Forecasting iNTS for the Global Burden of Disease Study

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Background

• Future Health Scenario (FHS) = forecasting component of GBD
  • Forecast population, all-cause mortality, predictive covariates (e.g. SDI), cause-specific and risk-attributable burden by location, year, age, and sex to 2100
  • Employs standard methodology: well suited to most but not all outcomes
  • Bespoke approach necessary for some causes, including iNTS
Methods

• **Inputs:** GBD estimates of iNTS and predictive covariates

• **Model:** shape constrained additive models (SCAMs) with varying combinations of predictive covariates and shape flexibility

• **Model selection:** Selected from collection of candidate models based on out-of-sample performance in cross-validation

• **Uncertainty:** propagate uncertainty from all model components using posterior simulation with 500 draws
Predictive covariates

- Water
- Sanitation
- Hygiene
- SDI

PCA

Interaction term

1st Component $\times$ GBD age group

Tensor product

HIV mortality (age & sex specific) $\times$ Malaria mortality (age & sex specific)

Sex

Location

Random effects
Incidence forecast

GBD estimates, 1990-2019
- iNTS incidence
- Covariates

SCAM model

FHS estimates, 2020-2100
- Covariates

Prediction

iNTS incidence forecasts
65.0% decline (50.4, 76.5)
Global iNTS incidence, age-standardized rates

56.7% decline (40.4, 69.9)
Mortality estimation

- HIV attribution using PAF approach
- Estimate CFR by HIV, age, and SDI

<table>
<thead>
<tr>
<th>Global Case Fatality Estimates</th>
<th>2020</th>
<th>2100</th>
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<tbody>
<tr>
<td>Total</td>
<td>13.7%</td>
<td>9.2%</td>
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- Estimate mortality as product of incidence and CFR
77.0% decline (64.2, 84.8)
Global iNTS mortality, age-standardized rates

80.8% decline (68.8, 87.9)
Conclusions

• Expected improvements in iNTS drivers/risk-factors likely to effect dramatic improvements in iNTS burden

• Expected population growth in SSA with stable or declining populations in other regions → larger proportion of global population living in higher risk locations

• R code for scenario-based forecasting to be published
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Gap metric estimation

\[ YLDs = \text{incidence} \times \text{duration} \times \text{disability weight} \]

\[ YLLs = \text{deaths} \times \text{target life expectancy} \]

\[ DALYs = YLLs + YLDs \]