The elimination of parasites under consideration of their numerically discrete and finite nature

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Program

- Modeling approach (recapitulation)
  - Calibration results
  - Limitation
  - Eradicability
  - Outlook
Parasite distributions often cannot be adequately characterized by the mean only:

In a finite world, limitation is the rule:
Acquisition, maturation & death of parasites
Model software

![Graph showing model software interface](image)

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Modeling approach Calibration Limitation Eradicability Outlook
Program

- Modeling approach (recapitulation)
- Calibration results
- Limitation
- Eradicability
- Outlook
Calibration: ABR - ATP

Calibration: $\text{Prev}_{\text{nodules}} - \text{Prev}_{\text{MF}}$
Calibration: $M_{\text{f, skin}} - \text{Prev}_{\text{MF}}$

Calibration: $\text{Mf}_{\text{skin snip}} - \text{MF}_{\text{fly}}$

Calibration: ATP - MF

Calibration: $\text{MF}_{\text{ingested}} - L_{\text{fly}}$

Program

• Modeling approach (recapitulation)
• Calibration results

• Limitation

• Eradicability
• Outlook
Interventions under chain limitation

Life cycle stages $s_1, s_2, s_3, s_4$:

Chain limitation:

- Equilibrium *before* intervention
- Equilibrium *after* intervention
Example:
limitation between $s_i$ and $s_{i+1}$ is of the form:

$$s_{i+1}(s_i) = \frac{\alpha_i s_i}{1 + \alpha_i s_i}$$

For $s_2$, the equilibrium solution results from

$$s_2 = s_1(s_4(s_3(s_2)))$$

which can be solved for $s_2$:

$$s_2^* = \frac{\alpha_1\alpha_2\alpha_3\alpha_4 - 1}{\alpha_2(1 + \alpha_3 + \alpha_3\alpha_4 + \alpha_1\alpha_3\alpha_4)}$$

Likewise:

$$s_3^* = \frac{\alpha_1\alpha_2\alpha_3\alpha_4 - 1}{\alpha_3(1 + \alpha_4 + \alpha_4 + \alpha_1\alpha_2\alpha_4)}$$

$$s_4^* = \frac{\alpha_1\alpha_2\alpha_3\alpha_4 - 1}{\alpha_4(1 + \alpha_1 + \alpha_1\alpha_2 + \alpha_1\alpha_2\alpha_3)}$$

Assume: an intervention reduces $s_1$ by 90%
and reductions in the other variables follow accordingly
Chain limitation causes stability
Program

• Modeling approach (recapitulation)

• Calibration results

• Limitation

• Eradicability

• Outlook
Eradicability of onchocerciasis

Threshold biting rate:
TBR ~ 30 bites per (person year)
Program

- Modeling approach (recapitulation)
- Calibration results
- Prevalence vs. intensity
- Limitation
- Eradicability

- Outlook
Outlook

• continue calibration
• determine Threshold Biting Rate (ABR\text{crit})
• analyze intervention with microfilaricides
• determine the critical coverage for elimination with microfilaricides
• analyze other interventions, e.g. exposure prophylaxis (clothing)
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