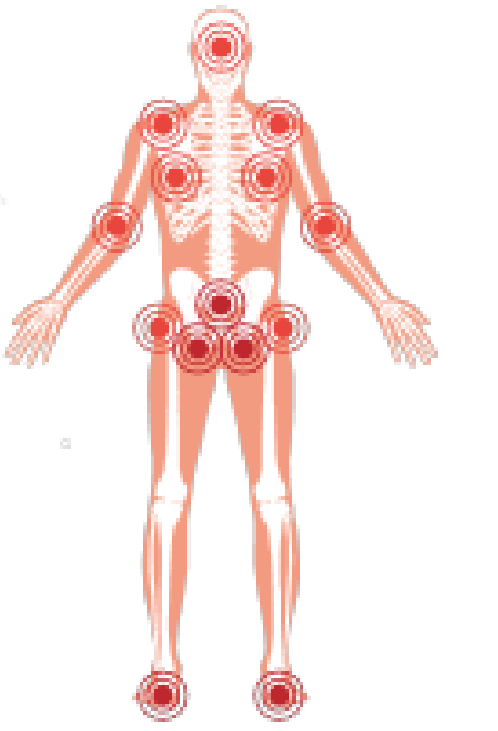




Pressure Ulcer Management—Getting Smarter

The emerging use of technology in pressure ulcer prevention and intervention

Dr Mark Bowtell, Dr Lorna Tasker, Rehabilitation Engineering Unit, Swansea



INTRODUCTION — The Pressure Problem

The aetiology and prevention of pressure ulcers are well understood amongst nursing professionals and those that work in the field of seating and posture. Despite this, and a strong evidence base for prevention^{1,2}, thousands of people develop pressure ulcers every year in the UK; whether in or out of hospital; whether elderly in care home or young and active wheelchair user. Pressure ulcers are commonly referred to as preventable, yet they cost the NHS in excess of £2 billion per year^{3,4}.

SUMMARY This poster presents current directions in the field of pressure ulcer prevention and intervention, particularly focusing on the use of technology to increase availability and affordability of tools key in reducing the impact of pressure ulcers; on healthcare systems and the lives of those at risk.

TECHNOLOGIES

A. Smart support surfaces

Sensor-integrated support surfaces - Thin and flexible sensing technology is allowing manufacturer's to consider 'smart cushions' (or other surfaces) with integrated sensors. Coupled with the cheaper, more accessible ability to send/receive data to auxiliary storage devices, and to power such sensors, the technology is there to empower the patient to feel by proxy; a form of **alternative or augmentative sensation**.

Clinical Benefits — Provide early warning when pressure and/or time increase beyond set thresholds. Can be used as an active, sensor-led movement reminder to redistribute weight or relieve pressure completely. Integration with smart phones would be powerful to log and view loading/pressure history.

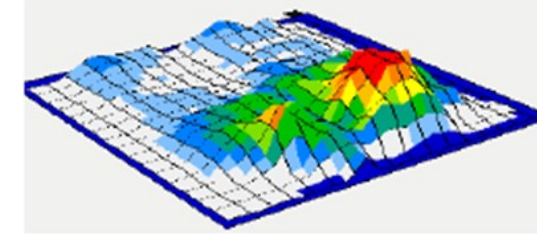
Air cushion pressure monitoring - 270 air-cell-based cushions are issued per year to highly vulnerable patients by the wheelchair service in South Wales (local audit). These high-end cushions are prone to faults in set-up and in air leakage which can result in them becoming ineffective or unsafe. Current set-up involves a hand check, is subjective and void of measurement⁵.

PUPIS — patients on these cushions have seen great benefit but report they feel vulnerable without knowing when it is set up optimally.

Clinical Benefits — **User confidence**; Less incorrectly set-up or faulty equipment in use; Reduce home visits/reliance on professionals.

B. Flexible pressure sensing mats/covers

Development in flexible sensing materials is allowing for more **representative mapping of interface pressure**. As cost reduces, systems may become more available for day-to-day use by patients, perhaps integrated with cushion covers or sheets.



C. Movement monitors/Reminders The time for which tissue is loaded is just as important as the pressure experienced. Monitoring/reminding tools may be powerful in limiting the **length of time a person spends in one position** by promoting mobility and/or repositioning⁶. These tools help people who are reliant on others to reposition, who have a tendency to forget to move, or have limited awareness. Most likely utilised in a care home or hospital environment.



D. Mobile technology — Education, Engagement, Empowerment

Mobile technology is set to meet the challenge of increasing awareness in at-risk individuals as well as **empowering** them, their family and support staff through tailored, practical education⁷. Streamlined logging and sharing of data might further allow **personal risk recording** of wound progression and related activity/events. The widespread accessibility of powerful mobile devices limits barriers in reaching a wide range of individuals with smart, interactive education.



E. Wound imaging Three-dimensional image capture has become popular in many different formats for different applications⁸. As this technology becomes more widely attainable, the **consistency and reliability of tracking wound** status might be greatly improved⁹.

F. Remote consultation through 'Tele-Rehab' brings opportunities to increase **efficiency and accessibility of specialist services**¹⁰. Its use is likely to be particularly key in pressure ulcer prevention as we meet the **increasing demand of our growing and aging population**.



EXAMPLES

ROHO Smart Check (A) <https://roho.com/smartcheck/>

Indicates when cushions internal pressure is within a set range (defined for size of cushion, calculated on generic algorithm considering expected body weight and anatomy). Individual set-up option — Clinician can set patient-specific minimum pressure (which then defines a smaller range)

PUPIS — local reliability and usability evaluation

Similar systems:

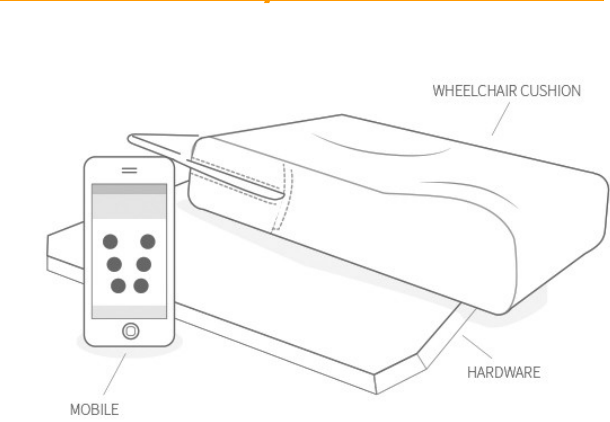
SYSTAM PolyAir — 1-6 scale of pressure; Advises to set to number corresponding to height and weight

WINNCARE Kineris — Analogue Manometer; Advises best pressure level (30-57 mmHg) based on height and weight



Sensimat (A,C) www.sensimatsystems.com/

Cushion integrated sensors track pressure
Bluetooth interface to mobile device
Reminders; analyse



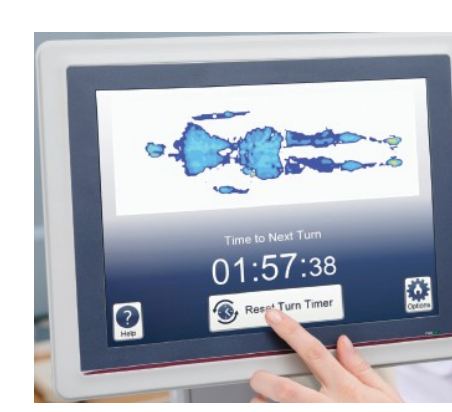
Mobility monitor (Compliant Concepts) (C) www.compliant-concept.ch/en/monitoring-systems

Record/analyse mobility
Alarm for repositioning
Adjustable tolerance



ForeSite Patient Turn System (XSensor) (B,C) www.xsensor.com/foresite

Flexible, fitted mattress cover with embedded sensors
Continual real-time imagery
Informs care decisions



Boditrak (FSA, Vista Medical) (B) www.boditrak.com/

Flexible pressure measurement system.
- Breathable, stretchable fabric

PUPIS - have found great advantage upgrading to a system which contours more closely to the body interface, reducing errors from hammocking and creasing.

TexiSense (B) www.taxisense.com

Long-term pressure measurement (sitting)
Option integral with cover

Sidhil M.A.P. (B,C) www.sidhil.com/map/

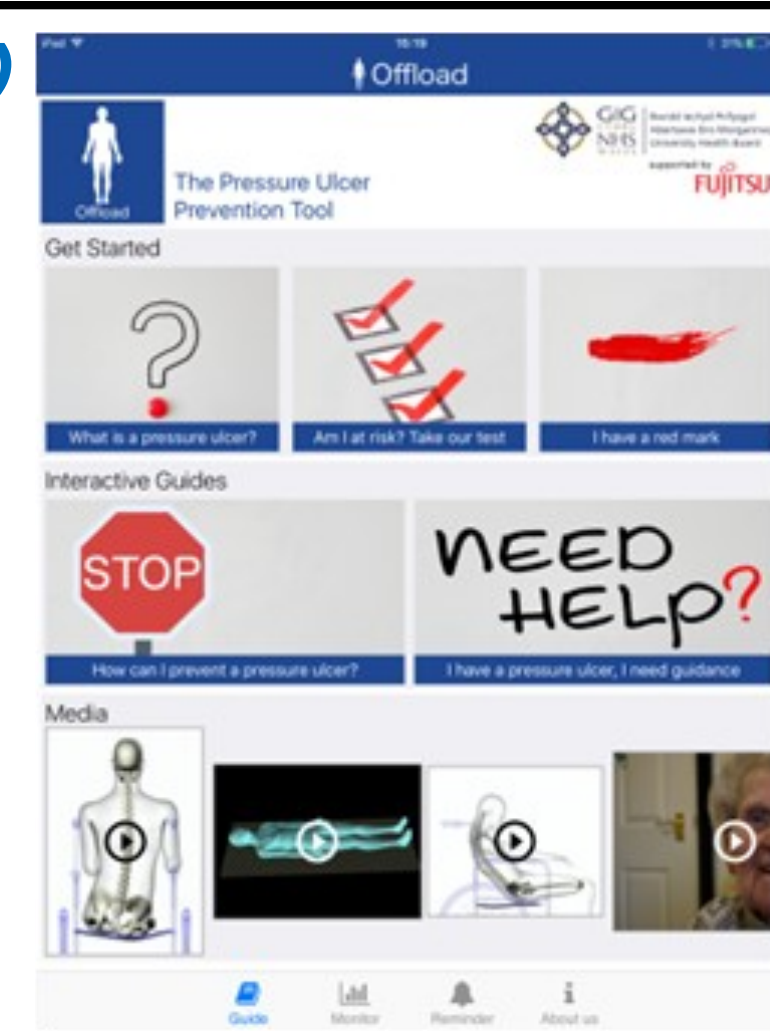
Continuous, real-life bedside pressure monitoring tool
Flexible, bed-size mat
Set repositioning schedule; alerts
Touch-screen interface, stand-alone



OFFLOAD mobile/tablet app (C,D)

In development by PUPIS and Fujitsu, as a nursing, carer and patient tool:

- Interactive education guides
- Movement reminders
- Wound/risk monitoring
- Film: patient stories



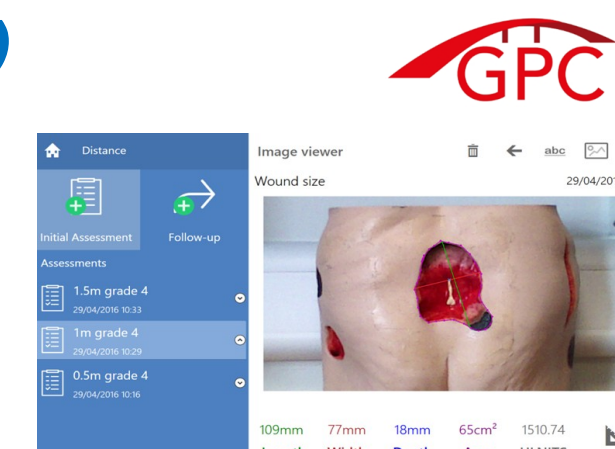
Other mobile apps

- Pressure Ulcer Prevention (PUP) (Andre Clark)
- Waterlow Score App (Mayflower Medical Supplies)
- Pressure Ulcer Guide (Mölnlycke Health Care)
- App to Care (Care of Sweden)
- PU info (Bucks New University)
- Pressure ulcer e-learning (3M)
- Pressure Ulcers (Patient Data Science)
- Pocket Guide to Pressure Ulcers (JM Levine)

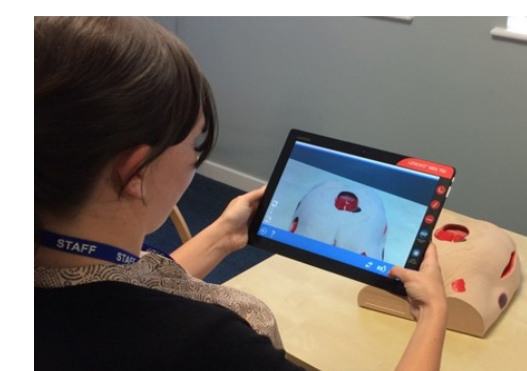
GPC Woundcare app (E, F) <http://gpccsl.com/wound-care/>

3D Intel® RealSense™ camera

- Simple, accurate, repeatable
- Non-specialist equipment
- Remote support to community staff



PUPIS — technical, clinical and usability evaluation; assisting development led by GPC solutions.



Eykona (E) www.fuel-3d.com/eykona/

Stand-alone device for measurement of wound parameters (wound length, width, depth, area, volume, colour)

PUPIS — evaluation study testing the accuracy of parameters and tested for feasibility of use within the service⁸.



Technology in research — Focus of this poster has been those technologies which promote direct patient benefit. There is, however, a wealth of research informing clinical practice capitalising on advancements in sensing, imaging and computing power. Examples include seated MRI and finite element modelling¹¹.

Technology in product evaluation — The question of how good is a cushion/mattress is one with many factors, and depends completely on the specific user requirements. Tools to support the objective classification of support surfaces, and judgement of suitability are key to assisting patients and their supporting professionals to make the right choices, reducing risk and ongoing cost. PUPIS is active in providing evaluations of cushions and mattresses for local services using current methods.

DISCUSSION The availability and affordability of mobile technology promises to improve the **efficiency, consistency and scalability of pressure ulcer prevention and intervention**. Sensor technology is redefining risk reduction through monitoring and smart sensing of support surfaces. Advancements in 3D image capture and data sharing are set to provide much needed wound tracking potential. Might these advances empower the at-risk individual, their loved ones and support staff; and ultimately change the face of pressure ulcer prevalence? Crucial is the extent to which developments are **reliable, robust, usable and universal**, for which **independent, clinical evaluation** is paramount.

References: **1)** NICE. *Pressure ulcers: prevention and management. Guidance and guidelines*. National Institute for Health and Care Excellence. **2)** EPUAP. *Prevention and Treatment of Pressure Ulcers: Quick Reference Guide*. European Pressure Ulcer Advisory Panel, 2014. **3)** Posnett, J. & Franks, P. J. *The costs of skin breakdown and ulceration in the UK*. Skin Breakdown – the silent epidemic. The Smith and Nephew Foundation, 2007. **4)** Bennett, G., Dealey, C. and Posnett, J. *The cost of pressure ulcers in the UK*. Age Ageing 2004 **5)** Andreasen J., et al. *Is a computer-based measurement method superior to a recommended manual method by the ROHO? Group to assess pressure in the sitting position?* Australian Occupational Therapy Journal 2013. **6)** Koopman, E. *Correlation between electronically generated nurse feedback and the frequency of position changes*. European Pressure Ulcer Advisory Panel (EPUAP). 2014. **7)** West, D. *How mobile devices are transforming healthcare*. Issues Technol. Innov. 2012. **8)** Hadley, Z. *Evaluation of the Eykona Wound Measurement System*. Unpublished MSc dissertation. Cardiff University. 2015. **9)** Rodrigues, J., Pedro, L. and Vardasca, T. *Mobile health platform for pressure ulcer monitoring with electronic health record integration*. Health Informatics. 2013. **10)** Tasker L., et al. *Use of Telerehabilitation to Improve Access to Specialist Services for Multiple Sclerosis Patients*. Poster presented at ABMU Health Board Therapies and Health Conference 2014. **11)** Levy A, Kopplin K, Gefen A. *An air-cell-based cushion for pressure ulcer protection remarkably reduces tissue stresses in the seated buttocks with respect to foams: finite element studies*. Journal of tissue viability. 2014

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Pressure Ulcer Prevention and Intervention Service (PUPIS)

PUPIS is an award-winning, collaborative team which sees in excess of 250 complex pressure ulcers per year. Consisting of nurse specialists, rehabilitation engineers and clinical scientists it adopts a truly multidisciplinary and holistic approach to ulcer management



GIG CYMRU NHS WALES
Bwrdd Iechyd Prifysgol Abertawe Bro Morgannwg University Health Board