Expanding hookworm control strategies to target adults

The neglected tropical diseases (NTDs) are a group of parasitic, bacterial, and viral infectious diseases, which affect over 1.5 billion of the world's most impoverished people. The most common NTDs are the soil-transmitted helminths (STH), such as the roundworm, whipworm and the hookworms. The hookworms are estimated to be responsible for over 65% of the total disability-adjusted life years (DALYs) lost due to STH infections and, worldwide, are the second leading cause of anaemia. The current WHO guidelines focus on targeting STH treatment to children with the ultimate goal to "eliminate STH as a public health problem" in children by 2020 (though treatment of women of childbearing age and adults in certain high risk occupations is also recommended where possible). However, unlike the other STH, the majority (70-85%) of the hookworms are harboured by adults. Consequently, although the current guidelines may be effective in terms of reducing the morbidity of the other STH (where the burden peaks in the targeted children), they may not be as effective against hookworm.

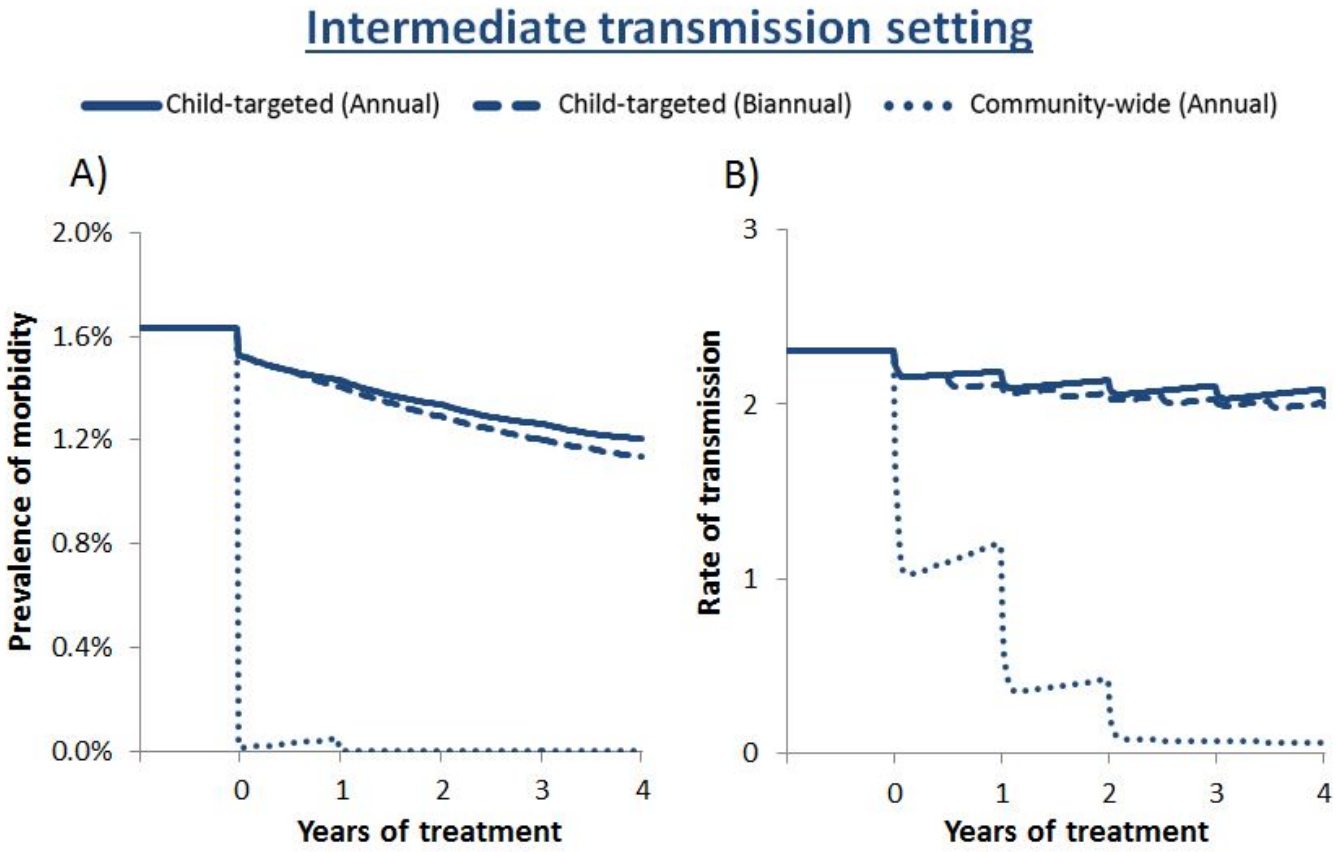

Fig. 1. Impact of different treatment strategies on the prevalence of morbidity in the overall community (A) and on the overall rate of transmission (B). The different styled lines represent different treatment strategies: solid – annual targeted treatment (2-15 year olds), dashed – biannual targeted treatment (2-15 year olds), and dotted – annual community-wide treatment (2-99 year

olds). The results assume 80% coverage, and 94.8% treatment efficacy. Rate of transmission: the mean number of incoming worms per person per year (a metric for the level of on-going transmission within the model). Results show an intermediate transmission (R0 =2.5).

Expanding treatment programmes to include adults through community-wide treatment is under consideration. However, it should be noted that this would be a major shift in STH control policy, and require an increase in resources and international commitment. Consequently, it is important to evaluate how cost-effective expanding control programmes to include adults is, and understand if it could potentially generate long term cost-savings.

The aim of our recent paper was to investigate the impact, long-term cost and cost-effectiveness of using community-wide treatment for the control of hookworm. To do this, we used a previously established mathematical models describing the infection cycle of hookworm to evaluate the impact of child-targeted (2-14 year olds) versus community-wide treatment against hookworm in terms of preventing morbidity. We also considered if the strategy could drive the proportion of the population infected to a threshold below which transmission of the infection is no longer sustainable (i.e. eliminate transmission).

Our results indicate that the current STH control strategy targeting children alone, is ineffective in reducing the overall burden of disease caused by hookworm infection (Fig. 1A.). Our analyses show that in order to control the overall disease burden of hookworm with chemotherapy, programmes must include adults (Fig. 1A.), which was estimated to be notably more cost-effective in terms of preventing morbidity.

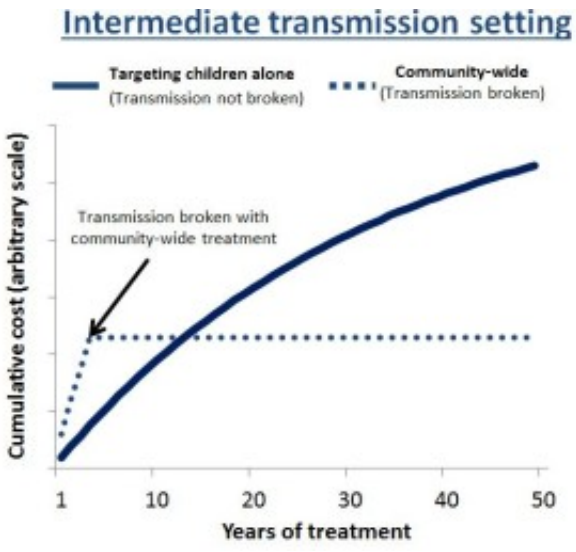

Fig. 2. Cumulative total cost of community-wide versus child-targeted treatment. Annual targeted treatment (Pre-SAC and SAC) and annual community-wide treatment are represented by a solid

and dashed line respectively. Costs were assumed to cease after breaking transmission is achieved. The results assume 75% coverage per round of targeted age group(s), and 94.8% treatment efficacy. Costs were discounted at 3% per year (resulting in the slope of the curve). The different vertical lines highlight the different employed time horizons. Individuals under two years of age were not eligible for treatment. Results show an intermediate transmission (R0 =2.5).

Our projections indicate that targeting children alone does not notably impact the level of hookworm transmission occurring and it was only possible to eliminate transmission when including the treatment of adults (Fig. 1B.). Due to this, programmes using community-wide treatment were projected to be shorter than those using the current child-targeted strategy and it was possible for them to generate cost savings in the long term (Fig. 2.). Although, the extent of these costing savings were sensitive to the assumed increase in distribution costs and the achieved level of coverage of adults.

In conclusion annual community-wide treatment is predicted to be markedly more cost-effective in controlling both hookworm's disease burden and the level of on-going transmission. Furthermore, because it is possible to eliminate transmission when using community-wide treatment, expanding programmes can generate long term cost savings when achieving a moderate to high coverage of adults – even if it notably increases the annual distribution costs of the programme.

Although expanding programmes to target adults will require greater programmatic resources and drug donations, the calculations highlight the notable benefits it can generate and the importance of further considering this strategy in any ongoing revisions of the treatment and control guidelines for STH.

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Publication

An economic evaluation of expanding hookworm control strategies to target the whole community.
Turner HC, Truscott JE, Bettis AA, Shuford KV, Dunn JC, Hollingsworth TD, Brooker SJ, Anderson RM.
Parasit Vectors. 2015 Nov 5