Title of PhD project	**Creating evidence for novel Tuberculosis vaccine introduction and implementation decision making - using math modelling**	
Supervisor	Professor Richard White	LSHTM
Co-Supervisor	Dr Christinah Mukandavire	LSHTM
Co-Supervisor	Mr Chathika Weerasuriya	LSTHM
Brief description of project	Despite being an ancient disease, tuberculosis (TB) remains a leading cause of death from infectious disease worldwide. A new TB vaccine, M72/AS01E, has shown considerable promise in clinical trials. Should this vaccine be approved, global and country decision makers do not know the optimal strategies to deploy it, nor what the interaction of vaccine programmes with other non-vaccine TB control efforts will be. This knowledge is essential for decision makers considering if, and how, to introduce the vaccine. The optimal strategies will vary substantially depending on when and how the vaccine is deployed, the country epidemiology and health system, the planned future changes to other TB control efforts, and other factors. This project will extend an existing state-of-the-art mathematical model of tuberculosis, developed and programmed in R, to identify optimum strategies for vaccine deployment. It will focus particularly on using the results of vaccine implementation strategies using real-time feedback in the model to identify the most optimum changes to the vaccine programme. This might include, for example, changing vaccine targeting strategy (e.g., by age, or by other comorbidities like diabetes, or by risk behaviour). The project will also focus on investigating how best to deploy vaccines in “alternative futures”, where other (non-vaccine) TB control options (e.g., new drug treatments, or better diagnostics) are introduced.	

	The evidence from this work will support countries in their TB vaccine introduction decision making and will be disseminated in policy briefs, publications, conference presentations and via policy networks (WHO, CTVD, Stop TB, country TB programmes).
Skills we expect a student to develop/acquire whilst pursuing this project	• Mathematical (dynamic transmission) modelling of tuberculosis, including model parameterisation and contextualisation. • Model inference and fitting using Bayesian methods, including but not limited to Monte Carlo simulation, history-matching and emulation, Sequential Monte Carlo methods. • Programming, including but not limited to R. • Familiarity with high performance computing. • Contribution to vaccine development and implementation policy.
Particular prior educational requirements for a student undertaking this project	• The student should have a background in quantitative data analysis (e.g. an MSc in Epidemiology, stats, economics), or a mathematical background (e.g. degree in maths, physics, engineering). • Some experience of mathematical modelling is desirable, but not essential. • Prior experience in programming, specifically in R would be highly advantages but not essential.
Project key words	Mathematical modelling Tuberculosis Vaccines
Possible under 1+4 route? Master's options identified.	Yes LSHTM - MSc Epidemiology LSHTM - MSc Medical Statistics LSHTM – MSc Public Health (Health Economics stream)
MRC Core Skills developed through this project	Quantitative skills
MRC LID themes	Global Health Infectious Diseases