of the support surface is crucial. The EU regulation (2017/745) demands as a law the existence of clinical evaluation documentation prepared by the manufacturer to critically summarizing all the clinical and other documentation of any particular support surface similar to approval documentation of medicines. The review of the clinical evaluation documentation of support surfaces is only way of assessing of their peer-to-peer performance.

**Methods:** Review of all clinical documentation of a single support surface involving nine original publications and numerous abstracts including mode of action data, randomized controlled trials, real world evidence as well as supporting experimental and clinical data.

**Results:** The mode of action data reveal unique pressure distribution properties, capillary blood flow information, but highlight that blood flow and tissue deformation may be disconnected in development of deep tissue injury. Results from randomized trial are confirmed utilizing real-world data and allowing head- to-head comparison of different types of support surfaces. All data are in line with each other and support the overall conclusions made.

**Conclusions:** Internationally very little information is available from a single type of support surfaces which makes the assessment of a functionality, safety and efficacy difficult. The requirement of preparing a rigorous document i.e. clinical evaluation documentation required by law (EU regulation 2017/745) to be updated periodically makes it possible to objectively to assess and compare the performance characteristics of different type of support surfaces. Every institution and wound care professional must familiarize oneself with clinical evaluation documentation of each wound care product (medical device) they are using. Only this ensures employment of the best products and practices, decreases patient suffering and saves a lot of money.



P47

## Skin Viability and Microvascular Function Under Localised Applications of Heat and Pressure

**Alex Robertson<sup>1</sup>**, Alex Lloyd<sup>1</sup>, Mike Fray<sup>2</sup>, Jo Barnes<sup>2</sup>

<sup>1</sup> Loughborough University, Environmental Ergonomics Research Centre, Loughborough, United Kingdom

<sup>2</sup> Loughborough University, School of Design and Creative Arts, Loughborough, United Kingdom

**Introduction:** The heel is one of the two most common sites for pressure injuries (PI), the other being the sacrum (Linden and Riordan, 2006). It is considered a particularly vulnerable area due to low adiposity, bone prominences, as well as the influence of vascular dysfunction in disease, and normal biological aging of the local tissue (Delmore et al., 2015). There is only a small amount of tissue covering the posterior surface of the calcaneum which leads to particularly high interface pressures between the heel and the supporting surfaces (Mayrovitz, Macdonald and Smith, 1999). The high interface pressure leads to damage of the microcirculation of the soft tissues overlaying the calcaneum, resulting in tissue ischaemia and necrosis (Ousey, 2009).

**Methods:** In the present study, a custom skin deformation device, with an area of 33cm<sup>2</sup>, was used to locally apply a combination of pressures (6, 20, 60 and 100mmHg) and temperatures (33, 38°C) at the left posterior heel of eight healthy male volunteers (mean age, 24 ± 2 years). A laser doppler flowmetry probe, embedded into the skin deformation device, was used to measure baseline skin blood flow, loaded skin blood flow (LSBF), and reactive hyperaemia (RH; quantified as area under curve) on pressure release. Skin Blood Flow measures are all expressed as cutaneous vascular conductance (CVC = Flux/MAP). The relationship between local temperature (33-38°C) and pressure (6-100mmHg) application of LSBF and RH was then assessed via non-linear regression.

**Results:** LSBF saw a significant reduction ( $p < 0.003$ ) as the applied pressure increased, falling from  $2.1 \pm 0.1$  au at 6mmHg, to  $0.8 \pm 0.01$  au at 20mmHg, to  $0.2 \pm 0.13$  au at 60mmHg, and finally to  $0.2 \pm 0.15$  au at 100mmHg. There were significant differences observed between all LSBF apart from the values for 60 and 100mmHg, which had a mean difference of only 0.01 au. Temperature had a significant ( $p = 0.015$ ) effect on LSBF, which increased from  $0.6 \pm 0.1$  au at 33°C to  $1.0 \pm 0.17$  au at 38°C. RH, saw a significant ( $p = 0.003$ ) increase between the temperatures of 33 and 38°C, increasing from  $9.0 \pm 5.9$  to  $17.9 \pm 12.9$ . Significant differences ( $p < 0.001$ ) were also observed between the body's hyperaemic response to the pressures of 20 to 60 and 100mmHg, increasing from  $7.4 \pm 2.67$  to  $18.8 \pm 11.2$  au and  $21.6 \pm 11.5$  au. RH data demonstrated a quadratic increase with increasing interface pressures at both 33°C and 38°C, plateauing at 90mmHg irrespective of temperature. When interpolated, LSBF demonstrated a quadratic decline with increasing pressure at 33°C, and a power decline with increasing pressure at 38°C, predicting LSBF to shut down completely at 45mmHg, and 55mmHg, respectively.

**Conclusions:** This study characterized the relationship between local temperature (33-38°C) and pressure application (6-100mmHg) on LSBF and RH.

## P48

# Stabilized ozonides as catalyst in the management of elderly people skin lesions with shockwaves and photobiomodulation

**Roberto Cassino**<sup>1</sup>, **Cristina Galuzzi**<sup>1</sup>, **Lorella Bettaglio**<sup>1</sup>, **Gabriela Sofia Barrionuevo Moreno**<sup>1</sup>, **Irena Cela**<sup>1</sup>, **Federica Maggi**<sup>1</sup>

<sup>1</sup> "Sacra Famiglia" Korian Nursing Home, Geriatrics - Long Term Care, Pieve del Cairo, Italy

**Introduction:** Technology has changed the approach to chronic skin lesions with significant results, just as the use of interactive dressings has further reduced healing times. Among these, the stabilized ozonides (antimicrobial formula\*) have shown particular efficacy. The aim of this work is to demonstrate that antimicrobial formula can be considered a catalyst that enhances the effect of both shock waves (ESWT) and photobiomodulation (PMB) in the treatment of pressure ulcers (PI) and Incontinence Associated Dermatitis (IAD)[1] in an institutionalized elderly population.

**Methods:** We enrolled 15 PI and 10 IAD, divided respectively into 3 (PI1, PI2, PI3) and 2 (IAD1, IAD2) groups of 5 each, all treated with Ozoile-based dressings: Spray, Alginate and Gauze to treat the PI, Barrier Cream to treat IAD. Lesions of the PI2 group were treated with ESWT while those of the PI3 group and IAD2 group were treated with PMB; both treatments twice a week for 4 weeks. We evaluated the wound area reduction (WAR) with the wound measurement system\*\* and the possible resolution within 4 weeks.

**Results:** All lesions improved significantly, but the ones in the ESWT and PMB groups achieved higher WAR and/or complete healing. In the PI groups, the increase in WAR was more than 30% higher, while the IADs, although they all resolved within the observation period, achieved the goal in about 50% less time. There were no allergies, intolerances, superinfections, or other adverse events. No discomfort for the patients of any group.

**Conclusions:** Comparing the literature data about ESWT [2] and PMB [3], we can conclude that Ozoile® acts as a catalyst, enhancing the effect of the two technological devices. It is presumed that this effect is due to the fact that both the instrumental treatments and antimicrobial formula\* act by modulating inflammation, increasing local oxygen and stimulating endogenous growth factors. We can therefore conclude that antimicrobial formula\* acts in synergy with both instrumental treatments, ensuring a faster and more effective healing even in very elderly patients.

## References

[1] Cassino R, Kopniak A. (2021) *Onde d'urto, Elettrostimolazione e Fotobiomodulazione: microbiota e biofilm. Best Presentation Award at the XVI A.I.U.C. (Italian Cutaneous Ulcers Association) National Congress – Rome Italy*

[2] Larking A.M, Duport S, Clinton M, Hardy M, Andrews K. *Randomized control of extracorporeal shock wave therapy versus placebo for chronic decubitus ulceration. Clin Rehabil OnlineFirst, 2010 as doi:10.1177/0269215509346083*

[3] Dini V et al. *Blue light emission in the management of hard-to-heal wounds. Giornale italiano di dermatologia e Venereologia 2020;155 doi: 10.23736/S0392-0488.20.06691-2*

\* Ozoile®

\*\* Visitrak™

P49

## Usage of NPWT in a Patient with Extensive Trochanteric Pressure Ulcer - a Case Study

Pavel Kůřil<sup>1,2,3</sup>, Andrea Menšíková<sup>1,2</sup>, Simona Saibertová<sup>1</sup>, Andrea Pokorná<sup>1</sup>

<sup>1</sup> Masaryk University, Faculty of Medicine, Department of Health Sciences, Brno, Czech Republic

<sup>2</sup> Masaryk University, Faculty of Medicine, Department of Public Health, Brno, Czech Republic

<sup>3</sup> Faculty Hospital Brno, Department of Surgery, Brno, Czech Republic

**Introduction:** Negative pressure wound therapy (NPWT) is a sophisticated method used for large problematic healing wounds. NPWT, also known as a vacuum-assisted closure (VAC), is a therapeutic technique using a suction pump, tubing, and a dressing to remove excess exudate and promote healing in either acute or chronic wounds. NPWT enhances granulation tissue formation over previously cleansed wounds by stimulating local angiogenesis, thereby improving the local blood supply. NPWT positively influences the healing process and the patient's quality of life. NPWT was used in a presented case of the patient with an extensive trochanteric pressure ulcer (TPU).

**Methods:** A case study.

**Results:** An 81-year-old male with an extensive TPU was admitted from a retirement home to a surgery department for abdominal pain and treatment of the extensive TPU (Fig. 1). He had associated diseases: right hemiparesis, Parkinson's disease, status after a brain stroke, global aphasia, dysphagia. The NPWT method (Vacuum therapy unit) \* was chosen for the treatment. The next day, a necrectomy was performed in the operating room, and NPWT was applied. The dressing of NPWT was changed every other day. On the 6th day, the healing process of the wound was found to be positively influenced by NPWT, and the patient was transferred to the Clinic of Burns and Reconstructive Surgery.

**Conclusions:** NPWT is a strongly recommended tool in surgery for various indications, including the TPU and was proven as effective in the presented case study recommend NPWT as the most efficient treatment technique.

This report was written at Masaryk University as part of the project "A comprehensive approach to skin and mucosal integrity disorders II." number MUNI/A/1341/2021 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 2021.

### References

1 Pokorná, A. *Introduction to Wound Management: A Guide for Chronic Wound Healing for Non-medical Students* [Úvod do wound managementu: příručka pro hojení chronických ran pro studenty nelékařských oborů]. Brno, Czechia: Masaryk University; 2012.

2 Broder KW, Nguyen B, Bodor RM. NPWT with Instillation in a Chronic Non-healing Right Hip Trochanteric Pressure Ulcer. *Cureus*. 2016. 8(11):e877. doi. 10.7759/cureus.877

\* VivanoTec Pro®

P50

## The Importance of the Differential Diagnosis of Pressures Ulcers and Moisture Lesions - A Case Study

Pavel Kůřil<sup>1,2,3</sup>, Andrea Menšíková<sup>1,2</sup>, Simona Saibertová<sup>1</sup>, Andrea Pokorná<sup>1</sup>

<sup>1</sup> Masaryk University, Faculty of Medicine, Department of Health Sciences, Brno, Czech Republic

<sup>2</sup> Masaryk University, Faculty of Medicine, Department of Public Health, Brno, Czech Republic

<sup>3</sup> Faculty Hospital Brno, Department of Surgery, Brno, Czech Republic

**Introduction:** Differential diagnostics of pressure ulcers and moisture lesions have great importance in nursing practice. Nurses in clinical practice are well trained and educated in pressure ulcers prevention and treatment; on the contrary, their knowledge of how to treat lesions caused by incontinence is poor. Skin impairment in these two lesions has some common features, but it is necessary to classify and differentiate them. A combination of moisture and friction is considered a potential cause of moisture lesions in skin folds. A pressure ulcers is most likely to occur over a bony prominence<sup>1;2</sup>.

**Methods:** A case study.

**Results:** A 70-year-old male with multiple comorbidities and mobility disorder was transferred from the Department of Cardiology to the Department of Surgery. He suffered from the wound in the sacrococcygeal region and the buttock area. He had associated diseases: chronic heart failure, hypertension, atrial fibrillation, hepatopathy, anaemia, urge incontinence, recurrent urinary tract infections. Hospital care: The 1 st day of hospitalization hydrogel\* + sterile grid\*\* + antimicrobial foam dressing with silver & silicone\*\*\* used in border sacrum treatment. On the 2nd - 9th day of hospitalization, hydrogel\* + antimicrobial foam dressing with silver & silicone\*\*\* were used. There was no bloody secretion, only serous secretion in the wound bed. On the 9th day of hospitalization, the patient was transferred to a district hospital.

**Conclusions:** Pressure ulcers and skin lesions caused by incontinence should be distinguished during the treatment to apply appropriate interventions. Recognition of the differences between them plays an important role both in prevention and different treatment. This case report describes the phases in the healing process in a patient with many internal comorbidities. The potential inappropriate use of the local treatment is discussed.

This report was written at Masaryk University as part of the project "A comprehensive approach to skin and mucosal integrity disorders II." number MUNI/A/1341/2021 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 2021.

### References

- 1 Beekman D., Schoonhoven J., Fletcher, J. et al. Pressure ulcers and incontinence associated dermatitis: effectiveness of the Pressure Ulcer CLASsification education tool on classification by nurses. *Quality and Safety in Health Care*. 2010; 19(5):e3 DOI:10.1136/qshc.2008.028415
- 2 Pokorná A. Possibilities of Differential Diagnosis of Pressure Ulcers and Lesions Caused by Incontinence [Možnosti diferenciální diagnostiky tlakových lézí a lézí v důsledku inkontinence]. *Postgraduate medicine, Czechia*. 2015;17(2):217-220.

\*Hyalecasan

\*\* Traumacel

\*\*\* Mepilex AG

## P51

# Turn over biceps femoris muscle technique in reconstruction of recurrent ischiadic pressure injuries - our experiences

**Alica Hokynkova<sup>1,2</sup>, Petr Sin<sup>1,2</sup>, Filip Černocho<sup>1,2</sup>, Zuzana Jelínková<sup>1,2</sup>**

1 University Hospital Brno, Department of Burns and Plastic Surgery, Brno, Czech Republic

2 Faculty of Medicine, Masaryk University Brno, Brno, Czech Republic

**Introduction:** Ischiadic pressure injury is the most frequent pressure injury in paraplegic wheelchair-bounded patients. Many reconstructive options using fasciocutaneous or musculocutaneous flaps in reconstruction of deep category pressure injuries in this localization were described. However, a risk of late complications, especially recurrence of ischiadic pressure injury after reconstruction, remains high (p2). This fact led us to searching of another reconstructive option(s). We decided to introduce less known reconstruction technique, using biceps femoris muscle and its "turn over" rotation above tuber ischiadicum with combination of fasciocutaneous dorsal thigh flap plasty in surgical treatment of recurrent ischiadic pressure injuries. This technique was first described by Conway and Griffith in 1956 2.

**Methods:** Total of 19 patients (men, mean age 49.53), suffering from recurrent ischiadic pressure injury, were included into this study. In all subjects, surgical reconstruction using "turn over" biceps femoris muscle technique was performed between the years 2015-2019 at the Department of Burns and Plastic Surgery, University Hospital Brno, Czech Republic. Mean surgery time, hospital stay, and acute and late complication were monitored.

**Results:** Successful reconstruction using "turn over" biceps muscle flap was performed in all cases with no flap loss. Mean surgery time was 91 min and mean hospital stay was 17 days. Acute complication with need of surgical revision was observed in one case only (wound dehiscence). Follow-up was carried out for 3 and 12 months after the reconstruction. Recurrence of pressure injury in the same localization was observed in four cases.

**Conclusions:** According to our experience, "turn over" biceps femoris muscle technique can be considered as an alternative reconstructive option in surgical treatment of recurrent ischiadic pressure injuries.

## References

1. Rubayi S, Wagenheim BR, Mcleland A. *Reconstructive Plastic Surgery of Pressure Ulcers*. Springer; 2015.
2. Conway H, Griffith BH. Plastic surgery for closure of decubitus ulcers in patients with paraplegia: based on experience with 1,000 cases. *The American journal of surgery*. 1956;91(6):946-975.

P52

## Quality of life in informal caregivers in wound care

**Mirna Žulec**<sup>1</sup>, **Martina Erić**<sup>2</sup>

1 Catholic University of Croatia, Zagreb, Croatia

2 Home care agency "Zagar", Bjelovar, Croatia

**Introduction:** Informal caregivers take a big part of chronic care patients, however, informal care givers in wound care have been largely unnoticed. Due to long term care they often experience emotional overload and lower quality of life. The aim of research was to determine the quality of life of people who do not have a formal health education and care for people with a chronic wound.

**Methods:** The research was conducted as a cross-sectional study in central Croatia, included informal caregivers involved in care of patients with different types of wounds. Data were collected using Burden Scale for Family Caregivers (BSFC) was used

**Results:** In total, 35 participants were included in the research. The majority of them were female (71%), age range 51-60 years (40%) They lived in the same household with the patient (91,4%), taking care for patient with leg ulcer (80,6 %) and pressure ulcer (11%). Almost quarter (22,9%) is involved in care for more than 5 years. Main problems were physical exhaustion, lack of communication and need for rest.

Women are significantly more likely to give up plans for the future due to patient care ( $p = 0.039$ ) and are significantly more likely to be torn between the demands of the society and the patient ( $p = 0.046$ ).

**Conclusions:** Informal caregivers are inseparable part of care for wound patients, they experience lower similar research is needed to detect specific problems according to cultural and wound type characteristics.

# Observational Study (PUCOVID) - Determinants of pressure ulcer development in intensive care patients with covid: cohort study

**Ulrika Källman**<sup>1,2</sup>, **Sofia Almeida**<sup>3</sup>, **João Costa Amado**<sup>3</sup>, **Camila Almeida**<sup>3</sup>, **Carina Bååth**<sup>4,5</sup>, **Paulo Alves**<sup>3</sup>

1 Södra Älvsborg Hospital, Research Department, Borås, Sweden

2 Institute of Health and Care Sciences, Gøthenburg University, Gøteborg, Sweden

3 Universidade Católica Portuguesa, Faculty of Health Science, Porto, Portugal

4 Karlstads University, Faculty of Health, Science and Technology, Karlstad, Sweden

5 Ostfold University College, Faculty of Health, Welfare and Organisation, Fredrikstad, Norway

The development of a pressure ulcer (PU) is a complex process that involves pressure and shear forces against the skin due to own body weight or based on medical technology equipment, but also patient-specific factors, especially in individuals > 65 years and with multiple disease. The most important risk factors for pressure ulcers include immobility and impaired perfusion [1], which are also features that occur in critically ill SARS-Cov-2 patients. In this presentation, based on a recent international multi-center, retrospective study, we describe the incidence of pressure ulcers in intensive care during one pandemic year 2020/2021 and investigate whether there are specific risk factors for pressure ulcer development in intensive care for COVID-19. Is the proportion of pressure ulcers higher in the group of patients treated for COVID-19 and if so, is it the prone position and / or medical equipment that is primarily associated with pressure ulcer development [2, 3] or are there other risk factors that we should be aware of [4-6]? The results are based on documented medical data records among ICU-patients, with and without COVID-19, from participating hospitals ICUs in Sweden and Portugal. Analysis is ongoing and some preliminary results will be presented at the conference.

## References

1. Coleman, S., Gorecki, C., Nelson, E. A., Closs, S. J., Defloor, T., Halfens, R., Farrin, A., Brown, J., Schoonhoven, L., & Nixon, J. (2013). Patient risk factors for pressure ulcer development: systematic review. *International journal of nursing studies*, 50(7), 974–1003.
2. Ibarra G, Rivera A, Fernandez-Ibarburu B, Lorca-García C, García-Ruano A. Prone position pressure sores in the COVID-19 pandemic: The Madrid experience. *Journal of plastic, reconstructive & aesthetic surgery: JPRAS*. 2020.
3. Moore Z, Patton D, Avsar P, McEvoy NL, Curley G, Budri A, et al. Prevention of pressure ulcers among individuals cared for in the prone position: lessons for the COVID-19 emergency. *J Wound Care*. 2020;29(6):312-20.
4. Cox J. Pressure Injury Risk Factors in Adult Critical Care Patients: A Review of the Literature. *Ostomy Wound Manage*. 2017;63(11):30-43.
5. Ahtiala M, Soppi E, Saari TI. Sequential Organ Failure Assessment (SOFA) to Predict Pressure Ulcer Risk in Intensive Care Patients: A Retrospective Cohort Study. *Ostomy Wound Manage*. 2018;64(10):32-8.
6. Jacq G, Valera S, Muller G, Decormeille G, Youssoufa A, Poiroux L, et al. Prevalence of pressure injuries among critically ill patients and factors associated with their occurrence in the intensive care unit: The PRESSURE study. *Aust Crit Care*. 2021.



Bold = Presenting author

Abbas, Shabira	10.1	Çakar, Vildan	3.3	Garajová, Marie	48, CS6
Abiakam, Nkemjika	10.2, <b>10.4</b> , 10.1	Calvo Aguirre, Juan José	9.3	Gefen, Amit	10.3
Adams, Michael J.	10.1	Cascolan, Wilnora	<b>7.5</b>	Gethin, Georgina	5.4
Ahmajärvi, Kirsti	<b>KS7.1</b>	Cassino, Roberto	<b>P9, P48, 8.3, 8.4</b>	Gillard, Nicolas	<b>P29</b>
Ahtiala, Maarit	<b>4.3</b>	Cavallini, Marco	<b>8.1</b>	Gillespie, Brigid	4.5
Allegre, Willy	P29	Cela, Irena	P9, P48, 8.3, 8.4	Giraud, Frédéric	10.5, 11.4
Almeida, Camila	373	Černoch, Filip	P51	Greenhalgh, Joanne	6.1
Almeida, Sofia	373	Chaboyer, Wendy	4.5	Greenwood, Clare	<b>P27, P28</b>
Alonso, Thierry	2.3	Chaboyer, Wendy	3.1	Gress Halasz, Beata	<b>14.1</b>
Alves, Paulo	373	Chaboyer, Wendy	7.2	Guilin, Eugénie	2.3
Amado, João Costa	373	Chagnon, Grégory	2.3	Gunningberg, Lena	P42, 13.2
Antalová, Natália	<b>KS4.1</b>	Chalabalová, Zdeňka	P40	Gunningberg, Lena	KS5.1
Antalová, Natália	48, CS6	Charlton, Sarah	<b>P10</b>	Habáňová, Jana	P41
Antalová, Natália	P6	Chen, Yisha	<b>11.4</b>	Hajek, Michal	KS12.3, <b>KS12.1</b> , KS12.2
Anwar, Kiran	3.3	Chmelar, Dittmar	KS12.1	Hancock, Kate	<b>9.3</b>
Araujo, Eliana Pereira	P4	Chudoba, Adam	P41	Hansen, Britt	<b>6.3</b>
Avsar, Pinar	4.5	Ciprandi, Guido	<b>KS3.2, 395</b>	Hashemi, Hamid	P13
Avsar, Pinar	3.1	Cipriani, Paola	P14	Hauss, Armin	<b>P8, 9.2</b>
Avsar, Pinar	7.4	Coignard, Pauline	P29	Haxby, Richard	<b>PS44</b>
Avsar, Pinar	P7, 6.2, <b>4.5</b> , 5.2	Colboc, Hester	<b>P22</b>	Hayward, Vincent	11.4
Avsar, Pinar	<b>7.2</b>	Coleman, Susanne	1.1	Heemskerk, Hans	2.4
Avsar, Pinar	P11	Coleman, Susanne	187	Heikkilä, Anniina	5.5
Bääth, Carina	373	Coleman, Susanne	7.3, 13.2, <b>6.1</b> , <b>KS8.3</b>	Hilde, Beele	9.5
Bääth, Carina	KS5.1	Connesson, Nathanael	2.3, 11.1	Hofstetrova Knotkova, Michaela	<b>CS2, CS1</b>
Bader, Dan	12.1, 10.2, 10.4, 10.1	Coppin, Thierry	<b>P23</b>	Hokynkova, Alica	<b>P51</b>
Bader, Dan L.	12.3	Couch, Seana	12.3	Holst, Kristina	P34
Bahuon, Manuelle	2.3	Crunden, Ewa	7.3	Housley, Callum	<b>P45</b>
Bailet, Mathieu	11.2	Crunden, Ewa	<b>187</b>	Hoyo, Javier	1.3
Balzer, Katrin	<b>4.6</b>	Curley, Ger	3.1	Hultin, Lisa	P42, <b>13.2</b>
Balzer, Katrin	4.6	Curley, Gerard	1.4, 7.6, 5.2	Hwang, Ji Hyeon	4.1
Balzer, Katrin	1.1	Dähnert, Enrico	9.2	Ilisan, Alina	8.4
Barbieri, Beatriz	P4	Dane, Aaron	P43	Iyer, Vignesh	P34, <b>P43, P26</b> , <b>9.1</b> , 5.1
Barnes, Jo	P47	Davies, Philip	<b>P25</b>	Jang, Insil	4.1
Barrionuevo Moreno, Gabriela Sofia	P9, P48, 8.3, 8.4	Degerman, Marianne	<b>P24</b>	Jankovič, Tomáš	<b>P33</b>
Bassegoda, Arnau	1.3	Delalić, Đidi	<b>13.3</b>	Jarkovsky, Jiri	P37
Bechniková, Kristýna	<b>P31</b>	Dolanová, Dana	CS3	Jayabal, Hemalatha	<b>10.2</b>
Beeckman, Dimitri	8.2, 5.4, 9.5, <b>KS3.1</b>	Dolanová, Dana	CS5	Jayabal, Hemalatha	10.4
Beharková, Natália	<b>P40, P5</b>	Dózsa, Csaba	<b>KS4.2</b>	Jelínková, Zuzana	P51
Bettaglio, Lorella	P48, 8.3	Drexlerová, Blanka	P41	Jeon, Jeong Ran	<b>P32</b>
Biasci, Elena	P14	Dymarek, Robert	P2, P38, P16, <b>1.6</b> , P3	Johnson, Deanna	P19
Binkanan, Abdulaziz	<b>3.6, 6.4</b>	El Genedy-Kalyoncu, Monira	<b>1.5</b> , 13.1	Johnson, Simon	10.1
Björn, Catrine	KS5.1	El Genedy-Kalyoncu, Monira	4.6	Jones, Craig	P1
Bjurbo, Charlotte	<b>P42</b>	Elisei, Massimo	P14	Jouklová, Marie	8.5
Blomberg, Karin	5.4	Eri, Martina	PS52	Källman, Ulrika	<b>373</b>
Boersema, Christelle	<b>292</b>	Evans, Sam	2.1	Kapp, Suzanne	7.1
Bohbot, Serge	P22, <b>P20</b>	Evora, Ana	<b>10.1</b>	Karadağ, Ayiše	<b>3.3</b>
Boland, Fiona	7.2	Falk-Brynhildsen, Karin	5.4	Karlsson, Ann-Christin	13.2
Botma, Yvonne	292	Faltýnková, Zdeňka	KS11.1	Kearney, Cathal	1.4, 7.6, 5.2
Boyle, Colin	<b>1.2</b>	Fastner, Alexandra	<b>P8</b> , 1.5, 13.1	Keenan, Bethany	11.2, <b>2.1</b>
Budithi, Srinivasa Chakravarty	P13	Fastner, Alexandra	4.6	Kerdraon, Jacques	P29
Budri, Aglecia	4.5	Faust, Elizabeth	<b>4.4</b>	Kim, Jung Yoon	<b>P39</b>
Budri, Aglecia	3.1	Fernández-Sánchez, César	1.3	Kirkham, Jamie	1.1
Budri, Aglecia	P7, 6.2	Ferrerres Cabanes, Guillem	<b>1.3, 12.4</b>	Klugar, Miloslav	CS4, KS12.3, KS12.1, <b>KS12.2</b>
Bufalini, Erika	P14	Fleming, Rebecca	<b>8.6</b>	Klugarová, Jitka	CS4, <b>KS12.3</b> , KS12.1, KS12.2
Búřilová, Petra	<b>CS5</b>	Forfori, Francesco	P14	Kohutova, Marie	P35
Búřilová, Petra	CS3	Fougeron, Nolwenn	<b>2.3</b>	Kolářová, Lenka	<b>8.5</b>
Burns, Martin	<b>5.1</b>	Fox, Hana	1.2	Kolkova, Adela	P35
Busby, Jonathan	P34, P1	Foxell, Finn	12.3	Kopniak, Agnieszka	8.4
Busby, Jonathan	P36	Fray, Mike	P47	Kortteisto, Tiina	<b>5.5</b>
Byrne, Sorcha	<b>7.4</b>	Fremmelevholm, Aase	6.3	Kottner, Jan	4.6
Byrne, Sorcha	7.4	Freret, Izabel	P22	Kottner, Jan	1.1, P8, 1.5, 13.1, <b>KS1.1</b>
Caggiari, Silvia	<b>12.3</b> , 1.2	Fryer, Sarah	12.1		
Caggiari, Silvia	<b>12.1</b>	Galuzzi, Cristina	P9, P48, 8.3, 8.4		
Cai, Qiong	11.3	Garajová, Marie	P6		

Bold = Presenting author

Krticka, Milan	4.2	O'Connor, Tom	P7	Sim, Jenny	<b>5.3</b>
Krupova, Lenka	CS5	öhman, micalael	P24	Šimečková, Veronika	P6
Krupová, Lenka	<b>CS7, CS7</b>	Okereke, Ihuoma Rosemary	<b>P13</b>	Šimečková, Veronika	CS6
Kuberka, Izabela	<b>P16, 1.6, P3</b>	Orlov, Aleksei	<b>10.3</b>	Šimečková, Veronika	48
Kuberka, Izabela	P2, <b>P38</b>	Orsetti, Monia	P14	Sin, Petr	P51
Kubicová, Monika	<b>P12</b>	Özmen, Selahattin	3.3	Smet, Steven	<b>9.5</b>
Kučerová, Jana	CS3	Pasquinet, Laurent	2.3	Smith, Bill	P36
Kuiper, Jan	P13	Patten, Declan	9.6	Smith, Bill	<b>P34, P1</b>
Kunhartová, Věra	<b>KS11.1</b>	Patton, Declan	P7, 6.2, 7.4, 1.4, 3.1, 4.5, 7.2, 7.6, 5.2	Sobrin, Sylvia	9.3
Kůřil, Pavel	P15	Patton, Declan	P11	Soegaard, Knaerke	<b>P18, KS11.2</b>
Kůřil, Pavel	<b>P49, P50</b>	Payan, Yohan	2.3, 11.2, 11.1	Sollie, Martin	P18
Lagus, Heli	<b>KS5.3</b>	Pearce, Katie	PS44	Sopel, Mirosław	<b>P2, P38, P16,</b> 1.6, <b>P3</b>
Lakin, Elizabeth	PS44	Peltokoski, Jaana	5.5	Soppi, Esa	<b>P46</b>
Latimer, Sharon	4.5	Perez-Rafael, Silvia	12.4	Strnadová, Alice	<b>CS1</b>
Latimor, Sharon	7.2	Perrier, Antoine	2.3, 11.2	Štrombachová, Veronika	CS3
Lechner, Anna	1.1	Pesatori, Stefania	P14	Stryja, Jan	<b>CS4</b>
Ledger, Lisa	<b>5.6, KS7.2,</b> <b>KS8.2</b>	Phelan, Niamh	9.6	Sugrue, Claire	<b>P7</b>
Lee, Mi Ju	4.1	Piasentin, Nicola	<b>11.3</b>	Sullivan, Rhonda	P25
Leerskov Sorensen, Camilla	<b>KS3.3</b>	Pipe, Nicolas	12.3	Švecová, Tereza	48, CS6
Lemaire-Semail, Betty	10.5, 11.4	Pokorna, Andrea	CS2	Švecová, Tereza	P6
Lian, Guoping	11.3	Pokorna, Andrea	P40, P49, P50, P5, <b>P6, 14.1, 48,</b> CS1, CS4, <b>CS3,</b> CS7, KS12.3, CS6, CS5, KS12.1, KS12.2	Sving, Eva	<b>KS5.1</b>
Lloyd, Alex	P47	Pokorna, Andrea	KS4.1	Szczuka, Izabela	P3
Lorenzetti, Laura	P14	Pokorná, Andrea	P15	Taradaj, Jakub	P2, P38, P16, 1.6, P3
Löwenmark, Malin	13.2	Porter Armstrong, Alison	3.1	Tervo-Heikkinen, Tarja	5.5
Lucas, Linda	8.6	Porter-Armstrong, Alison	8.6	Thunborg, David	P42
Maggi, Federica	P48, 8.3	Posnett, John	5.1	Trebbi, Alessio	<b>11.2</b>
Mašek, Michal	P37, 4.2	Pospíšil, Michal	CS3	Tucker-Kellogg, Lisa	<b>2.4</b>
Masouros, Spyros	1.2	Pradal, Marilena	P14	Türkay, Metin	3.3
McEvoy, Natalie	3.1	Prado, Thais Paulino	P4	Turner, Abbie	12.3
McEvoy, Natalie	<b>1.4, 7.6, 5.2</b>	Precechtelova, Sylvie	<b>P41</b>	Twiddy, Maureen	6.1
Meacci, Elisabetta	P14	Pukiova, Irena	<b>P17</b>	Tzanov, Tzanko	12.4
Meaume, Sylvie	P22	Raepsaet, Charlotte	<b>8.2, 5.4</b>	Tzanov, Tzanko	1.3
Melo Lima, Maria Helena	<b>P4</b>	randová, kamila	48	Uccelli, Francesco	<b>P14</b>
Menšíková, Andrea	<b>P15, P49, P50</b>	Randová, Kamila	P6, CS6	Vaara, Miska	P30
Moore, David	3.1	Reed, Robyn	P19	Vacová, Andrea	P31
Moore, Zena	3.1	Riad, Abanoub	KS4.1	Valešová, Michaela	P41
Moore, Zena	4.5	Rice, John	3.1	Välimäki, Tarja	4.3
Moore, Zena	9.6	Robertson, Alex	<b>P47</b>	Vasickova, Lia	<b>P37, 4.2</b>
Moore, Zena	7.4	Rodrigues, Alexandre	<b>KS10.3</b>	Verhaeghe, Sofie	8.2
Moore, Zena	P11	Rohan, Pierre-Yves	11.1	Volmanen, Pia	<b>P30</b>
Moore, Zena	P7, 6.2, 1.4, <b>3.1,</b> 7.2, 7.6, 5.2	Roher, Robert	13.3	Völzer, Bettina	1.5, <b>13.1</b>
Mukhina, Ekaterina	<b>11.1</b>	Rosińczuk, Joanna	P16, 1.6, P3	Walewicz, Karolina	1.6
Mulder, Magda	292	Rosińczuk, Joanna	P2, P38	Walker, Rachel	7.2
Mullerova, Nina	CS2, CS1	Ručková, Alice	<b>P21</b>	Walker, Rachel	4.5
Mužík, Jan	CS3	Ruhland, Julia	9.2	Walsh, Simone	3.1
Mynářová, Martina	P5	Saibertová, Simona	P49, P50	Weihs, Daphne	<b>2.2</b>
Nardi, Katia	P14	Saibertová, Simona	P15	Wilson, Hannah	<b>6.2</b>
Nasir, N Jannah M	2.4	Saibertová, Simona	P40, P6, <b>48,</b> <b>CS6, CS5</b>	Wilson, Julie	8.6
Newton, David	<b>P36</b>	Sales de Castro, Elis Marina	<b>10.5</b>	Wilson, Pauline	<b>9.6, KS6.3</b>
Nie, Ann Marie	<b>P19</b>	Scateni, Monica	P14	Wood, Zoe	P43, P45, P26, 9.1
Nixon, Jane	1.1	Schoonhoven, Lisette	6.1	Worsley, Pete	187
Nixon, Jane	<b>379</b>	Schoonhoven, Lisette	187	Worsley, Peter	12.1, 10.2, <b>7.3,</b> 1.2, 10.4, 10.1
Nixon, Jane	6.1	Schoonhoven, Lisette	7.3	Worsley, Peter	12.3
No, Da Yeong	4.1	Šeflová, Lenka	<b>P35, P41, 9.4</b>	Yeo, Hyunjung	<b>4.1</b>
Nováková, Karolína	<b>9.4</b>	Serraes, Brecht	8.2	Ylitörmänen, Tuija	5.5
Nugent, Linda	4.5	Shorney, Richard H	P45	Zanchetta, Flávia Cristina	P4
Nugent, Linda	3.1	Siegelova, Jarmila	P37	Žilezinski, Max	9.2
O'Brien, Niall	4.5	Sill, Janna	4.6	Žulec, Mirna	<b>PS52</b>
O'Brien, Noreen	<b>P11</b>				
O'Connor, Tom	4.5				
O'Connor, Tom	3.1				
O'Connor, Tom	9.6				
O'Connor, Tom	7.4				
O'Connor, Tom	P11				