

# Evidence Generation Case Study: BIOS

## Overview

BIOS Health is a technology company dedicated to understanding chronic health conditions, diagnosing patients living with them and treating them with the newest technologies.

As part of this work, BIOS developed an artificial intelligence (AI) platform to enhance care for individuals with chronic mobility conditions. The Remote Health platform analyses unstructured inertial data collected using smart watches to compute mobility biomarkers, or Objective Outcome Measures (OOMs), that describe someone's mobility health on a daily basis.

## Facilitated Research Partnership

DigitalHealth.London facilitated a partnership between BIOS and a research team at Queen Mary, University of London's (QMUL) Human Performance Laboratory, a national facility of gait analysis. This enabled the partners to secure InnovateUK grant funding to support a validation study.

This partnership gave BIOS the opportunity to implement their Remote Health platform at scale, test with two user groups and benchmark its performance against current best practice, clinically observed Objective Outcome Measures (OOMs) and Gold Standard gait assessment. The collaboration also included Andiamo, a DigitalHealth.London Accelerator alumnus, which makes user-centred orthotics, and CUSH Health, which makes smart devices for elderly patients.

Typically, OOMs are captured in clinics, however, BIOS' unique Machine Learning (ML) algorithms allow us to capture and automatically calculate these metrics for individuals as part of day-to-day life. The ML platform combines physiological data, inertial data, and Patient Reported Outcome Measures to compute a holistic snapshot of an individual's health without clinical intervention. BIOS have been able to transform this raw data into outcome measures for the clinical standard "Timed Up and Go" and "10 Metre Walk Test" achieving results within 20% of those recorded by the Human Performance Laboratory. This is within the Minimal Clinically Important Difference; the smallest change in a treatment outcome that an individual clinician would identify as important and would indicate a change in the patient's management.

Going forward, this technology could provide clinicians with a clear tool for baselining treatment efficacy, utilising objective data to support patient centred care. In turn, this will empower patients to manage self-care.

## Outcomes

BIOS presented research from this collaboration at the Intelligent Health AI conference in London, February 2020 and at the Institute for Engineering and Technology (IET) Human Motion Analysis for Healthcare Applications conference in June 2019. QMUL also presented the research at the Scandinavian Sports Medicine Congress, SportsKongres January 2020.

## Impact of the collaboration

BIOS has augmented the Remote Health platform to collect cardiac data in order to remotely monitor patients diagnosed with chronic cardiac conditions. This has been especially relevant during the current pandemic as this is a high-risk group.

BIOS are now looking for additional clinical partners in cardiac healthcare settings, with the aim to roll this out to more sites and hundreds, possibly thousands of patients. Providing cardiologists with this data from a large cohort of patients will not only be valuable during the COVID-19 pandemic but may also pave the way for more efficient and agile cardiac care in the future by reducing the need for in-person appointments.

QMUL identified potential further approaches to identify valid, simple and relevant metrics to represent “successful” and “deteriorating” gait. These metrics have the potential to further help clinical decision making. The collaboration has provided the opportunity to test these novel metrics, and with the current data is allowing QMUL to progress forwards with new grant applications to further expand these metrics, with potential robotic applications. The collaboration itself will likely lead to a couple of publications and further presentation of the research at conferences.

“The collaboration with QMUL, made possible by DigitalHealth.London Generator, gave our business the opportunity to trial our unique remote monitoring & machine learning capabilities in real world clinical settings. This played a major role in the development of our remote monitoring platform, which is now being used to understand cardiac disease patients and is in use clinically to enhance data from wearables used in remote chronic disease care. By expanding our platform capabilities, this has enabled us to leverage our proprietary datasets and biomarker discovery tool to enhance our understanding of the nervous system for treating chronic diseases” - Oliver Armitage, Co-Founder & CSO, BIOS