

## Biomedical engineering in low-resource settings (LRSs)

The United Nations' 17 sustainable development goals are based on the principle of "leaving no one behind". In particular, SDG3 focuses on Health and Wellbeing, striving for equitable healthcare access, worldwide. Notwithstanding, the actual situation is still far from being equitable. Although most of the world's population is treated in low-income countries, only a small oligarchy of high-income countries rules the medical device market, setting and following de facto standards and minimum requirements, which do not take into consideration the scarcity of resources and the harsh conditions of low-resource settings. This mismatch hinders the safe and efficient functioning of medical devices, jeopardizing the life of patients and healthcare workers.

In this context, the Applied Biomedical Signal Processing Intelligent eHealth Lab (ABSPIE) has been working on several projects since 2016. Several field studies were run to assess the main challenges and conditions of local medical devices and location, in South Africa, Ethiopia, Uganda, and Benin. These studies informed the creation of a framework for assessing medical locations in low-resource settings [6], of a framework for designing medical devices resilient to low-resource settings, and several frugal designs of medical devices. In fact, the ABSPIE lab aims to leverage novel technologies such as 3D printing, AI and mHealth, to bypass some of the most recurrent challenges of these settings (e.g., lack of expertise, lack of spare parts, etc.), also fostering local communities through circular economy. Prior to the design of particular medical devices, a new framework for the contextualized design of medical devices resilient to low-resource settings was created.

As regards the design of medical devices, in the field of AI and mHealth, members of the lab have been working on a smartphone based pupillometer to screen for brain trauma, an app with 3D-printed accessories for screening for diabetic neuropathies, and the validation of a machine learning algorithm for detecting pneumonia in low-resource settings. Following a scoping review on the use of mHealth to diagnose and manage hypertension in Africa, a systematic literature review is currently investigating the current state of the art in the use of technologies for healthcare provision of hypertension in Sub-Saharan Africa. Other two systematic reviews concerning maternal care have been recently performed.

As regards 3D printing projects, members of the lab have been working on a condom-based 3D-printed intrauterine balloon tamponade, and a 3D-printed activated charcoal inlet filter for oxygen concentrators. Finally, a newborn vest for treating jaundice was also designed, based on LEDs and optical fibers.

Members of the Lab are also involved in the ethical problems surrounding artificial intelligence, medical device regulatory frameworks, and COVID-19-related issues.

This webinar will give an overview of the ABSPIE Lab experience in Africa, with a specific focus on clinical and biomedical engineering, and ethics.

### BIOGRAPHY

Dr Leandro Pecchia graduated (2005) Biomedical Engineering at the University "Federico II" of Naples, where he also received the PhD in Biomedical Engineering & Management of Healthcare Services in 2009. In 2013, he joined The University of Warwick, UK, where he is Reader in Biomedical Engineering. Since 2014, he directs the ABSPIE lab. Dr Pecchia is PI and CI in several research projects focusing on AI and IoT for continuity of care in later life (e.g., GATEKEEPER Pilot Manager) and on the use of AI and robots to improve hospital efficiency and safety (e.g., ODIN Pilot Manager).

Dr Pecchia authored 150+ peer-reviewed papers on journals, books and conferences in the fields of medical devices, biomedical signal processing, Health Technology Assessment (HTA), IoT and machine learning.

Dr Pecchia is EAMBES President, IUPESM Secretary General, IFMBE CED Treasurer and IFMBE HTAD former Chair.

Lab: <https://warwick.ac.uk/fac/sci/eng/research/grouplist/biomedicaleng/abspie/>

Webpage: [https://warwick.ac.uk/fac/sci/eng/people/leandro\\_pecchia/](https://warwick.ac.uk/fac/sci/eng/people/leandro_pecchia/)