

Conquering schistosomiasis in China: The final chapter

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THE USE OF A MARKOV TRANSITION PROBABILITY MODEL AS A PROGRAMMATIC TOOL FOR THE CONTROL OF SCHISTOSOMIASIS

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The World Health Organization (WHO), in partnership with the global community, have set ambitious targets for the control and/or elimination of schistosomiasis by 2020. To be able to achieve this it is essential that control programme managers can monitor the impact of treatment and identify areas that are not responding as expected. This will allow suitable adjustments to be made to maximise the impact of the intervention. With this objective, in 2014 a programme-friendly Markov transmission model was developed at the Schistosomiasis Control Initiative (SCI) in collaboration with the WHO to model the changes in the levels of schistosomiasis infection following successive rounds of treatment. The model was parameterized using data obtained from the monitoring and evaluation components of the large-scale deworming programmes in Uganda and Mali. This model is an extension of an earlier Markov model developed for soil-transmitted helminth infection by WHO. Results showed that the transition probabilities derived from baseline and year 1 data can be used to predict the prevalence of each infection intensity group in the following year. The capacity of the model to predict changes in infection prevalence following successive rounds of treatment was then tested on various data sets from 2 countries in sub-Saharan Africa. These data were not used to develop and validate the model, so that only new scenarios could be tested. The model was tested to observe whether it could provide an early warning of the treatment campaigns that failed to meet their targets. The performance of the model was also tested against different parasite species (*S. mansoni* and *S. haematobium*), location and underlying endemicity as well as host age. The outputs of the model post-validation will be discussed as well as its suitability as a user-friendly programmatic tool to facilitate the monitoring of schistosomiasis control programmes.

HOTSPOTS OF SCHISTOSOMA MANSONI TRANSMISSION TEN YEARS INTO A MASS DRUG ADMINISTRATION PROGRAM

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The Schistosomiasis Control Initiative began mass drug administration (MDA) with praziquantel in Uganda in 2003 with great reductions in infection prevalence, intensities and associated morbidity. However, possible treatment failures have been recorded. In addition, theoretical models have indicated that cessation of MDA may result in higher egg counts than pre-intervention levels in certain individuals. Prevalence and intensity of infection by Kato-Katz were recorded for *Schistosoma mansoni* in children from three primary schools in Mayuge District, Uganda. Data were collected pre-, one-week-post- and four-weeks-post-praziquantel in 2004, 2005 and 2006, and pre-, one-week-post- and three-weeks-post-praziquantel in 2013 and pre-praziquantel in 2014. In 2004 and 2013 point-of-care circulating-cathodic-antigen tests (POC-CCA) were also performed. Mean egg reduction rates by three/four-weeks-post-

praziquantel from 2004, 2005, 2006, and 2013 were 94.5%, 97.8%, 97.1%, and 95.0% respectively and cure rates 72.3%, 75.7%, 80.7% and 87.2%. Cure rates by POC-CCA in 2004 and 2013 were however significantly lower at 47.8% and 9.4% respectively. Infection prevalence and intensities in 2013 and 2014 were higher than at baseline. We indicate that drug efficacy measured by Kato-Katz has not reduced with MDA, but that cure rates measured by POC-CCA are lower. Although cure rates are often considered to be a less important criteria for morbidity than a reduction in egg output, it is imperative that the causes for the significant differences between Kato-Katz and POC-CCA results, and the higher infection intensities after ten years MDA, are elucidated so we can understand any risks of MDA strategies as well as measure their benefits. Results presented will include model outputs to predict if higher infection intensities observed ten years into the MDA programme are due to high transmission, reduced drug efficacy, or reductions in the development of protective immunity, as control programmes progress.

CONQUERING SCHISTOSOMIASIS IN CHINA: THE FINAL CHAPTER

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Major control efforts over many decades have resulted in a substantial reduction in the prevalence of schistosomiasis japonica in the People's Republic of China, although pockets of new infection continue to arise, particularly in the mountainous areas of the south. As well, the completion of the Three Gorges Dam, which crosses the Yangtze River and other large irrigation projects underway, may have significant environmental and ecological impacts likely resulting in expansion of the habitats for the intermediate snail host *Oncomelania hupensis* in some areas, thereby increasing the risk of human and bovine infection, and resulting in potentially new challenging consequences for control. The epidemiological picture for China will be briefly summarised and the current effective control strategies highlighted. The situation in the Philippines will also be briefly outlined but the picture is far less encouraging as there is limited national funding for schistosomiasis control; since the termination of the World Bank Loan program for schistosomiasis control in the late 1990's, both schistosome prevalence and the associated morbidity have rebounded to former levels. Some results of recent surveillance studies we have undertaken in the Philippines will be described which indicate that schistosomiasis japonica is now far more prevalent, both in humans and bovines, than has been appreciated. Results of a large intervention trial we have completed in China - in the highly endemic Dongting Lake area downstream of the Three Gorges Dam, aimed at field-testing integrated strategies, including the use of a bovine transmission blocking vaccine, for schistosomiasis control, will be presented. The results of the trial in China will provide parameters for mathematical modelling of future control methods so as to define the long-term impact and cost-effectiveness of integrated control measures for both China and the Philippines. We believe that such an integrated approach, incorporating bovine vaccination, can lead to the future elimination of schistosomiasis from China.