Meeting report: Are you doing everything possible to prevent pressure injury throughout the patient's hospital stay?

First symposium: Keith Harding, Joyce Black, Amit Gefen, Nick Santamaria

Second symposium: Paulo Alves, Nick Santamaria, Joyce Black, Norihoko Ohura, Tod Brindle, Chenel Trevellini

This meeting report summarises the proceedings of two symposia held at the World Union of Wound Healing Societies (WUWHS) congress in Florence, Italy (2016). The first symposium focused on the consensus of opinion on the role of dressings in protecting against pressure injury (PI) and provided guidance on how to implement changes in clinical practice in line with evidence-based consensus. The second symposium highlighted the importance of delivering optimal care to at-risk patients throughout their hospital stay.

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Setting the scene

Keith Harding opened the first symposium with a reminder that pressure injuries (PIs) *[Box 1]* pose multiple clinical, economic and patient-centric challenges. Fundamentally, there is a need to drive down their numbers, as reflected in numerous initiatives; for example, in the USA, there is no reimbursement for preventable complications[1], while in Japan, a regulatory system for the management of PIs was introduced in 2002, including interdisciplinary prevention teams, clinical protocols for management, and use of effective support surface systems for high-risk patients[2]. These strategies represent positive change; however, the prevalence and incidence of PIs are still considerable and this continues to be a problem for clinicians, payers and patients. Indeed, in a Welsh national wound care audit (n=8365) undertaken in 2015, PI point prevalence was 8.9%. Within this 8.9%, 18.2% had been incorrectly categorised and 10.9% had no record of site/source, while an additional 18.2% were non-recorded[3].

It has been claimed that 95% of PIs are preventable[4;5]. As such, there is a need to question why their frequency and severity are so high and focus on targeting initiatives towards prevention, to save money and healthcare professional time, but critically, to lesson patient suffering. Keith reminded the audience that, in order to achieve these goals, translation of research into practice is critical. In recent years, the use of prophylactic dressings as a component of PI prevention has been an important advance and is, therefore, the focus of this meeting report.

Box 1. Evolving terminology

The terminology is evolving to recognise that pressure damage does not always manifest as an open wound – and to emphasise their preventability. The term 'pressure injury' has been in use by the Pan Pacific Pressure Injury Alliance (PPPIA) and has recently been adopted by the National Pressure Ulcer Advisory Panel (NPUAP)[6].

The evidence

According to Joyce Black, using multilayer dressings with Safetac® adhesive technology (a gentle, effective skin contact layer) plays an important role in providing optimal microclimate management and a protective effect against mechanical forces associated with PI formation. The following sections present the scientific and clinical evidence supporting Mepilex® Border Heel and Mepilex® Border Sacrum. These dressings comprise the following components:

- Safetac skin contact layer, which does not inflict trauma to the skin on removal
- Three layers of thickness that redistribute pressure and enable inner layers to deform, dissipating shear
- A redistribution layer that supports the tissues, preventing stretch and tear in the patient's sliding direction
- An outer surface with a low coefficient of friction, which allows evaporation for optimal microclimate[7].

Scientific evidence

The scientific rationale for these dressings was presented by Amit Gefen. He explained how finite element modelling (FEM) can be used to calculate internal mechanical loads

Table 1. Clinical evidence in support of multilayer foam dressings with Safetac for PI prevention.	
Clinical practice guidelines	The NPUAP, EPUAP, PPPIA (2014) guidelines advocate the use of polyurethane foam dressings over bony prominences to prevent PI. There are many types of polyurethane dressing available and often a lack of clarity around dressing structure, while not all cited studies evaluate polyutherane foam. It is vital to know how specific dressings work and if they can reduce pressure/shear and influence microclimate. Moreover, prophylactic dressings should be used in addition to (not instead of) standard preventive measure[8]
Systematic reviews	Moore and Webster[9] reported that the use of prophylactic dressings over bony prominences reduced the relative risk of PIs by 0.21 (p=0.0006); similar results were reported by Clark et al[10]. More evidence is needed on quality of life and comparison between different dressings
Randomised controlled trials (RCTs)	Results from three RCTs showed just 6 of 371 patients assigned to the prophylactic dressing developed PIs, compared with 30 of 361 patients who were not assigned to the dressing[11–13]
Non- RCTs (with concurrent controls)	Results from six non-RCTs with concurrent controls (in ICU or general care) showed 6 of 137 patients assigned to the prophylactic dressing developed PIs, while 67 of 392 patients not assigned to dressings developed PIs[14–19]
Non-RCTs without concurrent controls	21 studies are available for multilayer foam dressings with Safetac, predominantly involving patients in ICU[20]

Key: ED = Emergency Department; ICU = Intensive Care Unit; OR = Operating Room

(e.g. deformations) in structures with complex shapes and multiple materials[7]. Since most serious PIs are deep tissue injuries that develop internally, FEM can be used to create a map of how mechanical forces develop in the tissues, with mattresses and dressings added to represent real-world scenarios.

FEM has been used extensively across different medical fields, including recently to examine the efficacy of the multilayer prophylactic dressing Mepilex Border Heel[7], comparing compressive strain and maximal shear in soft tissues with the dressing on versus off. With the dressing on, internal mechanical loads were reduced substantially, including shear in the deep tissues. In comparison, individual pieces of foam cannot provide the same efficacy; the multilayer structure of Mepilex Border Heel allows the shear (deformation) to be taken by the dressing rather than the tissue, which does not happen with a single-layer dressing. Mepilex Border Sacrum is currently being tested in a similar fashion and findings to date are consistent with those reported for Mepilex Border Heel[21]. At the start and end of the first session, attendees were asked to vote on whether they believed multilayer foam dressings could redistribute pressure, minimise shear forces, reduce friction and manage microclimate. *Figure 1* gives the percentage of audience members answering 'highly agree' at the beginning and end of the session. After the session had taken place, attendees were more convinced of the benefits to be derived from prophylactic dressings in the setting of PI prevention.

Clinical evidence

Joyce Black went on to present clinical data in support of multilayer foam dressings, stressing the significance of the recently updated EPUAP, NPUAP and PPPIA Clinical Practice Guidelines, advocating that clinicians consider applying a polyutherane foam dressing to bony prominences for the prevention of PI: "Consider applying a polyurethane foam dressing to bony prominences (e.g. heel, sacrum) for the prevention of PI in anatomical areas frequently subjected to friction or shear[8]." To date, the largest, most consistent clinical evidence base for any wound dressing for PI prevention is for multilayer foam dressings with Safetac *[Table 1]*, with both clinically and statistically significant reductions in PI rates reported in

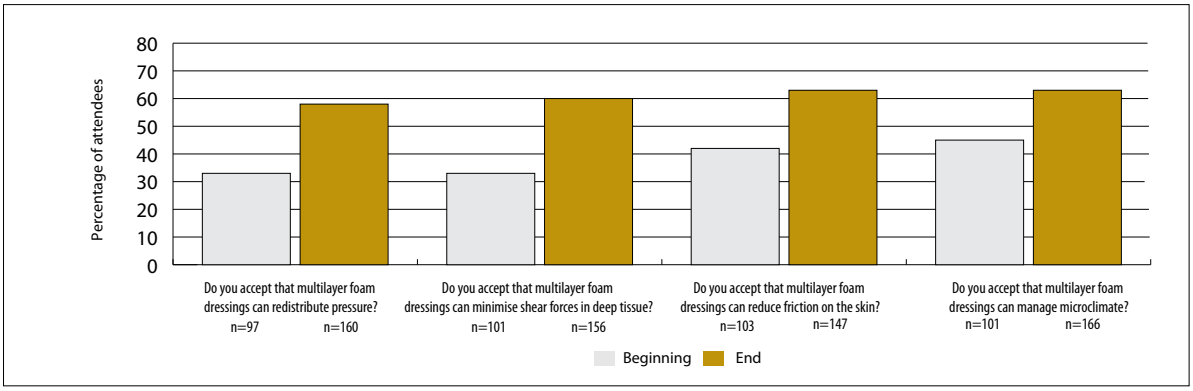

Figure 1. Percentage of audience answering 'highly agree' at the beginning and end of the symposium in regards to whether multilayer foam dressings can redistribute pressure, minimise shear forces, reduce friction and manage microclimate.

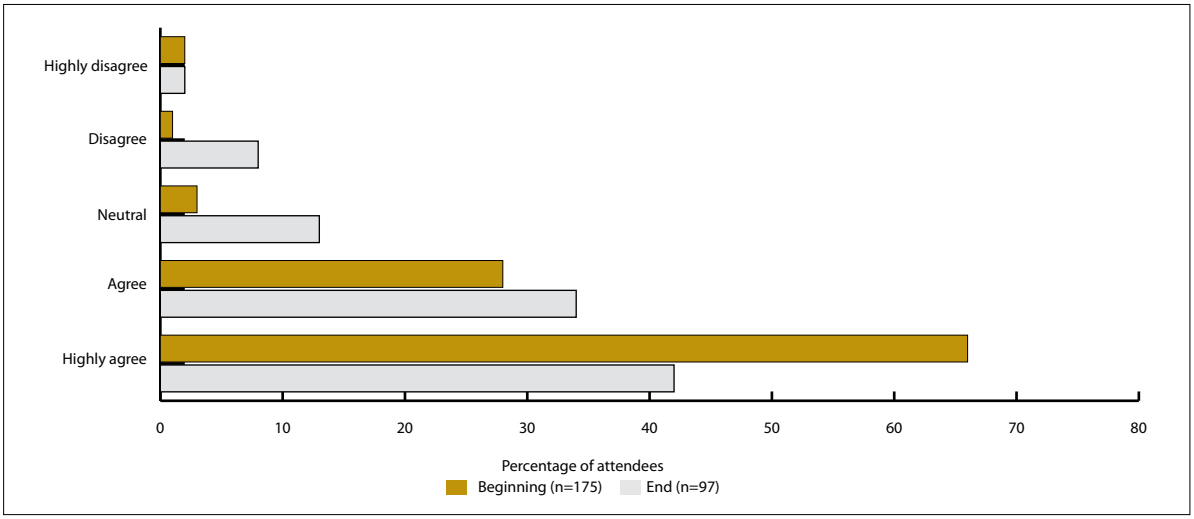

Figure 2. Degree of acceptance that multilayer foam dressings (in conjunction with standard preventative protocols) can reduce the occurrence of PIs.

numerous studies. *Figure 2* shows the results of an audience vote on whether multilayer foam dressings (in conjunction with standard preventative protocols) could reduce PI occurrence; the outcome correlates with the data shown in *Figure 1*.

Changing practice

The evidence strongly supports use of prophylactic dressings to reduce the risk of PI. However, as highlighted by Nick Santamaria, the key challenge in prevention is to ensure changes are implemented into routine clinical practice. Organisations must be able to show the need for change (i.e. incidence and prevalence of PIs within a facility), the effectiveness of proposed interventions (only clinically proven prophylactic dressings will ensure expected clinical and financial outcomes; it would be wrong to assume that all dressings will show the same results) and any savings that might result from the change. They must also have a clear plan for implementation, covering staff education, infrastructure support, and organisation-wide monitoring and evaluation.

Santamaria et al[11;22] undertook a randomised controlled trial (n=440) to ensure there was strong evidence to support the effectiveness of introducing the Mepilex Border Sacrum/Heel dressings to their PI prevention protocol. During the study, pressure ulcer rates reduced from 13.1% to 3%. Moreover, it was found that 3.6 times more would have been spent on PIs if the dressing had not been used *[Table 2]*.

Transformation of hospital policy was needed to ensure these benefits could be realised more widely, so the following changes were introduced, supporting a decrease in PI numbers and point prevalence[23]:

- All patients assessed as "high risk" for PI development, and patients with peripheral vascular disease, neuropathic/neuroishaemic foot disease or having major surgery, had Mepilex Border Sacrum/Heel applied on admission
- All patients had a risk assessment undertaken and documented within 4 hours of admission
- Appropriate interventions based on risk level were implemented and documented:
  - Repositioning schedule
  - Surfaces
  - Referrals
- Mandatory education was implemented for all clinical staff, including annual online training relating to PI prevention
- Every ward had an allocated wound resource nurse who assessed whether the policy was being adequately implemented
- Communications were colour-coded orange to match national policy and a local pressure injury prevention slogan was developed (Check, Detect, Act), which was used in all PI prevention documents
- Adhesive labels were added to patient histories to support clinical coders.

Figure 3 demonstrates the audience's acceptance that multilayer dressings for prevention of PI are a cost-effective option.

Preventing pressure injury throughout the hospital stay

Paulo Alves opened the second symposia by reminding the audience that success of prevention programmes depends on an

Table 2: Cost benefits of Mepilex Border dressing in the prevention of hospital-acquired PIs[23]		
Cost components	**Control (n=152)**	**Intervention (n=161)**
Average treatment costs per pressure injury	$1103.52	$1103.52
Weighted average treatment costs	$144.56	$34.21
Average marginal costs	-	$46.45
Total average costs per patient	$144.56	$80.66
Total costs per group	$25,173.20	$6,920.20

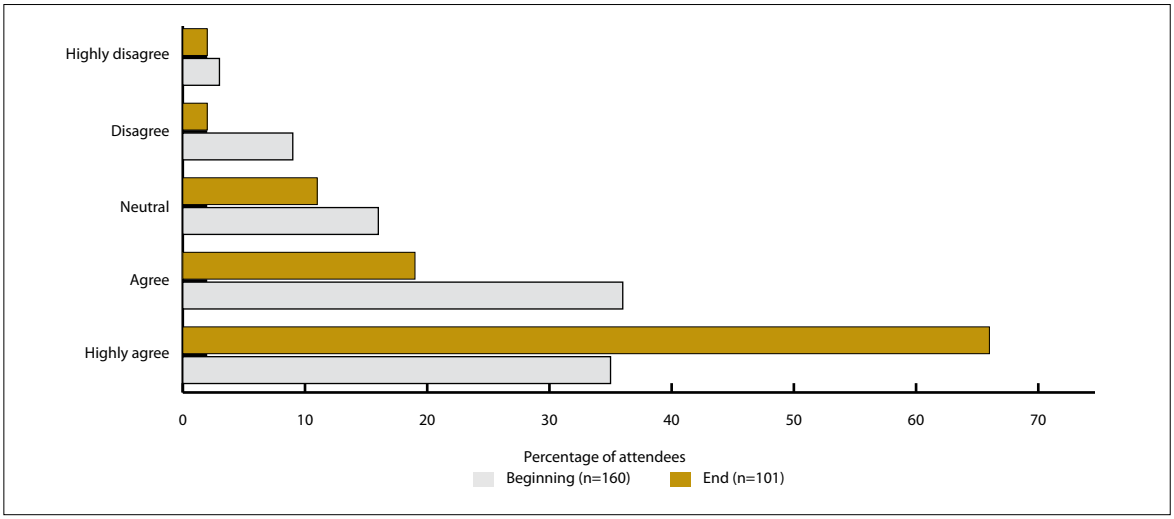

Figure 3. Degree of acceptance that using multilayer dressings for prevention of PIs is cost-effective.

understanding that different patients in different hospital settings can have very different needs. As soon as patients are admitted to hospital, risk assessments should be undertaken to identify susceptibility to PI and allow implementation of preventive interventions for the duration of the hospital stay, with awareness of evidence-based practices being instilled through staff education. Everything possible should be done to prevent PI in patient populations and/or those in specific clinical settings regarded as being at a relatively high risk; for example, bariatric, critically ill, older or paediatric patients; individuals in the operating room (OR); patients with spinal cord injuries; and patients in palliative care.

Emergency department

Nick Santamaria began by discussing issues in the emergency department (ED). Clinicians must consider prevention as soon as the patient arrives at the ED, despite the competing priorities for care. Many patients will have developed pre-admission hypotension or will have experienced entrapment (i.e. in a vehicle). The average stay in the ED is 6 hours, which is a long time for a hypotensive patient to be on an unsuitable mattress, and this is worsened if followed by a long surgical procedure. As such, patients should be rapidly triaged for risk, which can be done using a modified Braden scale (i.e. a cut-down version allowing the process to be commenced quickly), and appropriate prophylactic dressings should be applied as soon as possible. The use of Mepilex Border dressings is supported by strong evidence in this setting:

- Border I RCT – in 440 trauma and critically ill patients, PI incidence decreased from 13% to 3% (Mepilex Border Heel and Mepilex Border Sacrum applied in the ED)[11]
- Border II prospective cohort study – in 300 trauma and critically ill patients, PI was completely eliminated in individuals who had Mepilex Border Heel applied in the ED[24]
- Risk of PI was 4-5 times greater where Mepilex Border Sacrum dressings were not applied in the ED[12].

Operating room

Joyce Black and Norihoko Ohura moved on to discuss risk factors and prevention strategies for PI in the OR. Specific risk factors in this setting include: the comorbid state of the patient; the amount of time spent on the operating table; extracorporeal circulation; hypothermia;

transfusion; the type of surgery (e.g. cardiac, neurosurgery, head and neck, orthopaedic); and the patient's position (i.e. which part of the anatomy is loaded). Diffulties may arise since the Braden scale cannot be used to predict PI in the OR, the Munro scale (which can be used to assess patients before, during and after surgery) has not been validated, and staff do not necessarily see PIs in the OR as they tend to manifest later. When Bulfone (2012)[25] evaluated 102 consecutive surgical patients (85 supine; 8 prone; 6 lateral; 2 kneeling; 1 lithomy) who underwent various types of surgery (5 cardiac; 4 general; 2 neurosurgery; 2 vascular), 12.7% (13/102) developed a PI (2 sacrum; 2 face; 7 forearms, knees, heels, breasts, ears), while 2.9% (3/102) were repositioned (prone and lithotomy into supine position).

There are a number of prevention strategies that can be implemented before, during or after surgery:

- Examine the skin for existing wounds
- Dress sacral or heel areas (depending on position) with prophylactic dressings
- Dress anterior surfaces (in prone cases) with prophylactic dressings
- Use fixed position devices effectively – protect with prophylactic dressings, remembering these do not work in isolation
- Maintain appropriate microclimate
- Add overlay to bed/or table
- Relieve areas that have been under pressure
- Turn the patient to offload areas that have been under pressure
- Examine skin for the following 72 hours.

Evidence supports the use of Mepilex Border dressings in the OR. In 71 supine cases assigned to prophylactic dressings plus standard preventive care, there were 0 PIs, compared with 16.7% in a historical control group receiving standard preventive care only. In 104 prone (spinal fusion) cases, 12 of 114 patients receiving just standard preventive care developed PIs, while 0 of 104 patients assigned to prophylactic dressings plus standard preventive care developed a PI (p=0.0319)[19]. Further evidence comes from the BOSS (Border Operating Room Spinal Surgery) trial – a dual-centre, open-label comparison sham study – comparing the development of intra-operative PIs on the left and right sides of the same patient. Mepilex Border dressings and film dressings were applied to the left and right sides of the chest and iliac crest, respectively. Three (3.0%) PIs occured to the left side of the chest (treated with Mepilex Border), while 11 (11.0%) occurred on the right side of the chest (film dressing) (p=0.027). No PIs were observed on the iliac crest in either group[26].

Intensive care unit

Finally, Tod Brindle highlighted the unpredictable nature of the intensive care unit (ICU) and the requirement for a 'culture' of prevention that is needed from the top-down. In the ICU, PI prevention must happen seamlessly and vigilantly throughout the whole day, since patients tend to be at particularly high risk for a number of reasons: hidden pathophysiologies; immobility and inability to adhere to a 2-hour turning schedule; hypotension and vasopressor use; poor positioning and equipment; invasive procedures; and conflicting priorities that mean interventions cannot be put in place. It is important to assess for small changes in clinical condition that may precede changes visible at the skin surface, and to carefully consider when patients need boots or dressings applied. A total solution for prevention is required that is ready to go as soon as the patient is admitted:

- Skin care: cleanse, moisturise, protect, repair
- Appropriate surface
- Regular turning and positioning schedule – need to consider in-bed and chair positioning
- Occiput: Redistribute pressure by increasing surface area (e.g. Z-flo fluidised positioner)
- Heels: float, boots, dressings (e.g. Mepilex Border Heel)
- Sacrum: Proper offloading, prophylactic dressings (e.g. Mepilex Border Sacrum)
- Documentation, data collection and accountability
- Specialty beds – such as for bariatric patients who can be difficult to reposition and protect from injury.

Positioning for better outcomes

Chenel Trevellini closed the symposium by discussing the importance of offering caregivers a method of turning and positioning patients that maximises ergonomic efficiency and promotes proper body mechanics. She described how a 300+ bed acute care hospital identified patient-

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lifting-related staff injuries as a key problem. In 2012, there were 85 incidents related to patient handling, 31 involving claims. In January 2013, the Tortoise single-patient-use overlay turning, positioning and offloading system was successfully piloted, then implemented across inpatient units. In 2013, incidents and claims related to patient handling were reduced by 55% compared with 2012, resulting in approximately $222K cost avoidance. The 2013 bed rental usage was decreased by 66% compared with 2012, resulting in $58K cost savings. This $42K investment successfully reduced patient handling injuries[27;28].

Conclusion

It is well recognised that the development of a PI can change patients' lives forever. It is the duty of healthcare professionals and providers to do everything in their power to prevent PIs from the moment patients are admitted to the point at which they are discharged from hospital.

References

1. Armstrong D, Ayello E, Leask K. Opportunities to improve pressure ulcer prevention and treatment: implications of the CMS inpatient hospital care present on admission (POA) indicators/ hospital-acquired conditions (HAC) policy 2005; Available from: http://www.medscape.com/viewarticle/581767_1 (accessed 11.11.16)
2. Igarashi A, Yamamoto-Mitani N, Gushiken Y et al. Prevalence and incidence of pressure ulcers in Japanese long-term hospitals. *Arch Gerontol Geriatr* 2013; 56(1): 220–6
3. Phillips C, Humphreys I, Fletcher J, et al. Estimating the costs associated with the management of patients with chronic wounds using linked routine data. *Int Wound J* 2016; 13:1193–1197
4. Hibbs PJ. Economic benefits of a prevention plan for pressure sores. 4th National Pressure Sore Symposium, Bath: April 1988
5. Hibbs PJ. The past politics of pressure sores. *J Tissue Viability* 1998; 8(4): 14–5
6. World Union of Wound Healing Societies Consensus Document. *Role of dressings in pressure ulcer prevention* 2016; Wounds International, London. Available at: http://www.woundsinternational.com/wuwhs/view/consensus-document-role-of-dressings-in-pressure-ulcer-prevention (accessed 28.11.2016)
7. Levy A, Ben-Or Frank M, Gefen A. The biomechanical efficacy of dressings in preventing heel ulcers. J Tissue Viability 2015;24(1):1-11
8. National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific Pressure Injury Alliance. *Prevention and Treatment of Pressure Ulcers: Clinical Practice Guideline*. Haesler, E. (Ed) 2014; Cambridge Media: Perth, Australia
9. Moore Z, Webster J. Dressings and topical agents for preventing pressure ulcers. Cochrane Database Syst Rev 2013; 18(8): CD009362
10. Clark M, Black J, Alves P et al. Systematic review of the use of prophylactic dressings in the prevention of pressure ulcers. *Int Wound J* 2014; 11(5): 460–71
11. Santamaria N, Gerdtz M, Sage S et al. A randomised controlled trial of the effectiveness of soft silicone multi-layered foam dressings in the prevention of sacral and heel pressure ulcers in trauma and critically ill patients: the border trial. *Int Wound J* 2015; 12(3): 302–8
12. Kalowes P, Messina V, Li M. Five-layered soft silicone foam dressing to prevent pressure ulcers in the intensive care unit. *American Journal of Critical Care* 2016 25(6): e108–e19
13. Qiuli B, Qiongyu J. Observation on effect of Mepilex on the prevention and treatment of pressure sores. *Chinese Journal of Medical Nursing,* 2010
14. Thul J, Valero E. Sacral pressure ulcer prevention in trauma patients. Poster presentation at Wound Ostomy and Continence Nurses' Society conference, San Antonio, Texas, US, June 2015
15. Park KH. The effect of a silicone border foam dressing for prevention of pressure ulcers and incontinence associated dermatitis in intensive care unit patients. *J Wound Ostomy and Continence Nurs* 2014; 41(5): 424–9
16. Brindle CT, Wegelin JA. Prophylactic dressing application to reduce pressure ulcer formation in cardiac surgery patients. *J Wound Ostomy and Continence Nurs* 2012; 39(2): 133–42
17. Cubit K, McNally B, Lopez V. Taking the pressure off in the Emergency Department: evaluation of the prophylactic application of a low shear, soft silicon sacral dressing on high risk medical patients. *Int Wound J* 2013; 10(5): 579–84
18. Brindle CT. Outliers to the Braden Scale: identifying high-risk ICU patients and the results of prophylactic dressing use. *World Council of Enterostomal Therapists' Journal* 2010; 30(1): 11–8
19. Castelino I, Mercer D, Forrest Calland J. Reducing peri-operative pressure ulcers in thoracic, cardiovascular, and spinal surgery patients: achieving zero incidence is possible! Poster presentation at the Symposium on Advanced Wound Care (Spring), Atlanta, Georgia, US, April 2012
20. Levy A, Gefen J. Computer modeling studies to assess whether a prophylactic dressing reduces the risk for deep tissue injury in the heels of supine patients with diabetes. *Ostomy Wound Management* 2016, 62: 42-52
21. Gefen A. Sustained tissue deformations cause cell perforations: deep tissue injury in a nutshell. Oral presentation at World Union of Wound Healing Societies Conference, Florence, Italy, September 2016
22. Santamaria N, Gerdtz M, Sage S, et al .The cost-benefit of using soft silicone multi-layered foam dressings to prevent sacral and heel pressure ulcers in trauma and critically ill patients: a within-trial analysis of the Border Trial. *Int Wound J* 2015 12(3): 344–350
23. Santamaria N, O'Neil S, McCann J, Morrow F, Smith K, Rakis S, Ng AW, Tudor H, Sage S, Liu W. Clinical innovation: results from a five year pressure ulcer prevention project in an Australian university hospital. *Wounds Int*2015 6(3): 6–10
24. Santamaria N, Liu W, Gerdtz M, et al. Clinical effectiveness of a silicone foam heel dressing in the prevention of heel pressure ulcers in critically ill patients: The Border II Trial. *J Wound Care* 2015 24(8): 1-5
25. Bulfone G, Marzoli I, Quattrin R, et al. A longitudinal study of the incidence of pressure sores and the associated risks and strategies adopted in Italian operating theatres. *J Perioper Pract* 2012 Feb; 22(2): 50-6
26. Yoshimura M, Ohura N, Tanaka J, et al. The effectiveness of soft silicone multi-layered foam dressings for preventing intraoperatively acquired pressure ulcers in spine surgery patients: the Border Operating room Spine Surgery (BOSS) trial in Japan. Poster presentation at the 5th Congress of the World Union of Wound Healing Societies, Florence, Italy, May 2016
27. Trevellini C. Position for better outcomes with new fluidized technology. Oral presentation at Wound Ostomy and Continence Nurses Society and Canadian Association for Enterostomal Therapy Joint Conference, Montreal, Canada, June 2016
28. WOCN Society. *Wound, Ostomy, and Continence Nursing Scope & Standards of Practice*. 2016. Available at: https://www.osha.gov/dsg/hospitals/documents/1.1_Data_highlights_508 (accessed 6.21.2014)