Funding HIV prevention in developing countries: equity vs. efficiency

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Introduction

HIV/AIDS funding

- From 1996 to 2003 funding increased 10X; from US$ 300 Million to 3 Billion, but the estimated need was 6.3 Billion
- Despite considerable progress funding still falls short of need
- Projected AIDS funding gap in low and middle-income countries (Billion US$)

	2005	2006	2007
Resource needs	12	14.9	18.1
Funds available	8.3	8.9	10.0
Funding gap	3.7	6	8

Source: UNAIDS, 2005.

Resource allocation

- Resource allocation is the process of distributing resources among competing programs, populations or regions
- Funds traverse several levels of distribution and decision-making for resource allocation
- The way health funds are allocated has an important influence on health outcomes.

Allocation approaches

Consider two allocation approaches:

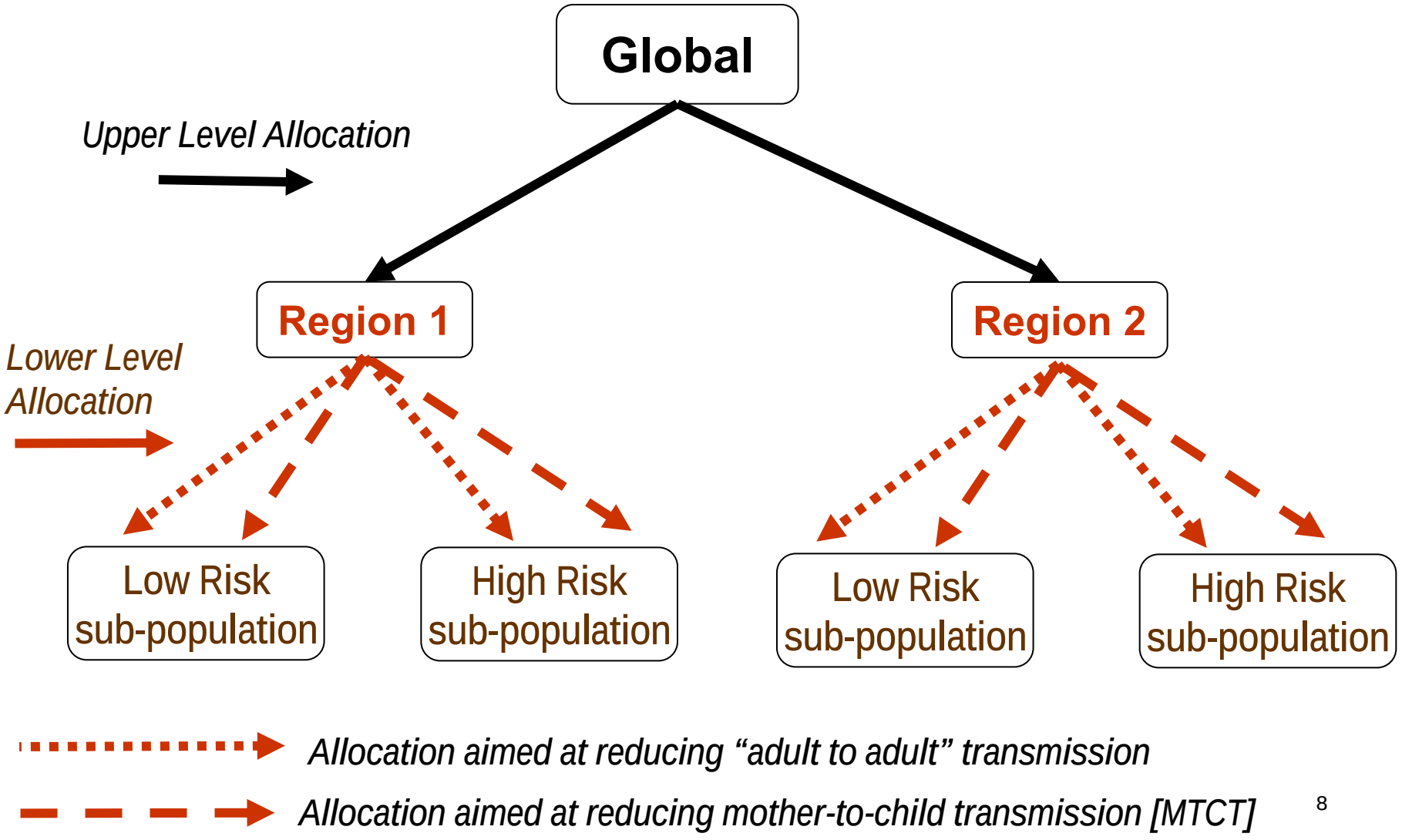
- **Efficiency** – optimization model where objective is to minimize the number of new infections
- **Equity** – allocating funds proportionally to the number of HIV cases in each sub-population

Objective

Research questions

- What is the impact of using an efficiency versus an equity-based approach for allocating HIV prevention resources in developing countries?
- Which level in the decision-making process should be optimized?

2-level allocation network



Objective

In the context of sub-Saharan Africa, I evaluate whether an optimal allocation of HIV prevention funds at an upper level yields a better outcome than an optimal allocation at the lower level.

	Option 1	Option 2	Option 3	Option 4
Upper level	Optimal	Equity	Optimal	Equity
Lower level	Optimal	Optimal	Equity	Equity
Outcome	Best	????	????	Worst

Methods

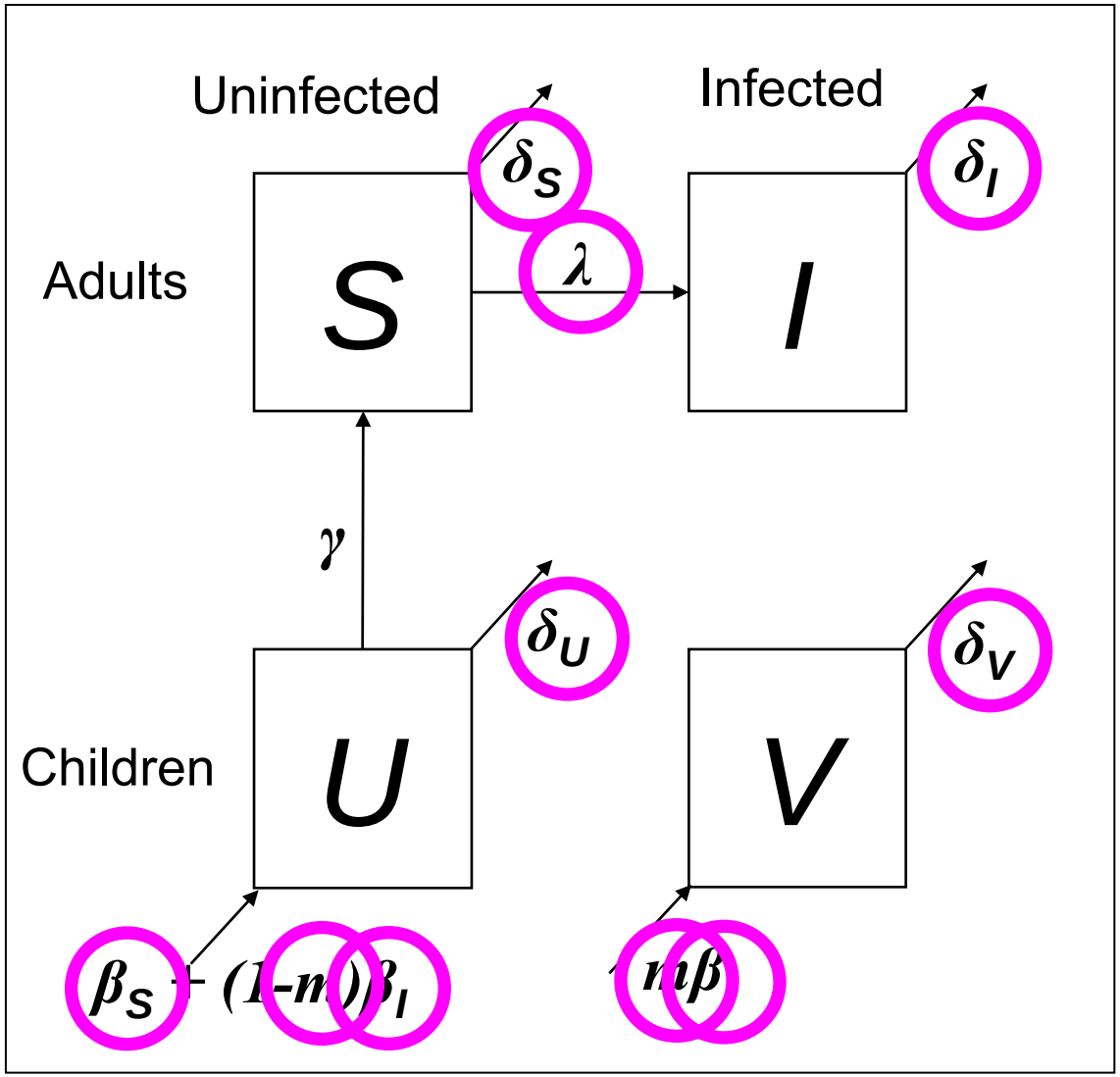
Modeling the efficiency allocation

The allocation problem can be defined using two components that interact.

A- Epidemic model: it determines the epidemic outcome given a defined allocation.

B- Optimization model: it generates different allocation scenarios, tests them on the epidemic model until it reaches the best outcome.

4-compartment epidemics model



Optimization model

The objective is to minimize the total number of new infections (NI) by allocating funds to programs aimed at reducing λ (contact rate) and to programs aimed at reducing m (MTCT rate) given a budgetary constraint.

$$\text{Min} = \quad \text{Sum}\ NI(x_i, y_j)$$

Objective function

subject to:

$$\text{Sum}\ (x_i + y_j) \quad \leq B$$

Budget Constraint

where:

i : represents programs aimed at reducing **λ**

j : represents programs aimed at reducing **m**

x_i : is a decision variable representing the amount spent on program i

y_j : is a decision variable representing the amount spent on program j

B : Budget constraint

Equity model

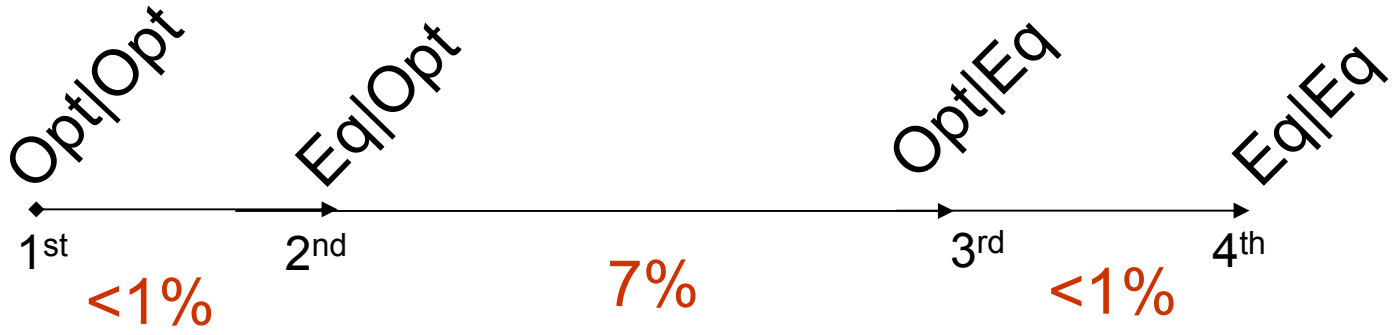
- Upper level allocation of total budget to region j

$$B_{region_j} = B_{Total} \cdot \frac{(I_j(0)+V_j(0))}{\sum_j (I_j(0)+V_j(0))}$$

Results

Results – Base Case

	Option 1	Option 2	Option 3	Option 4
Upper	Optimal	Equity	Optimal	Equity
Lower	Optimal	Optimal	Equity	Equity
NI	2,377,079	2,392,557	2,552,393	2,571,674
Outcome	Best	2nd	3rd	Worst



Conclusion

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- Ranking of 4 options maintained as per the baseline case throughout sensitivity analysis.
- Widest gap is between Eq|Opt and Opt|Eq
- Lower level allocation has greater influence on overall health outcomes.
- Implications for decision-makers in governments, public health agencies & NGOs:
  - efficiency approaches may narrow the funding gap
  - knowledge of lower level data is crucial
  - focusing on higher level can yield ineffective use of resources

Thank you

Questions?