

Model-predicted Impact of 25 years of Ivermectin Mass Treatment on the Burden of Onchocercal Skin Disease

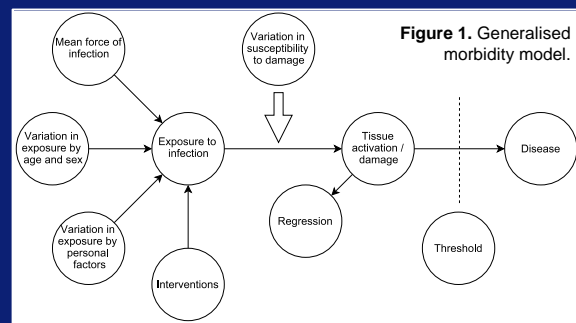
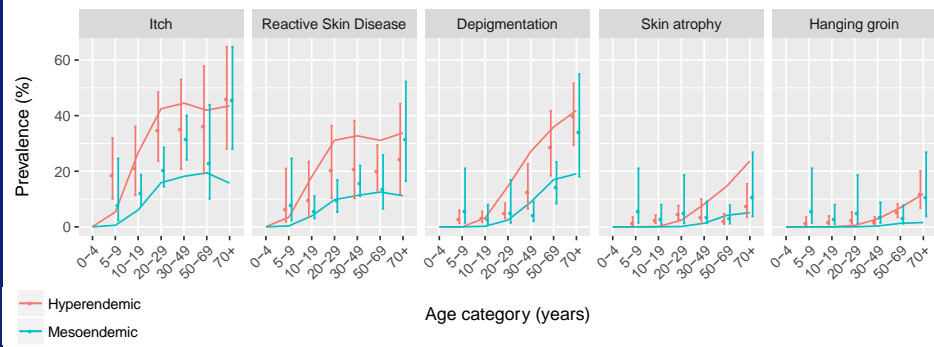


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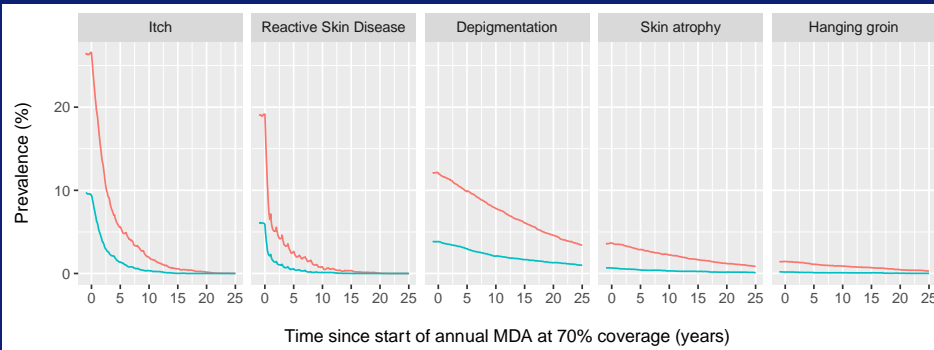
BACKGROUND AND OBJECTIVE: From 1995 to 2015, the African Programme for Onchocerciasis Control (APOC) coordinated the annual ivermectin mass treatment to control morbidity of onchocerciasis (river blindness). Recently, this goal has shifted from morbidity control to achieving elimination in 80% of all endemic countries by 2025. To better understand the potential remaining burden of onchocerciasis morbidity in the near future, we predict trends of onchocercal skin disease (OSD) for a 25-year time frame of annual mass drug administration (MDA).

Figure 4. Pre-control age-pattern in prevalence of onchocercal skin disease: model predictions (lines with 95%CI) versus observed data (data points).



RESULTS: The model could reasonably reproduce observed age patterns in prevalence of OSD (Fig. 4). The prevalence of reversible conditions declines rapidly during annual MDA (Fig. 5), while irreversible manifestations decline much more gradually over time. Concurrently, reversible conditions declined over approximately all age groups while age patterns in irreversible conditions mostly shifted with age (Fig. 6).

Figure 5. Predicted prevalence of clinical manifestations for the total population over 25 years of annual MDA.



CONCLUSIONS: Taking account of the total population in onchocerciasis-endemic areas, treatment history, and concurrence between different subtypes of OSD, the total number of prevalent cases with any OSD in the year 2025 was estimated at 3 - 3.7 million. (In)complete depigmentation is the main contributor accounting for 70% of total number of cases in 2025. These estimates may be useful for planning of control strategies by policy makers and national onchocerciasis control programmes.

METHODS: We expanded the individual-based model ONCHOSIM (Fig. 1) to predict trends in prevalence of five subtypes of OSD in meso- and hyper-endemic settings during 25 years of MDA with ivermectin at 70% overall population coverage. The model was calibrated to reproduce age-patterns in prevalence of morbidity as observed in a multi-country field study on OSD (Murdoch *et al. Ann Trop Med Parasitol* 2002, 96 (3)). We assumed that itch and reactive skin disease (Fig. 2) are reversible conditions, and that skin atrophy, depigmentation (Fig. 3), and hanging groin are irreversible.



Figure 2. Lichenified onchodermatitis of the left leg, a form of reactive skin disease.



Figure 3. Depigmentation of the shins as a result of onchocerciasis

Figure 6. Model-predicted evolution of age patterns in clinical manifestations during annual MDA (70% coverage).

