CAN WE REACH THE 2020 GOALS USING CURRENT STRATEGIES?

As control programs scale-up their efforts to control NTDs and new tools are being developed in diagnostics, treatments, vector control and surveillance, there is a growing body of evidence and data on which we can base more refined public health strategies.

Epidemiological modelling[1] has become an essential tool in developing public health policy for the control of infectious diseases.

An NTD modelling consortium[2] has been formed with funding from the Gates Foundation, the Children's Investment Fund Foundation and the Novartis Foundation to develop models across the diseases in the London Declaration (except Guinea worm disease) to support strategy development on the most effective control strategies to achieve the goals in particular settings.

For PCT NTDs, the models will be informed by the growing body of data from routine monitoring and evaluation of treatment programs across a range of different countries and epidemiological settings to assess how effective the current strategies are at reducing the level of infection. They will also be considering the potential impact of new drugs or drug combinations as the results of ongoing studies and trials become available. Validating the models against these data will increase their reliability and usefulness at the programmatic level.

The role of modelling in assisting in onchocerciasis control in Africa

Great progress has been made towards the elimination of onchocerciasis in Africa by annual mass treatment with ivermectin. In some areas, ivermectin mass treatment has been going for over 15 years and many of these areas may be close to the complete interruption of transmission. For these countries, there is the prospect of true local elimination and halting of transmission if no new cases arise between then and 2025. In contrast, other countries are lagging behind due to late starts, implementation problems or contraindications for the implementation of ivermectin mass treatment. To eliminate onchocerciasis in these countries by 2025, control activities must be intensified or alternative treatment strategies be implemented.

Using the established ONCHOSIM[3] simulation model, developed by Erasmus MC (Rotterdam, the Netherlands) in collaboration with the Onchocerciasis Control Program in West Africa (1974-2002), it was possible to estimate the final year of treatment for all onchocerciasis endemic areas under the assumption that the current strategies are continued (mostly annual ivermectin mass treatment, in some areas biannual treatment). The modelers identified 47 areas in 12 countries where interventions likely need to continue beyond 2022. This included areas in both currently targeted regions where treatment is already ongoing or has not yet started and potential new areas which are not yet targeted. The analysis highlighted that the Democratic Republic of Congo is likely to pose a particular challenge, with 24/47 problem areas located in this country.

Given this observation, the question then becomes what strategies should be used in those areas which are not Loa loa co-endemic. Possible strategies include increased coverage of treatment or more frequent treatment. The modelling analyses suggest that measures to improve treatment coverage where the achieved levels are <65% should be prioritized. Doubling the frequency of treatment from yearly to 6-monthly might make elimination by 2025 in reach for about half of the identified problem areas: reducing the remaining program duration by about 40%. The most effective strategies for Loa loa co-endemic regions are an area of active research and modelers are closely involved in these activities.

Modelling has been included as an essential tool in the development and evaluation of control strategies for onchocerciasis in Africa, as well as in the assessment of new treatments and diagnostics.

The collaborative relationship between the modelers, other researchers, and policy makers, which included active sharing of data, methodologies, and results, ensured that the models were well informed and addressed the right policy questions, providing valuable lessons for the other NTDs.

1. Modelling is a method for bringing together our understanding of the life cycle of the disease, transmission, clinical processes and health systems to project the likely impact of different strategies.

2. For further information on the research group, their activities and other modelling publications, please see www.ntdmodelling.org

3. ONCHOSIM is a computer program for modelling the transmission and control of the tropical parasitic disease onchocerciasis, or river blindness.

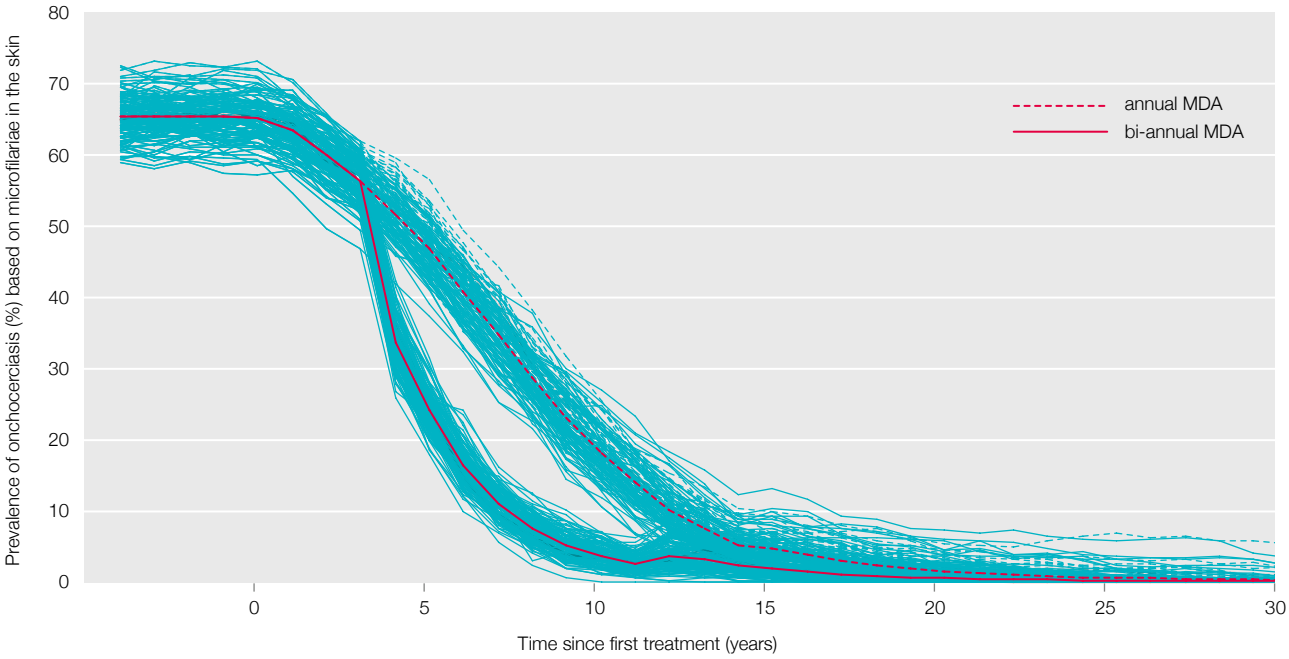
For preventive chemotherapy (PCT) NTDs, the modelers are addressing questions on how frequently treatment should be given, to which age groups, using which drug combinations, and at what coverage to reach the goals more quickly in communities with different prevalence of disease.

For IDM diseases, incidence of diagnosed cases is dependent on the accessibility of the health system, as well as the level of active case detection, in each particular setting. This makes interpretation of these data particularly challenging, but by working with the researchers and control programs to gain a better understanding of the routes to diagnosis and the response to detection of cases, these teams are giving new insights on the underlying dynamics of transmission which will be crucial in controlling these infections. The development of new diagnostics and drug treatments for these diseases are also providing data which have the potential to change our understanding of the epidemiology of these infections, and the modelers are supporting efforts to link data using older and newer diagnostics so that they can be analyzed alongside each other to improve programs and outcomes.

The consortium's results for this year will be published in early November 2015. Further information on the research group, their activities, and other modelling publications will be posted on www.ntdmodelling.org

For Intensive Disease Management (IDM) diseases, such as sleeping sickness or leprosy, the modelers are developing better quantitative estimates, e.g. the time from infection to symptoms, the proportion of the population asymptomatically affected, or the importance of particular vector behaviors.

Prevalence of onchocerciasis (%) based on microfilariae in the skin



Simulated trends in the prevalence of onchocerciasis (based on presence of microfilariae in the skin) for a high endemic community. The figure shows the impact of increasing the frequency of mass treatment from annual (dashed and lighter lines) to biannual (solid and darker lines). In the scenario with annual treatment, the first treatment is given at time=0 and 14 treatment rounds are provided in total (last treatment at time = 13). In the alternative scenario, treatment again starts annually at time 0, but from the 4th treatment round onward treatment is given biannually with 19 treatment rounds in total (last treatment at time 10.5). In both scenarios, 70% of the total population is treated per round, excluding children under 5, and pregnant or lactating women. Simulations were done with the established ONCHOSIM simulation model (Coffeng et al 2014). The presented trends are based on yearly surveys carried out at time 0 with yearly intervals before and after this timepoint, with surveys always just preceding treatment in case the two coincide. The thick lines shows the average predicted trends of 125 simulations per scenario, the thin lines show the results of each of the 125 individual simulation runs per scenario.