MSc Research internship Erasmus MC, Department of Public Health, Infectious Disease Control group

Topic:	Predicting the required efficacy of vaccines for control and elimination of soil-transmitted helminths
Hosting dept.:	Erasmus MC Rotterdam, Department of Public Health, Infectious Disease Control Research Group
Collaborators:	NTD Modelling Consortium

About one billion people globally are infected by one or more species of soil-transmitted helminths (STH), a group of worm species that live in the host intestines and are transmitted through faecal contamination of the environment. STH infections are responsible for malnutrition, anaemia, growth retardation, and delayed cognitive development. Because of this, STH are currently targeted by the World Health Organization to be controlled or eliminated by 2020, which is defined as a prevalence of moderate to heavy infection under 1%. The main control strategy is mass drug administration (MDA), which involves distributing deworming drugs to entire populations or specific target groups like school age children in endemic areas on a regular basis, typically annually or six-monthly. Successful control or elimination of STH requires that MDA is implemented at high coverage of the target population and that MDA rounds are repeated over an extended period of time, sometimes as long as more than ten years. In the long run, sustained control or elimination can be achieved by improved access to water, sanitation, and hygiene, but this has proven to be very challenging and expensive to implement successfully in endemic areas.

To decrease the required duration of MDA programmes and prevent the anticipated emergence of drug resistance, there are ongoing efforts to develop a vaccine against STH infections. The impact of an STH vaccine will depend on the vaccine target (e.g. the adult worm and/or incoming infective L3 larvae) and efficacy, and the context in which it is implemented (e.g. transmission conditions, history of MDA), and who is being vaccinated (e.g. children vs. whole population). For the development of vaccine candidates, it is important to understand what the minimal required efficacy of a vaccine candidate is on STH transmission. This is ideally investigated by means of mathematical modelling, a powerful technique to translated the individual-level outcomes of intervention to the larger population by accounting for the interactions between individuals in the population.

The Infectious Disease Control Research Group in the Department of Public Health is specialized in mathematical modelling of transmission and control of infectious diseases and has developed a generalised individual-based model for transmission of worm infections called WORMSIM. The MSc student will have the opportunity to use WORMSIM to generate, visualise, and analyse a large database of predicted outcomes of vaccinating various target populations with hypothetical vaccines in a large number of scenarios pertaining to transmission conditions and MDA history. Based on this database, the MSc student will correlate vaccine mechanism and efficacy with the expected added benefit of vaccination in terms of worm control and elimination, and determine the required minimal efficacy of future vaccine candidates.

This project is suitable for students with an interest in and affinity for quantitative science. The student will be heavily using the statistical package R; experience with R or programming experience with another language is therefore highly valued.

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