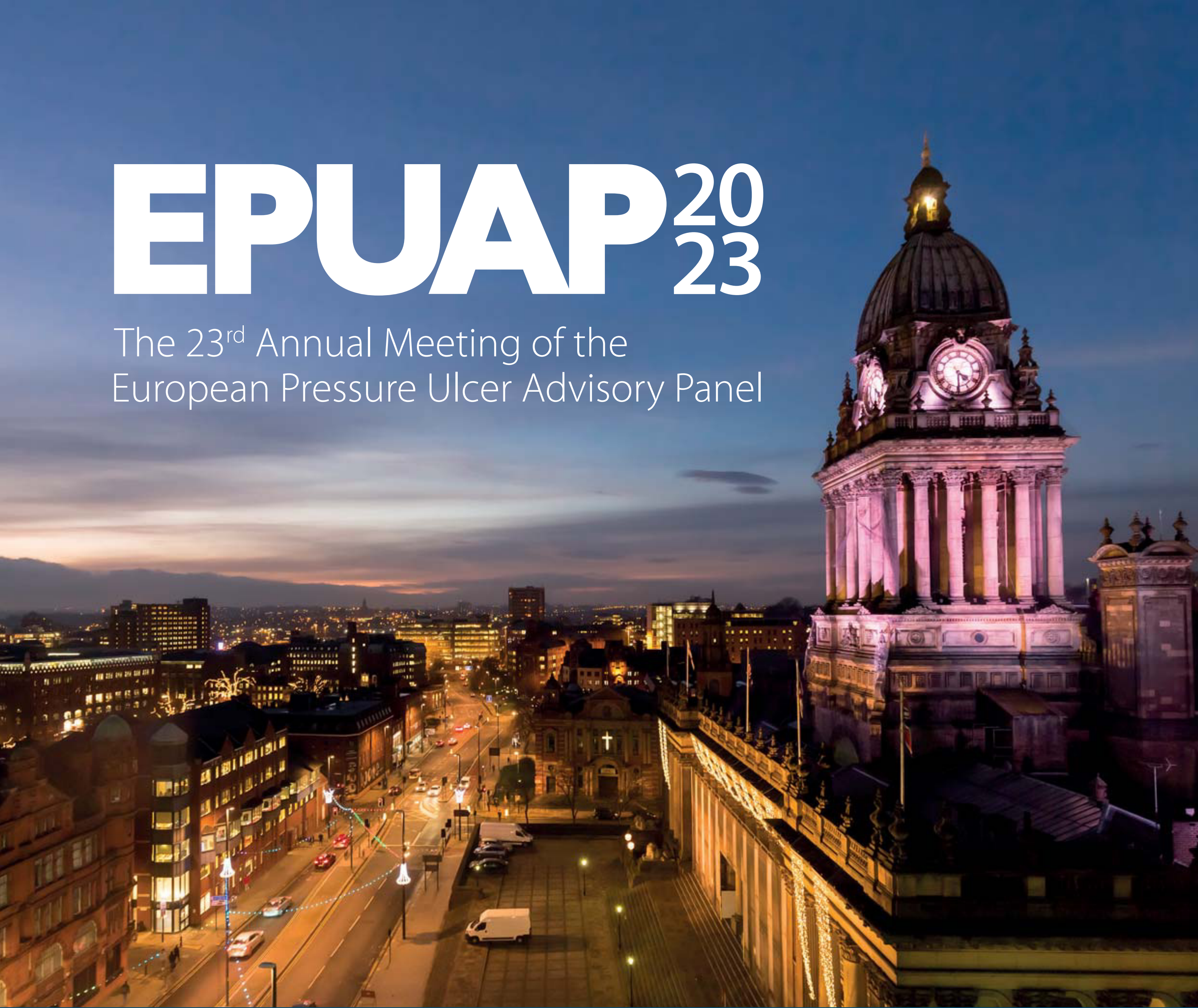

EPUAP 2023

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ABSTRACT BOOK

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

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

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

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

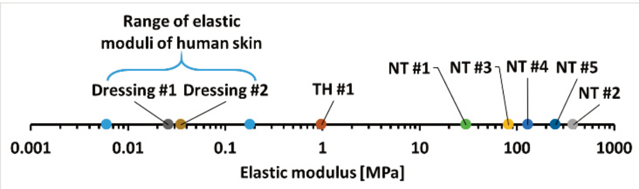

Figure 1: Mapping of the stiffness properties of prophylactic dressings and skin-contacting materials in medical devices with respect to the stiffness of an adult skin (NT – nasogastric tube; TH – tube holder).

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

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