HIV Modelling Consortium

Review of allocative efficiency tools

Improving Efficiency in Health Conference

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Aim & objectives of the HIV Modelling Consortium

The HIV Modelling Consortium aims to improve scientific support for decision-making through the co-ordination of a wide-range of research activities in mathematical modelling of the HIV epidemic

The Consortium’s key objectives are to:

- Identify questions that demand mathematical modelling input and identifying new modelling results that may require further validation.
- Facilitate sharing of information; modelling techniques, data and expertise between research groups.
- Provide a forum for rigorous review of new mathematical modelling research and tools.
- Provide funding through sub-contracts to commission research to address those needs.
Workshop to review allocative efficiency tools

• The HIV Modelling Consortium Secretariat were approached by World Bank ERG to convene a workshop to undertake a review of allocative efficiency tools

• The main tools being applied at country level that were identified for review were Goals, the AIDS Epidemic Model (AEM), and Optima

• HIV MC convened a one-day workshop in Vancouver on Saturday 18 July 2015 that brought together the modelling teams for the three AE tools identified by the ERG and researchers from disciplines relevant to aspects of allocative efficiency analysis: mathematical modellers, health economists, researchers in behavioural science
Objectives of workshop

1. Create an opportunity for the HIV modelling community to better understand the technical characteristics of the different models used to inform country programs;

2. To generate discussion of how the models address the specific HIV policy questions for which these models might be used;

3. To create a suitable space for the modellers to interact, comment on and learn from each other’s approaches.
(1) Process for reviewing the AE tools

- Each modelling group were asked to summarise:
  - The technical details of their model, including the epidemiological module (e.g. natural history assumptions, population groups and mixing, data calibration)
  - The intervention module (e.g. which are included and what are the baseline interventions)
  - The costing module (e.g. the cost function used for funding and spending)
  - The optimisation algorithm (i.e. the methods and constraints)
  - The data requirements and limitations of each tool were also discussed.
(2) Process for reviewing the AE tools

In addition, each modelling group was asked to detail how their model would address the following policy questions:

• What is a suitable (or maximum) target for reductions in HIV incidence and AIDS-related deaths for a country, given a specified amount of resources (current budget, 20% more; 50% less) and what interventions would be used?

• How much money would be needed to achieve National HIV Strategic Plan objectives of halving new HIV infections and reducing new AIDS-related deaths by 90% (or other target)?
FINDINGS
There are many commonalities across models

- All three modelling tools have broadly similar technical characteristics for the representation of HIV transmission, disease progression and the scale-up of interventions.

- The process through which decisions are made is of great importance and should support country deliberation. In all cases, the models should be used to facilitate the discussion about program design, trade-offs and targets, rather than obfuscate it, and all models could be successfully used in this way.

- All three modelling tools are constrained by data availability, particularly in regard to cost and epidemic drivers, and as such, conclusions have to be considered carefully in light of this.
Main intended uses of the allocative efficiency tools

<table>
<thead>
<tr>
<th>All models</th>
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<tbody>
<tr>
<td>• Estimating the amount of funding, coverage and behaviour changes needed to achieve national strategic plan objectives</td>
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<tr>
<td>• Assessing the effects of combinations of intervention programmes in different populations.</td>
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<tr>
<td>• Assessing the impact of scaling up prevention and treatment programmes</td>
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<td>• Conducting global analysis to support target settings and resource mobilization (UNAIDS) and guidelines development (WHO)</td>
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<tr>
<td>• Informing donor strategic planning (PEPFAR, Global Fund)</td>
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<td>• Assessing the projected future trajectory of the country’s HIV epidemic with and without investment in specific programmes, or with/without attaining programme-specific targets</td>
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<tr>
<td>• Financial commitment analysis to assess the spending commitment towards people living with HIV, the long term projections of the annual unit cost for people in various health states, and the public debt implication for the Government.</td>
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<table>
<thead>
<tr>
<th>Goals</th>
<th>AEM</th>
<th>Optima</th>
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<tbody>
<tr>
<td>• Assessing the effect of alternate allocation patterns</td>
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<tr>
<td>• Estimating the impact of available funding on the HIV epidemic</td>
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<tr>
<td>• Assessing the effects of scaling up programs with different effectiveness and cost in concentrated epidemics</td>
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<tr>
<td>• Assessing the effect of alternate allocation patterns</td>
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<tr>
<td>Estimating how much funding should be optimally allocated to which HIV service delivery model across the mix of HIV programmes targeting different population groups and geographies to best meet objectives</td>
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The models are best used in different ways and suited for different purposes

- The analysis process for each model has differences
- The suitability of a model depends on:
  - The policy and programming questions they are faced with,
  - The purpose of the exercise (e.g. for resource allocation or resource mobilisation efforts),
  - Their time and data availability,
  - Country engagement, training, and other resources available.
## Summary of models

<table>
<thead>
<tr>
<th>Model</th>
<th>Epidemic setting</th>
<th>Epidemic and intervention effectiveness data input</th>
<th>Components of the ART scale-up programme considered</th>
<th>Range of programme interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals</td>
<td>Concentrated and generalised epidemics</td>
<td>Default assumptions often provided. More input improves projections.</td>
<td>Few components of the ART programme can be assessed</td>
<td>Conventional programme interventions are assessed</td>
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<tr>
<td>AEM</td>
<td>Concentrated epidemics</td>
<td>Local data collation necessary</td>
<td>Few components of the ART programme can be assessed</td>
<td>Novel programme interventions can be assessed</td>
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<tr>
<td>Optima</td>
<td>Concentrated and generalised epidemics</td>
<td>Local data collation necessary</td>
<td>Several components of the ART cascade can be assessed</td>
<td>Novel programme interventions can be assessed</td>
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There are issues of interpretation across all models

- Representation of programme interventions
- Representation of ART
- Epidemic projections and model fitting
- Costs
(1) Representation of programme interventions

- Representation of intervention effectiveness - in terms of individual-level efficacy and population-level effectiveness.
- Effect sizes at scale are unknown; Goals and AEM attempt to take a systematic approach to this but this can be overridden by a user; the approach of Optima is to solicit the assumption from the user but work is in progress to also develop defaults for Optima, including defaults used by Goals and AEM, where applicable.
- All models offer to generate sub-national estimates, but this requires further assumptions about epidemic and cost data, for which guidance is quite weak.
- All assume that interventions act independently, and synergies among interventions (as well as between HIV interventions and broader primary health care interventions), both epidemiological and at implementation level, are not well addressed.
(2) Representation of ART

- Goals and AEM include ART as a single programme intervention. ART is provided to eligible individuals according to selected criteria such as CD4 cell count or population group. But components of the treatment cascade such as diagnosis, treatment failure, second line of treatment and viral suppression are not explicitly included in the models. This prevents the evaluation of other interventions targeting specific components of the treatment cascade.

- The ART module in Optima includes several components of the treatment cascade. Diagnosis is explicitly modelled, and infected individuals are categorised as unaware and diagnosed. Likewise, first and second lines of treatment as well as viral suppression are also included. ART adherence is also modelled separately.
(3) Epidemic projections and model fitting

- Each of the models have fitting procedures and approaches for collecting sets of parameters that give a reasonable fit to the epidemic data.
- All models have the facility to reproduce analyses on each of these fits in order to understand the uncertainty that arises in model results from uncertainties in the underlying epidemic data.
- There are minor differences in the approaches taken by each.
- The meeting attendees commented on the importance of this as it provides an opportunity to discuss data requirement and deficiencies.
- It was noted that results used in final outputs by the modelling groups rarely communicate these uncertainties explicitly and more could be done.
(4) Costs

- Goals includes a linear relationship between coverage and cost whereas AEM and Optima provide facility for incorporating other non-linear patterns.
- Optima attempts to make inference on the relationship between cost and coverage by fitting a function to available data points from within a country - whilst innovative, the data available will often be sparse and heavy reliance on over extrapolation will be needed.
- Functions that convey a non-linear relationship between cost and coverage should be preferred *a priori*, but the group advises users of the Optima model to inspect curves used in the model.
- For all models, assumptions of the stability of unit costs are contentious, and due to the nature of projecting the future and, in many cases, massive scale-up of interventions - it is impossible to have a great deal of confidence in historical cost data as a basis for future costs, or of future projections of any kind.
Recommendations

- Attendees noted areas of improvement for the models, the following were common to all:
  - When presenting results, discuss the uncertainties in the underlying data more explicitly
  - Models need to be expanded to include analyses for geographic prioritization and for different service delivery modalities.
  - Consider adding more granularity in the ART model to include disengagement in care, adherence, and treatment failure
  - Consider allowing user to specify a lower level of ART efficacy to allow for adherence failures
  - Consider including of synergies and joint costs for interventions and scale-dependent effects - pending availability of such data to inform analysis
Conclusions

Each of the three tools hold value in offering governments an approach through which to consider complex decisions on how to best project, estimate or optimise HIV resource allocations.

Future directions

• Encourage continued research and evaluation of allocative efficiency tools and their application

• Advocate for access to accurate cost data and improved representation of costs in models