PhD PROJECT PROPOSAL

## **PhD Project Title**

Analysis of research and clinical trial networks in lower and middle-income countries

## **PhD Supervisory Team**

Principal Supervisors: Dr Fabian Spill, f.spill@bham.ac.uk, Mathematical Biology, School of Mathematics

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## **Project Abstract**

Modern drugs for complex diseases such as cancer are largely developed in high-income countries, and tested in clinical trials with populations that are not representative of the global population of our planet. Including researchers and patients worldwide, therefore, requires more effective collaborations with researchers and clinicians in lower and middle-income countries, so patients in these countries can be included in trials and can benefit from the new drugs identified. In this project, we will investigate the global network of researchers and clinicians that work on specific diseases such as cancer to identify areas of strength in LMICs.

## **Detailed Project Description**

***Background***

Pharmaceutical interventions are predominantly developed for populations in high-income countries and tested in clinical trials that have cohorts that do not well-represent the diversity of the global population. To identify drugs that best work for the diverse population of our planet, pharmaceutical industries are increasingly looking to collaborate with researchers and clinicians in lower and middle-income countries (LMICs) that have access to patient cohorts that currently do not optimally benefit from research performed in high-income countries (HICs). However, universities, hospitals and research institutes in LMICs are often less visible than those in HICs, making the identification of local experts for specific diseases challenging.

**Outcome**

In this project, the student will develop tools based on network analysis to identify experts on specific diseases in specific countries or regions in LMICs. The student will therefore extract information from databases of scientific publications or ongoing clinical trials that focus on specific diseases to build a network of interactions and perform network analysis of this data to identify key researchers or institutions that focus on a given disease. The topology of the interaction network of scientific or clinical collaboration is used as a proxy to identify these researchers or institutions due to their degree or other network metrics. The developed methodology will assist the pharmaceutical industry, largely based in HICs, to quickly identify potential collaborators in LMICs for any given disease.

**Methodology**

The project will advance methods from network sciences to uncover how researchers and clinicians in LMICs collaborate with those in HICs. First, based on scientific papers from specific areas of interest, e.g. a specific cancer such as multiple myeloma, a network of collaborations will be constructed by considering universities as nodes, and edges are drawn when two universities collaborated on a paper. Similar networks will be constructed for ongoing clinical trials. Degree distributions, centrality and similar statistics will reveal key institutions of strength. Bipartite graphs will reveal specific collaborations between LMIC and HIC institutions. Community detection algorithms will reveal clusters of excellence.

**Suitability for CDT and University**

This project fits very well into the CDT due to its employment of techniques related to the analysis of networks. It is highly interdisciplinary in nature, at the interface of mathematics, computer science and biomedicine.