EPUAP CURRICULUM VITAE

Name Silvia Caggiari

Work Title Post Doctoral Research Fellow

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Year of joining EPUAP 2016

Relevant publications for the last two years (in English only):

Caggiari, S. et al., 2023 Optimisation of spa□al and temporal configuration of a pressure sensing array to predict posture and mobility in lying. Sensors. 23, 15, p. 6872 11 p., 6872.

Caggiari, S., et al., 2023, Retrospective evaluation of factors affecting successful fit testing of respiratory protective equipment during the early phase of COVID-19. BMJ Open. 13, 5, p. e065068 8.

Valenza A., et al., 2023 Thermal modulation of skin friction at the finger pad. Journal of the Mechanical Behaviour of Biomedical Materials. 146, 8 p., 106072.

Caggiari, S., et al., 2022 A combined imaging, deformation and registration methodology for predicting respirator fiting. PLoS ONE, 17 (11)

Moore Z., et al., 2022 A systematic review of movement monitoring devices to aid the Prediction of pressure ulcers in at-risk adults. Int Wound J.

Caggiari, S, et al., 2022, Biomechanical and physiological evaluation of respiratory protective equipment application. Medical Devices Evidence and Research, 15, 241—252

Fryer S., S. Caggiari, et al., 2022 Continuous Pressure Monitoring of Inpatient Spinal Cord Injured Patients: Implications for Pressure Ulcer Development. Spinal Cord

Please comment on your involvement with pressure ulcers under the following headings:

Scientific research

In the past 8 years, I have developed a *national* and *international* reputation within the research field surrounding the prevention of pressure ulcers, through the translation of sensing technologies and intelligent algorithms. During my PhD (2016-2020), I demonstrated the long-term use of pressure monitoring systems to inform posture and mobility in lying and sitting. I have identified temporal pressure parameters within the pressure data both sensitive and specific to postural movements [Caggiari, 2019].

Following a travel bursary awarded by EPUAP (2019), I had the opportunity to collaborate with the research group of Prof. Payan (University of Grenoble, France), and develop an algorithm using artificial intelligence (AI) to efficiently detect movements and predict static postures. This has been published in Journal of Biomechanics [Caggiari, 2020]. The algorithm was then successfully translated to assess prolonged periods of immobility in Spinal Cord Injured (SCI) patients [Caggiari, 2021] and the most recent analysis demonstrated a significant association between mobility, SCI injury level and incidence of skin damage [Fryer, Caggiari, 2022].

My research contribution was recognised in 2021 by EPUAP as invited speaker at the virtual annual meeting, where I presented my research at the key session 'Artificial Intelligence and Machine Learning in Pressure Ulcer prevention and care'. As part of this work, I also co-authored the review paper published on International Wound Journal [Moore et al., 2021], on movement monitoring devices for PU risk prediction. At the EPUAP meeting 2022, I received the best free paper award for my presentation on 'Intelligent Sensing to detect postural changes in Spinal Cord Injured patients'.

Following PhD, I had the opportunity to translate my research knowledge to other medical devices, exploring the design and fitting of FFP3 respirators, in collaboration with colleagues at Cardiff University, UK National Health Service (NHS), and industry partners (BE-SAFE, 2020-2022). I led the design and development of a novel algorithm which combines 3D imaging, facial landmark recognition, respirator alignment and deformation, to estimate fitting, which is now ready to be applied to clinics as part of an institutional funded project. I also performed lab-based and clinical studies of their effects on skin health. This resulted in notables research outputs including publications in PlosOne (2022) and Medical Device journal (2022). I also led the analysis of a national data set of fitting outcomes and the recent paper published in BMJ Open (2023). This analysis demonstrated the inequality of respirator fitting for females and ethnic minorities. Combined this research provided new insights into device related pressure ulcers caused by personal protective equipment, and I have worked with policy makers in the UK (Dept of Health and Social Care) to improve fitting practice in the future.

I am currently the named post-doctoral research fellow and work package lead of the project 'Intelligent Sensing to Promote Self-management of Posture and Mobility in Community dwelling Individuals (SEAMLESS)' (2022-2025). I lead all the technical development and bench to bedside testing for a new community co-designed pressure sensing technology. This addresses the unmet need of providing assistive technologies for promotion of self-management of posture, mobility, and PU risk in the community. This funding represents a continued collaboration with key international and national commercial partners (XSensor, Canada and Sumed, UK). As part of this I have identified strategies to minimise the cost of monitoring technologies through reducing redundancy, published in Sensors (Caggiari, 2022). I am now developing a new refined algorithm to detect posture and mobility events and incorporate key pressure parameters which can be associated with thresholds of tissue risk, which I aim to present at EPAUP conference in 2024.

Clinical

My clinical involvement within the pressure ulcer field dates my doctoral research, which has been supported by a UK healthcare company (Sumed Ltd), who are leaders in manufacturing and distributing equipment for pressure ulcer prevention. During extended visit to their HQ, I had the great opportunity to liaise with costumers, clinicians, and patients in the NHS. This provided me with a clinical insight into the activities of a healthcare company and most importantly it gave me a critical user-based view to translate my research into clinical setting. During my PhD, I have also closely collaborated with a specialist nurse (Dr Sarah Fryer) based in Salisbury NHS Trust. This gave me the opportunity to evaluate clinical data and it resulted in the translation of the predictive algorithm for posture and mobility detection [Caggiari, 2021, Fryer, 2022] to patients in acute care settings, e.g., spinal cord injured patients.

My clinical involvement within the filed continued after my PhD, within the framework of a collaboration with NHS England and improvement as part of a research project [BESAFE RPE] which aimed at investigating the fitting of FFP3 respirator and their risk of causing device related pressure ulcers. As part of the SEAMLESS project, I am closely engaging with service providers and lead clinicians based in Cornwall, Devon and Somerset in the UK, associated with a quality improvement study 'PROMISE'. This includes close working with patients and members of public, and industry to develop new sensing interfaces.

Organisational
At the organisation level, I have taken the lead and been involved in a range of public engagement events. These included:

- EPUAP 2025 guideline panel group on the topics related to support surfaces and pressure ulcer assessment and monitoring.
- Engineering and Physical Sciences Research Council (EPSRC) Business and Commercialisation fellow (2023-2024), supporting new intellectual property development and start up companies.
- Medical Devices and Vulnerable Skin Network (MDVSN) NetworkPlus multistakeholder sandpit events (2018, 2019)

Educational
I teach several modules across both the School of Health Sciences and Faculty of Engineering, where I deliver research-informed teaching on the following learning outcomes:

- Understanding the fundamental of pressure ulcer development.
- Preventive strategies and treatments in clinical practice.
- Patients and care providers perspective on managing pressure ulcer risk.
- Bioengineering technologies and biomechanical interactions to support and promote skin heath.
- Role of prosthetics in amputees and their implications on skin and soft tissue health.

I actively lead BSc and MSc research projects, aligned to my research interests in sensing technologies and biomechanical interactions at the skin interface. I currently supervise 2 MSc and 2 BSc physiotherapy students on their research project on 'bioengineering technologies to monitor posture and mobility in lying and sitting'.

Strengths not utilised

Membership of other organisations
Member of Institution for Life Science (University of Southampton)