

Mac Robertson Postgraduate Travel Scholarship Report

About Me



I am Herbert Cherukut, a PhD student in Biomedical Engineering at the University of Glasgow. My research focuses on digital diabetes management, specifically how multimodal wearable data and machine learning can be used to improve real-world glycaemic control in Uganda. I am originally from Uganda and was in my third year of doctoral study when I received the Mac Robertson Travel Scholarship in 2025. The scholarship awarded me £5,000 to undertake a research visit at Lancaster University.

Why I Applied for the Travel Scholarship

I applied for the travel scholarship to advance my statistical research during my PhD. I specifically wanted to work with Prof. Rebecca Killick at Lancaster University to gain advanced skills in time-series analysis. At the time, I had started developing a dashboard and predictive model to track blood glucose patterns linked to behaviour and infections. But I needed expert guidance to refine the models and improve their clinical relevance, and my supervisor, Prof Jon Cooper, linked me with Prof Rebecca. The visit would offer a valuable opportunity to test ideas, strengthen the analytical foundation of my project, and shape a more practical tool for patient care. Lastly, I looked forward to the environment itself. Being in Lancaster and visiting places like the Lake District would give me time to reflect, recharge, and think more creatively about my work. The scholarship felt like the right step to grow both academically and personally.

My Research Project

My PhD research focuses on using wearable technology and machine learning to better understand lifestyle and co-morbidities in diabetes management in Uganda. In most low-resource settings, people lack access to regular monitoring or personalised care, leading to poor health outcomes. My project aims to improve this by collecting and integrating data from continuous glucose monitors (CGMs), smartwatches, and food logging apps into a single platform to help health workers understand what daily factors affect blood glucose levels.

I'm collecting real-world data on infections, glucose, stress, sleep, heart rate, steps, and meals. The goal is to use this information to build predictive models that detect early warning signs of glucose instability, especially those driven by behavioural changes and infections. I'm also designing a simple digital dashboard that provides valuable feedback to both patients and clinicians, helping them make more informed decisions without the need for constant lab tests or clinic visits. This is one of the first studies of its kind in Uganda to bring together multiple data types in a real-world setting. The hope is that the tools and findings from this work can eventually be scaled up to improve diabetes care not only in Uganda but also in other low-resource settings.

Why Travelling Was Important



Travelling to Lancaster gave me the space to step back from my regular environment and fully focus on the data and tools I've been developing for my PhD. It enabled close, in-person

collaboration with Professor Rebecca Killick, whose expertise in time-series analysis helped me sharpen my approach to changes in glucose levels. Being physically present meant we could explore ideas more deeply and work through challenges in real time, something that would've been much harder to achieve remotely. I also had the opportunity to interact with colleagues in the time series group, who shared ideas on how to improve my work and helped guide its development. Being in Lancaster pushed me to think more critically about how to make my work practical and relevant, especially in low-resource settings where it's most needed. Beyond the research, being in Lancaster gave me a fresh outlook. Visiting the Lake District and the Brontë Parsonage Museum reminded me to slow down, reflect, and reconnect with the creative side of research, something that often gets buried under fieldwork and day-to-day pressure.

Duration and Location

My research collaboration visit took place at Lancaster University, UK, from 18 September to 29th November 2025. This 10-week stay was followed by a two-week visit to the University of Glasgow from 30th to 13th December 2025.

Academic Work and Research Progress

Thanks to Prof. Rebecca's guidance, I explored how everyday behaviours, such as stress, sleep, and physical activity, influence short-term blood glucose instability. Instead of seeing these fluctuations as random, we examined their patterns. We found that prediction uncertainty tends to occur during key behavioural changes, such as after meals or during sleep-wake transitions. This understanding shaped how we evaluate and interpret the model, making it more meaningful and insightful.

We expanded the GluFormer architecture to support multiple physiological and behavioural data streams simultaneously. Unlike typical glucose-only models, our version combines CGM values, wearable measurements, and meal context into a single, easy-to-understand representation. This helps the system understand not just when glucose might change, but why it changes. The multimodal approach demonstrated greater stability in real-world conditions and provided more reliable predictions during periods when physiology is more volatile.

These exciting methodological improvements have really boosted both how easy it is to understand the forecasting system and how useful it can be in real life. They form a vital part of the manuscript my supervisors are currently reviewing, which is titled "Short-Term Glycaemic Prediction Using Multimodal Wearables in Adults with Diabetes in Uganda." I also

had the opportunity to attend a seminar on change-point approaches, which helped me better understand how to identify behavioural shifts. This knowledge will be valuable as I work on future versions of the model.

Key People and Interactions

Professor Rebecca Killick graciously guided the visit, and we often met to review outputs and collaboratively design evaluation metrics that enhanced both technical depth and clinical relevance. I also happily engaged with the broader time series group through seminars and informal discussions. A particularly memorable moment was attending a seminar by Prof. Stergios Fotopoulos on change detection in high-dimensional settings. These exchanges not only expanded my network but also introduced me to new statistical tools that are incredibly useful for wearable health data.

Cultural and Personal Highlights

One thing that stood out during my visit was how friendly and welcoming the people in Lancaster were. Whether at the university or around town, I always felt at ease. This warm atmosphere made it easier to focus on my research and also enjoy everyday life.

A particularly inspiring moment was visiting the Brontë Parsonage Museum. Learning about



Attended a presentation by a drumming group in the square outside the Lancaster City Museum

the Brontë sisters and seeing the environment where they wrote gave me a deeper appreciation for the power of storytelling and the discipline it takes to produce meaningful work, something I could relate to as I continue writing my thesis and manuscripts.

I also visited Lancaster Castle, a site rich in history, and explored the Lake District, including Force Waterfalls. These outdoor experiences were not just scenic; they also gave me and Prof. Rebecca space to reflect on our research, discuss ideas away from the office, and think creatively.

Being surrounded by nature while talking through complex academic questions was refreshing and added a new layer of clarity to the work we were doing.



A view of Rydal Water in the Lake District



Me and Prof Rebecca during the visit to the Brontë Parsonage Museum



*I visited the Aira Force, and Gowbarrow Park in Lancaster Castle
the background is the Aira Force waterfall*



Impact of the travel scholarship on My Research

The visit fundamentally shifted my approach from pursuing model accuracy to understanding the mechanisms behind prediction uncertainty. Through discussions with Prof. Rebecca's group, I learned to treat glucose instability as meaningful physiological information rather than noise, especially during behavioural transitions such as stress spikes, post-meal responses, and sleep–wake boundaries. This reframing improved the project's scientific maturity and led to a more clinically relevant evaluation framework that prioritises safety thresholds over global averages. It also supported the development of a multimodal forecasting model that integrates CGM, wearable signals, and meal context, allowing the system to anticipate not only *what* glucose will do, but *why*.

Acknowledgements

I am sincerely grateful to the University of Glasgow for awarding me the Mac Robertson Postgraduate Travel Scholarship, which enabled this research visit. My deep thanks go to Professor Rebecca Killick and the time series group at Lancaster University for their generous welcome, mentorship, and collaboration. Their insights and openness created an environment where I could grow both technically and academically.

I also wish to thank my supervisors, Professor Jonathan Cooper and Professor Julien Reboud, for their consistent support, critical feedback, and encouragement throughout this process. Lastly, I appreciate the many people in Lancaster, both within and outside the university, whose kindness, conversations, and day-to-day interactions enriched this experience.



This was me and Prof Rebecca inside the Rydal Cave, on the north side of Loughrigg Fell, above Rydal Water.



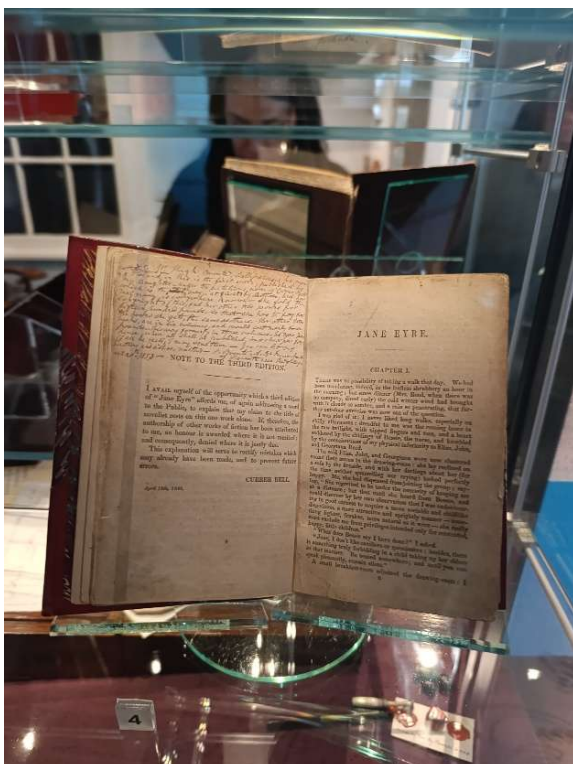
Ducks outside the Fylde college offices where I was based



I visited the Rydal Cave on the mountain above Rydal Water during my visit to the Lake District in Cumbria



At the banks of one of the Lakes in the Lake District



An early edition of the novel Jane Eyre: An Autobiography by Charlotte Brontë.

