THE BURDEN OF SKIN AND EYE DISEASE DUE TO ONCHOCERCIASIS IN AFRICA FOR 1990, 2015 AND 2025

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Burden estimates: why?

- High disease prevalence in Africa
- Clinical manifestations create large burden
- MDA contributes to massive decline in burden, but not completely
- Quantify remaining burden to:
  - Evaluate impact of interventions
  - Understand requirements of new interventions (what and who)
Study aim

To estimate the burden of onchocerciasis in Africa* for 1990, 2015, 2025 in terms of:

• Number of cases
• Disability-adjusted life years (DALYs) lost

* African Programme for Onchocerciasis Control (APOC) countries only
Method

Using computer simulation model “ONCHOSIM”:

- Individual-based model
- Simulates onchocerciasis transmission in dynamic population, and impact of MDA over time
- New disease module: simultaneous prediction of clinical manifestations for each individual in the population
# Clinical manifestations

<table>
<thead>
<tr>
<th>Reversible</th>
<th>Reversible skin disease</th>
<th>Irreversible skin disease</th>
<th>Irreversible vision loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Palpable nodules</td>
<td>- Severe itch</td>
<td>- Depigmentation</td>
<td>- Visual impairment</td>
</tr>
<tr>
<td></td>
<td>- Reactive skin disease</td>
<td>- Hanging groin</td>
<td>- Blindness</td>
</tr>
<tr>
<td></td>
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<td>- Atrophy</td>
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</tbody>
</table>
ONCHOSIM: quantifying new disease module

Model parameters are quantified for each manifestation, to reproduce:

Pre-control prevalence of morbidity by age and endemicity level, e.g.

Pre-control association between endemicity and disease prevalence, e.g.
Simulate trends in morbidity prevalence for each APOC project

- Convert nodule prevalence into mf prevalence
- Distribution of population density over various endemicity levels
- Cases = Multiplication of predicted prevalence * population

MDA coverage
- 60%
- 70%
- 80%

Stratification:
- APOC project
- Age
- Sex
- Bioclime
- Endemicity

Time since start of annual MDA (years)

Prevalence of morbidity (%)
# Number of infected and diseased cases (APOC countries)

<table>
<thead>
<tr>
<th></th>
<th>Number of individuals (x1000) (% of total population at risk)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1990</td>
</tr>
<tr>
<td>Total pop. at risk</td>
<td>77,550</td>
</tr>
<tr>
<td>Mf infected cases</td>
<td>21,770 (28.1%)</td>
</tr>
<tr>
<td>Worm infected cases</td>
<td>28,380 (36.6%)</td>
</tr>
<tr>
<td>Palpable nodules</td>
<td>7,080 (9.1%)</td>
</tr>
<tr>
<td>Rev. skin dis.</td>
<td>4,370 (5.6%)</td>
</tr>
<tr>
<td>Irrev. skin dis.</td>
<td>472 (0.6%)</td>
</tr>
<tr>
<td>Vision loss</td>
<td>1,919 (2.5%)</td>
</tr>
</tbody>
</table>

Rev. skin disease: severe itch and RSD
Irrev. skin disease: any depigmentation, atrophy, and hanging groin
Vision loss: visual impairment and blindness
Total number of DALYs by year for APOC countries
Total DALYs lost per country for 2025

Country
- DRC
- Cameroon
- Nigeria
- Ethiopia
- S. Sudan
- Tanzania
- Uganda
- CAR
- Congo
- Angola
- Chad
- Burundi
- Malawi
- Sudan
- Gabon
- Mozamb.
Conclusion

Case estimate:

• >4 million cases remaining with any clinical manifestation in 2025

• Most prevailing symptoms among all symptoms:
  • Nodules (45%)
  • Visual impairment (30%)

Burden estimate:

• Predicted total disease burden due to onchocerciasis in 2025: 2.6 million DALYs

• Main clinical manifestations contributing to burden:
  • Blindness (95%)
  • Severe itch (4.6%)

Major reduction in burden: ~11 million DALYs averted thanks to MDA and a decrease of 50% between 1990-2025
Implications

• Our DALY estimates (4.8 million DALYs) are considerably higher than GBD estimates (1.1 million DALYs) for 2015.
  • Wider spectrum of clinical manifestations taken into account.
  • Specific application of disability weights for each subtype of skin disease in DALY calculation.

• Still millions of persons infected (6.5 million) in 2025 that require treatment to prevent morbidity and to target disease elimination.
  • ~44% in hypoendemic areas
  • ~56% in DRC, ~17% in Nigeria
  • Need for alternative treatment strategies in *Loa*-endemic areas
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