3 day training for Optima HIV

Optima HIV

Funding for the creation of these materials was provided by

WORLD BANK GROUP
Health, Nutrition & Population

Agenda - Day 1: Overview and introduction to Optima HIV

Time	Session name and description
8.30	**Welcome and introduction to the track of the Training Program** • Welcome remarks • Introduction of participants and trainers • Participants to present their expectations • Presentation of objectives and confirm objective(s) for the training
	OVERVIEW OF KEY CONCEPT: RATIONALE FOR EFFICIENCY ANALYSIS
8:45	**Overview of allocative and implementation efficiency in the HIV response** • Sources of inefficiency in health • Rationale for efficiency analyses • Overview of mathematical model tools to conduct allocative and implementation efficiency analysis for HIV • Case studies • Questions and answers
9:15	Program decisions in the case of programs with multiple benefits (UNDP presentation of their structural drivers tool)
	EPIDEMIC AND ALLOCATIVE EFFICIENCY ANALYSIS IN OPTIMA
9:45	**Concept: Introduction to Optima HIV and Optima HIV interface** • Introduction to Optima HIV and tour of Optima HIV interface • Brief demonstration of a complete analysis from beginning to end • Questions and answers
10:30	**Break**
11:00	**Allocative efficiency implementation process, analytical framework and scope of work** • Allocative efficiency implementation process • Optima HIV analytical framework • The importance of defining a scope of work for an Optima analysis
11.15	**Training: Creating an Optima project and data spreadsheet** • Creating and naming an Optima HIV project • Managing Optima HIV project files • Defining population groups • Downloading the databook spreadsheet
11.30	**Practice: Create an Optima HIV project and define population groups**
12.30	**Lunch**
13.30	**Collating key demographic, epidemiological and behavioural data and populating the Optima HIV spreadsheet** **Concept: Principles of project design and data entry** • Key data needs and sources • Interpreting data sources and considerations for model parameters • Handling data uncertainties
13.45	**Training: Reviewing data sources and avoiding data inconsistencies when completing the Optima HIV spreadsheet**
14.30	**Practice: Review of Optima HIV databook and uploading a completed Optima HIV spreadsheet**
15.30	**Break**
16:00	**Training: Optima HIV model calibration** • Steps for calibrating and what to look for in a calibration
16.10	**Practice: Calibrating a model**
17.10	**Interactive discussion of questions and ideas arising from Day 1**
17.25	**Evening exercise(s)/reading in preparation for Day 4 (optional)** Review Optima HIV input parameter priors Review Optima HIV spreadsheet and provide additional data
17.30	**Closure of Day 3**

Agenda - Day 2: Getting to grips with Optima HIV

Time	Session name and description
8.30	**Review of materials covered on Day 3, review questions, and plan for Day 4**
8.45	**Training: Defining programs, service delivery modalities, parameters and cost functions**
9.15	**Concepts: Collating data to inform cost functions** • Data requirements, sources, and concerns • Provide examples
9.30	**Practice: Defining programs, service delivery modalities, parameters and cost functions**
10.30	**Break**
11.00	**Training: Optima HIV scenario analyses** • How to define scenarios • How to run scenario analyses, view, export, and interpret results
11.15	**Practice: Running Optima HIV scenario analyses, viewing, exporting, and interpreting results**
12.30	**Lunch**
13.30	**Concepts: Optima HIV optimization analyses** • How mathematical optimization is achieved • Description of the Optima HIV optimization algorithm
14.00	**Training: Introduction to cascade optimization**
14.20	**Practice: Defining objectives and constraints in Optima and performing an optimization analysis, including with cascades** • How objectives, constraints, and time horizons are incorporated in Optima • Specifying settings in Optima to meet objectives and set constraints • Understanding and interpreting results with respect to objectives, time horizons, constraints, and cost functions
15.30	**Break**
16.00	**Practice: Defining objectives and constraints in Optima and performing an optimization analysis, including with cascades (continued)** • How objectives, constraints, and time horizons are incorporated in Optima • Specifying settings in Optima to meet objectives and set constraints • Understanding and interpreting results with respect to objectives, time horizons, constraints, and cost functions
17.25	**Evening practical exercise: Complete a full country Optima HIV analysis (optional)** • Work on an Optima HIV epidemic and allocative efficiency analysis
17.30	**Closure of Day 4**

Agenda - Day 3: Completing an Optima HIV analyses

Time	Session name and description
8.30	**Review of material covered on Day 4, review questions, and plan for Day 5** • Access to training materials
8.45	**Exercise: Complete full country Optima HIV analysis** • If complete, interpret findings and extract key messages and recommendations
10.30	**Break**
11.00	**Concepts: Integrating implementation efficiency within allocative efficiency**
11.20	**Training: Different service modalities** Choosing implementation modalities and options, defining interactions, and how they work in Optima HIV
12.10	**Practice: Conducting an analysis with interacting programs**
12.30	**Lunch**
13.30	**Concepts: Interpreting analysis findings and extracting key messages and recommendations** • Review of different analysis and outputs with a focus on interpretation • Extracting key messages or lessons from the analysis • Structuring recommendations
14.00	**Practice: Structure key recommendations from an allocative efficiency analysis using Optima HIV model** • If full country Optima HIV analysis is complete, use your results otherwise, use default results Prepare a 4-slide PowerPoint presentation summarizing your Optima HIV analysis results
15.00	**Next steps in using tools for analytical applications and General Questions**
15.40	**Concepts: Access to Optima HIV and Q&A**
15.50	Participant reflection and feedback
16.10	Concluding remarks
16.30	**Plenary closing session**
17.30	**Workshop closure**

Learning objectives for Skills Track: Optima HIV

- Formulate policy questions for HIV and collect data with which to parameterise
- Use Optima HIV to address allocative and implementation efficiency questions in HIV policy and programmes
- Interpret results from Optima HIV analyses for program and policy improvement

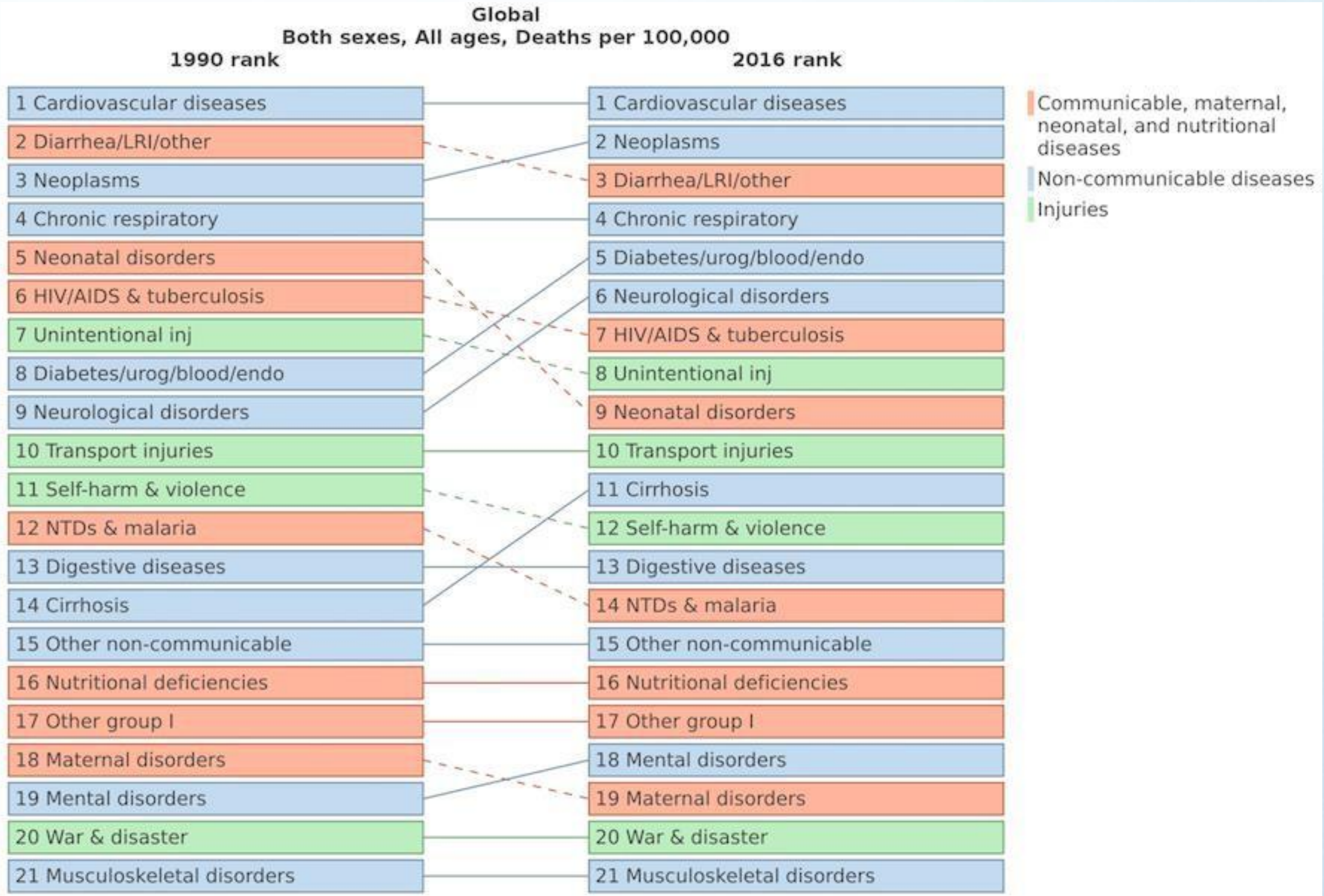
Overview of allocative and implementation efficiency in the HIV response

Learning objectives

- Rationale for efficiency analyses
- Sources of inefficiency in health
- Overview of tools to conduct allocative and implementation efficiency analysis for HIV
- Case studies – how has the tool been applied?

SOURCE: Chisholm, D and Evans, D. 2010. Improving health system efficiency as a means of moving towards universal coverage. *World Health Report (2010) Background Paper, No 28.* World Health Organization

HIV/AIDS and the TB co-epidemic remain drivers of mortality worldwide

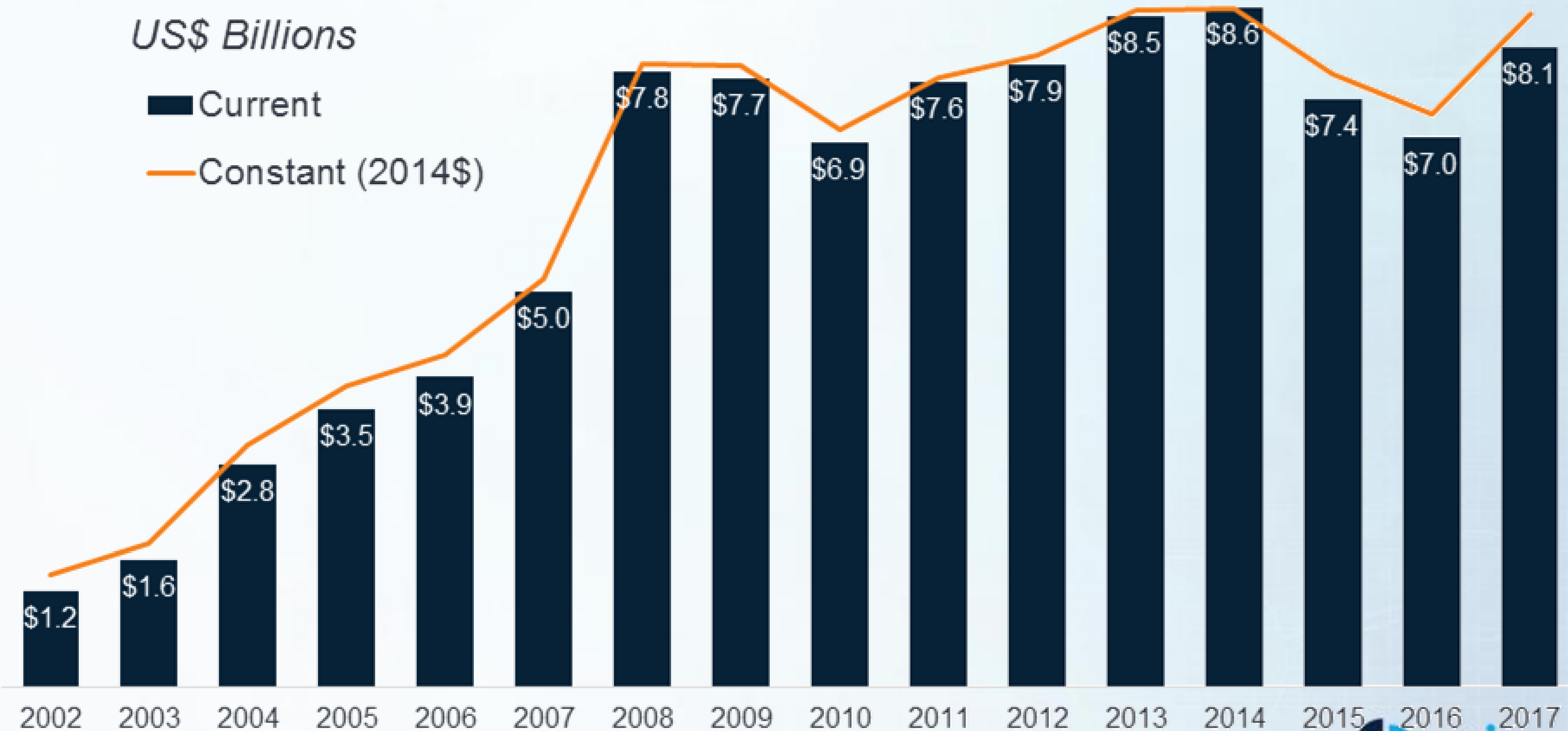


Source: IHME. Global Burden of Disease (2016)

Decline international HIV financing

- Kaiser report 2018 – the 2017 funding increase is due to timing of US funding, not a predicted sustainable increase in funding

Donor Government Disbursements for HIV, 2002-2017



SOURCES: UNAIDS and Kaiser Family Foundation analyses; Global Fund to Fight AIDS, Tuberculosis and Malaria online data queries; UNITAID Annual Reports and direct communication; OECD CRS online data queries.

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2017 increased funding is due to delayed US funding,, not a projected increase in funding.

- Better **Decision** and **Delivery** Choices

Decision *and* Delivery Science Goals

Support countries to:

Make the best possible investment **decisions**

Generate demand for and **deliver services to the best feasible standards**:

for the right **people**

in the right **places**

at the right **time**

in the right **ways**

Achieve the best possible **health impact**

Plan early to ensure that proven approaches are **institutionalized and sustained**

Scarce health resources are not being put to their best use

10 sources of inefficiency in health systems

1. **Medicines:** underuse of generics and higher than necessary prices for medicines
2. **Medicines:** use of substandard and counterfeit medicines
3. **Medicines:** inappropriate and ineffective use
4. **Health-care products and services**: overuse or supply of equipment, investigations and procedures
5. **Health workers:** inappropriate or costly staff mix, unmotivated workers
6. **Health-care services:** inappropriate hospital admissions and length of stay
7. **Health-care services:** inappropriate hospital size (low use of infrastructure)
8. **Health-care services:** medical errors and suboptimal quality of care
9. **Health system leakages:** waste, corruption and fraud
10. **Health interventions:** inefficient mix/ inappropriate level of strategies

SOURCE: Chisholm, D and Evans, D. 2010. Improving health system efficiency as a means of moving towards universal coverage. *World Health Report (2010) Background Paper, No 28.* World Health Organization

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Types of inefficiency in health systems

1. **Allocative inefficiency:** The distribution of resources to a combination of programs, which will yield the largest possible effect for available resources
2. **Pareto inefficiency:** economy is not producing the maximum with available resources
3. **Productive inefficiency:** not producing at its lowest unit cost
4. **Social inefficiency:** when price mechanism does not take into account all costs and benefits associated with economic exchange (typically, price mechanism only take into account costs and benefits arising directly from production and consumption)
5. **Dynamic inefficiency:** no incentive to become technologically progressive, i.e. not using or investing in new products and new production methods (or services and service delivery modalities)
6. **'X' inefficiency:** no incentive for managers to maximize output (typically, uncompetitive markets)

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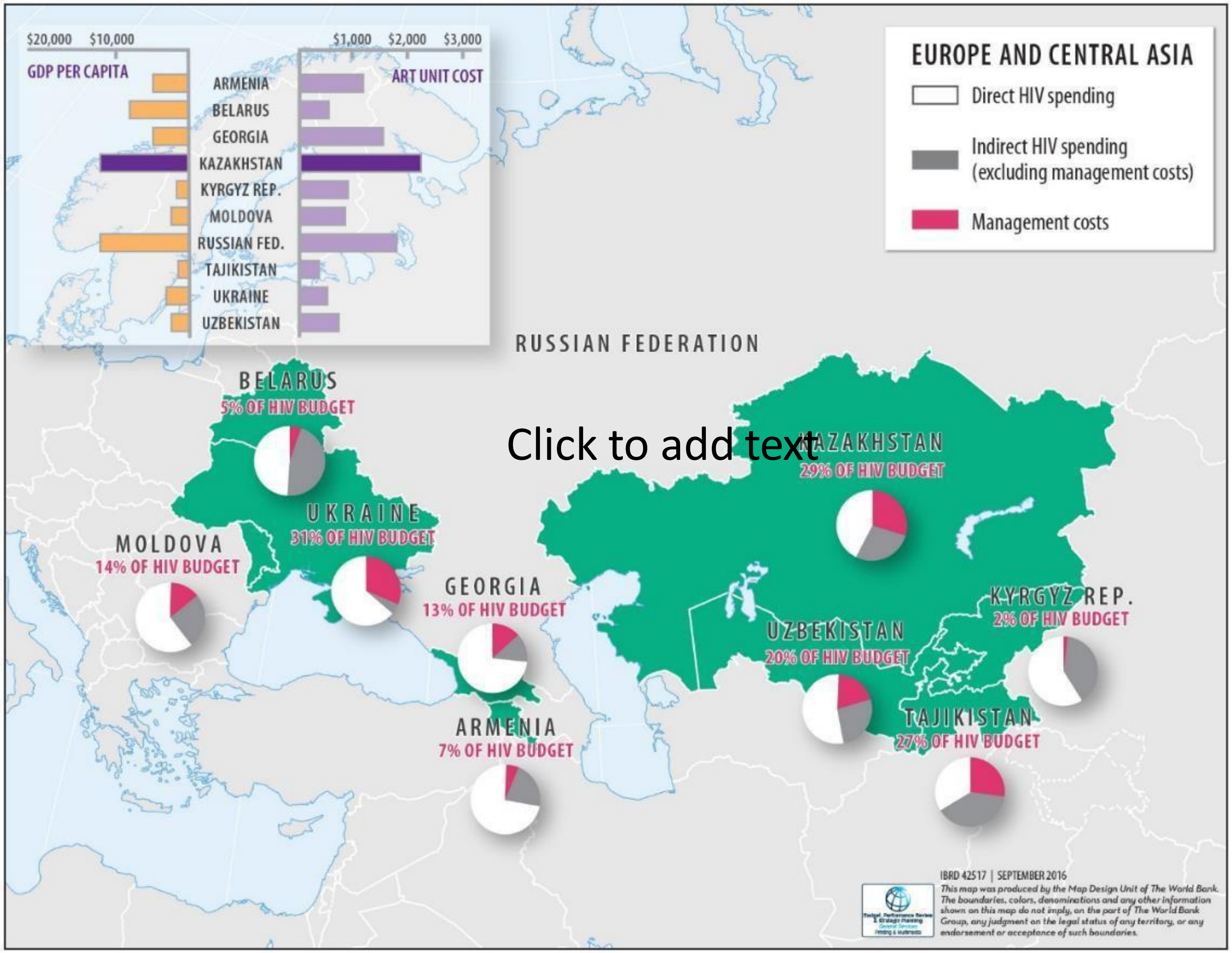
‘X’-Inefficiency in HIV programmes



Click to add text

Source: Optima HIV ECA studies

Types of Inefficiency in Health Systems

WHAT to do: Allocative efficiency

1. **Allocative Inefficiency:** The distribution of resources to a combination of programs, which will yield the largest possible effect for available resources
2. **Pareto inefficiency:** economy is not producing the maximum with available resources

HOW to do: Implementation efficiency

3. **Productive inefficiency:** not producing at its lowest unit cost
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To improve health outcomes in resource constrained settings, we need to….

- ….focus on both what and how

Focusing on the WHAT

Improving the WHAT: Improving Allocative Efficiency

- The distribution of resources to a combination of programs, which will yield the largest possible effect for available resources
- The right intervention being provided to the right people at the right place in a way that health outcomes are maximized for a given level of resource envelope
- Implies shifts in funding allocations over time, understanding funding envelopes, and a focus on service delivery modalities

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Ways in which to improve the 'WHAT' (Allocative Efficiency)

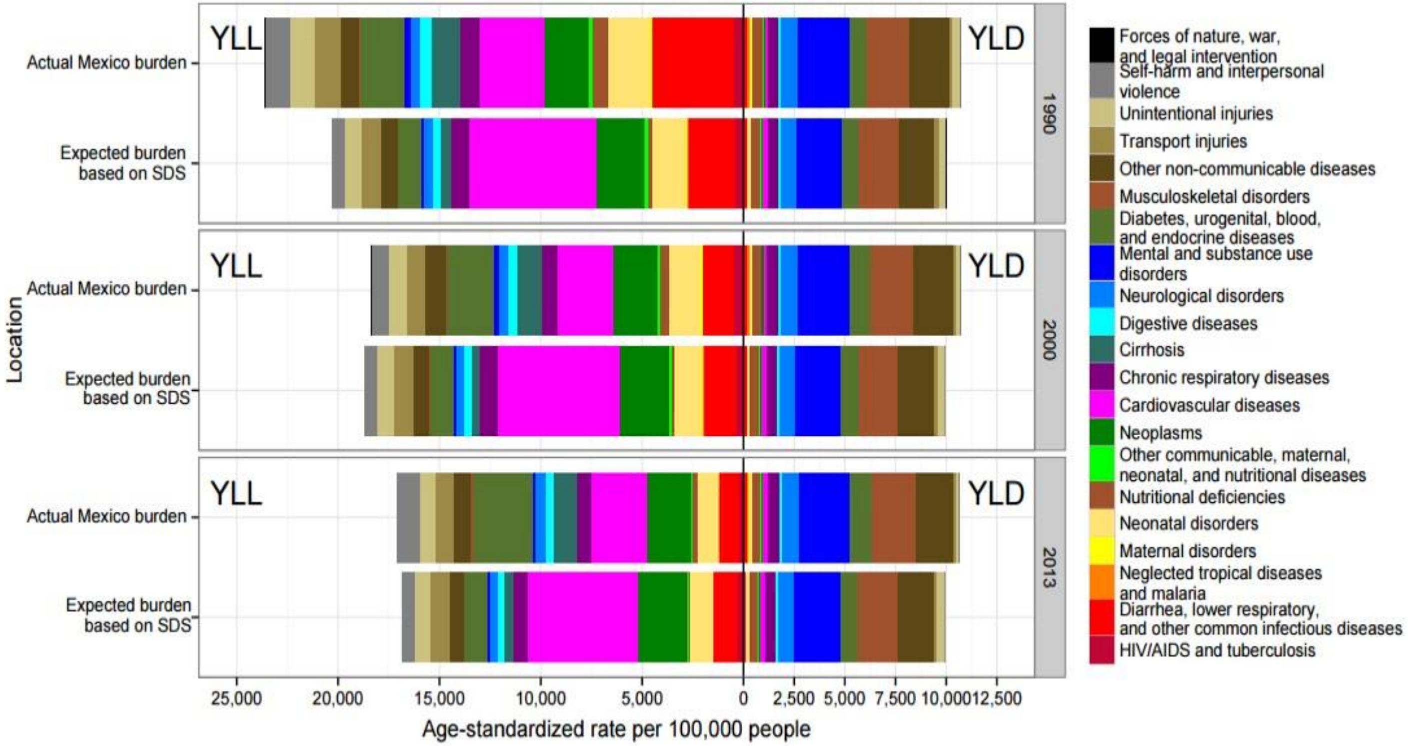
A. Analyses of temporal changes in epidemiological trends and benchmarking between countries

B. Use of cost-effectiveness analysis

C. Use of mathematical modelling

A: Use of epidemiological modelling and benchmarking to improve allocative efficiency

What patterns are unexpected compared to epidemiological transition?



IHME | UNIVERSITY of WASHINGTON

Institute for Health Metrics and Evaluation

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B: Use of Cost-Effectiveness Analysis (CEA) as a basis for improving decision-making in health

- CEA principle : healthcare interventions can be ranked on the basis of their incremental costs relative to their incremental benefits (subject to a number of important assumptions)
  - Benefits are usually measured in terms of expected health gain

CONVENTIONAL LEAGUE TABLE	ICER ($/LYS)
Condom availability	Cost saving
Male medical circumcision	Cost saving
SBCC 1 *(HCT in adolescents, reduction in MSP)*	46
ART (current guidelines	96
PMCTC	132
Universal ART	186
Infant testing in 6 weeks	208
HCT for sex workers	366
SBBC 2 *(condoms)*	566
SBBC 3 *(condoms, HCT, MMC)*	697
PrEP for sex workers	926
General population HCT	1,273
Infant testing at birth	1,349
HCT for adolescents	1,772
PrEP for young women	3,703
Early infant male circumcision	8,712,984

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But, cost effectiveness has its weaknesses

- The **interrelationship between causes of burden of disease and associated health interventions is missing**: it considers interventions as independent, neglecting their interactions.
- The **nonlinear relationship** between **health service coverage and health outcomes**.
- The **nonlinear relationship** between **cost and coverage of interventions**, by not calculating the marginal costs of scaling up or scaling down a service.
- The **dynamic nature of burden of disease** due to wider primary prevention, epidemiological, or population-wide impacts of the health services being implemented (e.g. the impact of vaccination or treatment on transmission of infection).
- The **changing nature of financing for interventions**, such starting costs and diminishing returns, or the fact that health services cannot instantly be either scaled up or scaled down.
- The fact that **priority-setting may change** at different funding levels or provide different scenarios for a health system stakeholder.
- Because **services and funding are already in existence** and both the development of, and priority-setting within, that context needs to take the context and existing services into account, to not contribute to further fragmentation.

Mathematical modelling

C: Mathematical modelling tools for improving allocative efficiency

"To address the limits of cost-effectiveness analysis and consider broader factors in decision systems, packages of services and technologies should be considered together rather than in isolation and analyses incorporate overall health, financial and equity objectives and relevant constraints. Optimization tools have recently emerged to do this and can help to optimize a health benefits package tailored to specific objectives and time horizons within available budget envelopes, local and changing epidemiology, dynamic costs, and variable, non-linear benefits on different populations."

Gorgens, Petravic, Wilson, and Wilson, 2017

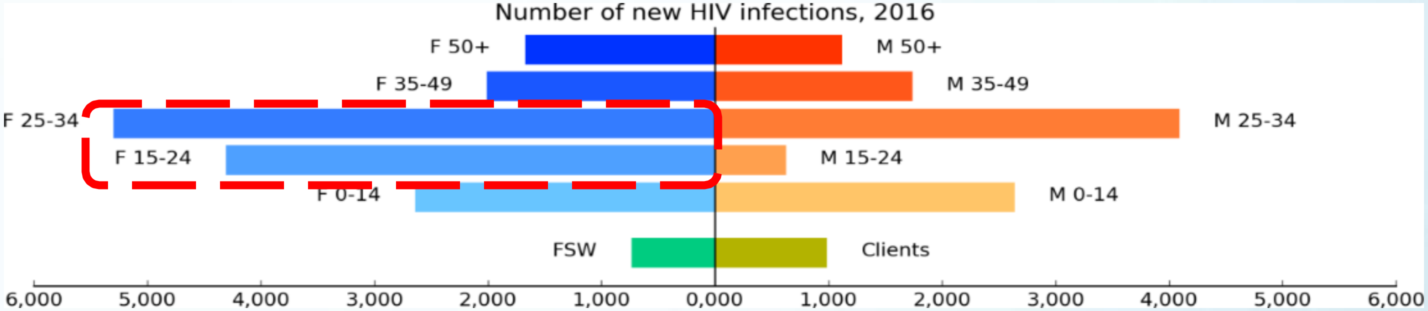
CEA to modelling comparison in South Africa

- League tables do not account for interacting effects
- Optimization around epidemiological model
  - account for interacting effects
  - any other quantifiable components in entire system

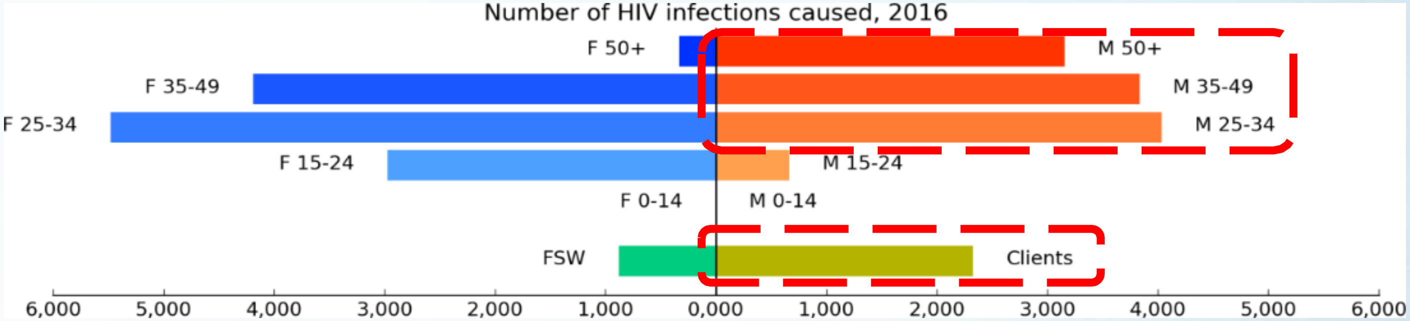
CONVENTIONAL LEAGUE TABLE	ICER ($/LYS)	OPTIMISATION ROUTINE	ICER ($/LYS)	ICER between methods
Condom availability	Cost saving	Condom availability	Cost saving	N/A
Male medical circumcision	Cost saving	Male medical circumcision	Cost saving	N/A
SBCC 1 *(HCT in adolescents, reduction in MSP)*	46	ART (current guidelines	109	14%
ART (current guidelines	96	PMCTC	142	7%
PMCTC	132	Infant testing in 6 weeks	248	20%
Universal ART	186	Universal ART	249	34%
Infant testing in 6 weeks	208	SBCC 1 *(HCT in adolescents, reduction in MSP)*	749	1525%
HCT for sex workers	366	SBBC 2 *(condoms)*	*1,200	112%
SBBC 2 *(condoms)*	566	General population HCT	1,236	-3%
SBBC 3 *(condoms, HCT, MMC)*	697	SBBC 3 *(condoms, HCT, MMC)*	1,816	161%
PrEP for sex workers	926	HCT for sex workers	2,643	621%
General population HCT	1,273	Infant testing at birth	2,937	118%
Infant testing at birth	1,349	PrEP for sex workers	9,947	974%
HCT for adolescents	1,772	HCT for adolescents	19,540	1003%
PrEP for young women	3,703	PrEP for young women Max	26,375	612%
Early infant male circumcision	8,712,984	Early infant male circumcision	89,642,731	929%

HIV: Epidemic modeling enables us to understand transmission dynamics

Number of new HIV infections acquired, 2016



Number of new HIV infections transmitted, 2016



The World Bank. 2017. Improving the allocative efficiency of Malawi's HIV response: Findings from a mathematical modelling analysis. Washington DC: World Bank.

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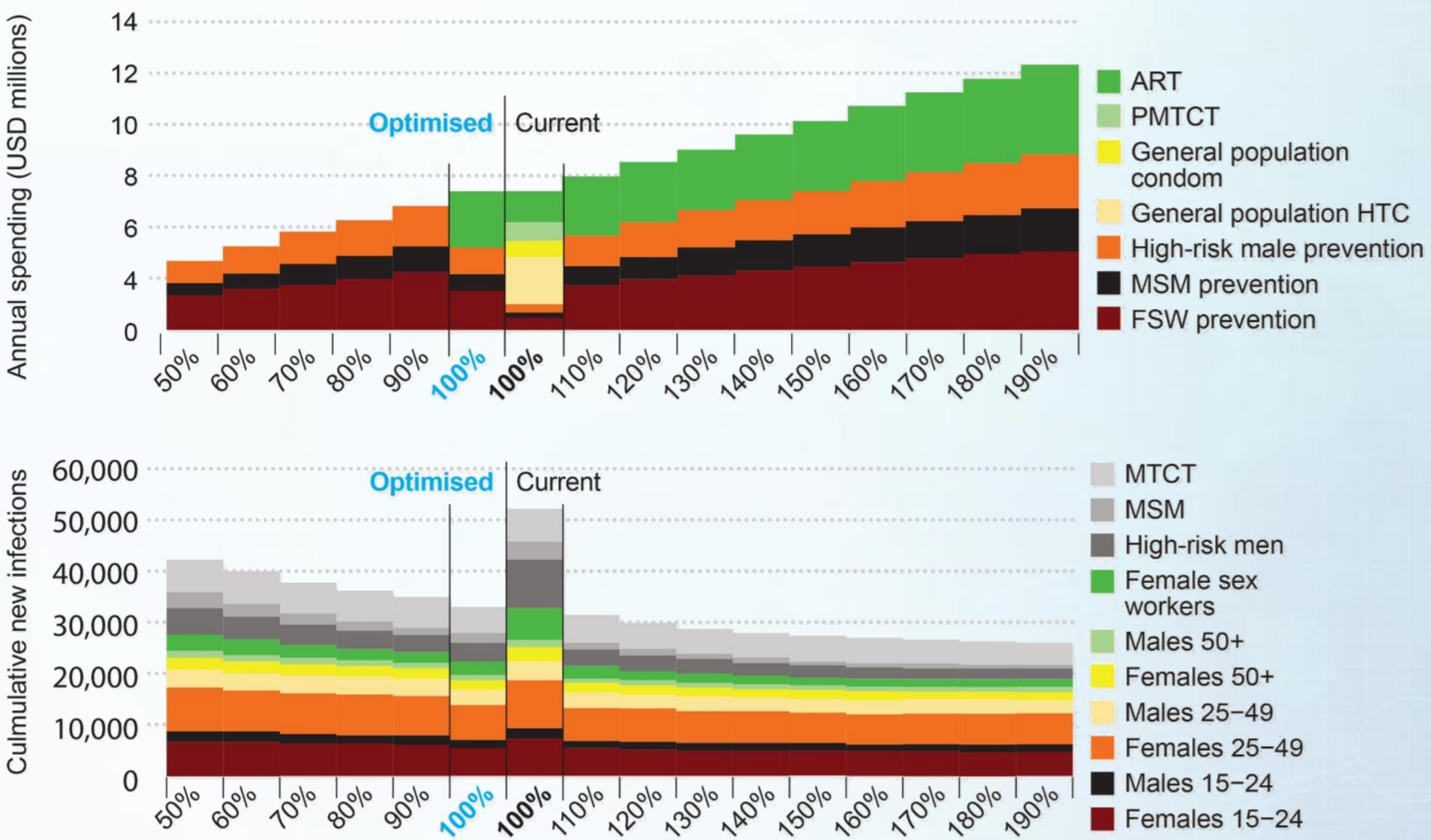
Example of using a mathematical model to improve HIV allocative efficiency in HIV in Sudan

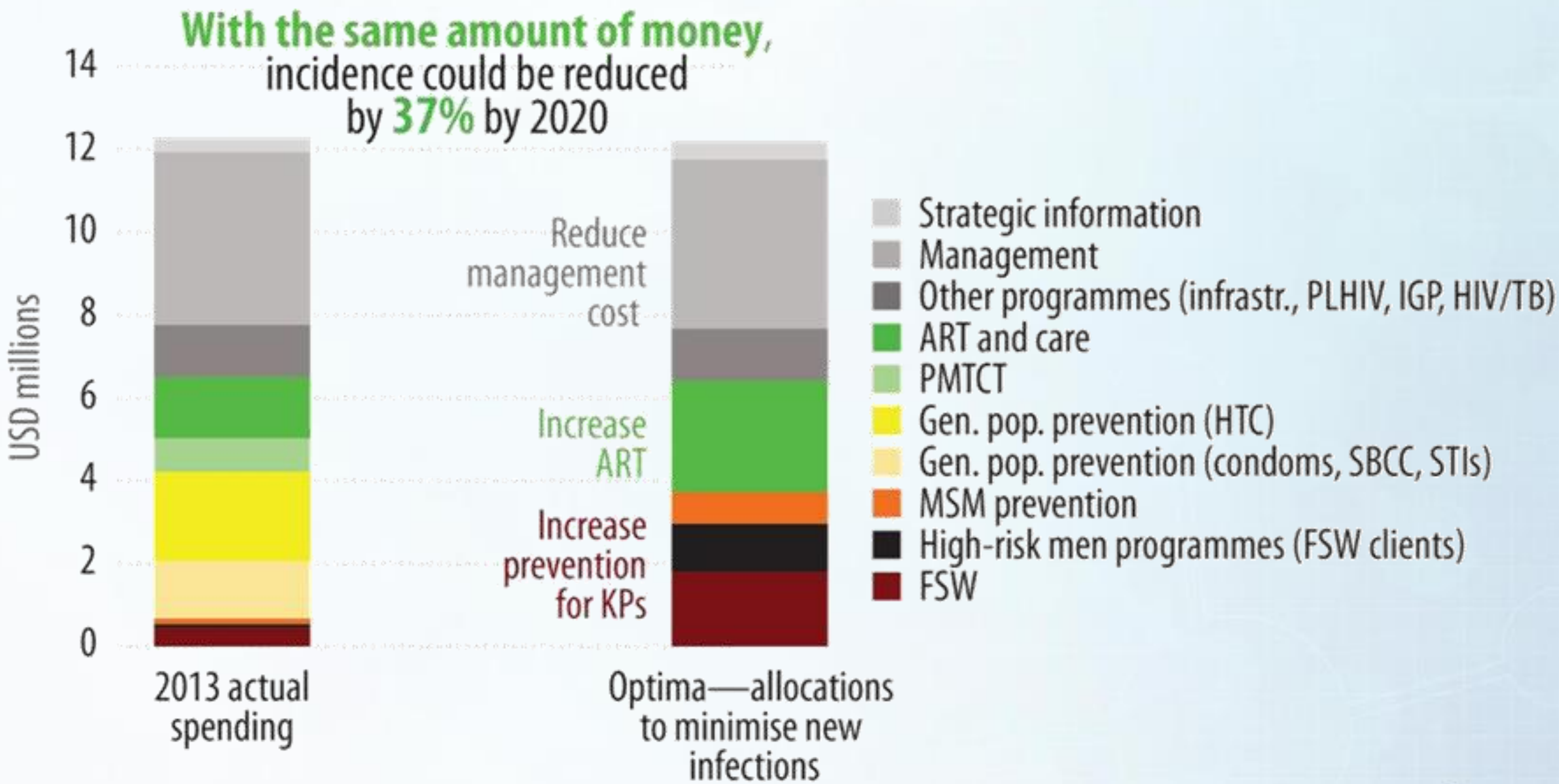


SOURCE: The World Bank Group. “A Case Study on How Allocative Efficiency Analysis Supported by Mathematical Modelling Changed HIV Investment in Sudan. From Analysis to Action” 2015

Sudan example, a Fragility, conflict, and violence (FCV) country with political and religious opposition to HIV programs

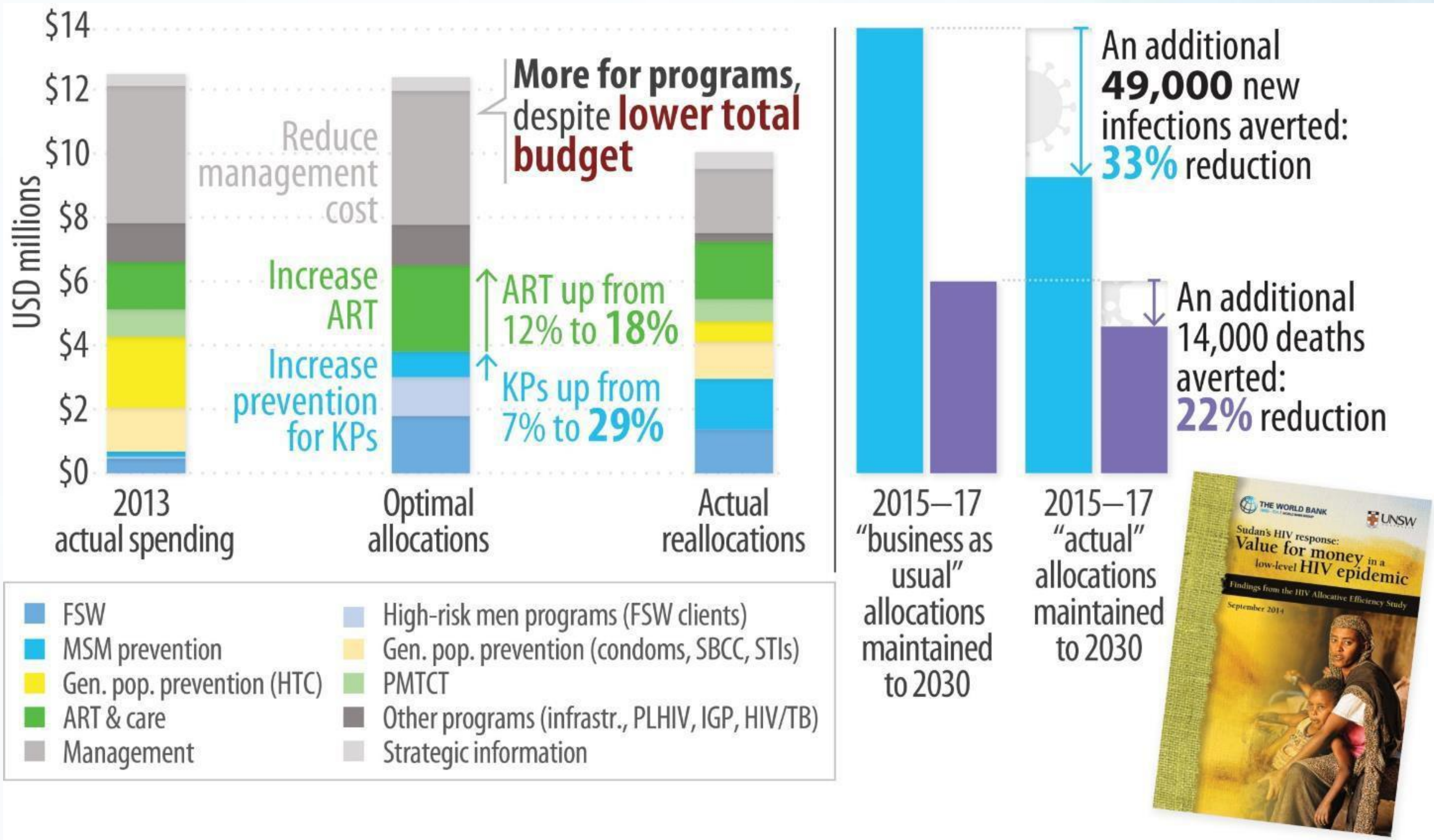
How were funds spent and where did the study recommend?

Spending pattern in 2013 and optimized allocations to minimize new HIV infections between 2014 and 2020, at 2013 resource level of USD 12.3 million



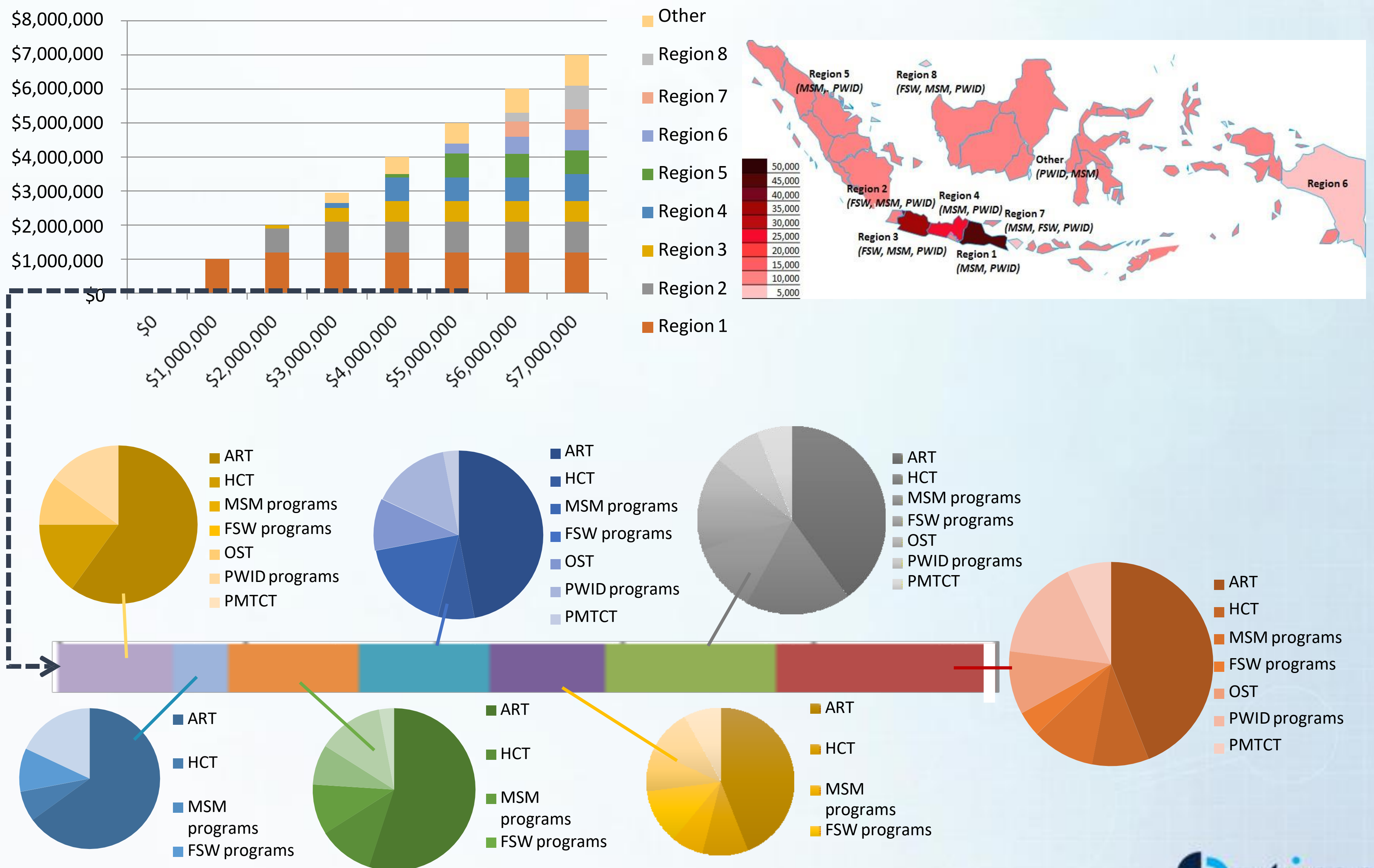
SOURCE: The World Bank Group. "A Case Study on How Allocative Efficiency Analysis Supported by Mathematical Modelling Changed HIV Investment in Sudan. From Analysis to Action" 2015

Sudan: Actual changes in allocations

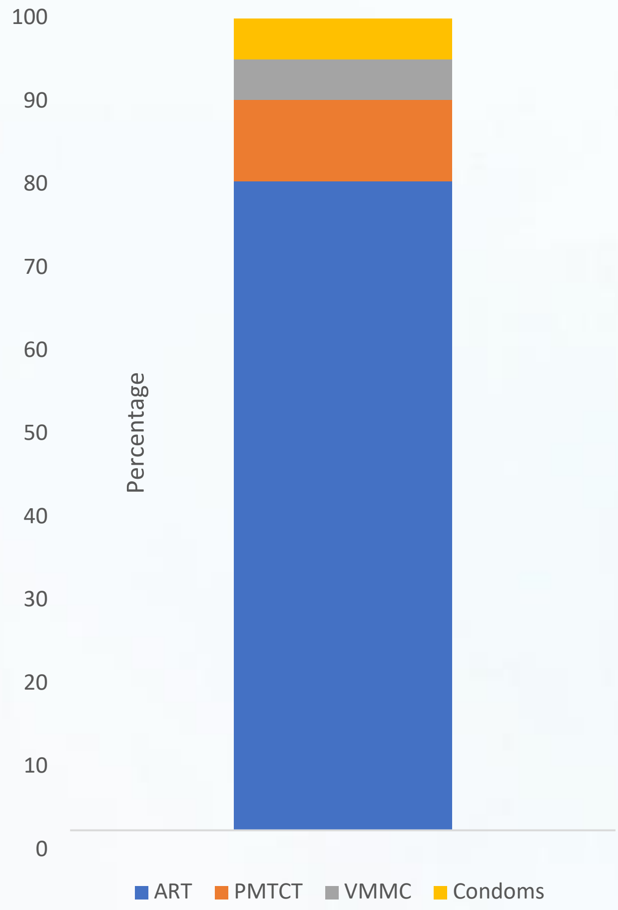


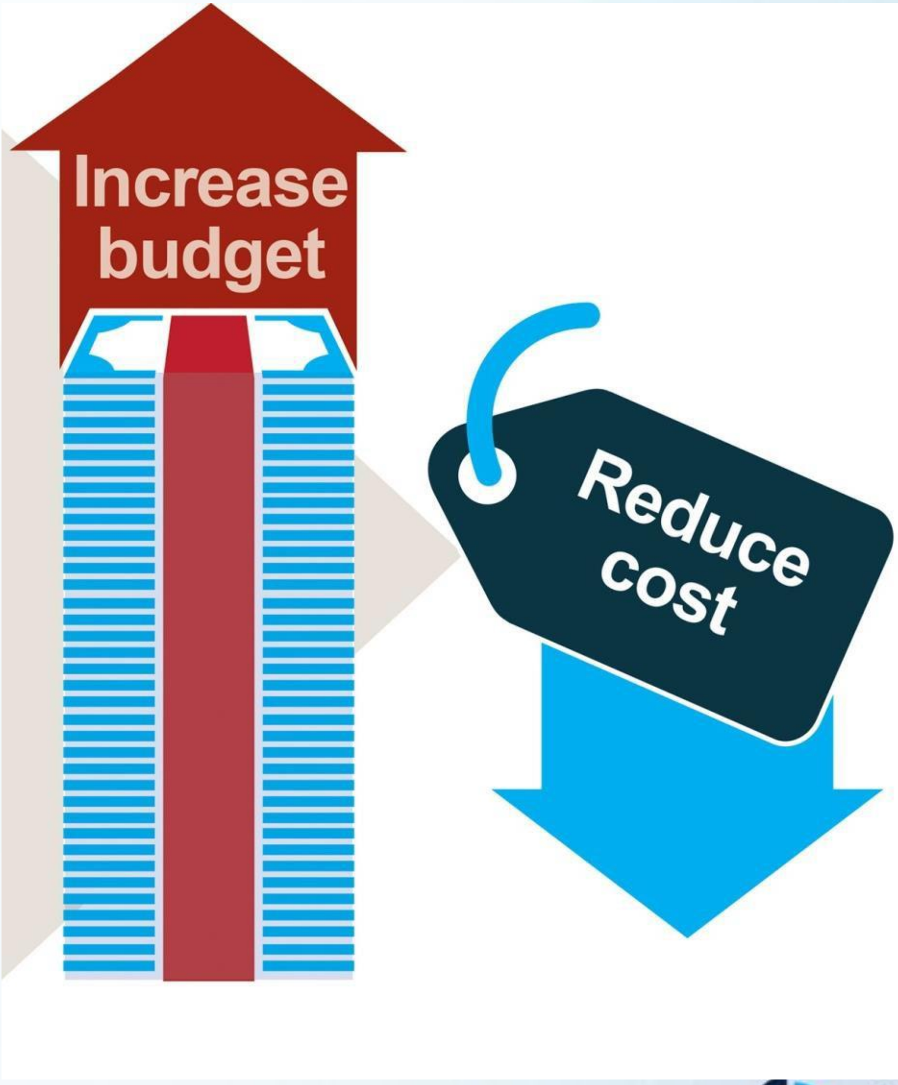
SOURCE: The World Bank Group. "A Case Study on How Allocative Efficiency Analysis Supported by Mathematical Modelling Changed HIV Investment in Sudan. From Analysis to Action" 2015

HIV sub-national: Geographical prioritization in Indonesia

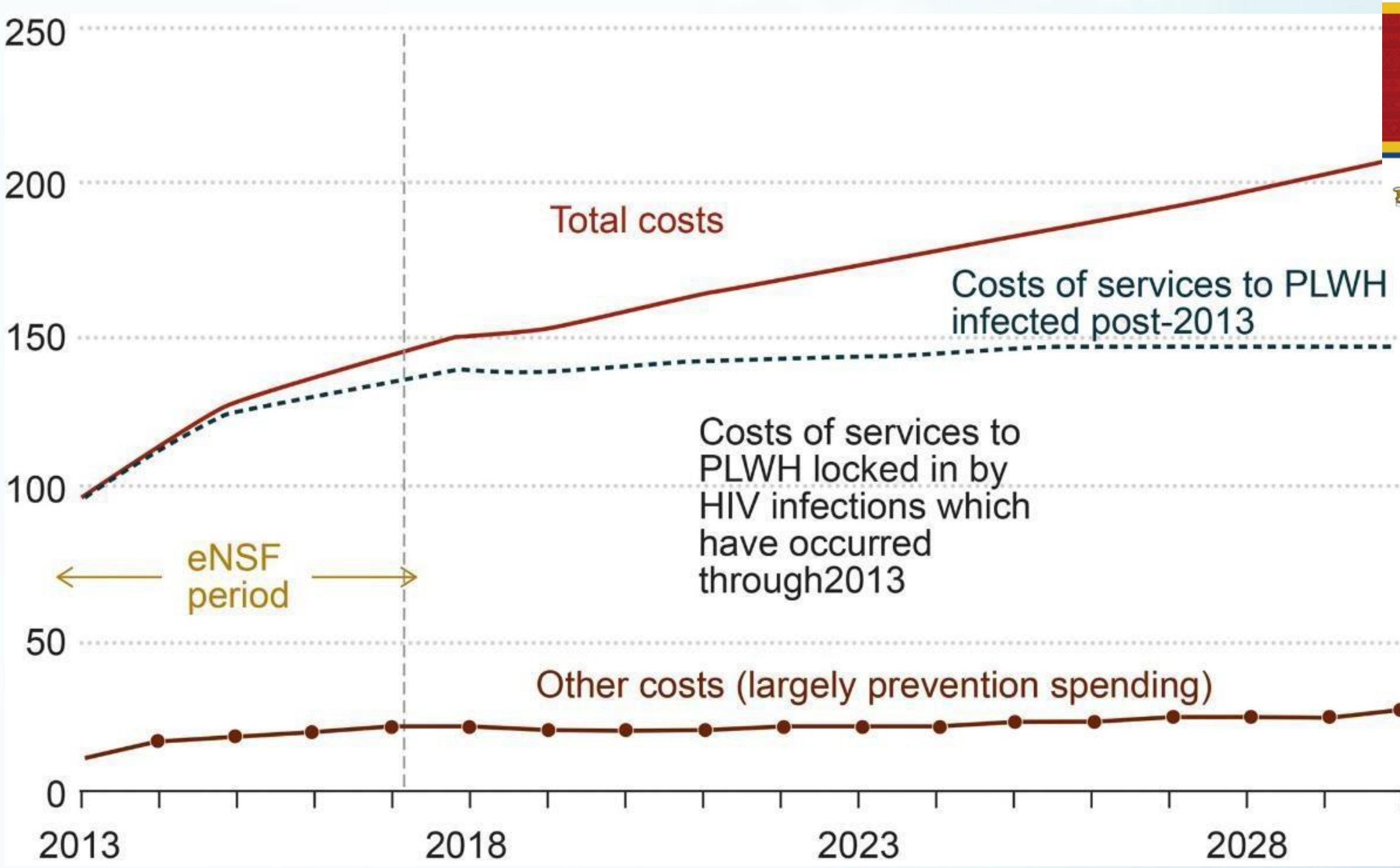


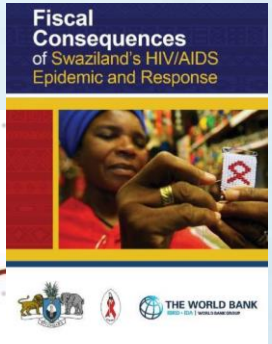
Limits to allocative efficiency in generalized HIV epidemics



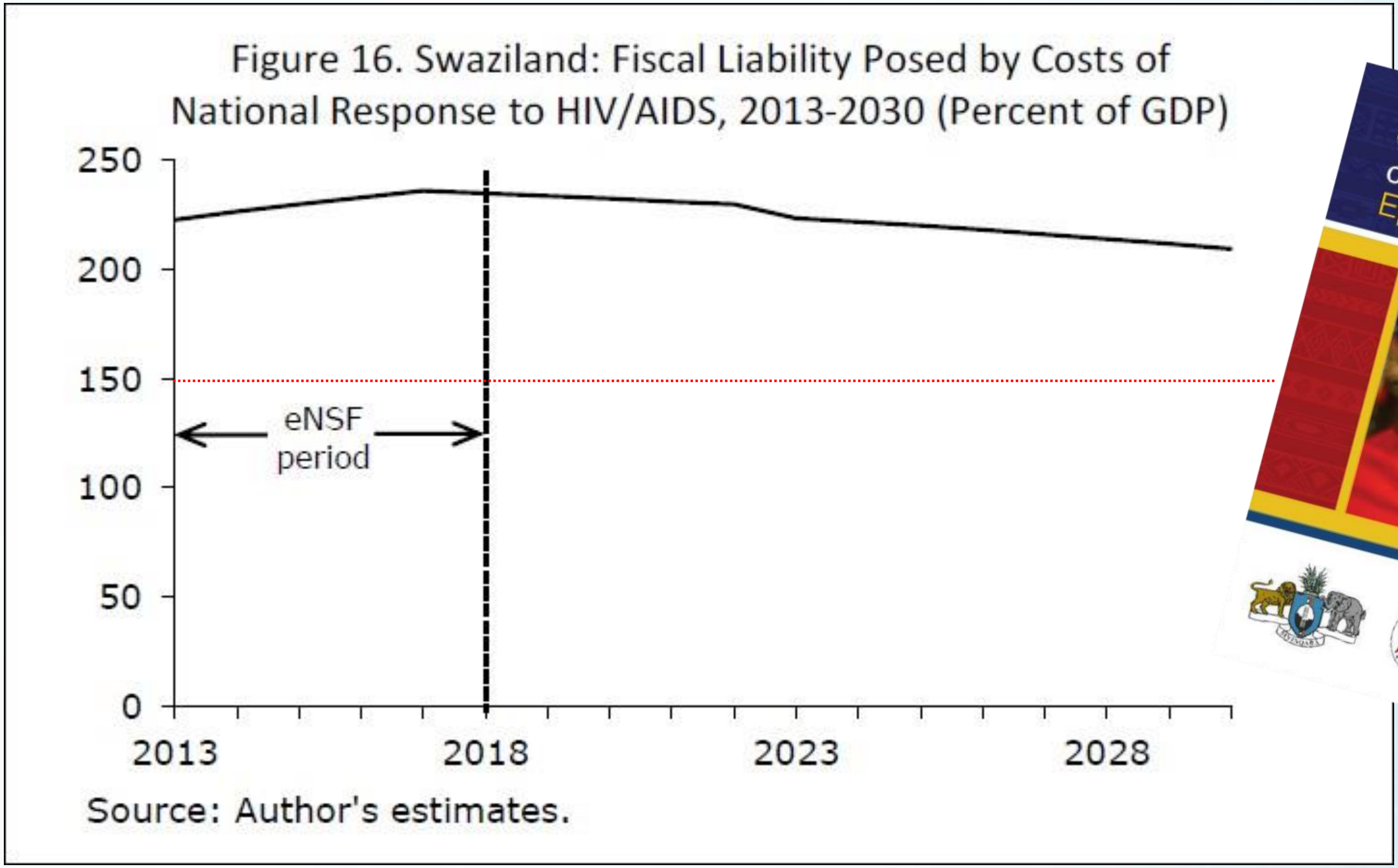


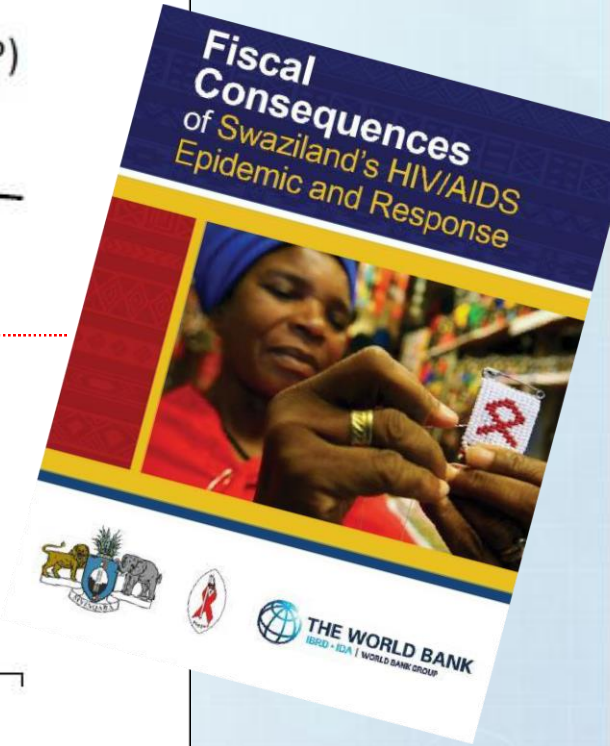
Limits to allocative efficiency in generalized HIV epidemics





Results of these limits on allocative efficiency: where to find efficiencies?





Focusing on the HOW

When we discuss implementation, it is appropriate to consider failure

- Two key reasons interventions fail:
  - One reason is because of ignorance.
    - We just don’t know what works, and therefore need research and discovery (i.e. need to figure out the WHAT)
  - Another reason is ineptitude.
    - The knowledge exists but an individual or group of individuals fails to apply that knowledge correctly. (i.e. need to figure out the HOW)

“What’s really interesting to me about living in our time and in our generation is that … ineptitude is as much or a bigger force in our lives than ignorance.”

Atul Gawande, author of The Checklist Manifesto

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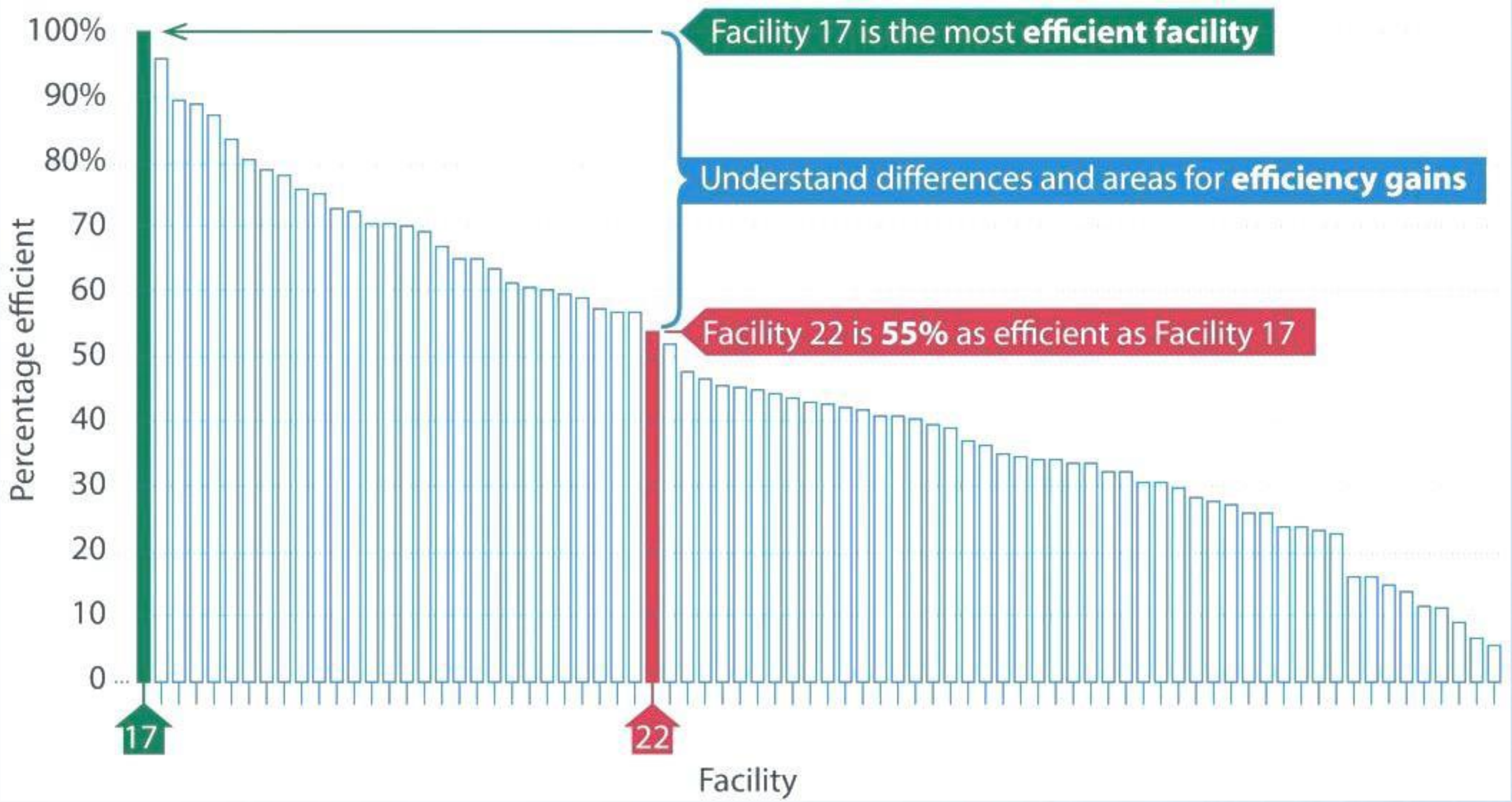
Tools and approaches to improve the **HOW**

- All about implementation
- Benchmarking
- Supply and demand analysis
- Management assessments
- Geospatial analysis
- Big data analysis
- Cascade analysis

Example: implementation efficiency analysis



Cascade concept

- Framework that outlines the sequential steps or stages of medical care that people go through from initial diagnosis to achieving disease control
- Initially used for HIV, especially in PMTCT; now increasingly use for other infections/ conditions like TB, NCDs (and also for prevention)
- Both terms “care cascade” and “treatment cascade” are used interchangeably
- For many years, the “continuum of care” term was used and referred to the same concept of successive stages in somebody’s diagnosis-care-treatment journey, and the importance of a person to keep moving through these stages

Better health outcomes requires that one identifies bottlenecks and chokepoints along the cascade

- Bottlenecks and chokepoints are points along critical path to effective service delivery
- Better health outcomes require that we find and fix these chokepoints

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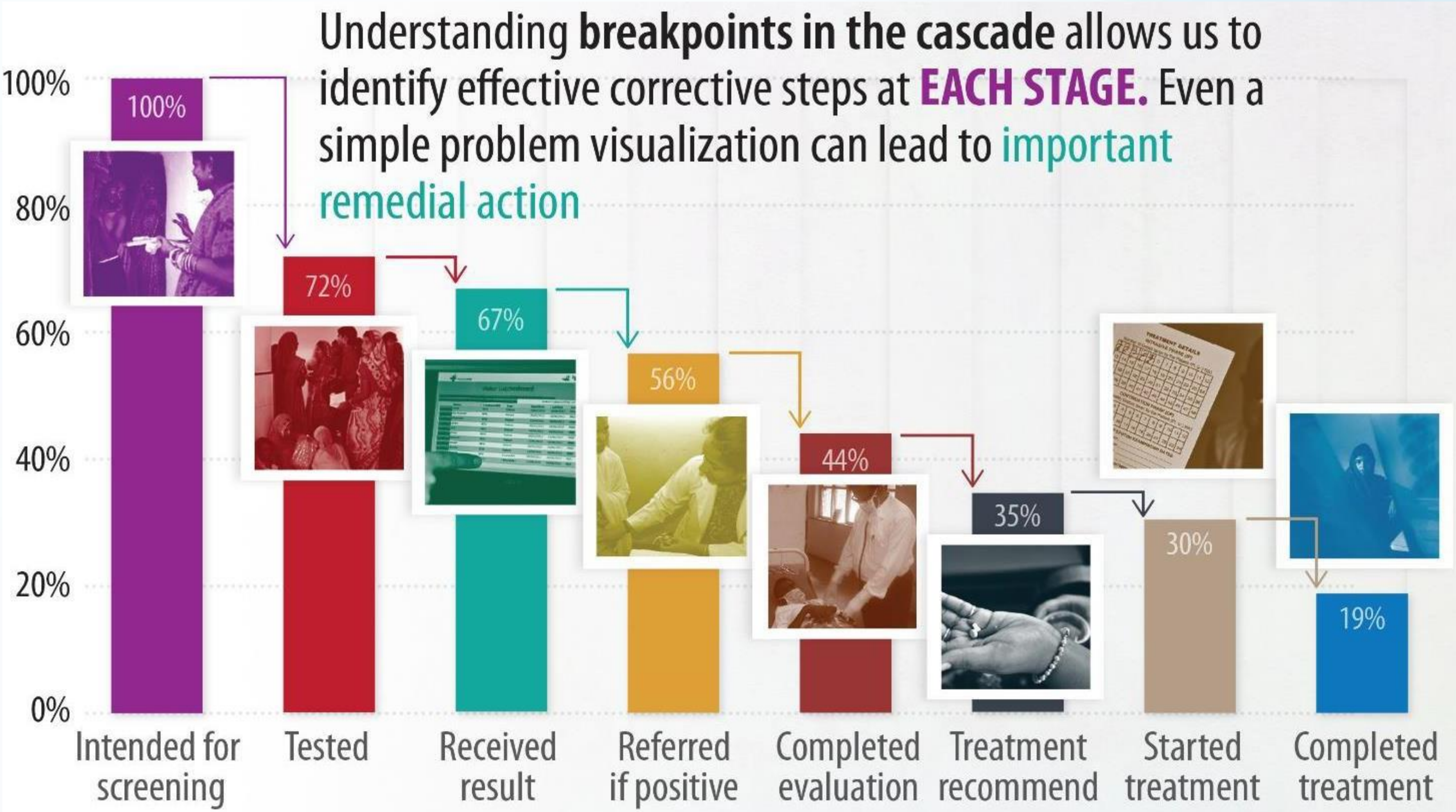
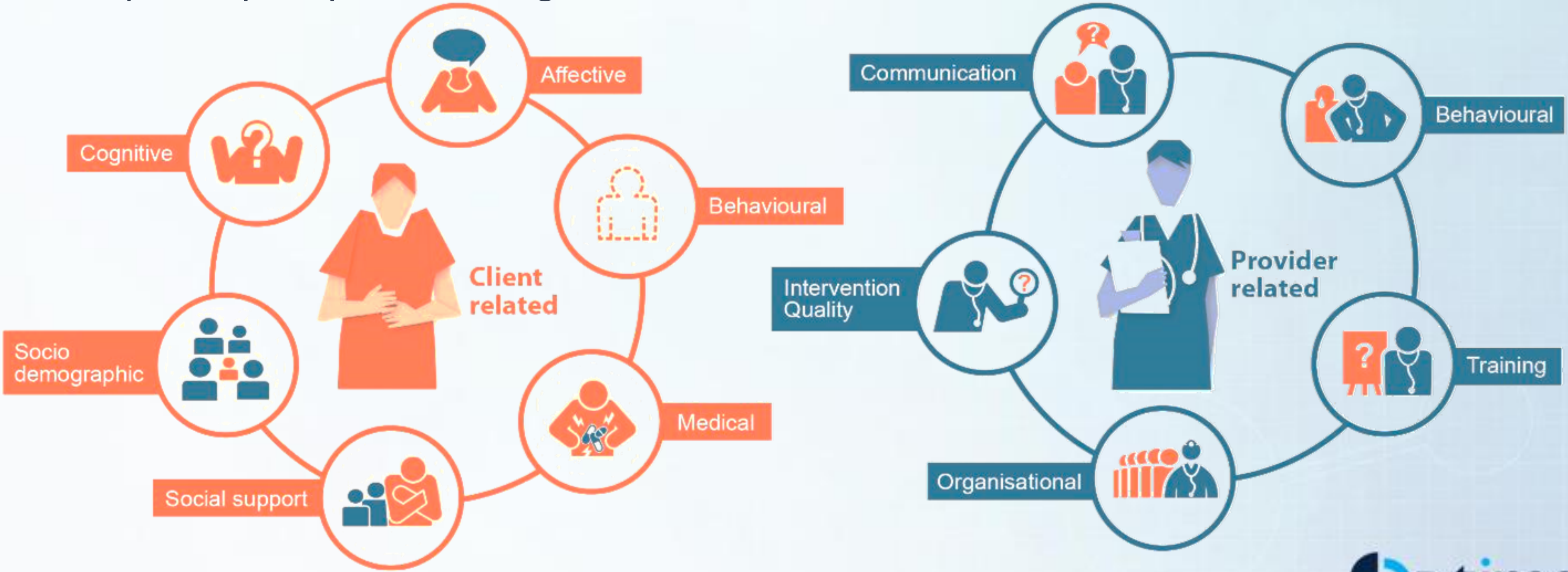
Cascades can help to identify and address bottlenecks

Example of cascade: IndiaTB



Both supply-side and demand-side barriers need to be addressed

- Individuals who want to prevent a specific disease or who already live with a medical condition need access to a **continuum of services** to achieve disease control—with each service in the delivery cascade **conditional on having received the previous one**
- But: people can experience **barriers** to getting tested, linking to or staying in care, and starting/adhering to treatment
- Need to address supply side and demand side gaps in order to improve cascade, improve quality and coverage, and health outcomes



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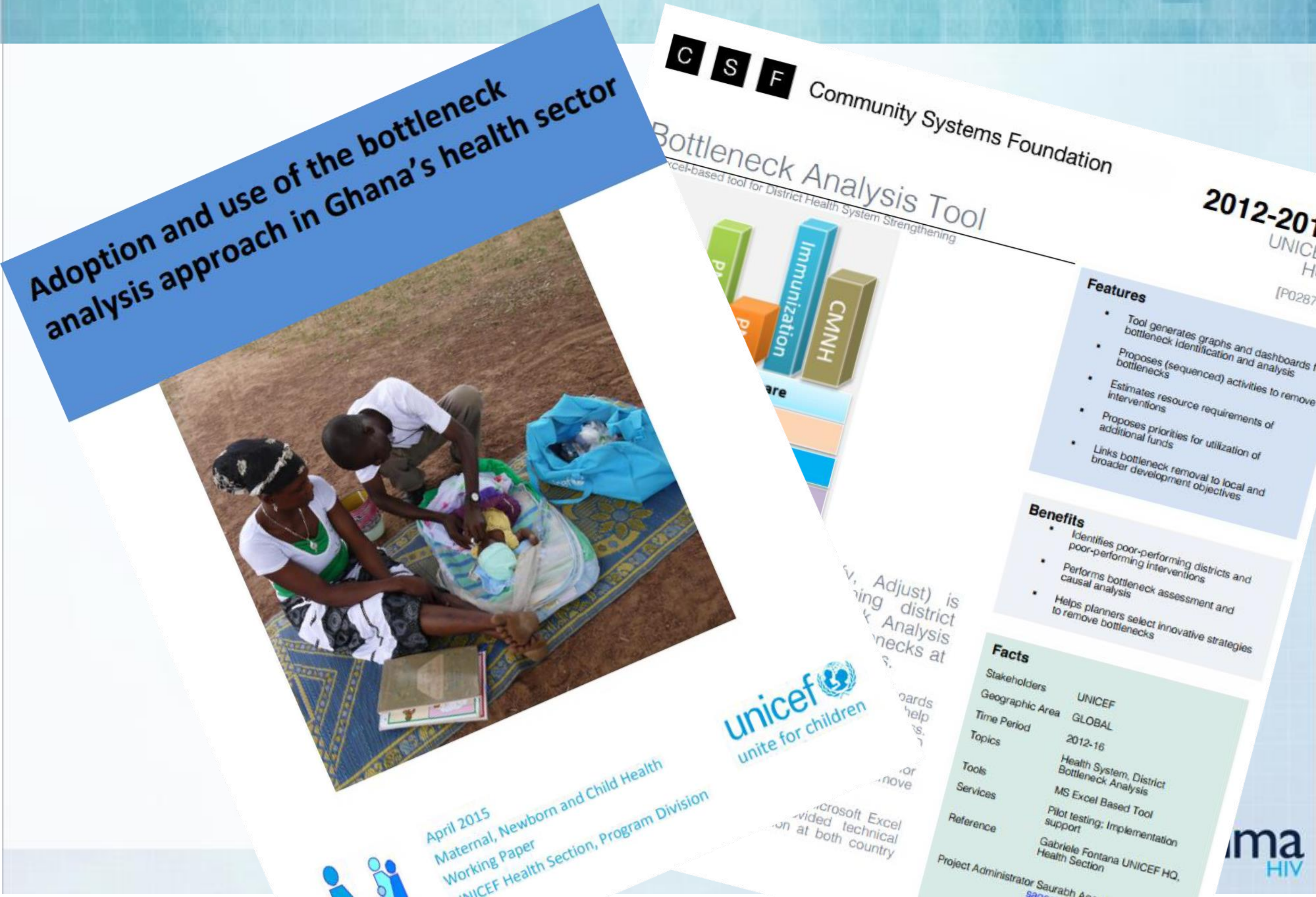
Bottleneck Analyses is not a new concept


Adoption and use of the bottleneck analysis approach in Ghana's health sector

unicef
unite for children

April 2015
Maternal, Newborn and Child Health
Working Paper
UNICEF Health Section, Program Division

C S F Community Systems Foundation

Bottleneck Analysis Tool

Excel-based tool for District Health System Strengthening

Immunization

CMNH

2012-201

Features

- Tool generates graphs and dashboards bottleneck identification and analysis
- Proposes (sequenced) activities to remove bottlenecks
- Estimates resource requirements of interventions
- Proposes priorities for utilization of additional funds
- Links bottleneck removal to local and broader development objectives

Benefits

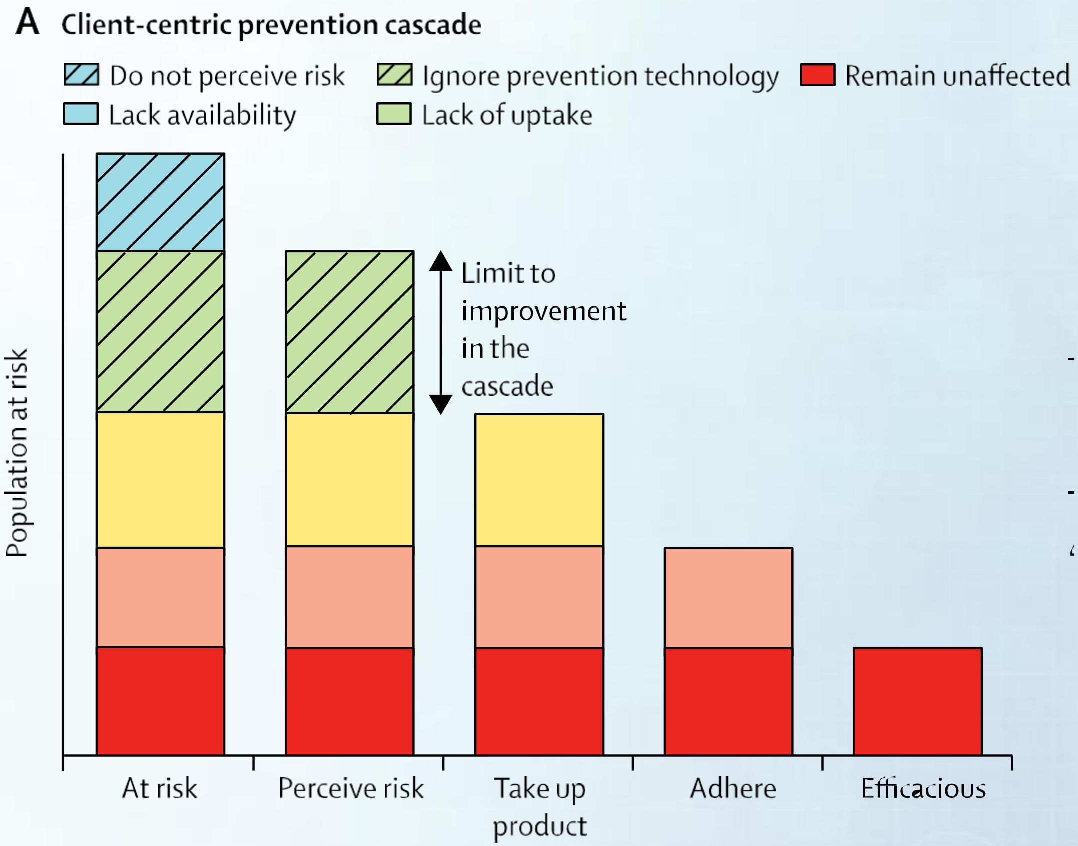
- Identifies poor-performing districts and poor-performing interventions
- Performs bottleneck assessment and causal analysis
- Helps planners select innovative strategies to remove bottlenecks

Facts

Stakeholders	UNICEF
Geographic Area	GLOBAL
Time Period	2012-16
Topics	Health System, District Bottleneck Analysis
Tools	MS Excel Based Tool
Services	Pilot testing; Implementation support
Reference	Gabriele Fontana UNICEF HQ, Health Section
Project Administrator Saurabh	

Client-centric: how can those at risk of infection avoid it?

- Assumes intervention is available



Source: Garnett et al. 2016. HIV Prevention Cascades: Identifying Gaps in the Delivery of HIV Prevention Interventions. https://spiral.imperial.ac.uk/bitstream/10044/1/43765/2/Geoff_cascadesposter_2016.pdf

LONDON SCHOOL of HYGIENE &TROPICAL MEDICINE

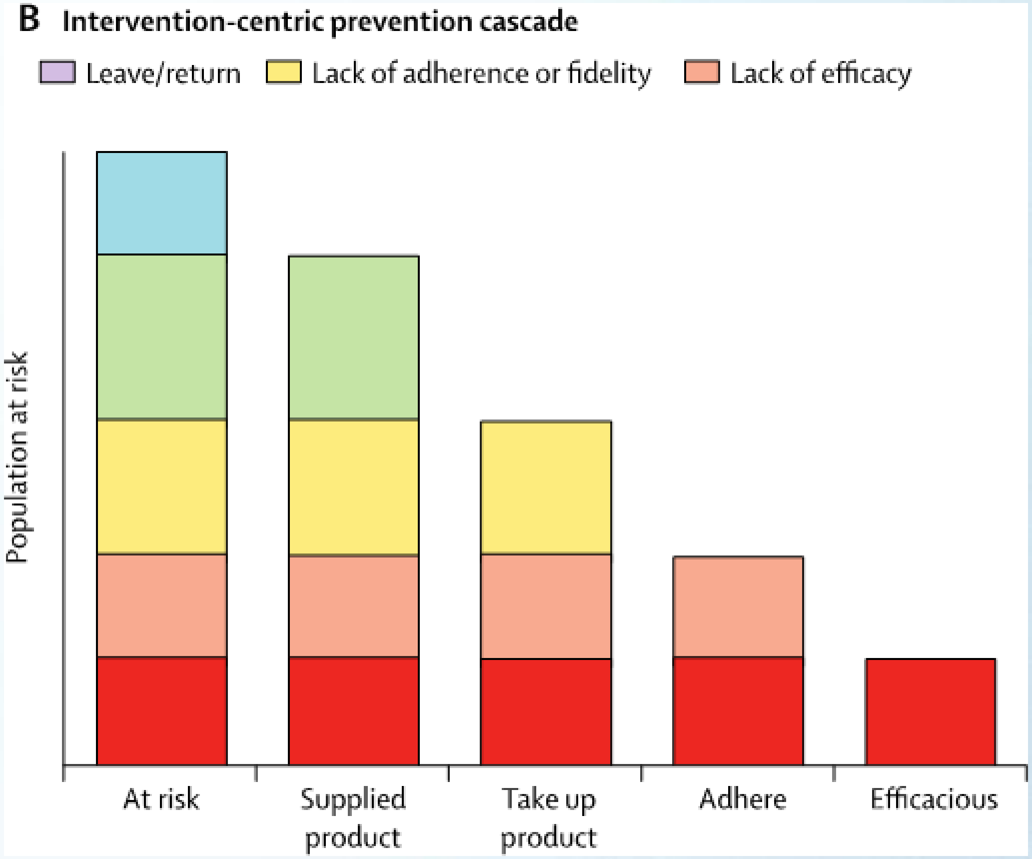
CENTRE FOR EVALUATION

Imperial College London

optima HIV

Intervention-centric: programme perspective

- Programme staff:
  - Identify target population
  - Make intervention available
  - Observe uptake
  - Observe appropriate use
  - Observe efficacy
- Denominator = persons **at risk** of infection over a given time period



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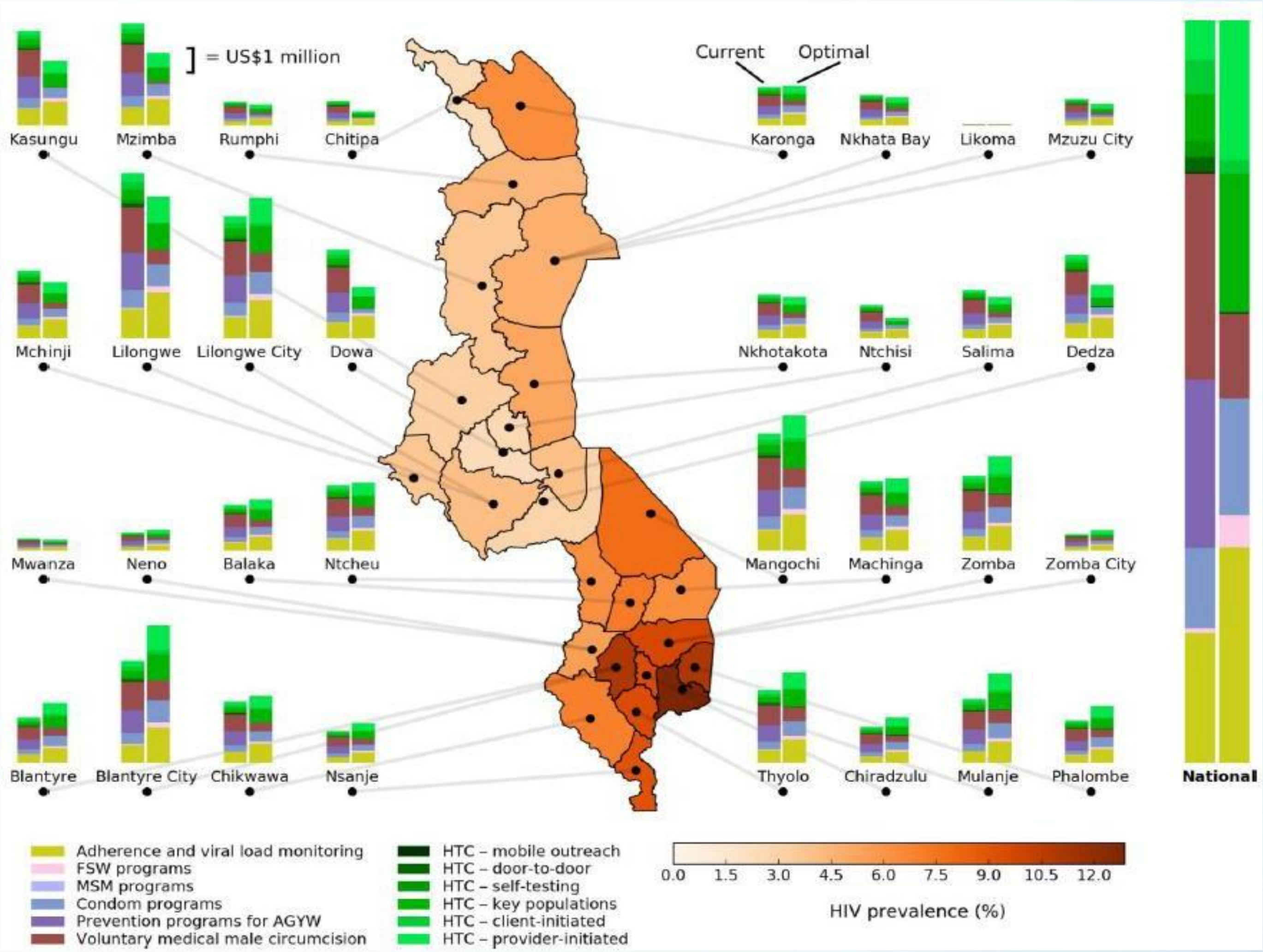
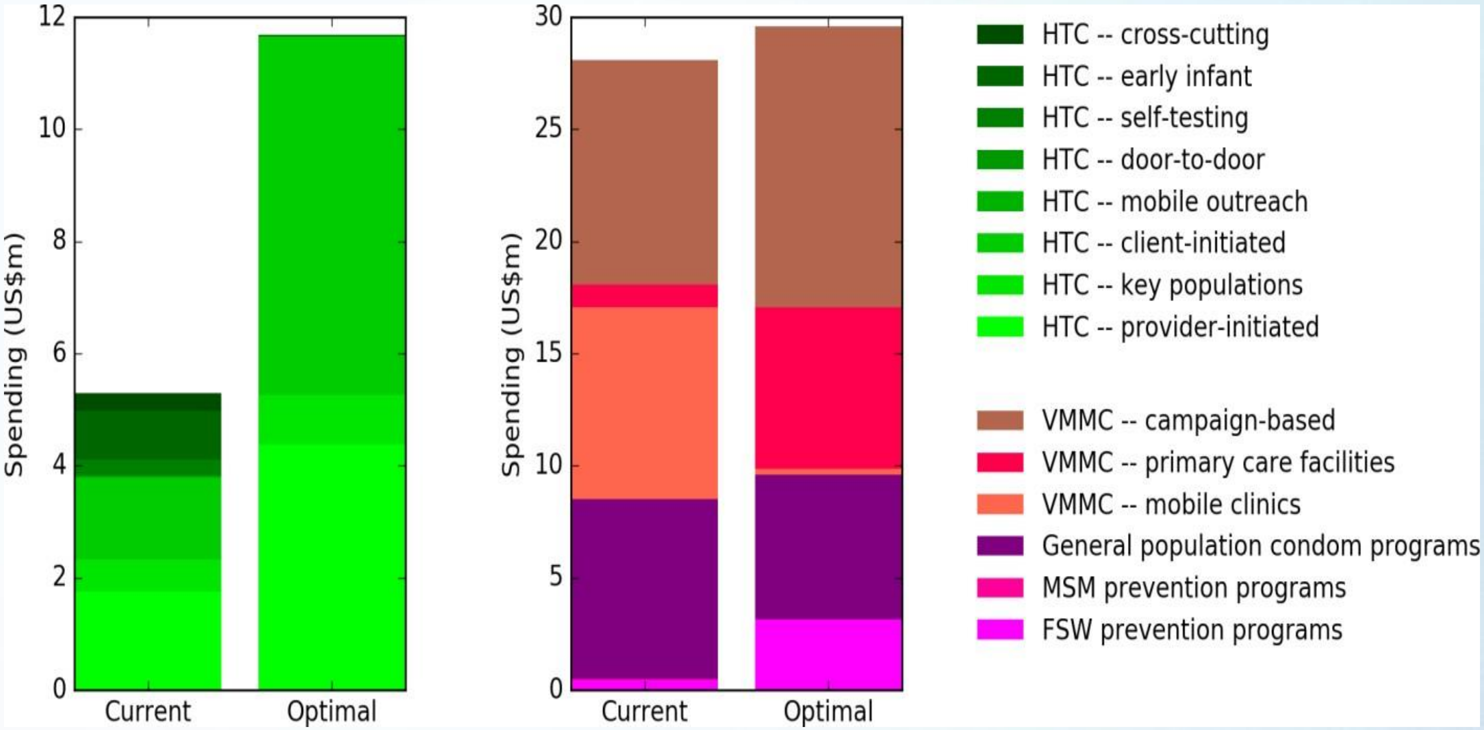
Geographical optimization - Malawi



The World Bank. 2017. Improving the allocative efficiency of Malawi's HIV response: Findings from a mathematical modelling analysis. Washington DC: World Bank.

HIV: improve implementation efficiency by choosing the best service delivery modalities

Comparison of current and optimal allocations in:
Spending on HCT (left) and prevention (right)



The World Bank. 2017. Improving the allocative efficiency of Malawi's HIV response: Findings from a mathematical modelling analysis. Washington DC: World Bank.

Types of inefficiency in health systems

- Allocative inefficiency
- Pareto inefficiency
- Productive inefficiency
- Social inefficiency
- Dynamic inefficiency
- 'X' inefficiency

QUESTIONS?

Introduction to Optima HIV and Optima HIV interface

Learning objectives

- Introduction to Optima HIV and tour of Optima HIV interface
- Brief demonstration of a complete analysis from beginning to end

SOURCE: Chisholm, D and Evans, D. 2010. Improving health system efficiency as a means of moving towards universal coverage. *World Health Report (2010) Background Paper, No 28.* World Health Organization

Optima

What is it?

How will it fit my needs?

How does it work?

Where do I get it?

Tour of the interface

What is Optima HIV?

Effective interventions and service delivery

Optima HIV aims to support countries to make the best possible investment **decisions**

Support demand for and **delivery of services** to the best feasible **standards:**

- for the right **people**
- in the right **places**
- at the right **time**
- in the right **ways**

For the greatest **HIV** and **health impact**

While moving early and urgently to **institutionalize** and **sustain services**

The Optima approach

Burden of disease

- Epidemic model
- Data synthesis
- Calibration / projections

Programmatic responses

- Identify interventions
- Delivery modes
- Costs and effects

Objectives and constraints

- Strategic objectives
- Ethical, logistic, and/or economic constraints

Scenario analysis

Optimization

Projected health and economic outcomes

Addressing objectives using Optima

- What health benefits can be achieved if resources are optimally allocated?
  - For example: how many new HIV infections or HIV-related deaths can be averted?
- Optima analysis can help inform strategies to achieve HIV-related objectives
  - Optima HIV is an efficiency analysis tool
  - Optima HIV is *not* a budgeting tool

Which model for which purpose?

How does Optima HIV compare with other models?

Comparison of HIV epidemic model characteristics	Approach	Populations	Purpose	Inputs	Outputs
EPP	Fits four parameters to a simple model; written in Java	MSM, PWID, FSW, male SW, CSW, and low-risk (separated into urban and rural)	Estimate and project adult HIV prevalence and incidence	Size of subpopulations; HIV prevalence among subpopulations; treatment data	Current number of HIV infections; HIV infection trends (5-year projections)
AEM	Semi-empirical process model; written in Java	PWID, direct FSW, indirect FSW, MSW, CSW, and MSM	Provide a policy and planning tool for Asian countries	Size of subpopulations; HIV and STI prevalence; risk behavior data; average duration in each population	Trends of HIV infections; impacts on AIDS cases, ART needs, deaths, etc. (long term projections)
MOT	Risk equations; written in Excel	PWID, FSW, MSM, and low-risk (separated into males and females)	Calculate expected number of infections over coming year	HIV prevalence; number of individuals with particular exposure; rates of exposure	Incidence (HIV acquisition) per risk group
Goals / Spectrum	Compartmental rate-based model; written in Visual Basic	MSM and high, medium, and low-risk groups	Estimate costs and impact of different interventions	Sexual behavior by risk group; demographic data; base year human capacity	Costs; HIV prevalence and incidence (5- year projections)
Optima	Compartmental rate-based model; versions available for MATLAB and Python	Flexible; unlimited but usually around 8-20 groups, including key affected and general populations and different age groups	Analyze and project HIV epidemics; determine optimal resource allocations	Size of population groups; HIV and STI prevalence; risk behavior data (e.g. condom use); biological constants (e.g. background death rates)	HIV prevalence and incidence trends; healthcare costs; deaths; optimal resource allocations

SOURCE: Kerr et al. (2015) Optima: A Model for HIV Epidemic Analysis, Program Prioritization, and Resource Optimization, JAIDS, 69(3): 365-76.

Optima HIV

How does Optima HIV work?

Optima HIV is a model

Outcome: how many people can we safely fly in this plane?

How much further will the plane fly when program $ allocation is **optimized**?

Scenarios: what if we scaled up the size of wings?

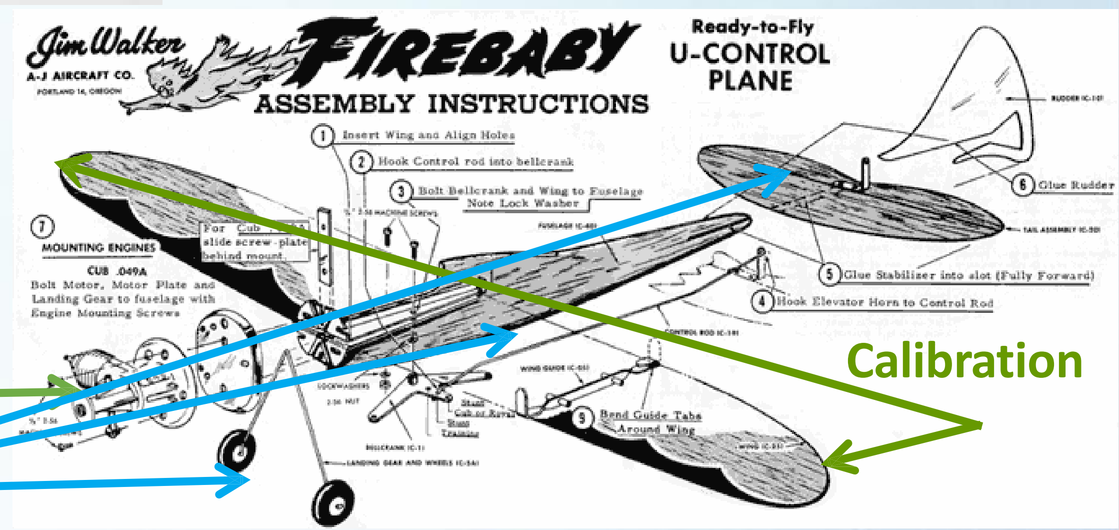
Populations: passenger groups

Programs: piloting, flight service, maintenance, etc.

Spending: part costs $

Epidemic model

Optimization of $



Calibration

Optima HIV

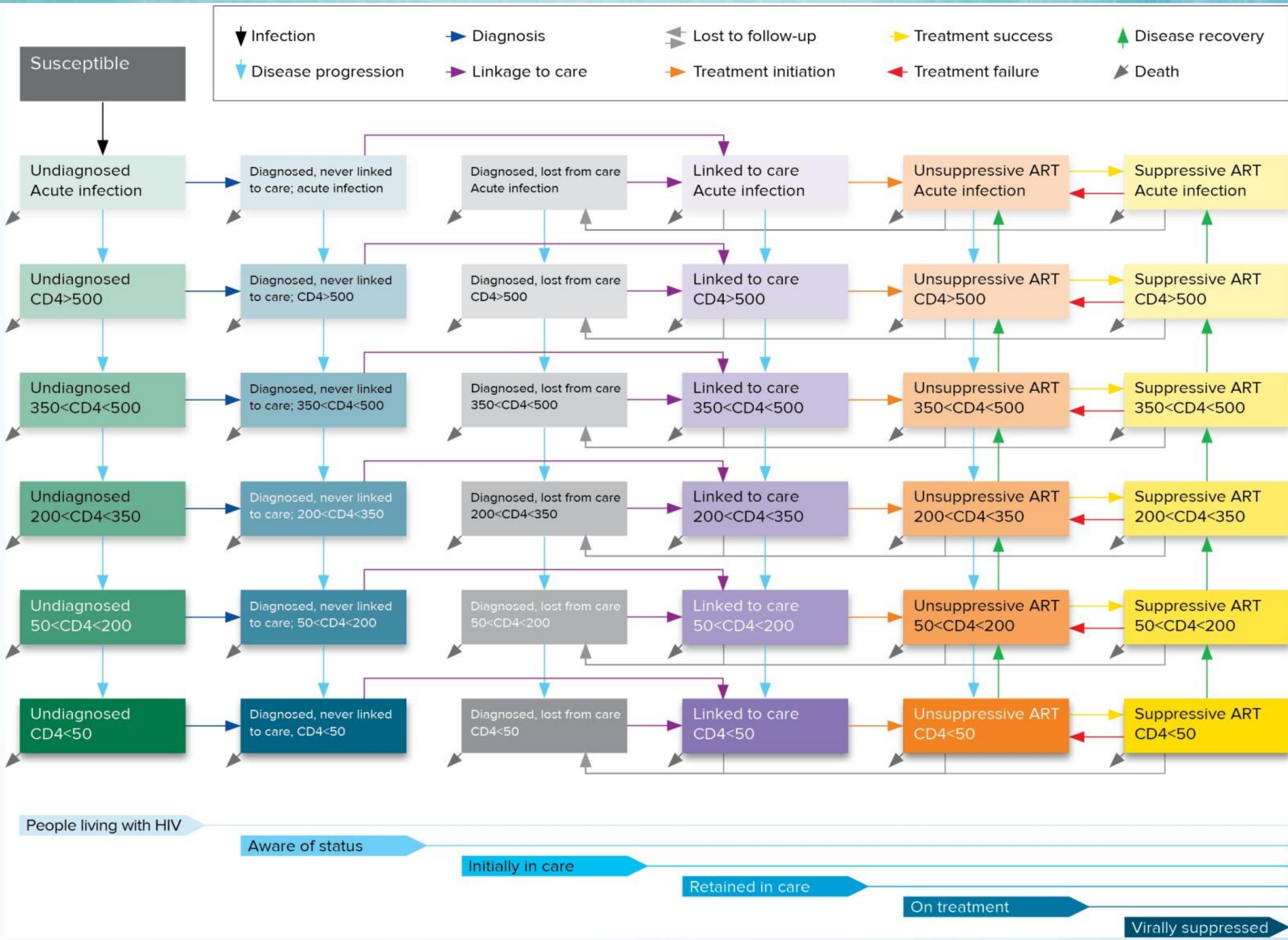
Epidemiological component

- Optima HIV is a **dynamic compartmental population-based** model

- The population is divided into compartments based on:
  - User-defined criteria
    - Age, sex, risk behavior, location, etc.
  - Health states across HIV cascade

- At each point in time, people can move between health states (i.e. compartments)

Compartmental model structure

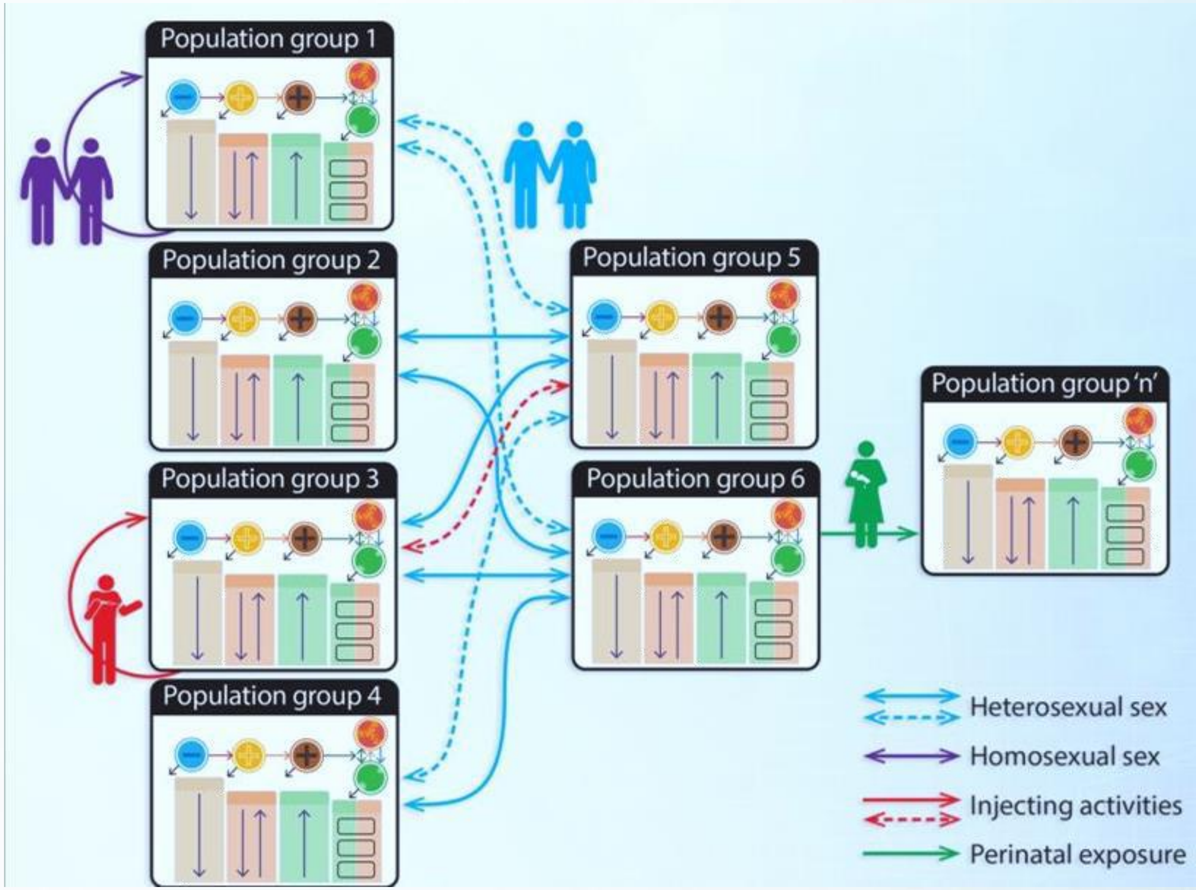


Optima HIV

Compartmental model structure

- Tracks disease progression for each population group

- And viral transmissions between populations (i.e. partnerships)



Optima HIV

How does Optima model HIV transmission?

- **Force of infection**
- Transmission for each population group
- Incidence depends on:
  - Risk-related interaction with others
  - Type of risk events (sexual, injecting, mother-child)
  - Prevalence of HIV among sexual and/or injecting partners
  - Viral load in partners
  - Frequency of risk events and types
  - Was protection used, e.g. condoms, clean needle-syringes?

What is the probability of transmission of HIV in a discordant partnership?

- **N** number of risk events (e.g. average number of interaction events with HIV-infected people where HIV transmission may occur
- **P** transmission probability of each event

Force of infection

$$F = 1 - (1 - P)^N$$

SOURCE: Kerr et al. (2015) Optima: A Model for HIV Epidemic Analysis, Program Prioritization, and Resource Optimization, JAIDS, 69(3): 365-76.

Programs in Optima HIV

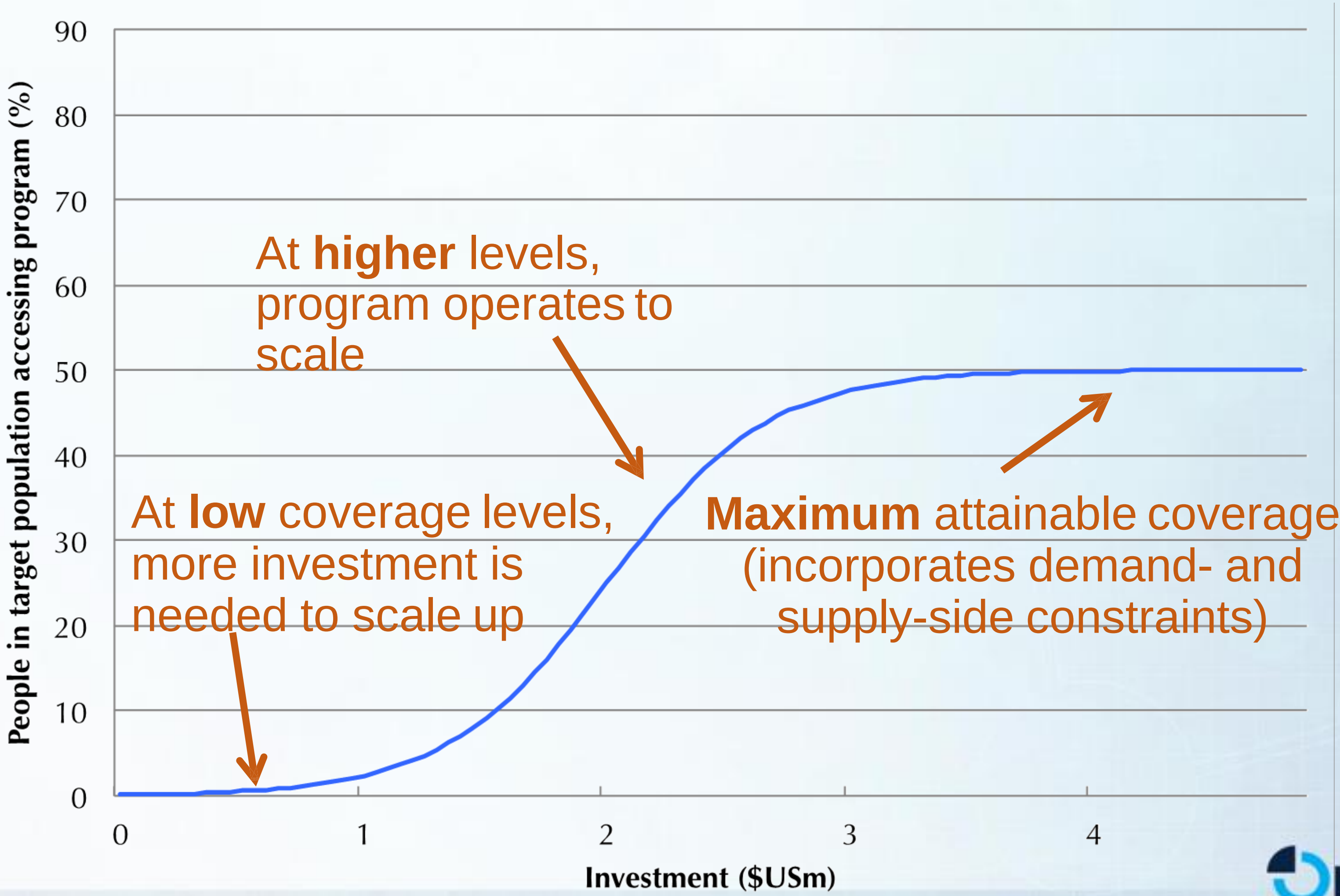
- HIV programs can be:
  - Targeted programs: direct impact on the epidemic
  - Non-targeted programs: indirect impact on the epidemic, not considered in the optimization

- Collate program cost (spending and unit costs) and coverage data (or make assumptions, as necessary)

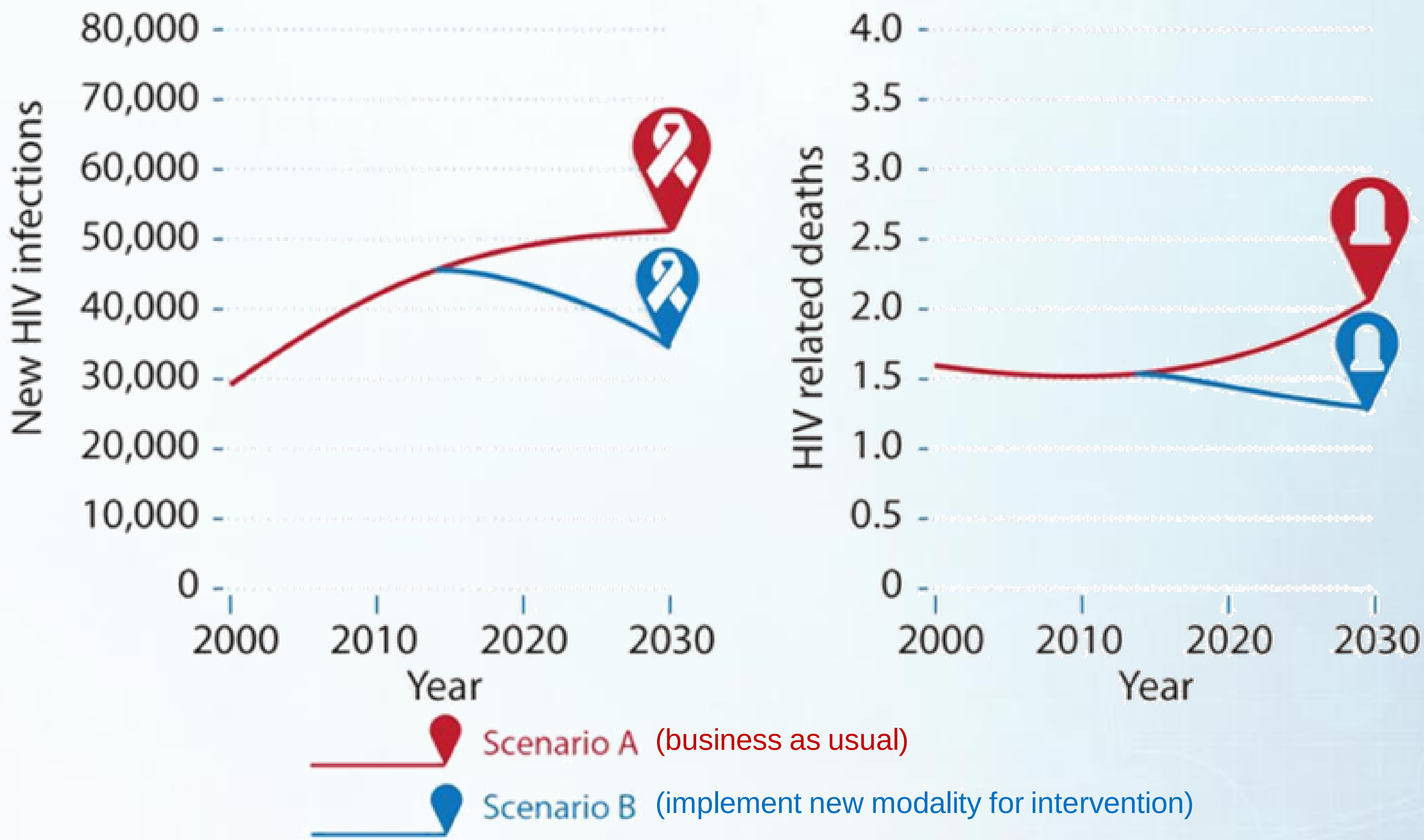
- Cost functions link:
  - program spending to program coverage
  - program coverage to program outcome

Cost function curve: spending versus coverage

Cost functions define relationships between investment and coverage (coverage and outcome relationships are also defined)



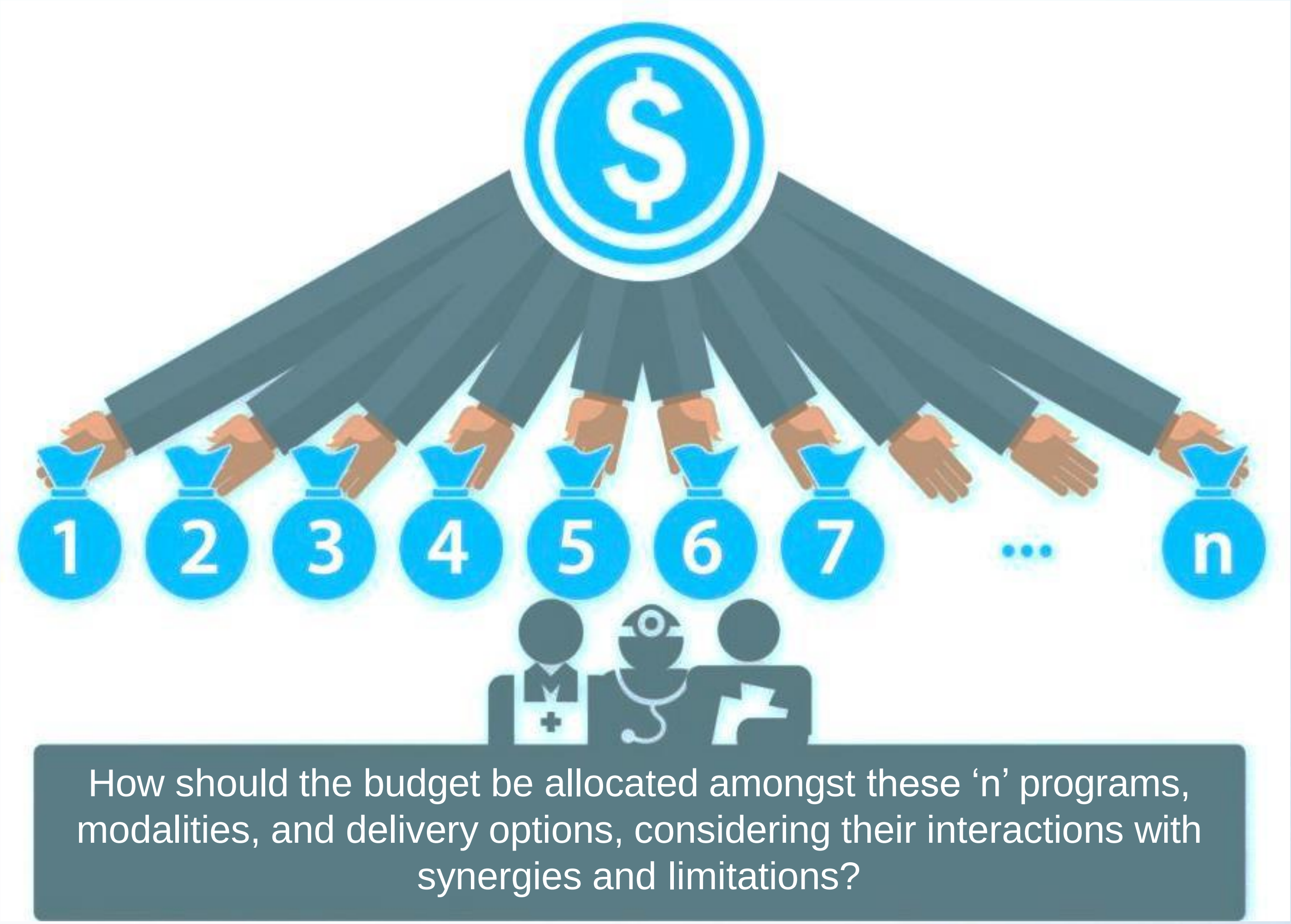
Scenario analysis



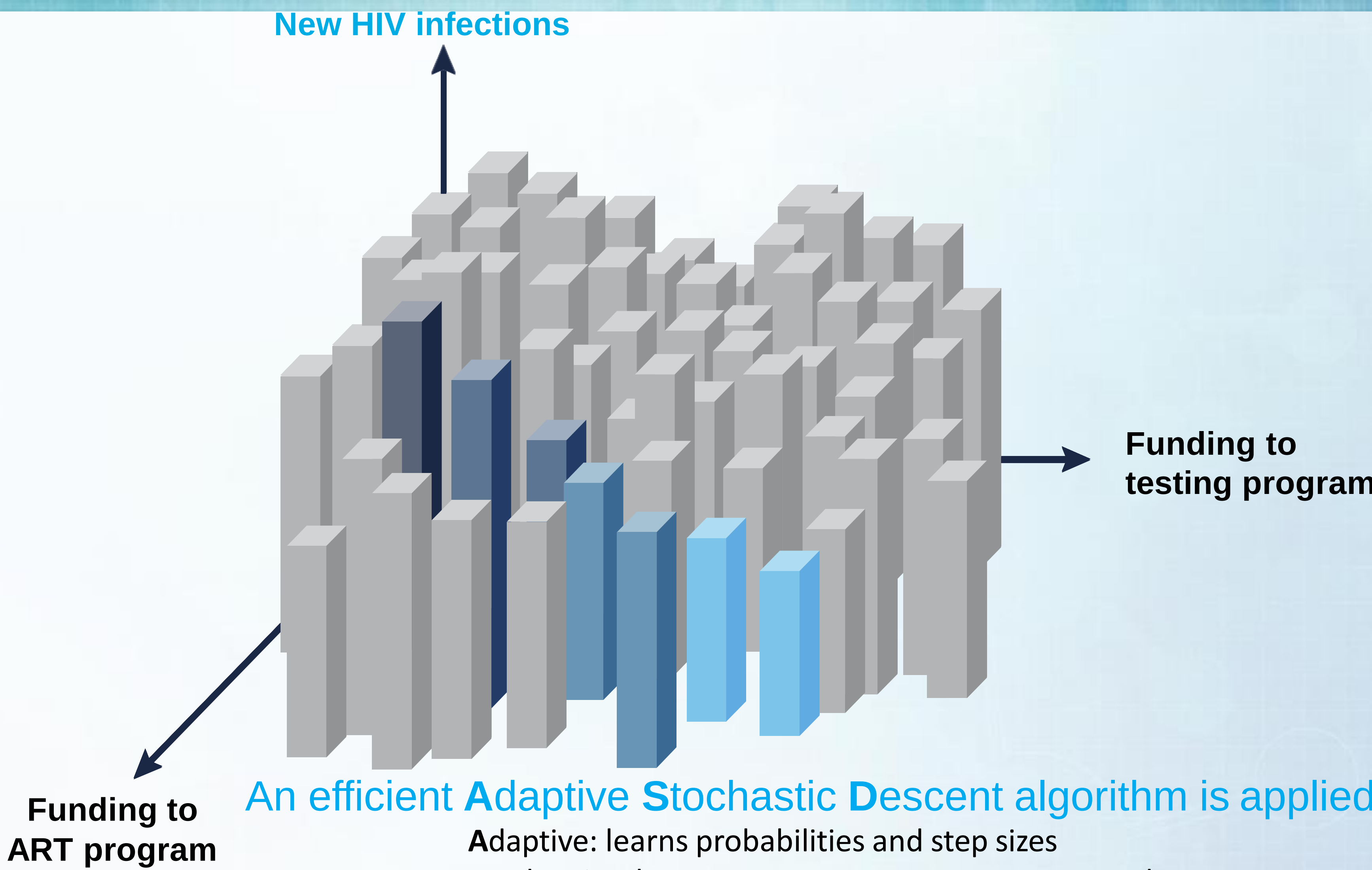
(business as usual)

(implement new modality for intervention)

Optimize resource allocation to best meet objectives



Optimization: **consider just two dimensions**



An efficient **A**daptive **S**tochastic **D**escent algorithm is applied

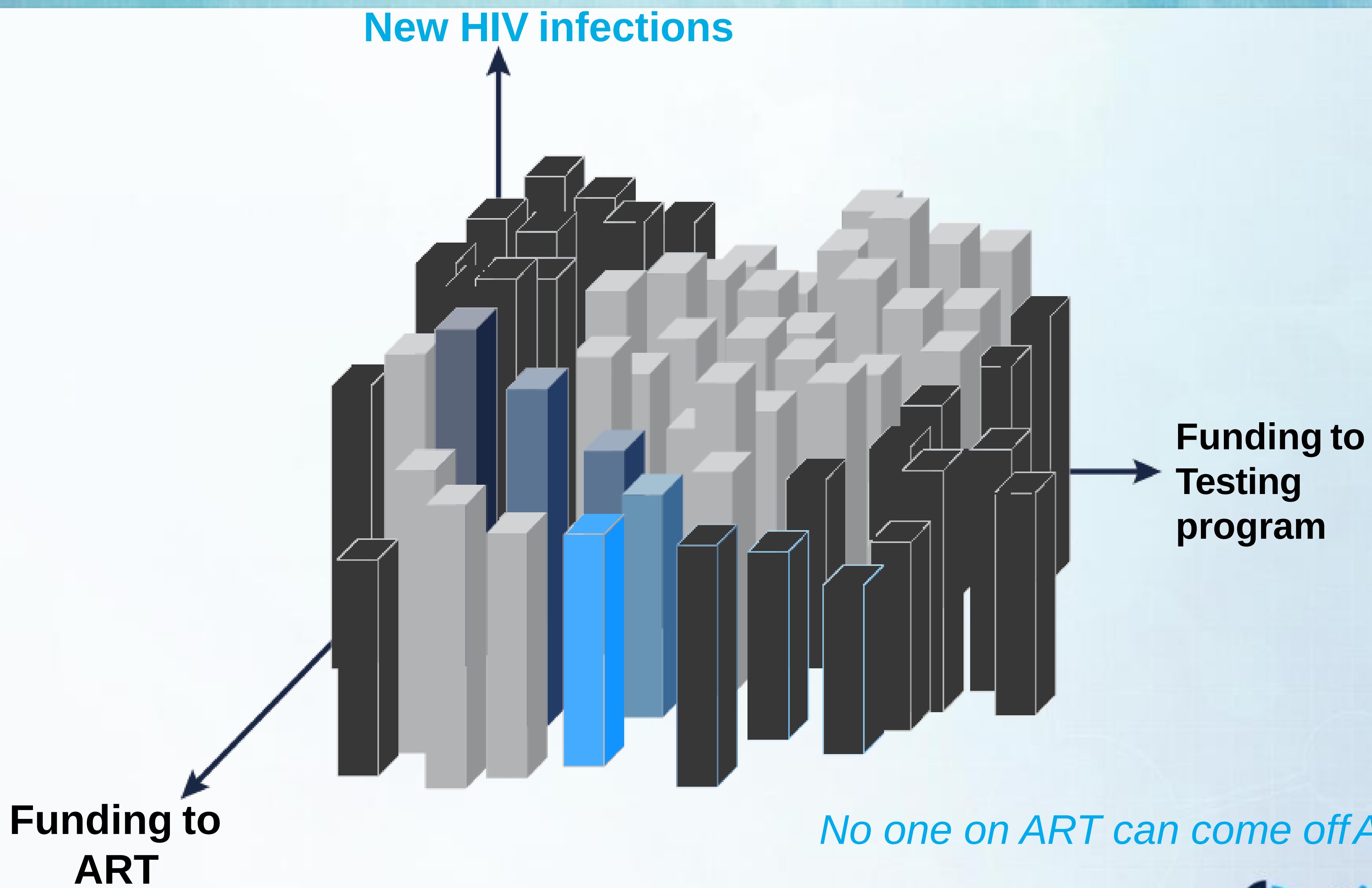
Adaptive: learns probabilities and step sizes

Stochastic: chooses next parameter to vary at random

Descent: only accepts downhill steps

SOURCE: Kerr et al. (2015) Optima: A Model for HIV Epidemic Analysis, Program Prioritization, and Resource Optimization, JAIDS, 69(3): 365-76.

Constraints: ethical, economic, logistic, political



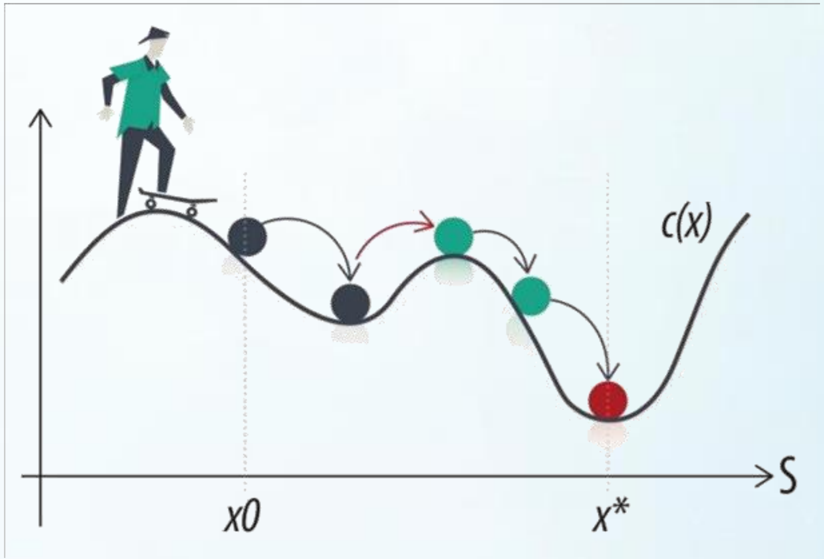
No one on ART can come off ART

SOURCE: Kerr et al. (2015) Optima: A Model for HIV Epidemic Analysis, Program Prioritization, and Resource Optimization, JAIDS, 69(3): 365-76.

Optima HIV

Which optimization algorithm?

- Traditional algorithms (e.g., simulated annealing) require many function evaluations—slow



Optima’s optimization algorithm

Adaptive **s**tochastic **d**escent

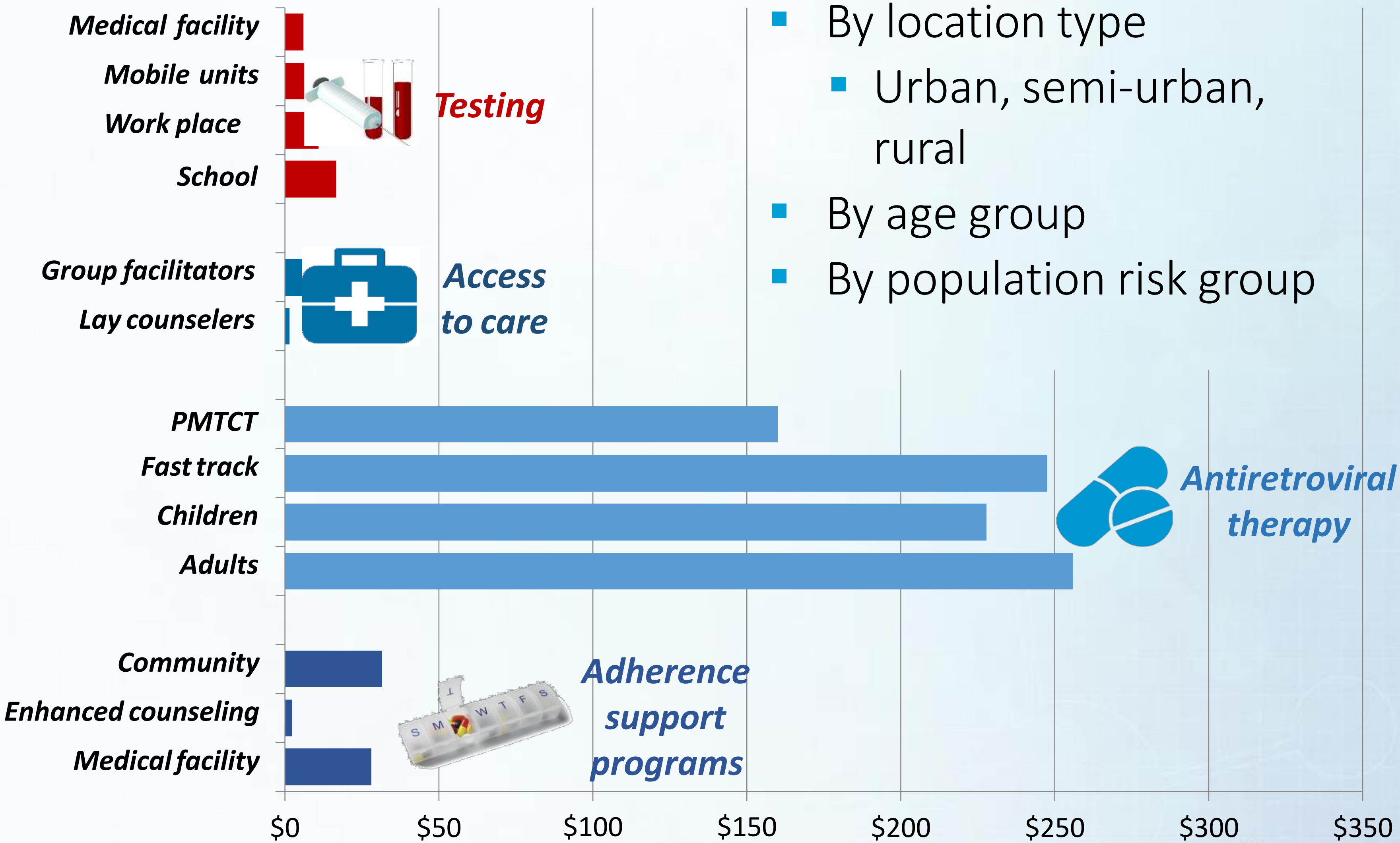
- **Adaptive**: learns probabilities and step sizes
- **Stochastic**: chooses next parameter to vary at random
- **Descent**: only accepts downhill steps

SOURCE: Kerr et al. (2015) Optima: A Model for HIV Epidemic Analysis, Program Prioritization, and Resource Optimization, JAIDS, 69(3): 365-76.

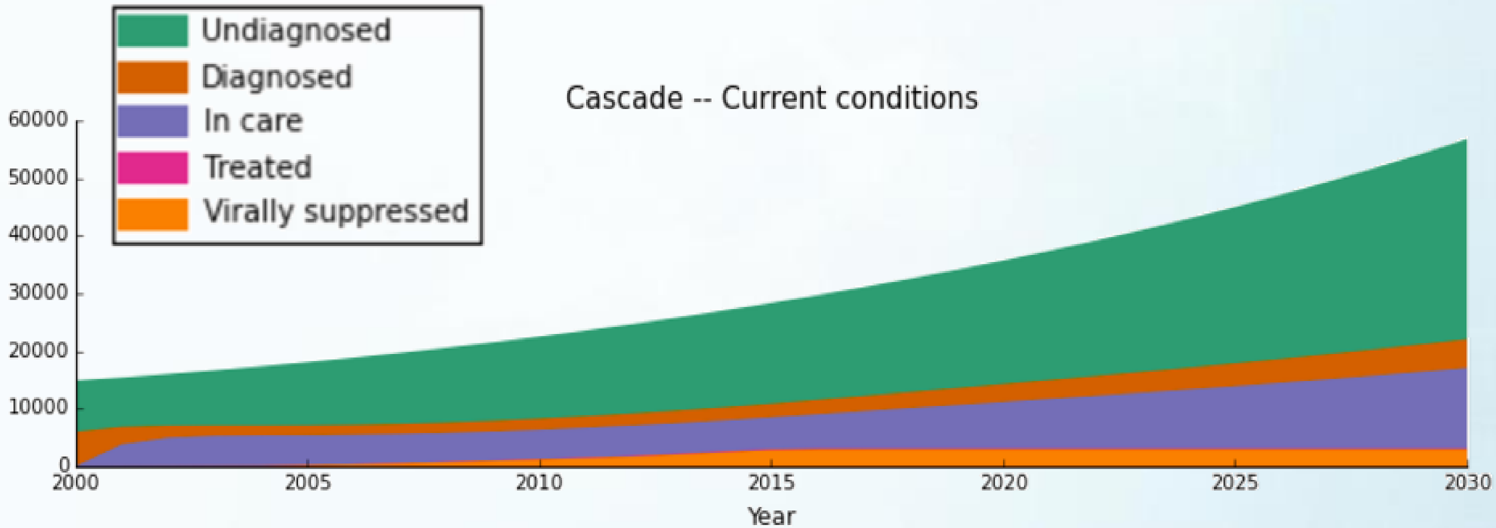
Optima HIV

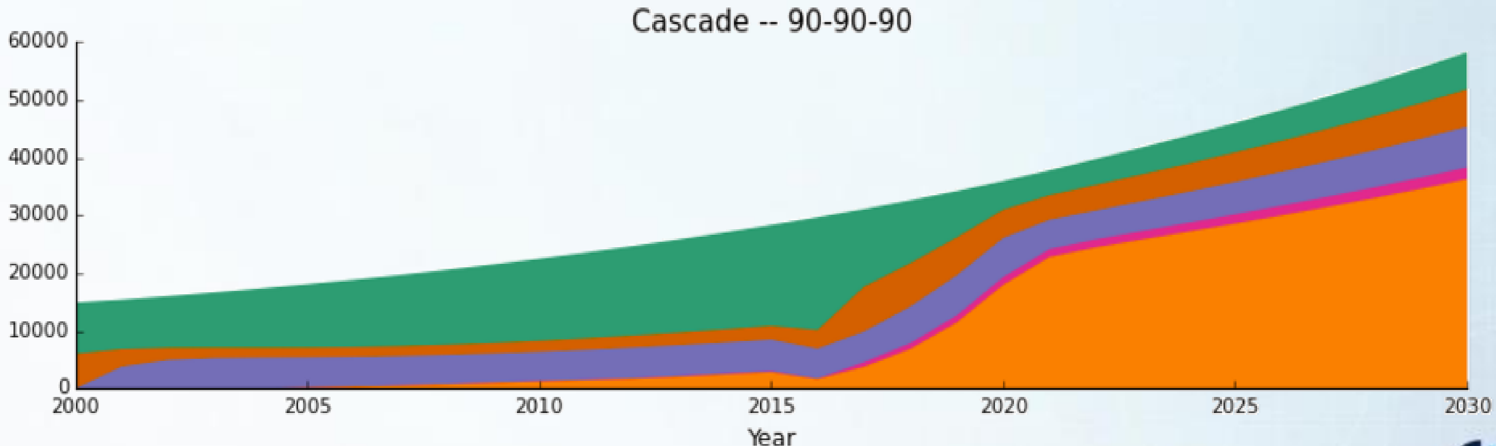
Implementation and allocative efficiency

- By location type
  - Urban, semi-urban, rural
- By age group
- By population risk group



Towards 90-90-90

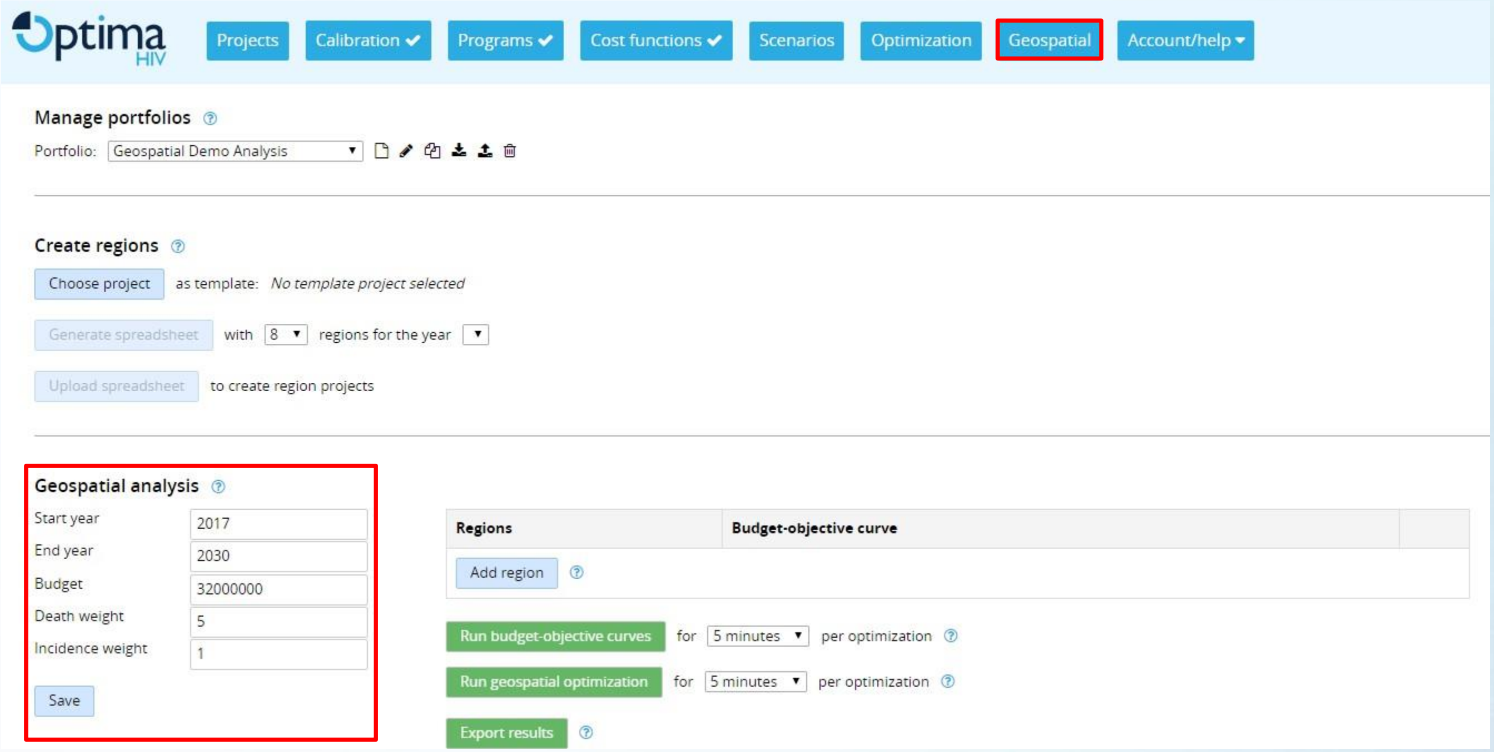




Optima HIV

Geospatial analysis

- For conducting analyses across two or more settings (regional, subnational, district or facility level)



QUESTIONS?

Scope of Work and Analytical Framework

Session objectives

1. What is a scope of work and why is it needed
2. An understanding of the key issues to specify in the scope, in particular concerning the analytical framework and timeline

What is a Scope of Work (SOW) and why is it needed?

- The SOW is an agreement document in which the analysis to be performed is described
- It should be specific and detailed, so that:
  - The study team has clear guidance
  - The stakeholders are clear on what to expect from the analysis
- The SOW should contain:
  - Any deliverables and end products that are expected to be provided by the study team
  - A time line for all deliverables
  - The roles and responsibilities within the study team and other parties involved in supporting or overseeing roles

Elements of a SOW (table of contents)

- Background (or Problem Statement) - *Brief description of the Program/Service, challenges and opportunities; include relevant strategies, program objectives, operational plans, targets or key performance indicators, and any available budget or expenditure information*
- Rationale *why the analysis is proposed and how it links to Government policy*
- Objectives – *analysis questions to be answered*
- Specifications for the analysis – *next slide*
- Deliverables – *detailed description of expected outputs*
- Implementation and Coordination – *roles and responsibilities and any coordination mechanisms*
- Timeline – *All milestones and deliverables*

Optima HIV

TYPICAL ANALYTICAL FRAMEWORK

Overview of typical analyses

PREPARE → **1. Descriptive analyses of epidemiological, program, budget and cost data** (inputs to model parameterisation)

EPI ANALYSES → **2. Epidemiological curve fitting (to historical data) and future epidemiological projections** (under current program coverage and budget allocations)

OPTIMISATION ANALYSES → **3. Optimisation of funding allocations to programs:**

1. Optimisation within *current* funding volume
2. Optimisation with *higher or lower* funding volumes
3. *Geographical optimisation* of funding within & between sub-national levels of Govt

OPTIMISATION/ SCENARIO ANALYSES → **4. Estimation of minimum funding needed** to achieve strategic plan targets

SCENARIO ANALYSES → **5. Scenario analyses** to assess impact of changes to the program, coverage, service delivery modalities or unit costs

HISTORICAL ANALYSES → **6. Impact** of historical funding allocations

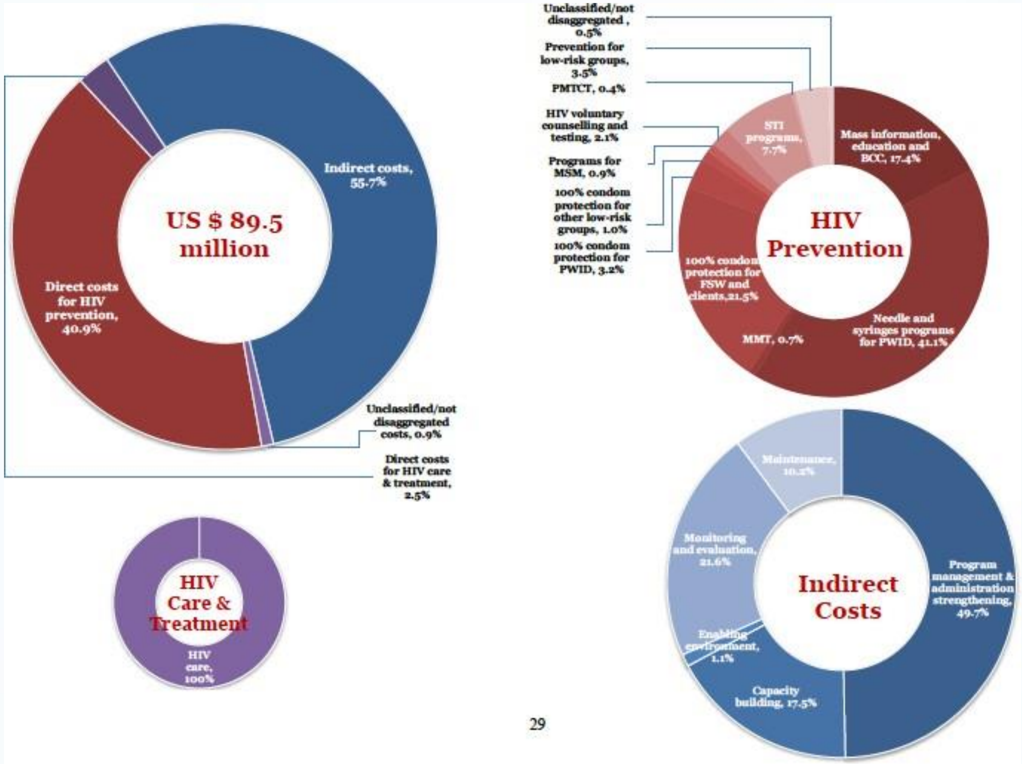
Optima HIV

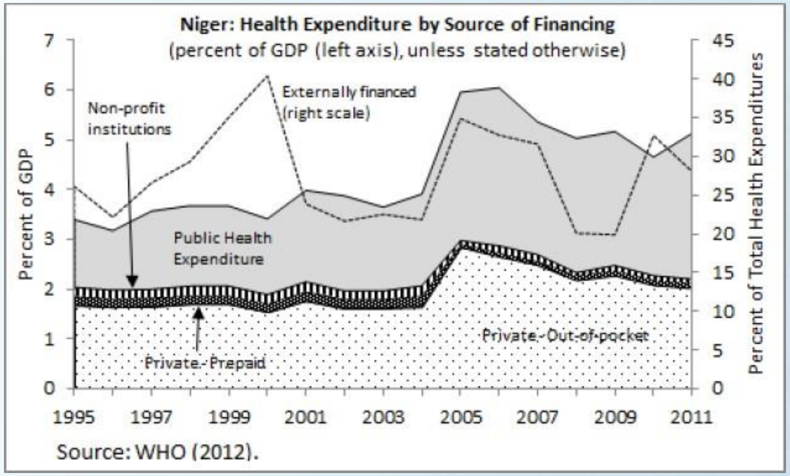
Analysis 1: Descriptive analyses of epidemiological, program, budget and cost data with which to parameterise the mathematical model

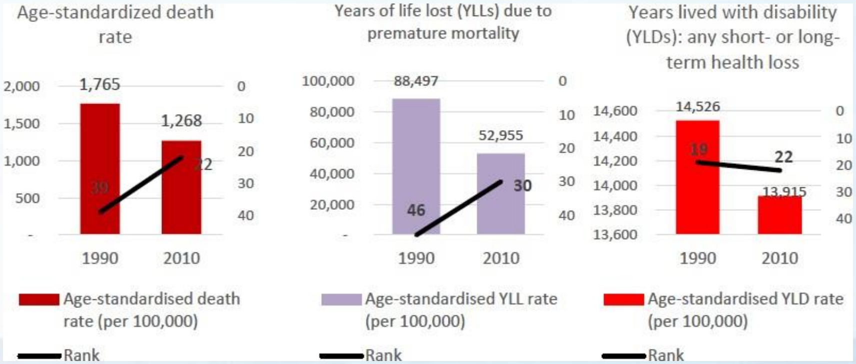
Analysis of:

Epidemiological data
Overall funding
Current program expenditure
Unit costs
Program coverage

Examples


US $ 89.5 million
Indirect costs, 55.7%
Direct costs for HIV prevention, 40.9%
Unclassified/not disaggregated costs, 0.9%
Direct costs for HIV care & treatment, 2.5%
HIV Prevention
Unclassified/not disaggregated, 0.5%
Prevention for low-risk groups, 3.5%
PMTCT, 0.4%
HIV voluntary counselling and testing, 2.1%
Programs for MSM, 0.9%
100% condom protection for other low-risk groups, 1.0%
100% condom protection for PWID, 3.2%
STI programs, 7.7%
Mass information, education and BCC, 17.4%
100% condom protection for FSW and clients, 21.5%
MMT, 0.7%
Needle and syringes programs for PWID, 41.1%
HIV Care & Treatment
HIV care, 100%
Indirect Costs
Maintenance, 10.2%
Monitoring and evaluation, 21.6%
Enabling environment, 1.1%
Capacity building, 17.5%
Program management & administration strengthening, 49.7%
29


Niger: Health Expenditure by Source of Financing
(percent of GDP (left axis), unless stated otherwise)
Percent of GDP
Percent of Total Health Expenditures
Non-profit institutions
Externally financed (right scale)
Public Health Expenditure
Private- Out-of-pocket
Private- Prepaid
1995
1997
1999
2001
2003
2005
2007
2009
2011
Source: WHO (2012).


Age-standardized death rate
1,765
1,268
39
22
1990
2010
Age-standardised death rate (per 100,000)
Rank
Years of life lost (YLLs) due to premature mortality
88,497
52,955
46
30
1990
2010
Age-standardised YLL rate (per 100,000)
Rank
Years lived with disability (YLDs): any short- or long-term health loss
14,526
13,915
19
22
1990
2010
Age-standardised YLD rate (per 100,000)
Rank

Analysis 2

Fit to historical epidemiological data and project future HIV epidemiological trends

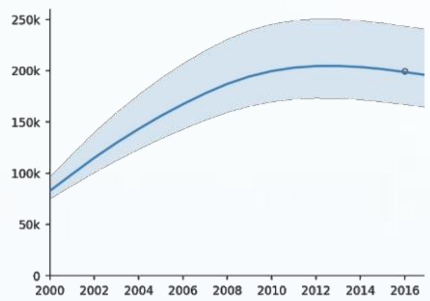
Epidemiological curve fitting (to historical data) and future epidemiological projections

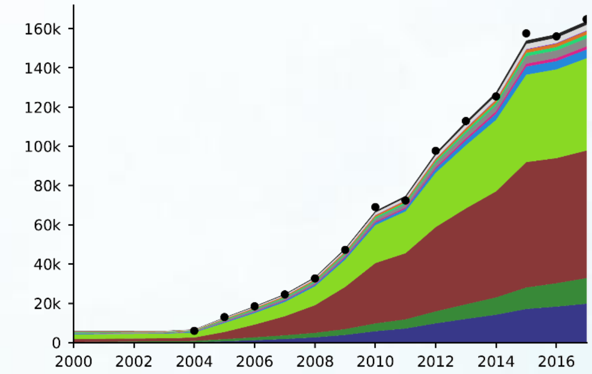
Unit costs / cost functions	Funding volume	Funding proportionate allocation	Coverage	Program target outcomes	Epidemiological outcomes
Fixed	Current funding	Current allocation	Current allocation	N/A	Assess impact

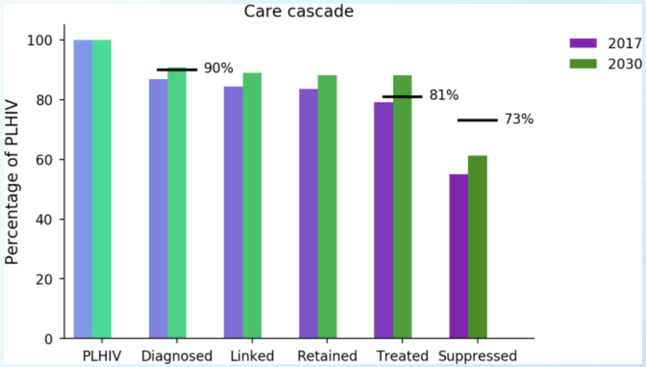
- **Fit to historical epidemiological data**
- **Project future HIV epidemiological trends**
- Estimate HIV prevalence, incidence, AIDS-related deaths as well as outcomes across the HIV care cascade
  - Historically (2000-2017)
  - In the future (2018-2030)
  - **Assuming current % programme coverage and other epidemic determinants (e.g. sexual behaviour) remain constant**
- Total population and by population group
  - Sex, Age, Key populations (e.g. FSW, clients, MSM, PWID)

Examples

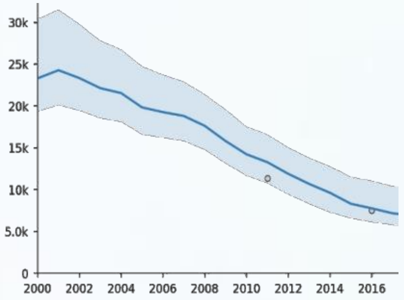
PLHIV

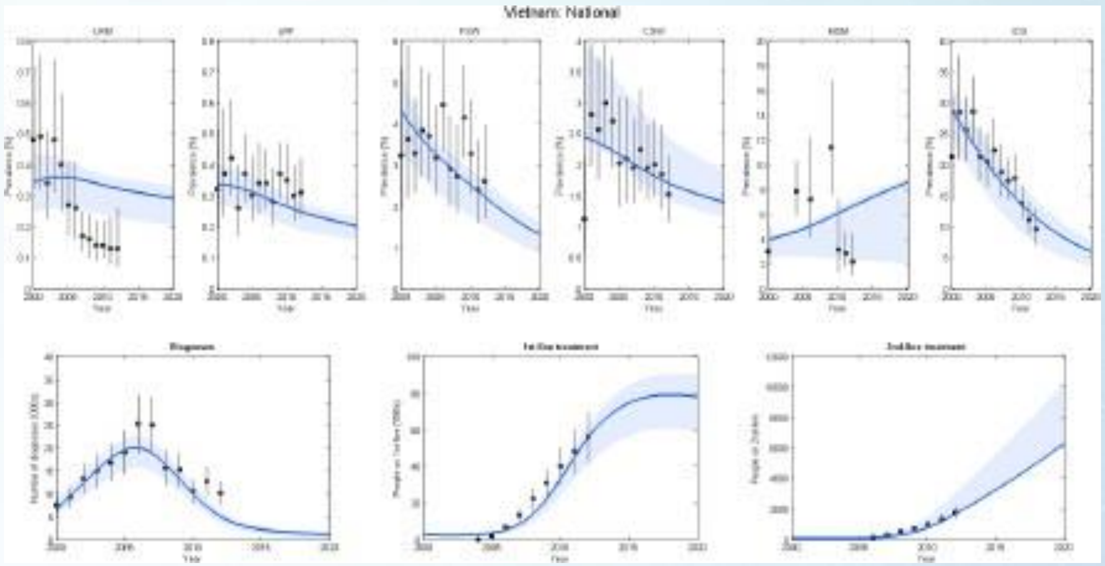




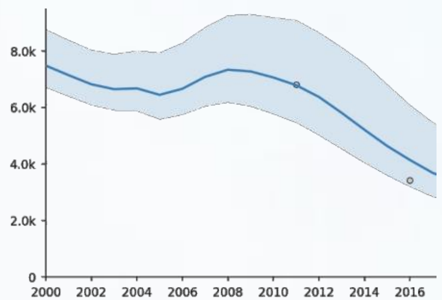


New HIV infections





HIV-related deaths



Analysis 3.1

Determine, through mathematical algorithms, optimised funding allocations to programs, within current funding volume

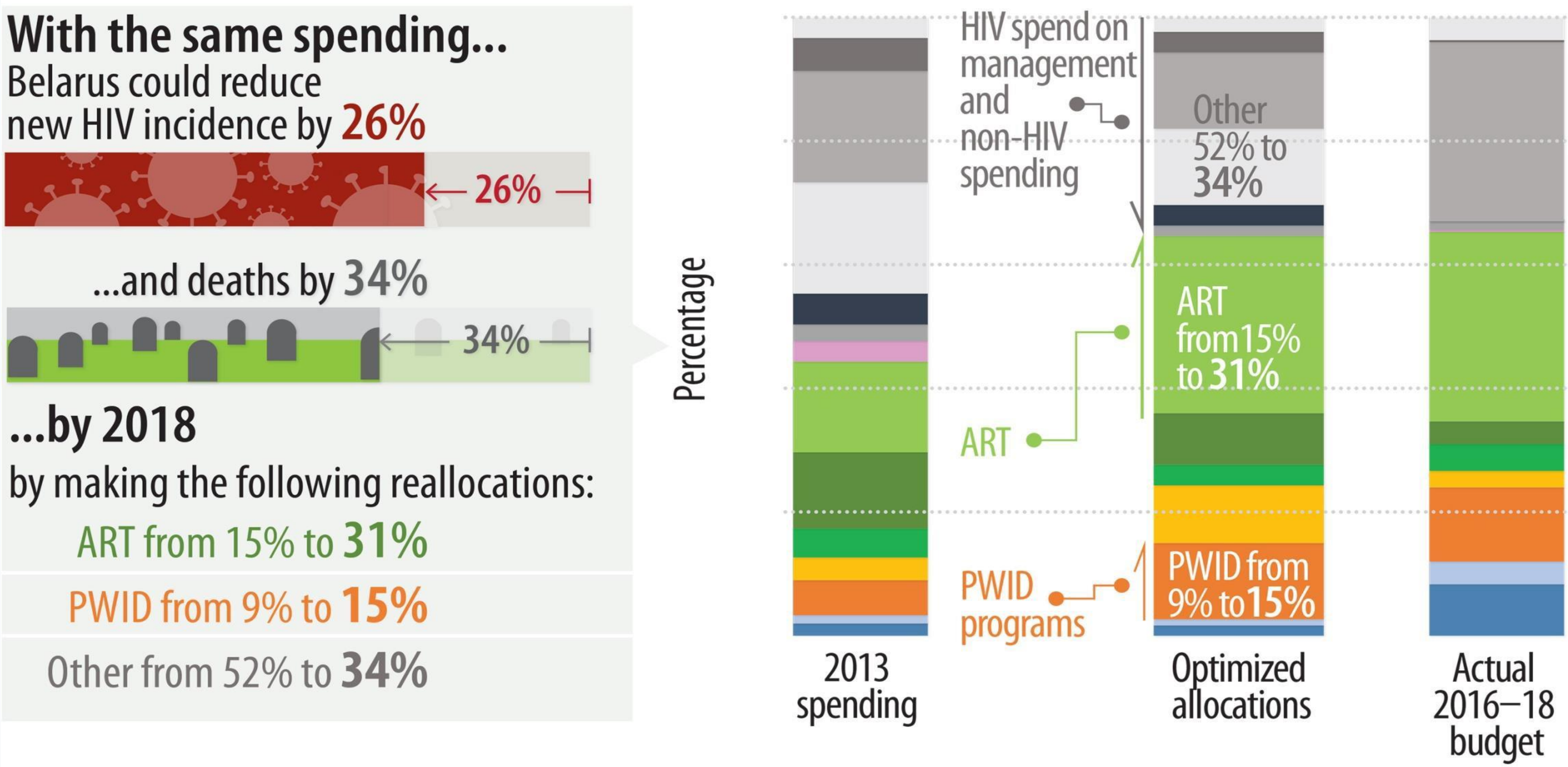
Optimisation within *current* funding volume

Unit costs / cost functions	Funding volume	Funding proportionate allocation	Coverage	Program target outcomes	Epidemiological outcomes
Fixed	Current funding	Optimise	Vary, based on optimisation	N/A	Assess impact

- **Quantify program objectives** and determine the objective function
- Determine, through mathematical algorithms, **optimised funding allocations**
- Project **future trends** of the HIV epidemic with **optimised allocation** of resources
  - Estimate the future number of new infections and HIV-related deaths if the current funding for HIV programmes was allocated optimally throughout:
    - The remaining national strategic plan period (20XX to 20XX)
    - The time period for achieving global HIV targets (2030 SDG & End AIDS targets)

Optima HIV

The case of Belarus



Analysis 3.2

Determine, through mathematical algorithms, optimised funding allocations for different levels of funding

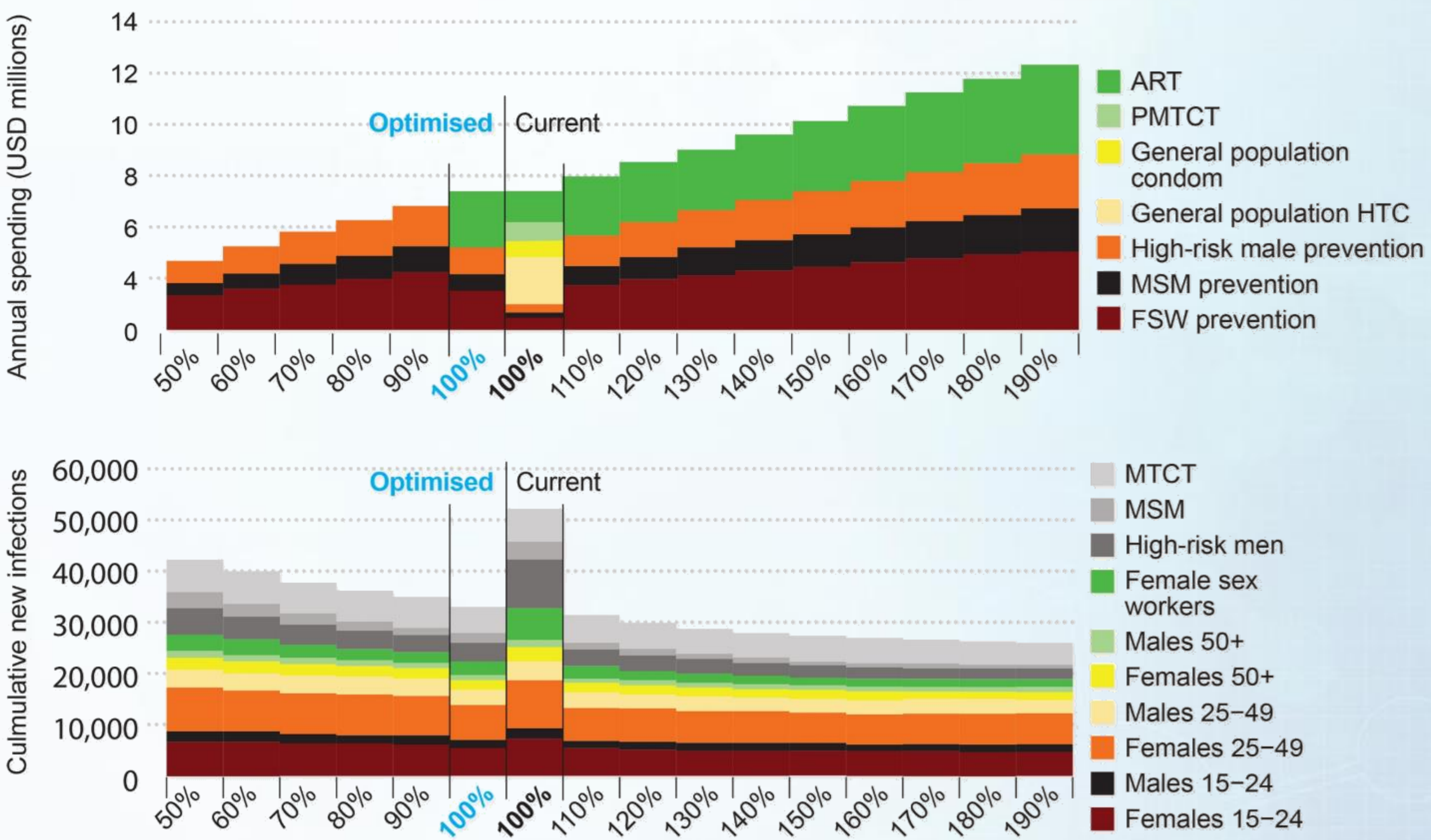
Optima HIV

Optimisation with *higher or lower* funding volumes

Unit costs / cost functions	Funding volume	Funding proportionate allocation	Coverage	Program target outcomes	Epidemiological outcomes
Fixed	Fixed volume (either higher or lower than current volume)	Optimise	Vary, based on optimisation	N/A	Assess impact

- **Quantify program objectives** and determine the objective function
- Determine, through mathematical algorithms, **optimised funding allocations for different levels of funding**. Typically:
  - With reduced funding to 50-90% of current HIV spending
  - With increased funding to 100-200% of current HIV spending
- Project **future trends** of the HIV epidemic with **optimised allocation** of resources
  - Estimate the future number of new infections and HIV-related deaths if the current funding for HIV programmes was allocated optimally throughout:
    - The remaining national strategic plan period (20XX to 20XX)
    - The time period for achieving global HIV targets (2030 SDG & End AIDS targets)

Example of using a mathematical model to improve HIV allocative efficiency in HIV in Sudan



Optima HIV

Analysis 3.3: Geographical optimisation

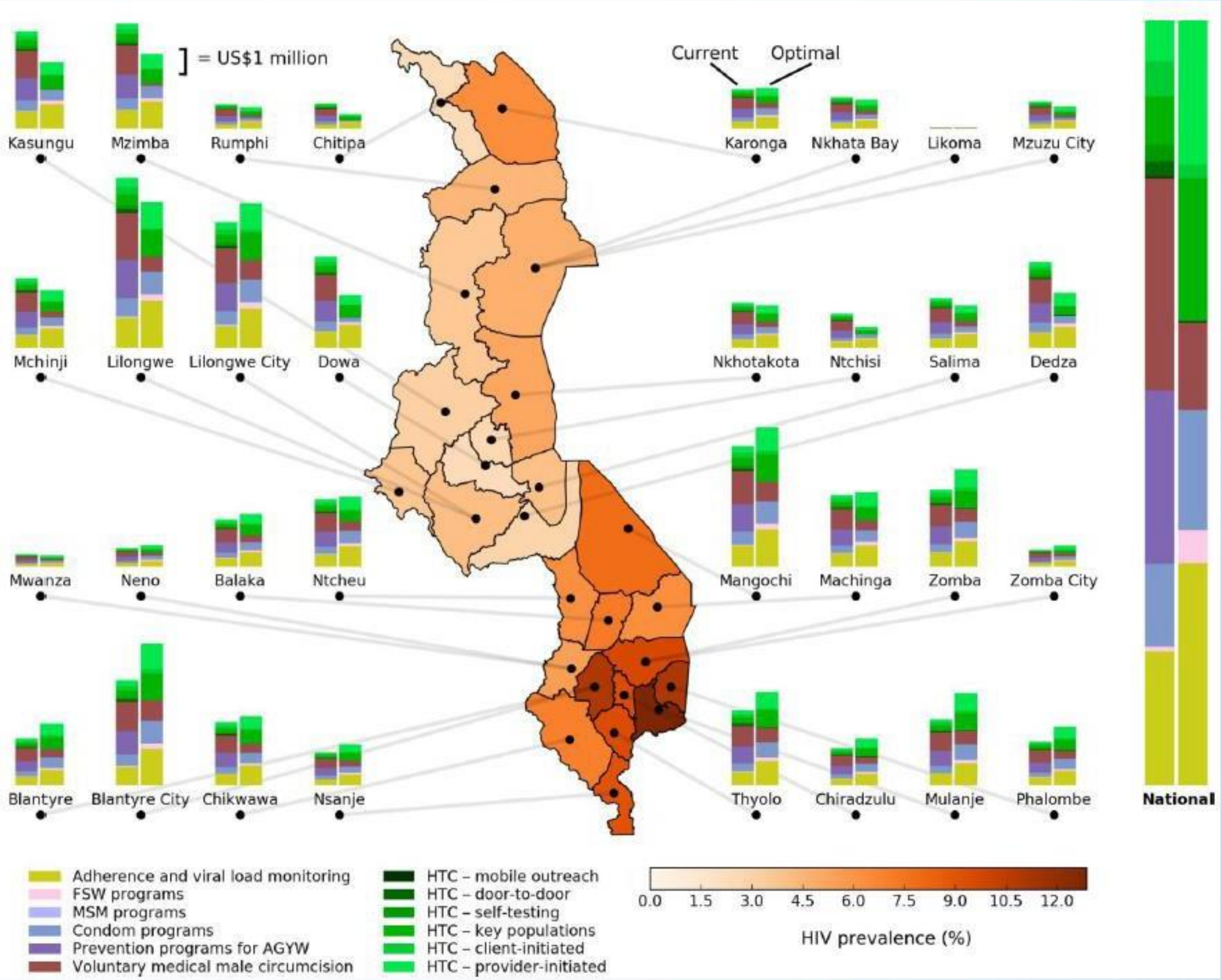
Determine, through mathematical algorithms, optimised funding allocations between and within sub-national entities (e.g. regions, districts or facilities)

Optimisation of funding to programs in specific geographic units

Unit costs / cost functions	Funding volume	Funding proportionate allocation	Coverage	Program target outcomes	Epidemiological outcomes
Fixed (for each sub-national entity)	Current or different funding (for each sub-national entity)	Optimise (to and within sub-national entities)	Vary, based on optimisation	N/A	Assess impact (for each sub-national entity)

- **Quantify program objectives** and determine the objective function
- Determine, through mathematical algorithms, **optimised funding allocations between and within sub-national entities**
- Project **future trends** of the HIV epidemic with **optimised allocation** of resources **for each sub-national entity**
  - Estimate the future number of new infections and HIV-related deaths if the current funding for HIV programmes was allocated optimally throughout:
    - The remaining national strategic plan period (20XX to 20XX)
    - The time period for achieving global HIV targets (2030 SDG & End AIDS targets)

Malawi: geographical optimisation



Optima HIV

Analysis 4

Estimate the minimum financial resources – if optimally allocated – required to achieve HIV response targets

Optima HIV

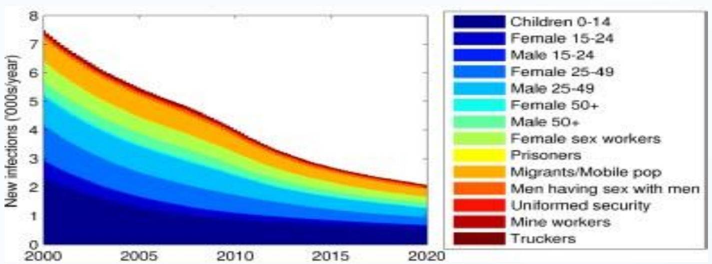
Minimum funding needed to achieve strategic plan targets

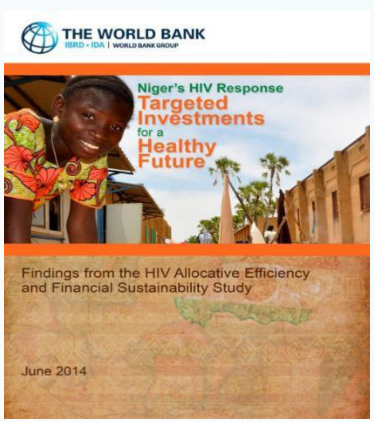
Unit costs / cost functions	Funding volume	Funding proportionate allocation	Coverage	Program target outcomes	Epidemiological outcomes
Fixed	Optimise	Optimise	Vary, based on optimisation	Vary, based on optimisation	Fixed, based on strategy

- Estimate the amount of funding required to achieve targets and determine how the resources should be allocated across different HIV response interventions:
  - To reduce HIV incidence by x % and AIDS-deaths by y% by 202x (national targets)
  - To reduce HIV incidence and AIDS-deaths by 90% by 2030 (from 2010) (End AIDS targets)

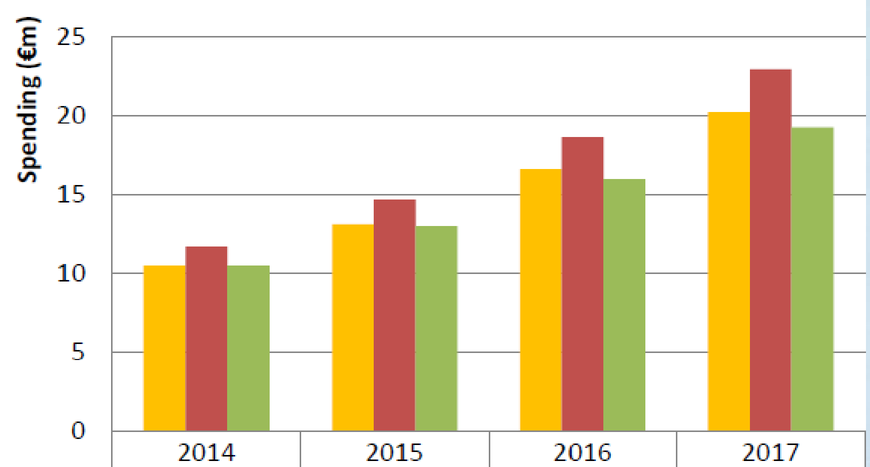
Achieving National Strategic Plan targets in Niger

- Reduce HIV incidence by 50% and scale-up ART to at least 80% of eligible people (2013-2017)





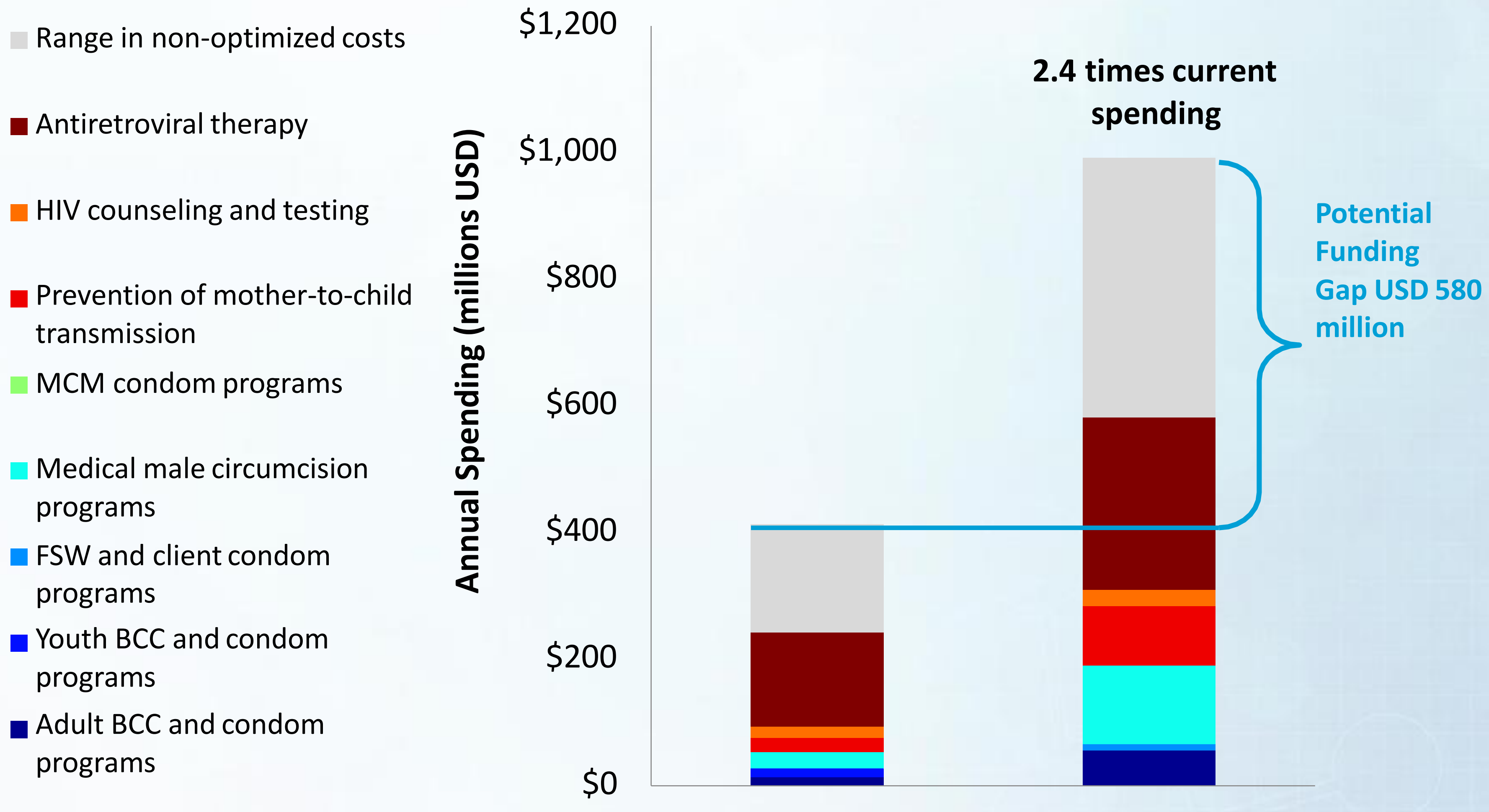
Minimum budgets required to meet NSP coverage targets, Niger 2013–17



	2014	2015	2016	2017
Default (€m)	10.5	13.1	16.6	20.2
Higher CD4 threshold	11.7	14.7	18.6	22.9
Lower management costs	10.5	13.0	16.0	19.2

Spending required for ambitious targets in Zambia

“Reality check”



Optima HIV

Analysis 5

Scenario Analyses:

Estimate how the future HIV epidemic would be influenced by specific changes to the status quo conditions

Implementation scenarios

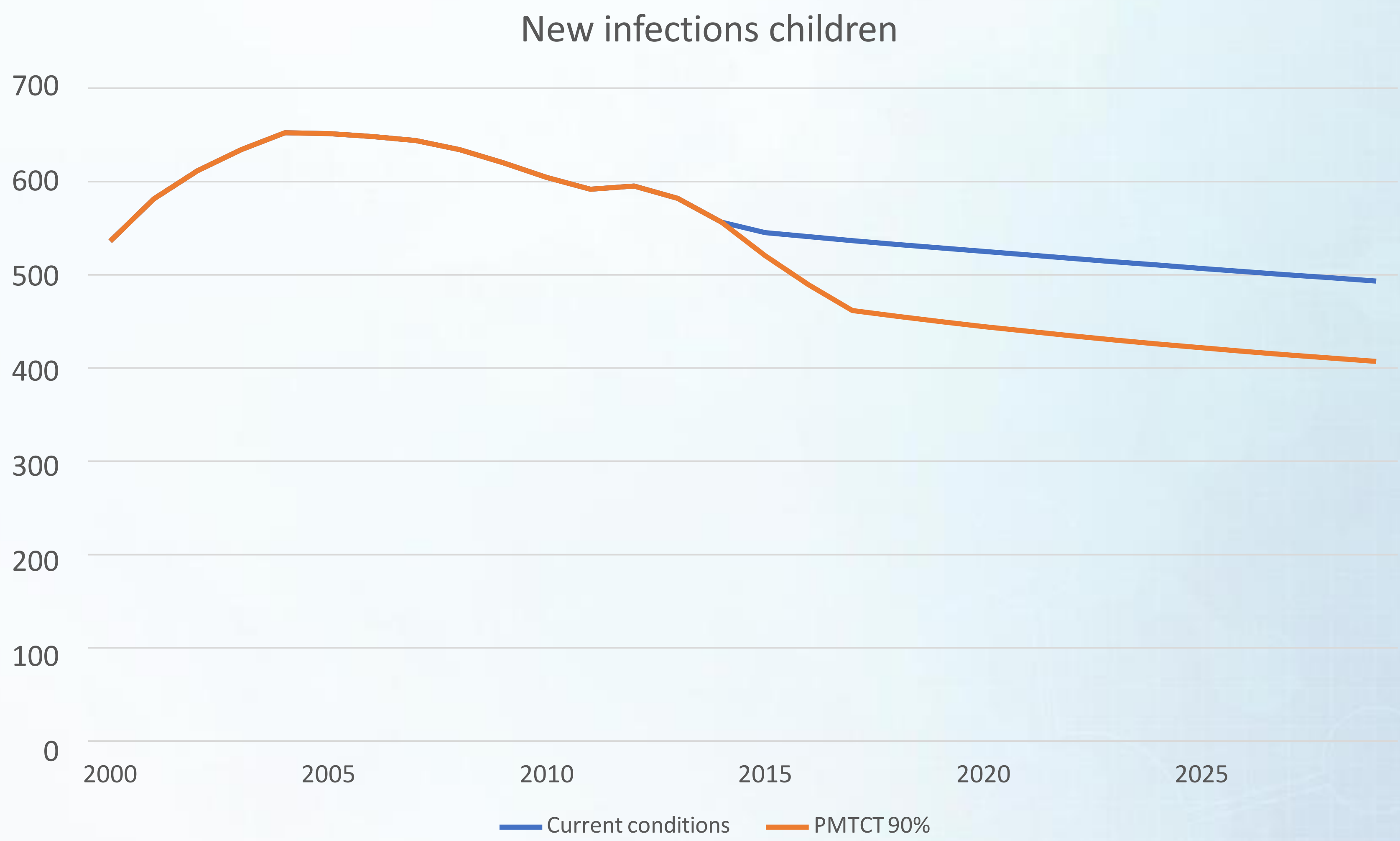
Unit costs / cost functions	Funding volume	Funding proportionate allocation	Coverage	Program target outcomes	Epidemiological outcomes
Vary as per analysis requests	Vary as per analysis requests	Vary as per analysis requests	Vary as per analysis requests	Vary as per analysis requests	Vary as per analysis requests

- Estimate the future number of new HIV infections and AIDS-deaths if program specific changes were achieved through implementation of the following actions (examples):
  - Scaling up coverage of testing, treatment and adherence programmes to achieve 90/90/90 targets
  - Achieving other programme coverage targets
  - Defunding key population non-ART prevention programmes

Implementation scenarios are typically defined based on country priorities and can involve some of the examples above, but potentially a range of other analyses.

Optima HIV

Example: Impact of scaling up PMTCT coverage



Analysis 6: Impact of historical funding allocations

Estimate the epidemiological impact and cost-effectiveness of the past HIV response funding as spent and with historical changes in coverage levels

Impact of historical funding allocations

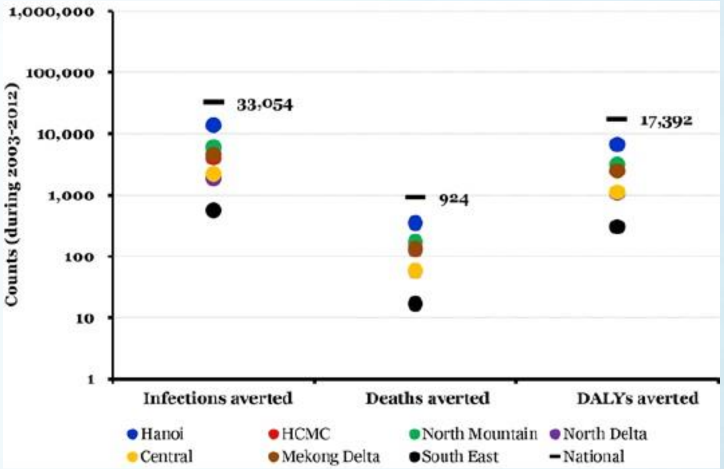
Unit costs / cost functions	Funding volume	Funding proportionate allocation	Coverage	Program target outcomes	Epidemiological outcomes
Fixed	Past funding	Past allocation	Past allocation	N/A	Assess impact

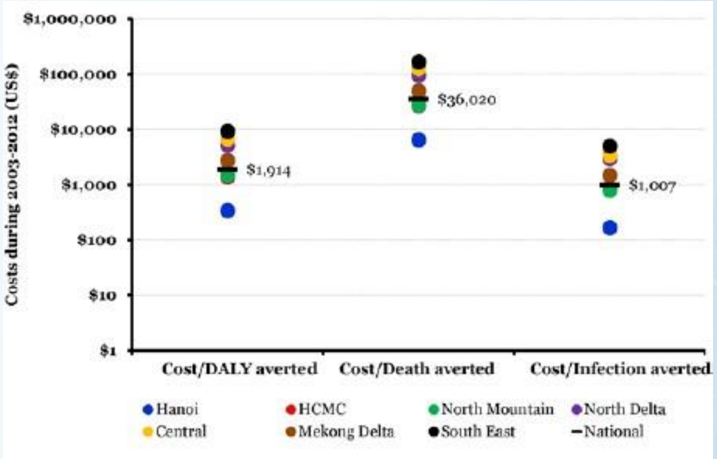
- Estimate the number of additional new HIV infections and AIDS-deaths that would have occurred had investment not been made in (examples):
  - Any component of the last National Strategic Plan (20xx-20xx)
  - PWID programs (needle and syringe programs and OST)
- Based on investment and estimated number of new HIV-infections and AIDS-deaths averted, estimate the cost-effectiveness of the past response

Optima HIV

Example: Evaluating a decade of DFID and WB supported HIV/ AIDS programmes in Vietnam (2003-2012)

- It was estimated that the **DFID/WB programmes averted ~33,000 HIV infections, 924 HIV-related deaths, and 17,392 DALYs**
- Most of the health benefits were attributed to NSPs for PWID.
- Programme costs amounted to an estimated (2003-2012):
  - US $1,007 per HIV infection averted
  - US $36,020 per HIV-related death averted
  - US $1,914 per DALY averted
- According to standard willingness to pay thresholds, these values indicate that the programmes are **good value for money.**
- For every $ spent on NSPs, the estimated rate of return in healthcare costs saved was US $1.93.





Specifications for the Analysis ("Analysis Framework")

- Time horizons (reference year, etc.)
- Populations and sub-populations
- Interventions/ Modalities
  - Target groups
  - Characterization of each intervention
  - Parameters (and/or cascade stage(s)) affected
  - Baseline coverage in target populations
  - Saturation
  - Effectiveness
  - Cost (unit or marginal)
- Definition of scenarios/optimisations
- Constraints applied in modelling
- Model constants, parameters, assumptions (e.g. for base case)
- Critical data gaps and strategies to fill them
  - Additional data collation, secondary data or sensitivity analysis etc.

Collating data and populating the Optima HIV databook

Learning objectives

- Key data needs and sources
- Interpreting data sources and considerations for model parameters
- Handling data uncertainties

SOURCE: Chisholm, D and Evans, D. 2010. Improving health system efficiency as a means of moving towards universal coverage. *World Health Report (2010) Background Paper, No 28.* World Health Organization

Optima HIV data requirements

- Demographic, epidemiological and behavioural data are to be collated in the Optima HIV databook.
  - Once collected, databook is uploaded directly to Optima HIV model

- Costing, coverage and cost-coverage values are entered in the Optima HIV interface.

Minimum data requirements for Optima HIV databook: demographic, epidemiological, and behavioral values

Sheet	Indicators	Mandatory or optional
Populations	Populations by age, sex, risk	Mandatory
Population size	Population sizes by population	Mandatory
HIV prevalence	HIV prevalence by population	Mandatory
Other epidemiology	Background mortality, prevalence of STIs, TB prevalence by population	Mandatory
Testing & treatment	HIV testing rates by population, probability of a person with CD4 <200 being tested per year, on ART, covered by ARV-based prophylaxis (PrEP, PEP) by population, on PMTCT, birth rate by female population, percentage of HIV-positive women who breastfeed	Mandatory
Optional indicators	Tests, diagnosis, modelled estimates (infections, prevalence, PLHIV, HIV-related deaths), initiating ART, PLHIV aware of status, diagnosed in care, in care on treatment (%), pregnant women on PMTCT (%), on ART with VS (%)	Optional
Cascade	Time to be linked to care by populations, time to be linked to care for people with CD4<200, lost to follow-up by population, people with CD4<200 lost to follow-up (%/year), VL monitoring, proportion of those with VL failure who are provided with effective adherence support or a successful new regimen, treatment failure rate	Optional*
Sexual behavior	By population: number of regular, casual, commercial acts and condom use by partner type, and circumcisions by male population	Mandatory
Injecting behavior	Frequency of injection and needle-syringe sharing by populations, number on OST	Mandatory
Partnerships & transitions	Interactions for sexual and injecting partners, occurrence of births specified from which female population to youngest general population by sex where applicable, age- and risk-related movement between populations	Mandatory
Constants	Parameters (transmissibility, efficacy, disease progression, mortality, etc.)	Only edit where context values available

*Recommend entering values for these two indicators within the cascade sheet:

(1) time take to be linked to care, if left blank everyone diagnosed will immediately be linked to care, and

(2) loss to follow up, if left blank no one would be lost to follow-up

if left blank will be **interpreted as zero** by the model, the model will run, but the outcome will not be realistic

Common data sources

For demographic, epidemiological and behavioural values:

- UNAIDS Global AIDS Monitoring (GAM) reports
- Integrated Bio-behavioural Surveillance (IBBS) reports
- Demographic and Health Survey (DHS)
- Annual M&E progress reports
- Multiple Indicator Cluster Surveys (MICS)

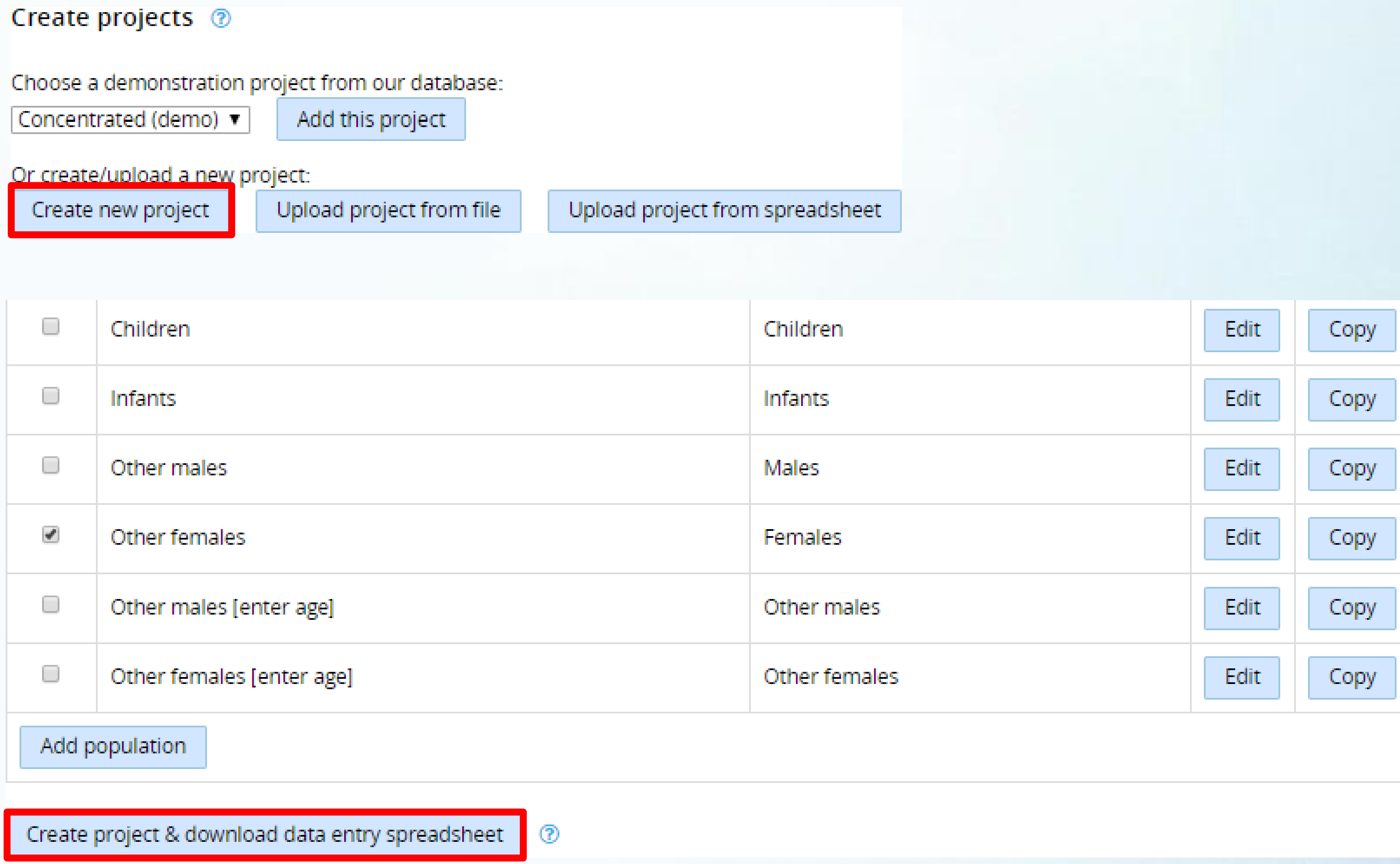
Model estimates for 'Optional indicators' sheet in databook:

- National HIV estimates produced using EPP/Spectrum

Consult the **Optima HIV User Guide Vol. IV - Indicator Guide**

https://docs.google.com/document/d/1AayY5PmIkmt-rwkjawWjg56omDPZ9Igv7qiNB7wifbo/edit#heading=h.kn3gck778icg

Create project and download spreadsheet (databook)



Optima HIV

Entering data in the Optima HIV databook

- Demographic, epidemiological and behavioral data is entered in an excel data entry spreadsheet template (Databook)
  - for the total population or by population group*,
  - by year or as an assumption value, and
  - for certain indicators, for the best value, as well as low and high bound values (bound values are optional)

HIV prevalence										
		2000	2001	2002	2003	2004	2005	2006	2007	2008
FSW	high	5.00%					7.00%			
FSW	best	3.50%					4.40%			
FSW	low	2.00%					3.00%			
Clients	high									
Clients	best									
Clients	low									
MSM	high									
MSM	best				2.16%		2.65%			3.62%
MSM	low									

*When entering in the databook - key population size values are subtracted from the general population values to ensure that the total population is the total for that particular setting

Entering data in the Optima HIV databook – only in designated areas of the databook

- In the databook note the following:
  - Do not alter values in columns A (indicator), B (population names), X (“OR”) or Y (Assumption)
  - Extra rows may be added, but do not move existing text and cells shaded in blue
  - New sheets can be added for additional data or calculations

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
1	Percentage of people who die from non-HIV-related causes per year																								
2			2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		Assumption
3		FSW																						OR	1%
4		Clients																						OR	1%
5		MSM																						OR	1%
6		Males 0-9																						OR	1%
7		Females 0-9																						OR	1%
8		Males 10-19																						OR	1%
9		Females 10-19																						OR	1%
10		Males 20-24																						OR	1%
11		Females 20-24																						OR	1%
12		Males 25-49																						OR	1%
13		Females 25-49																						OR	1%
14		Males 50+																						OR	1%
15		Females 50+																						OR	1%

Partnerships and risk transitions

- Interactions between regular sexual partners:
  - Entered from left column for male populations to their corresponding partners
  - Rows for female populations should be left <u>blank</u>
  - Weighting values relate to each other within population group
  - Cells left blank are interpreted as 0 (i.e. no interaction)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Interactions between regular partners														
2			FSW	Clients	MSM	Males 0-9	Females 0-9	Males 10-19	Females 10-19	Males 20-24	Females 20-24	Males 25-49	Females 25-49	Males 50+	Females 50+
3		FSW													
4		Clients							1		5		5		
5		MSM			1										
6		Males 0-9													
7		Females 0-9													
8		Males 10-19							5		3		1		
9		Females 10-19													
10		Males 20-24							1		5		3		
11		Females 20-24													
12		Males 25-49							1		3		5		3
13		Females 25-49													
14		Males 50+									1		3		5
15		Females 50+													

Partnerships and risk transitions

- Risk transitions
  - The average number of years those at risk spend in that risk group before moving back to the general population
  - If only 1 risk population → general population, enter average number of years before transition, e.g., 10 years for clients
  - Risk population transitioning to more than one general population group, use the simple calculation

$$\frac{1}{(1/60 + 1/20)} = 15 \text{ years on average}$$

Risk-related population transitions (average number of years before movement)							
	Males 20-24	Females 20-24	Males 25-49	Females 25-49	Males 50+	Females 50+	Average
FSW		60		20			15
Clients	50		17		50		10

... Testing & treatment | Optional indicators | Cascade | Sexual behavior | Injecting behavior | **Partnerships & transitions** | Constants

Considerations

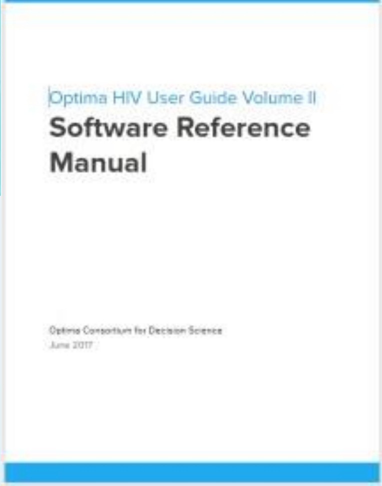
- Data availability (or lack thereof)
  - **Population sizes** for key populations may be difficult to estimate where not reported
    - **Assumptions** may need to be made, for example, estimating the population size for clients of FSW as three-times the pop size of FSW
  - Limited data on sexual and injecting behaviour. IBBS (Integrated Bio-behavioural Surveillance) reports are one possible source for these values.
  - Variation in the reliability of data values must be assessed and handled together with the modelling team on a case-by-case basis as necessary.

Considerations

- Data inconsistencies
  - For example, there may be discrepancies in the number of sexual acts reported by men and by women who are sexual partners

- Data, estimates and assumptions used to inform the model must be carefully reviewed by the country team together with the modelling team.

Support for Optima users on data entry


Optima HIV User Guide Volume II

Software Reference Manual

Optima Consortium for Decision Science

June 2017

- User **training**, including practical exercises
- User guide
- **Indicator guide**: with mapping to UNAIDS GAM and NASA, PEPFAR, and GF indicators
- Data spreadsheets undergo several **reviews** by Optima HIV team together with country M&E team
- Optima HIV (Burnet and WB) **support team** provides online support

info@optima.com

Practice

Review of Optima HIV databook and uploading a completed Optima HIV spreadsheet

QUESTIONS?

Optima HIV model calibration

Learning objectives

- What is calibration?
- Data sources for calibration
- Steps for calibrating and what to look for in a calibration

What is calibration?

- **Calibration:** *is the process of adjusting the parameters of the model to get the best possible match to all available data*
- Ideally:
  - The model structure would perfectly reflect the real world
  - All data would be self-consistent
  - Uncertainties and biases would be minimal
- In practice:
  - The model makes simplifying assumptions (e.g., population homogeneity)
  - Epidemiological and behavioral data are not consistent
  - Data (especially historical) have large uncertainties and biases

Optima HIV

Data sources for calibration

- All data entered can be used for calibration

- In practice, the most reliable data for the model are (in order):
  - Number of people on treatment
  - Prevalence estimates
  - Other cascade data (proportion diagnosed, proportion virally suppressed, etc.)
  - Estimates of new HIV infections, HIV-related deaths, etc. (typically from Spectrum or another model)

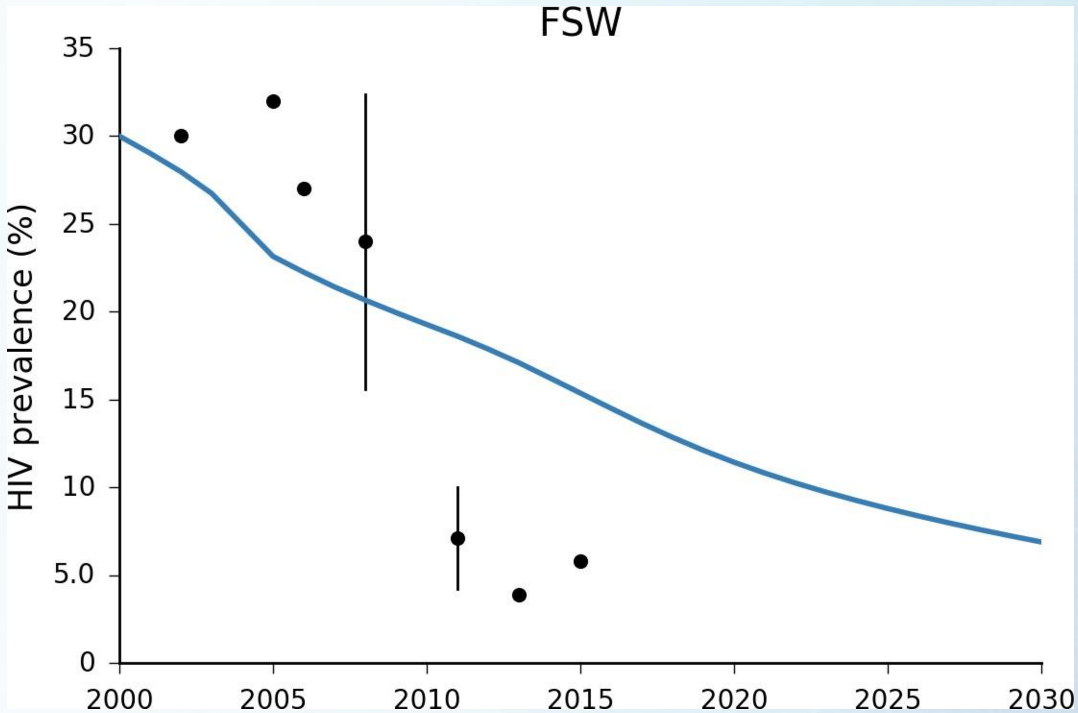
Are the data points consistent?

- Examine trends over time
- Examine all data sources to identify the most reliable source(s) and value(s)
- Consider values across populations who are sexual partners. For example, sexual behaviours (acts, condom use) between FSW and their clients. Are they balanced?
- Consider values as to their contribution to the status of the national epidemic. For example, prevalence for each population multiplied by population size, for an estimate of the total number of PLHIV. Does this seem reasonable?

Does the data make sense?

- Data that come from different sources may not be consistent
- Methodologies, sites, etc. can change from year to year

- For example: **Does this seem realistic?**



How to calibrate in Optima HIV

1. Run an auto-calibration

2. Adjust using manual calibration as necessary

Most common parameters to adjust, by population group:

- Initial HIV prevalence
- Force of infection (unitless, rule: <10, > 0.01)

Other parameters

- Inhomogeniety (by how much the curve "bends" away from current trajectory or changes over time) (unitless)
- Death rate, failure rate

Calibration is an iterative process to fit the model to the epidemic

Optima HIV

Additional notes for calibration

- When **calibrating** the model, you have the option to pay *more attention to some data points than others*
- Optima will **automatically correct for most data inconsistencies** (e.g. by balancing the number of sexual acts, interpolating missing values for population size)

Practice

Calibrating a model

QUESTIONS?

Overview of steps for Optima HIV modelling

1. Access & resources: login and logout, user guide, demo project instructions, and help
2. Projects: start a new project and define programs
3. Data: create project & download spreadsheet
   a. Enter data in spreadsheet: ensure completeness, model needs *at least one* data *or* assumption value for each population for: population size, prevalence, behaviour, etc.)
4. Upload complete spreadsheet to project
5. Calibration
   a. Automatic calibration
   b. Manual calibration: adjust as necessary
6. Define programs and enter costs and coverage
7. Cost functions
   a. Define cost functions
   b. Define outcome functions
8. Analyses
   a. Scenario
   b. Optimization
9. Analyze results, generate slides and report, disseminate results
10. In future: update the project & regenerate results in consultation with the Optima team

Defining programs, service delivery modalities, parameters, and cost functions

Learning objectives

- HIV programs including service delivery modalities
- Cost functions
- Data requirements, sources, and concerns
- Currency

Effect of programs on HIV response

To model the effect of HIV programs on the epidemic, the first step is to relate changes in program **spending** to changes in program **coverage**.

Then changes in program **coverage** on **outcome** using **cost functions**.

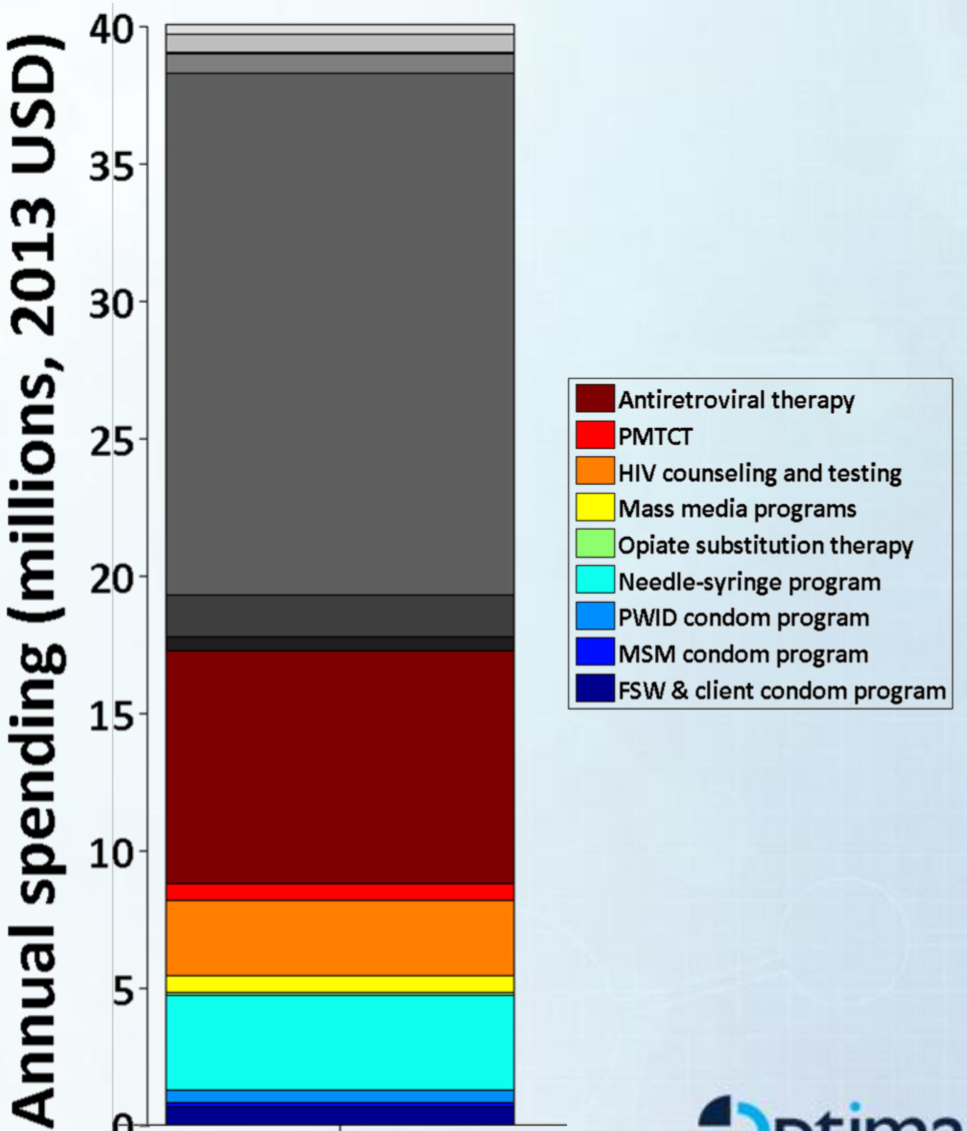
Overview of HIV programs

- Optima HIV can accommodate programs that:
  - Directly target HIV response (i.e. diagnostic, treatment, prevention)
  - Less directly target HIV (i.e. behavioral, awareness campaigns)
  - Non-targeted, but included in the budget (i.e. management)
- Each targeted program implemented requires:
  - Coverage (number of people reached)
  - Unit cost
  - Spending
  - Impact on disease
- Program component can include programs not currently implemented, but may be included in the future
- There may be >1 service delivery modalities for each type of program or intervention (e.g. self-testing, mobile testing etc.). These are handled as separate programs in the Optima HIV model

Optima HIV

HIV program spending

- Can be reported directly (top-down costing)
- Alternatively, can be reconstructed from unit costs and program coverage (bottom-up costing)



Cost definitions

- Unit cost
    - Total program cost divided by the number of people covered
    - Total cost/number of people covered
    - E.g. $100/10 = $10

- Marginal cost
    - Cost of covering one more person

Variable unit costs

- Relationships between costs and coverage are generally nonlinear, because costs change depending on the level at which the program is operating

- Optima allows users to **specify** programs with costs that vary depending on coverage

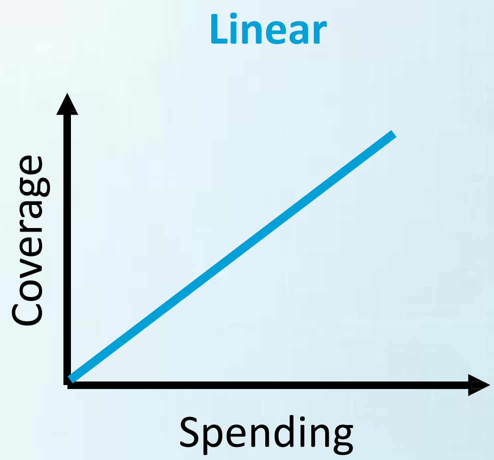
- We expect **increasing marginal costs** as programs **expand coverage** to increasingly hard to reach populations [saturation]

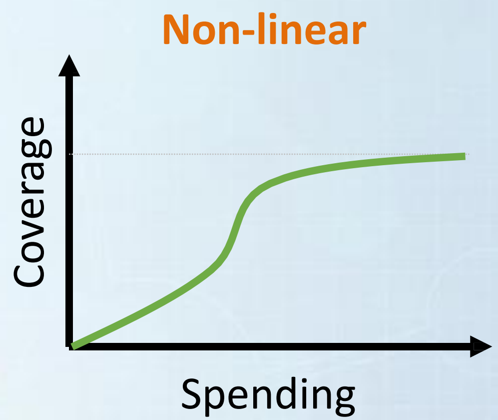
Optima HIV

Relating program costs and population coverage

Cost-coverage curves:

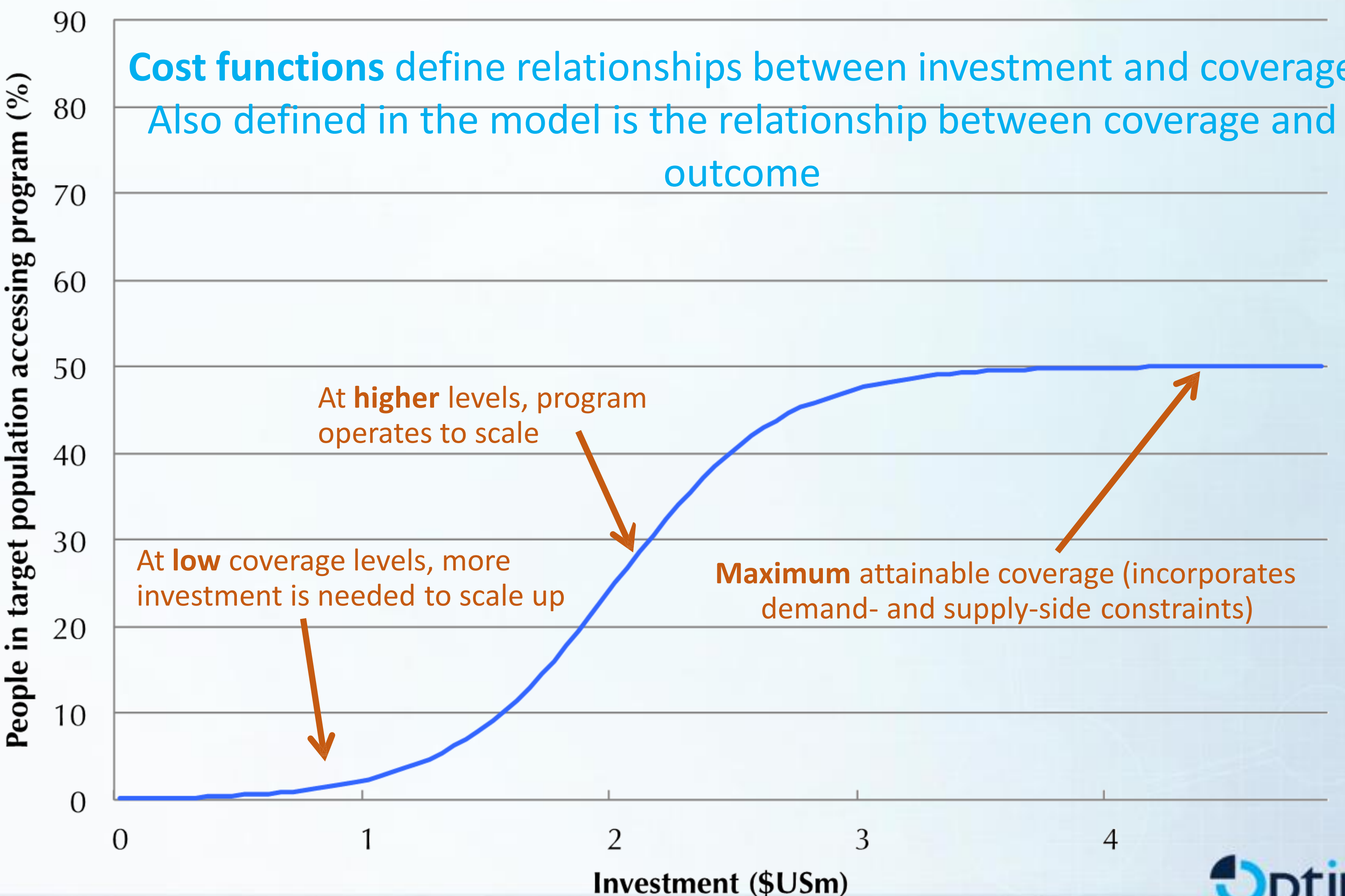
- Relates program spending to program coverage
- Cost-coverage curves can be
  - **Linear**: slope represents a single unit cost, or
  - **Non-linear**: slope represent scale-up, stable implementation, and increasing effort in reaching additional people
- In the absence of estimates, **linear** cost-coverage curves are assumed





Optima HIV

Cost function curve: spending versus coverage



Cost functions: requirements and data sources

Data requirements

1.Cost: total spending and unit costs

Data sources

- National AIDS Spending Assessment (NASA)
- PEPFAR/Global Fund expenditures
- Country programme reports
- Other (e.g. Global Health Costing Consortium Unit Cost Repository)

2. Coverage: number of people reached

3. Outcomes under:

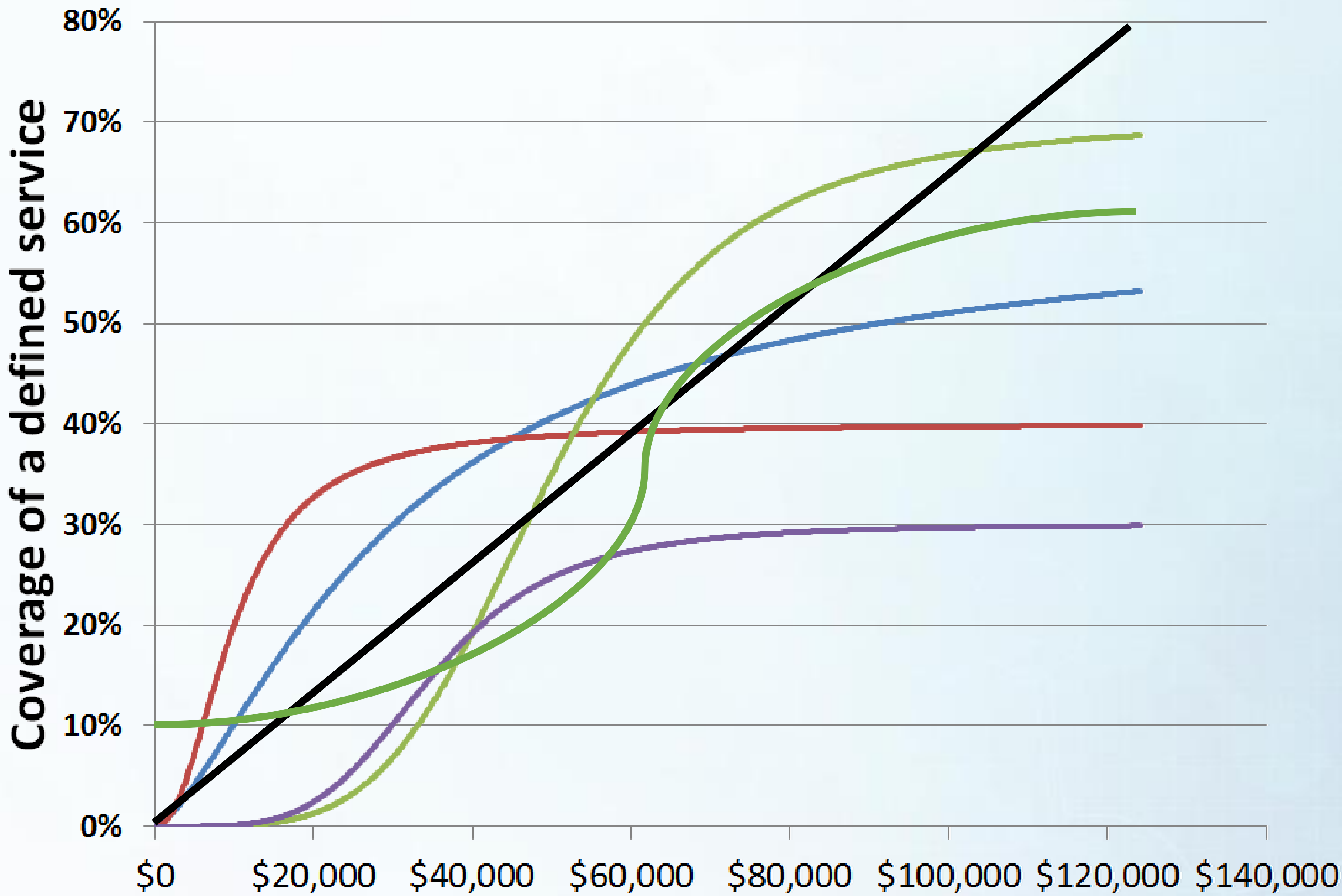
- Zero spending ($0): in the absence of any programs targeting this parameter
- Maximum attainable coverage (unlimited spending): for each program acting in isolation

Data sources

- Global AIDS Monitoring (GAM) reports
- Annual programme/ M&E reports

Optima HIV

Cost functions for each program or modality

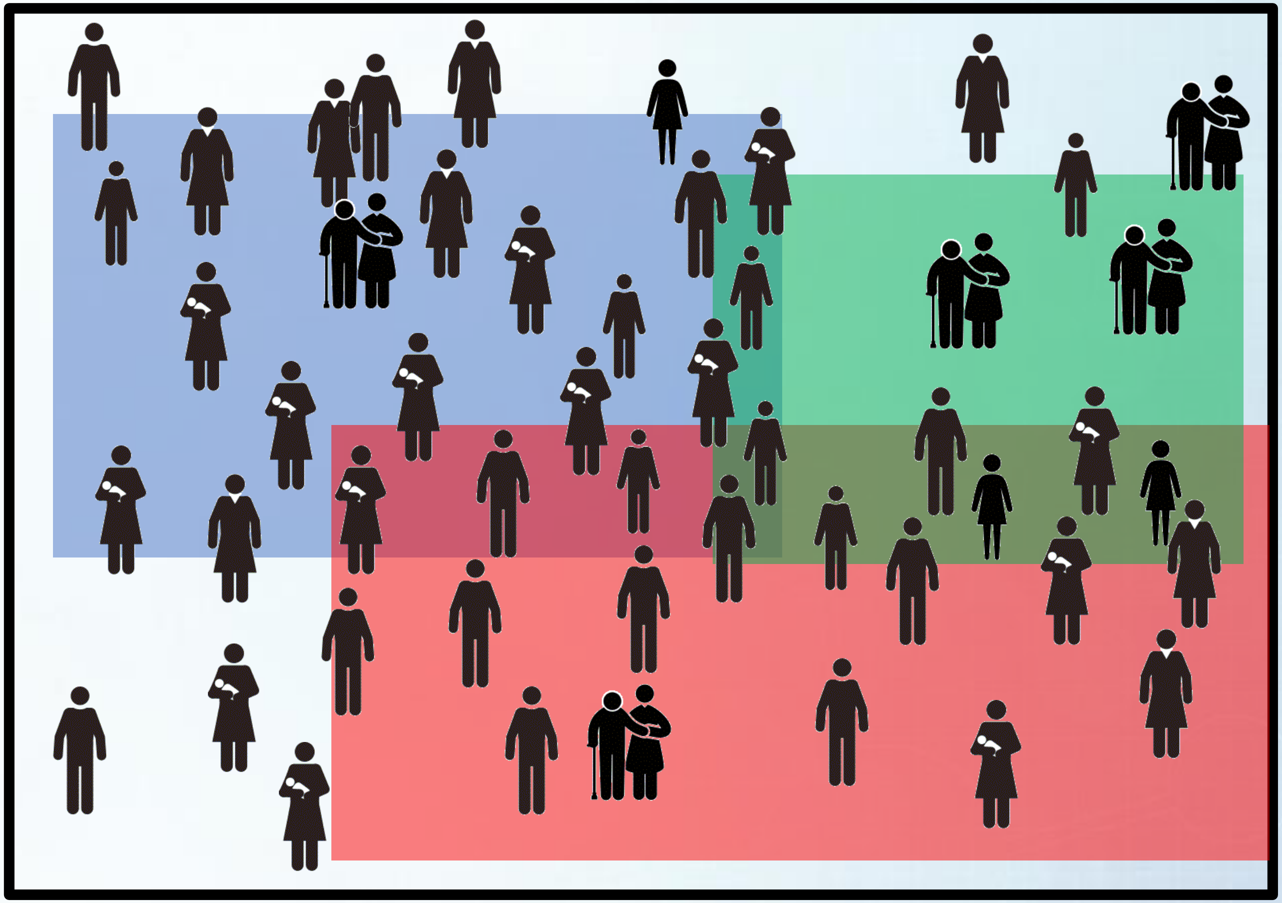


Each program/service modality has it's own **cost-coverage** curve

Spending on different programs/modalities mapped to coverage

$[\$_0, \$_1, \ldots, \$_N] \rightarrow [C_0, C_1, \ldots, C_N]$ ($ maps to coverage)

Entire target population



Coverage reached by program X for $\$_X$

program 1

program 2

program 3

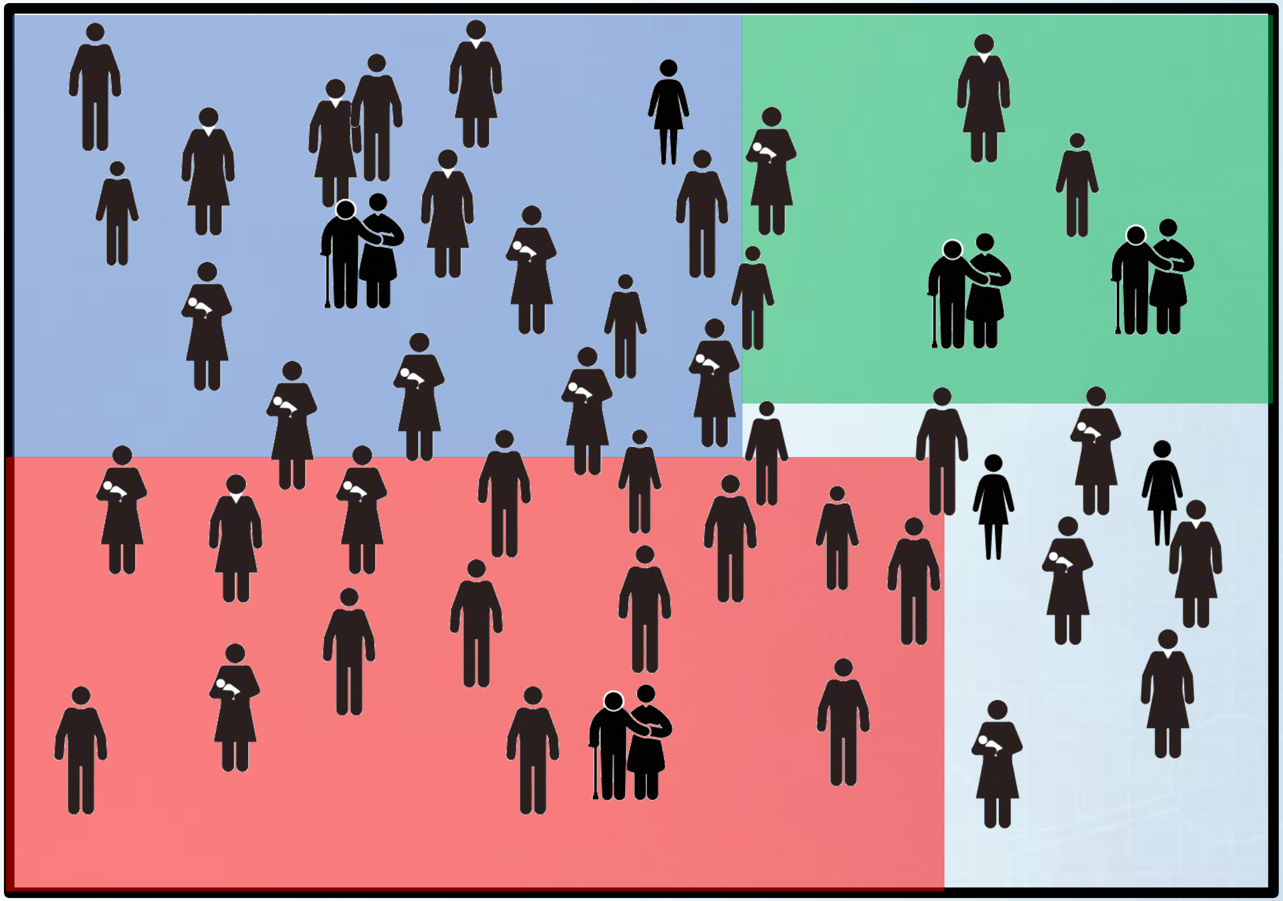
For every parameter, the type of program interaction is set

Option 1: **additive** (optional)

Entire target population

Coverage reached by program X for $\$_X$

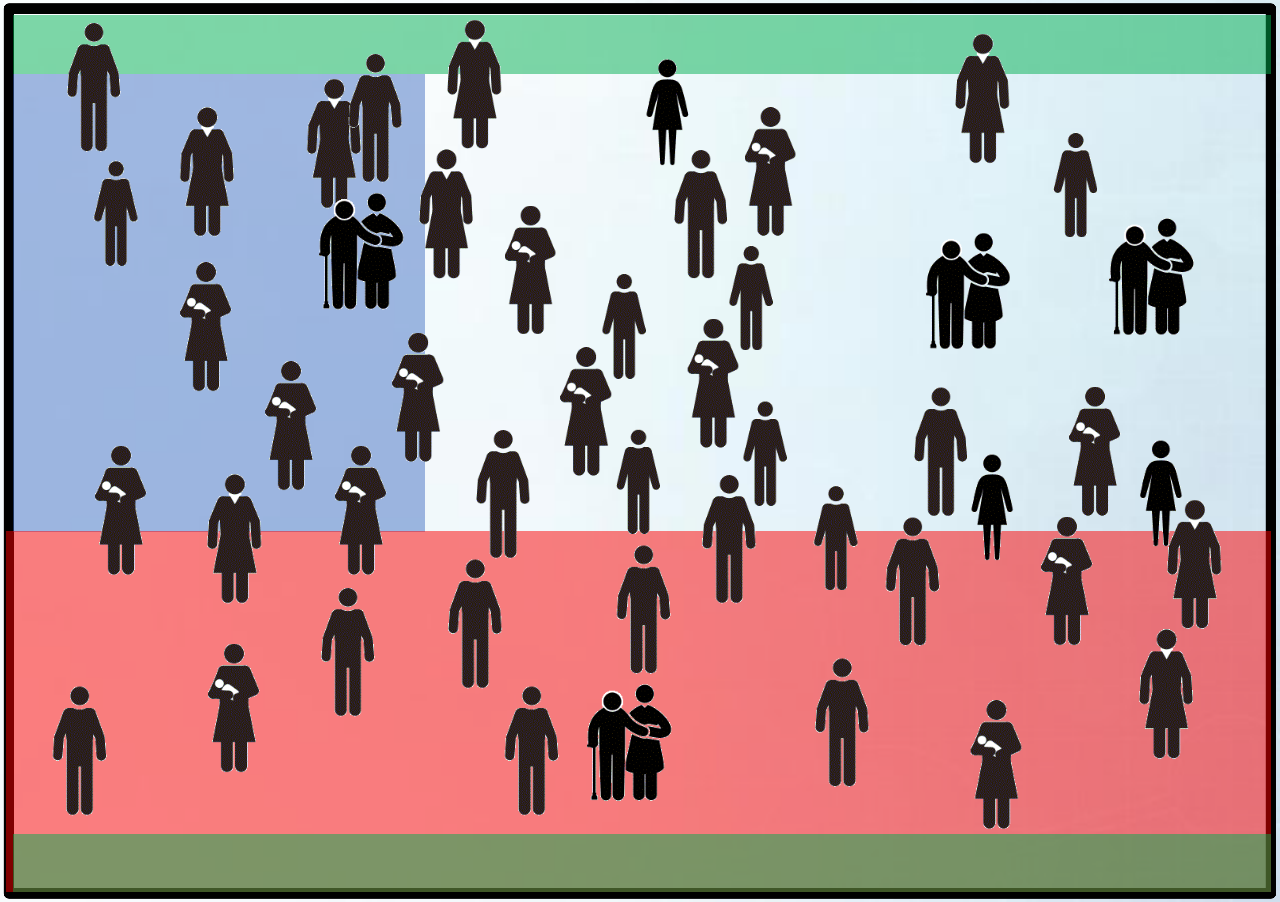
- program 1
- program 2
- program 3



For every parameter, the type of program interaction is set

Option 2: **random** (default)

Entire target population



Coverage reached by program X for $\$_X$

program 1

program 2

program 3

For every parameter, the type of program interaction is set

Option 3: **nested** (optional)

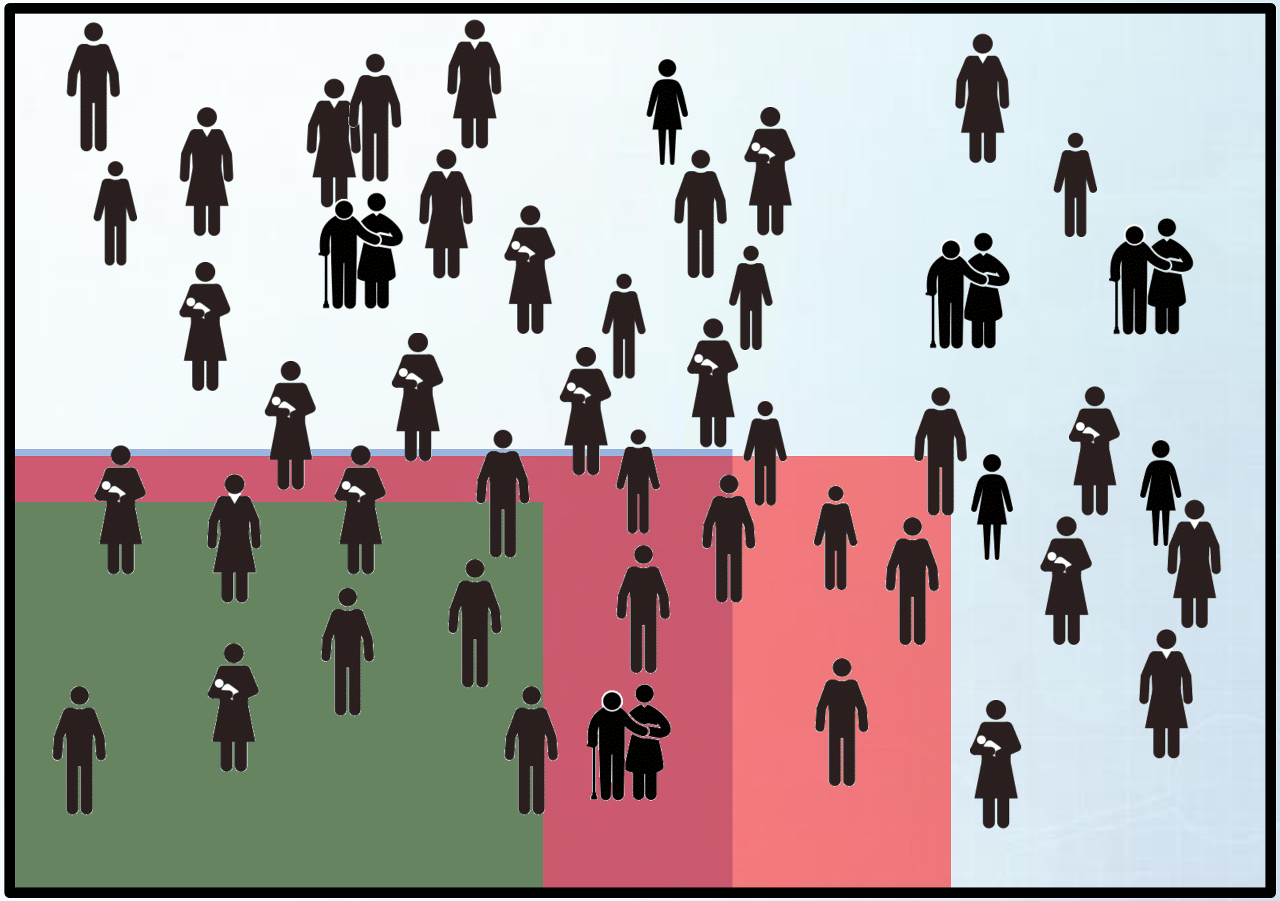
Coverage reached by program X for $\$_X$

program 1

program 2

program 3

Entire target population



Reconciliation – a critical step before running an analysis

From the Cost functions, Summary tab, if calibration and coverage values do not match +/-10% as a guide, the modeling team will:

- Check the databook and calibration output for values that might be unrealistic
- Check outcome functions to see if values are realistic:

Define cost functions | Define outcome functions | Summary

Year: 2018

Parameter	Population	Calibration value	Coverage value
Condom use for commercial acts	["Clients","FSW"]	0.6900	0.6847
Condom use for commercial acts	["MSM","FSW"]	0.3925	0.3730
Number of people on treatment	tot	700,000.0000	697,668.1332
Number of people on PMTCT	tot	75,165.0000	75,182.2664
Condom use for casual acts	["Clients","Females 20-24"]	0.3755	0.3497
Condom use for casual acts	["Clients","Females 25-49"]	0.3645	0.3497
Condom use for casual acts	["MSM","MSM"]	0.3000	0.2876
Condom use for casual acts	["Males 10-19","Females 10-19"]	0.3965	0.3830
Condom use for casual acts	["Males 10-19","Females 20-24"]	0.4400	0.4079
Condom use for casual acts	["Males 10-19","Females 25-49"]	0.4290	0.3996
Condom use for casual acts	["Males 20-24","Females 10-19"]	0.4630	0.4328

Note: reconciliation does not apply for number of circumcisions

Currency

- Suggested **currency** (for consistency): USD
- **Any** currency can be used - inform modelling team of currency chosen and ensure the same currency is consistently used across the entire project
- Model does *not apply* inflation or discounting
  - These adjustments to spending output can be made outside the model

Practice

Defining programs, service delivery modalities, parameters, and cost functions

QUESTIONS?

Optima HIV scenario analyses

Learning objectives

- How to define scenarios
- How to run scenario analyses, view, and export results

Scenario analysis in Optima HIV

- Explore the impact of past spending
- Compare the impact of theoretical changes to the epidemic
- Compare the impact of different program assumptions
- Compare different model assumptions
- Many other factors can be examined using scenario analysis

Budget and coverage scenarios

- Specify spending or coverage amounts for each program within the scenario (compared to baseline ”business as usual”)

- Results can be used to inform **policy analyses**

Active	Scenario name	Parameter set	Program set	Scenario type	Manage
✔	90-90-90/95-95-95	Treatment fixed	default	parameter	
✔	Status quo	Status quo	default	parameter	

Run scenarios from 2000 ▾ to 2030 ▾ ? Add parameter scenario ? Add budget scenario ? Add coverage scenario ?

Optima HIV

Setting up a scenario analysis in Optima HIV

Projects

Active	Scenario name
✔	90-90-90/95-95-95
✔	Status quo

Run scenarios from 2000

CREATE OR EDIT A PARAMETER SCENARIO

Name

90-90-90/95-95-95

Parameter set:

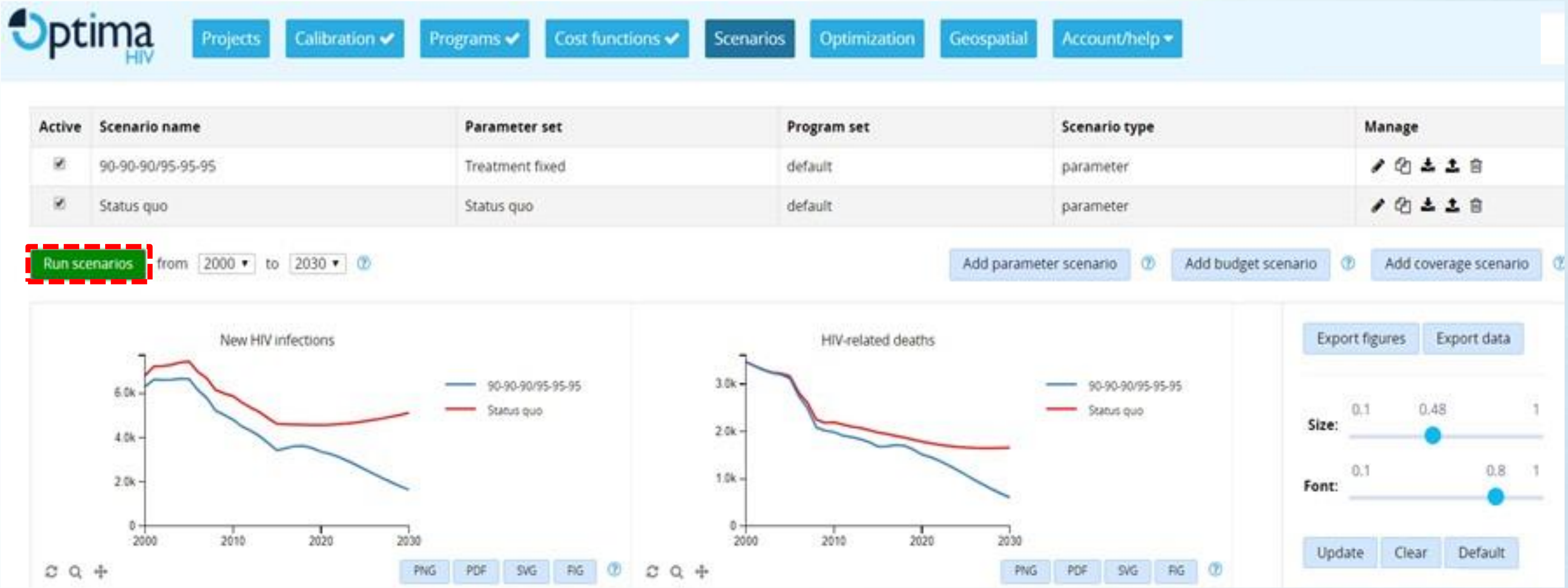
Treatment fixed

Model parameters	Population	Start year	Final year	Start value	Final value
Proportion of PLHIV aware of their status	Total Populati	2015	2020		0.9
Proportion of PLHIV aware of their status	Total Populati	2020	2030	0.9	0.95
Proportion of diagnosed PLHIV in care	Total Populati	2015		1	
Proportion of PLHIV in care on treatment	Total Populati	2015	2020		0.9
Proportion of PLHIV in care on treatment	Total Populati	2020	2030	0.9	0.95
Proportion of people on ART with viral suppres	Total Populati	2015	2020		0.9
Proportion of people on ART with viral suppres	Total Populati	2020	2030	0.9	0.95

Add parameter

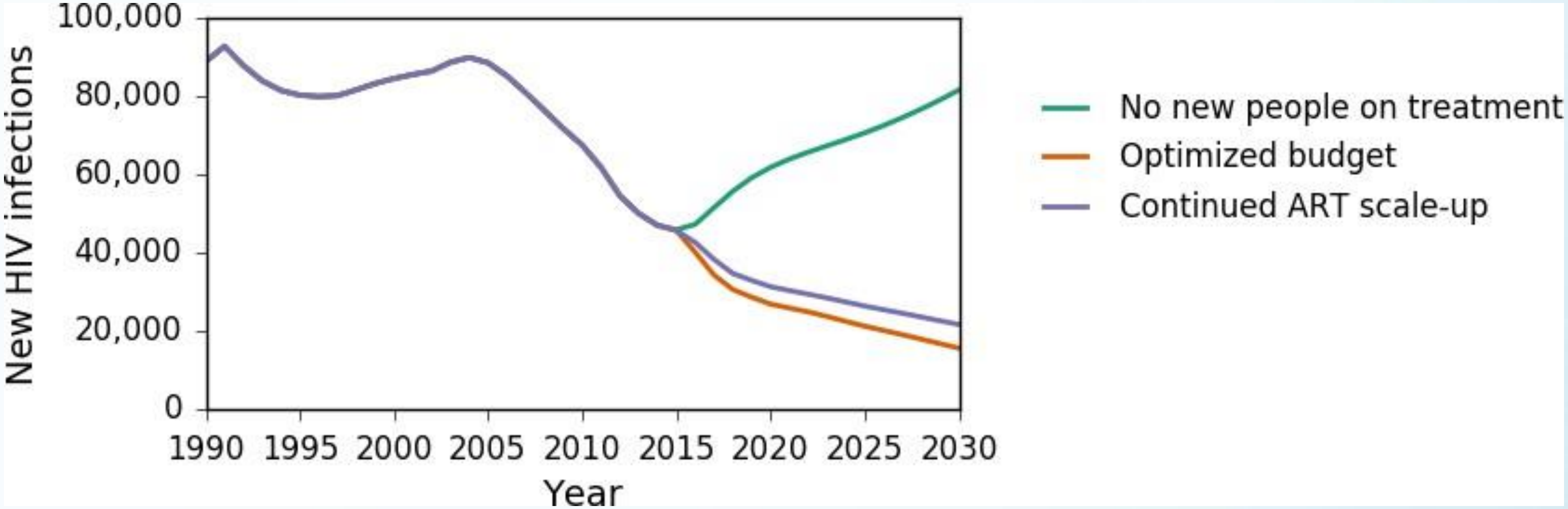
Cancel Save

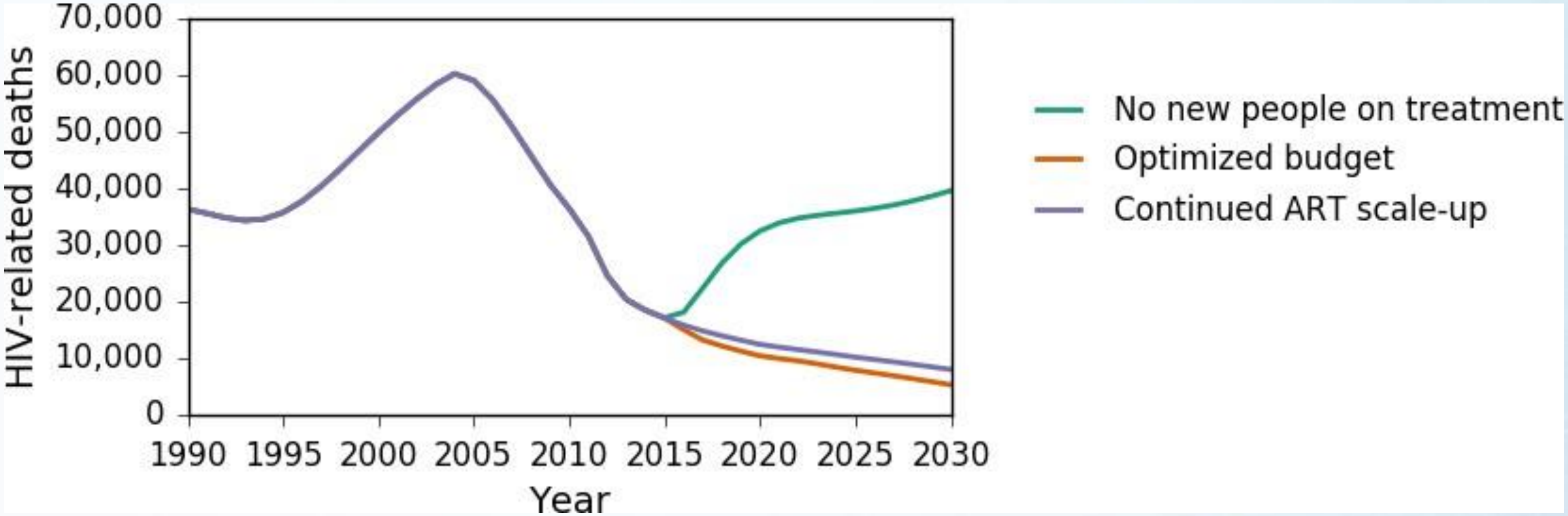
Run a scenario in Optima HIV



Exporting figures

Example from Malawi - prioritize diagnosis and treatment scale-up





Practice

Running Optima HIV scenario analyses, viewing, and exporting results

QUESTIONS?

Optima HIV optimization analyses

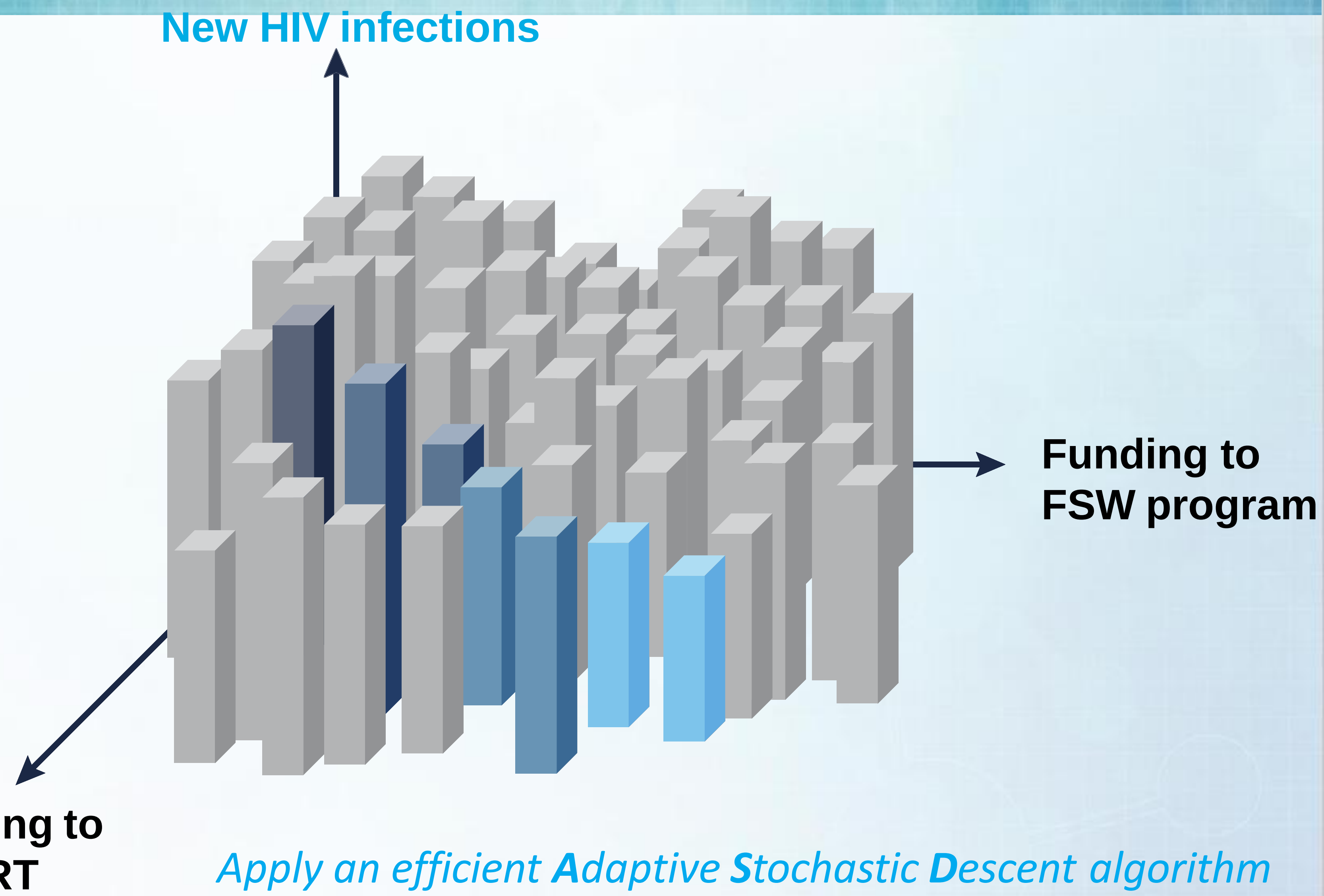
Learning objectives

- How mathematical optimization is achieved
- Description of the Optima HIV optimization algorithm

Optimize resource allocation to best meet objectives

How should the budget be allocated amongst these ‘n’ programs, modalities, and delivery options, considering their interactions with synergies and limitations?

Optimization: **consider just two dimensions**

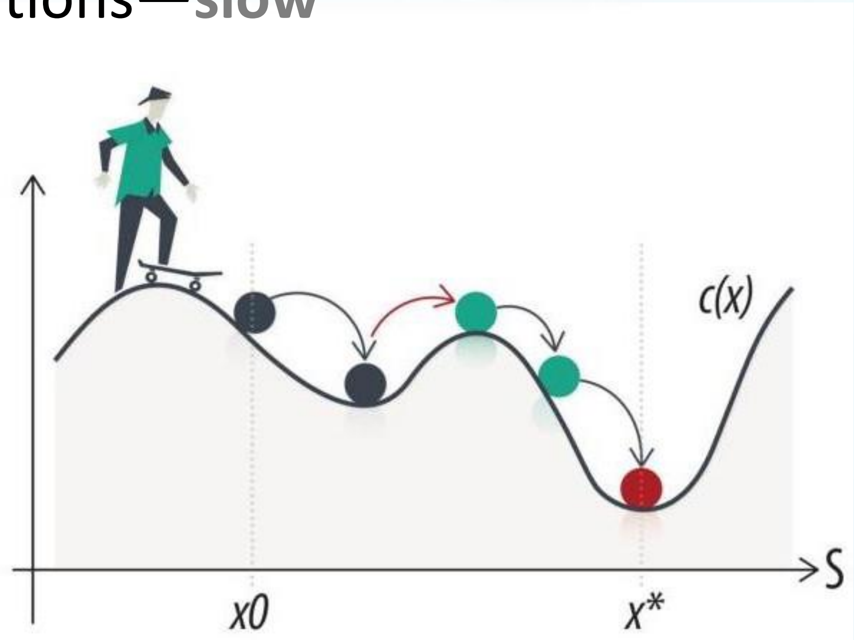


*Apply an efficient **A**daptive **S**tochastic **D**escent algorithm*

Source: Kerr et al 2016

Which optimization algorithm?

Traditional algorithms (e.g., simulated annealing) require many function evaluations—**slow**



Optima's optimization algorithm

Adaptive **s**tochastic **d**escent

- **Adaptive:** learns probabilities and step sizes
- **Stochastic:** chooses next parameter to vary at random
- **Descent:** only accepts downhill steps

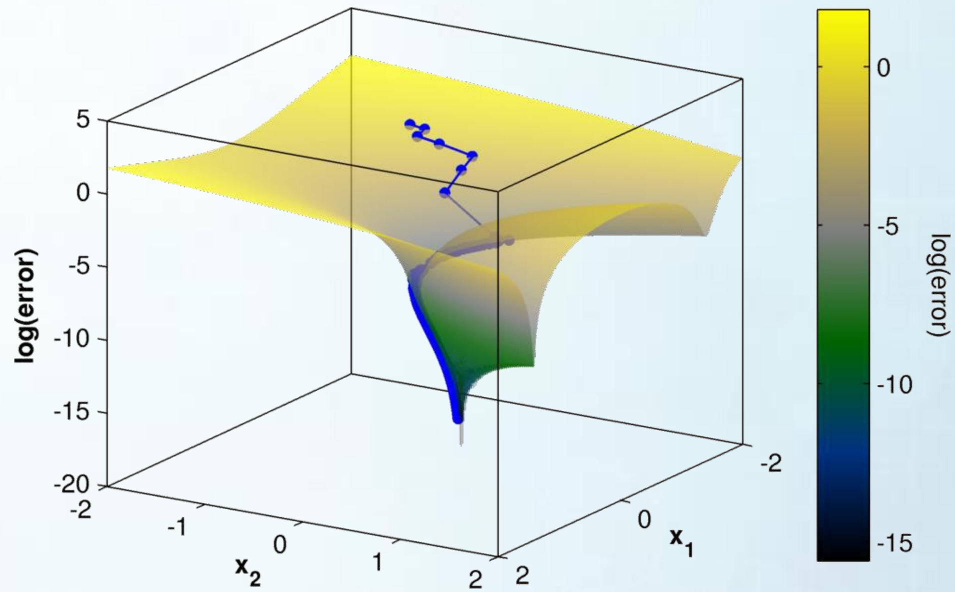
Optima HIV

Theory of optimization

Aim: For a given amount of money, what's the best outcome we can achieve?

"Best" could mean:

- Fewest infections
- Fewest deaths
- Lowest costs
- All of the above

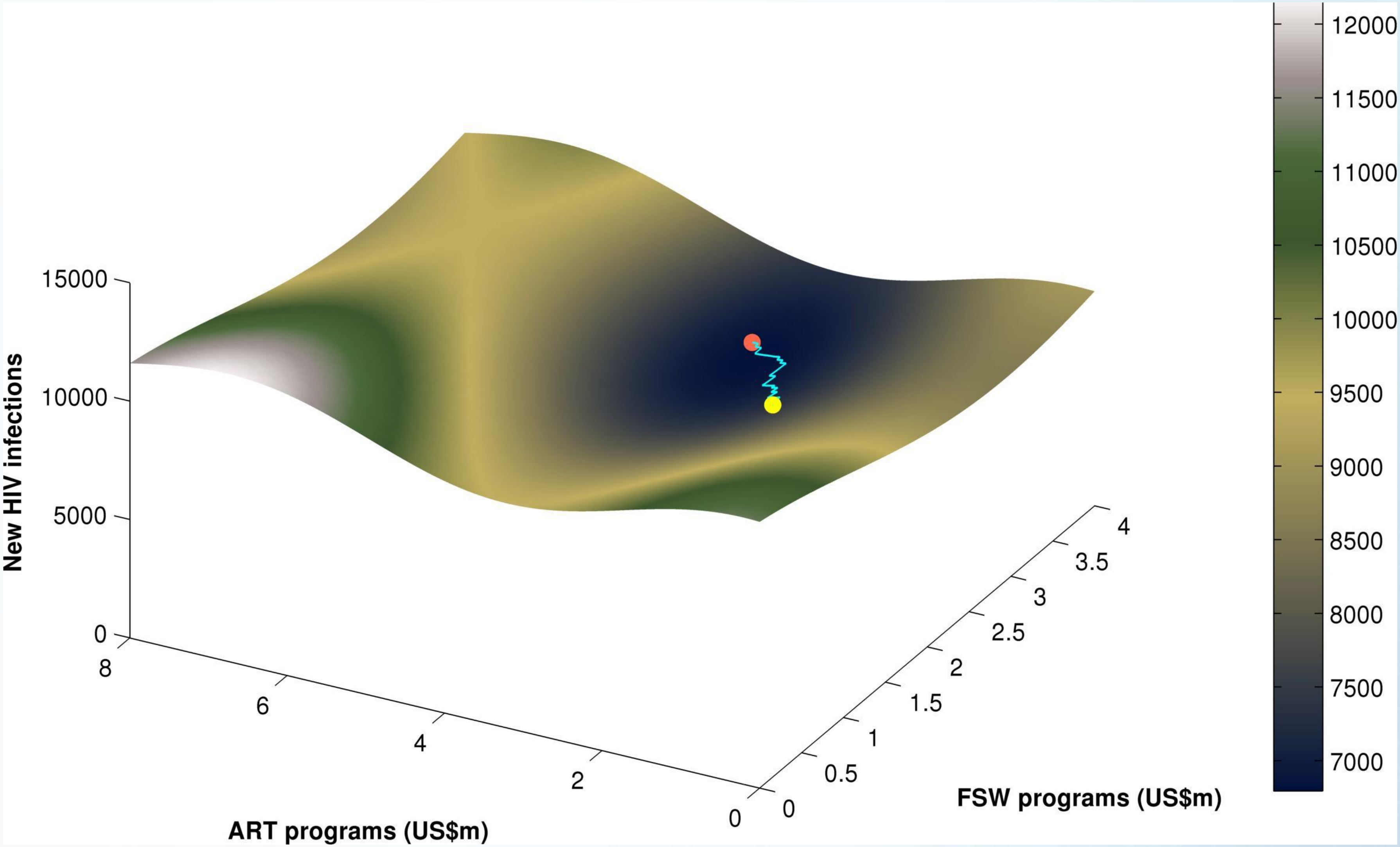


Formally:

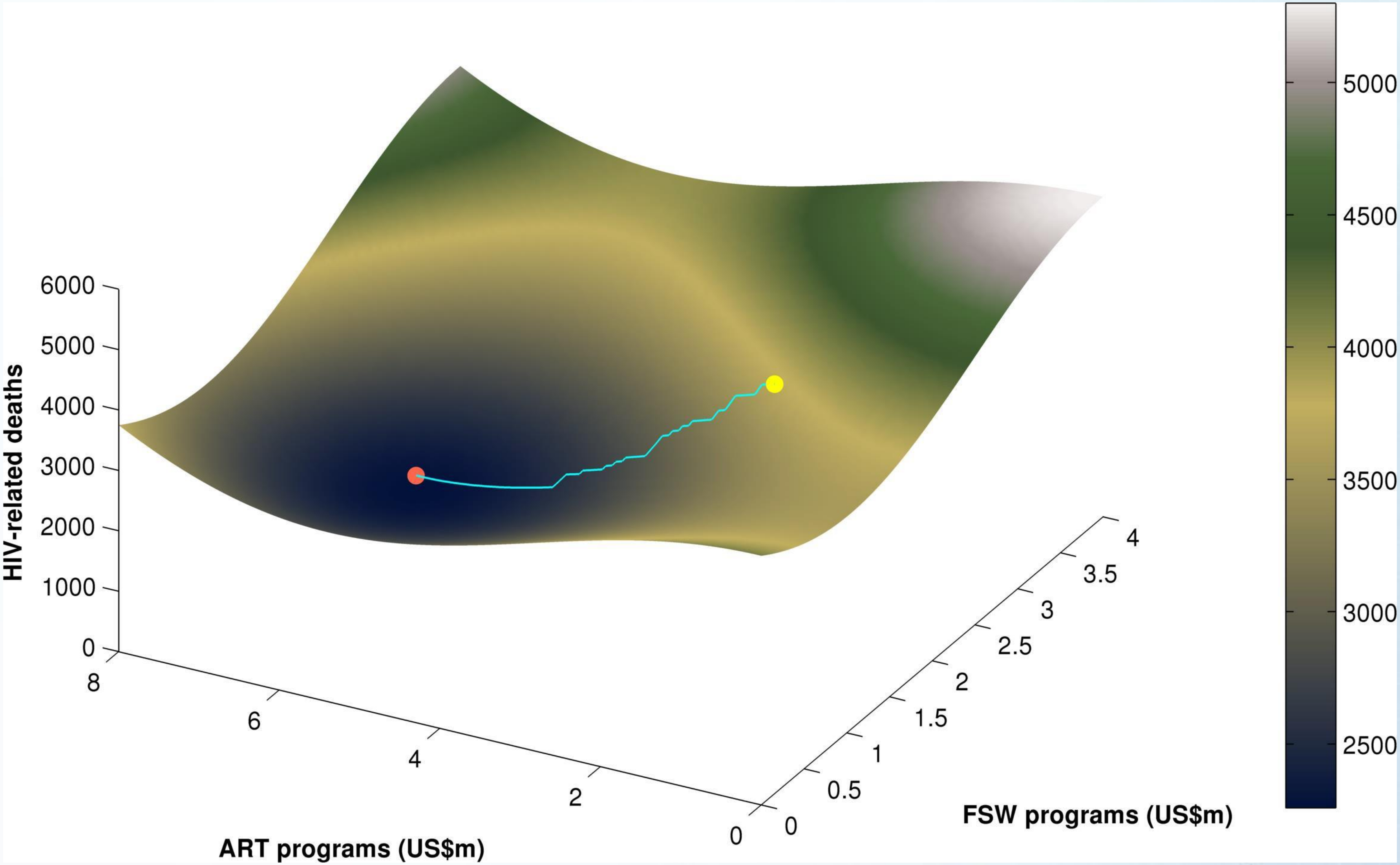
For resource vector $\mathbf{R}$ such that $\sum \mathbf{R} = \text{const.}$ and outcome $O = f(\mathbf{R})$, find $\mathbf{R}$ that minimizes O.

Optima HIV

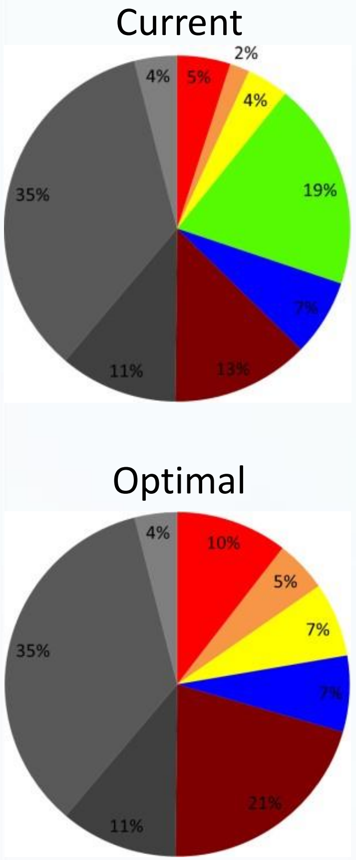
Different outcomes lead to different results

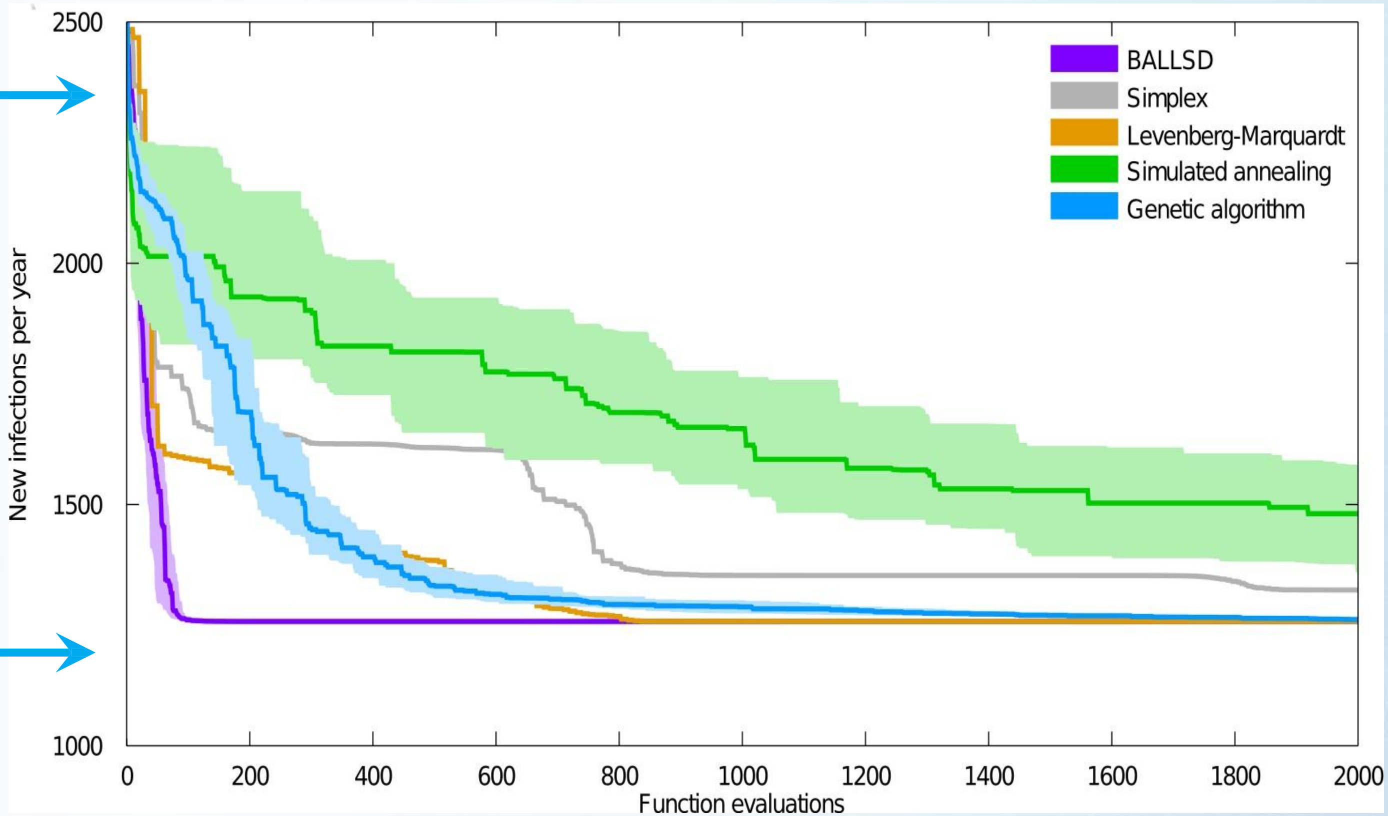


Different outcomes lead to different results

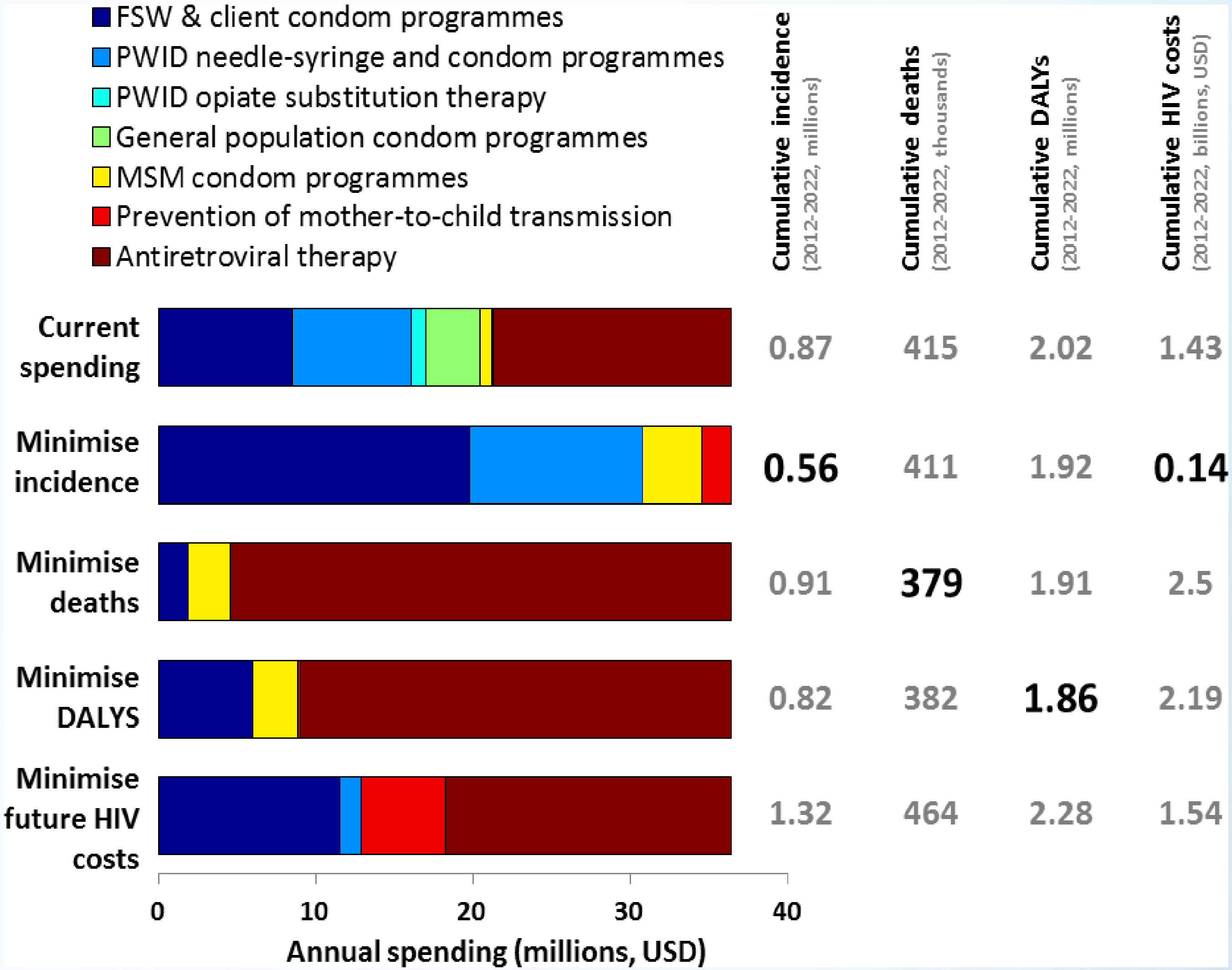


Example: reducing incidence in Sudan



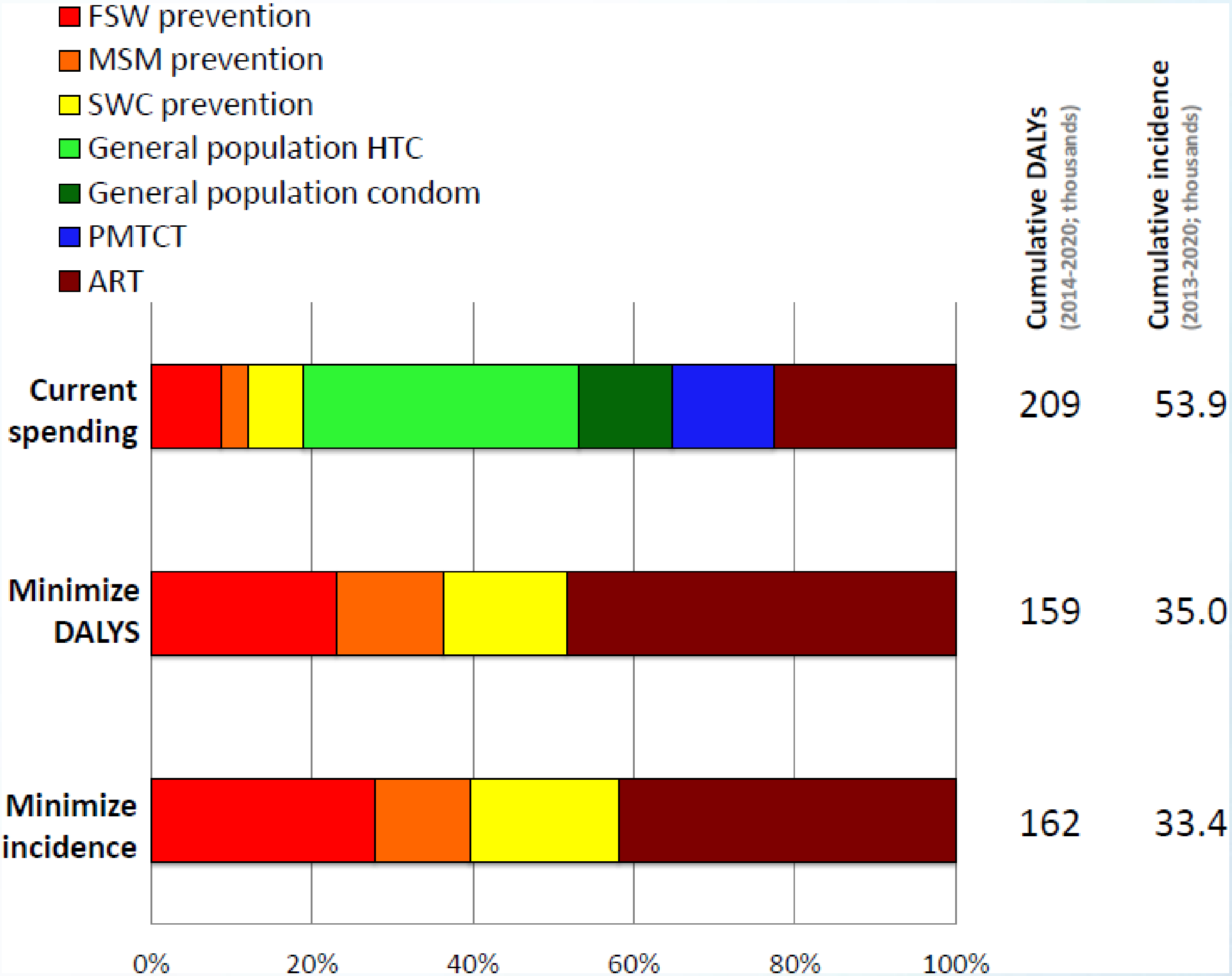


Example: Optima HIV optimization for Indonesia



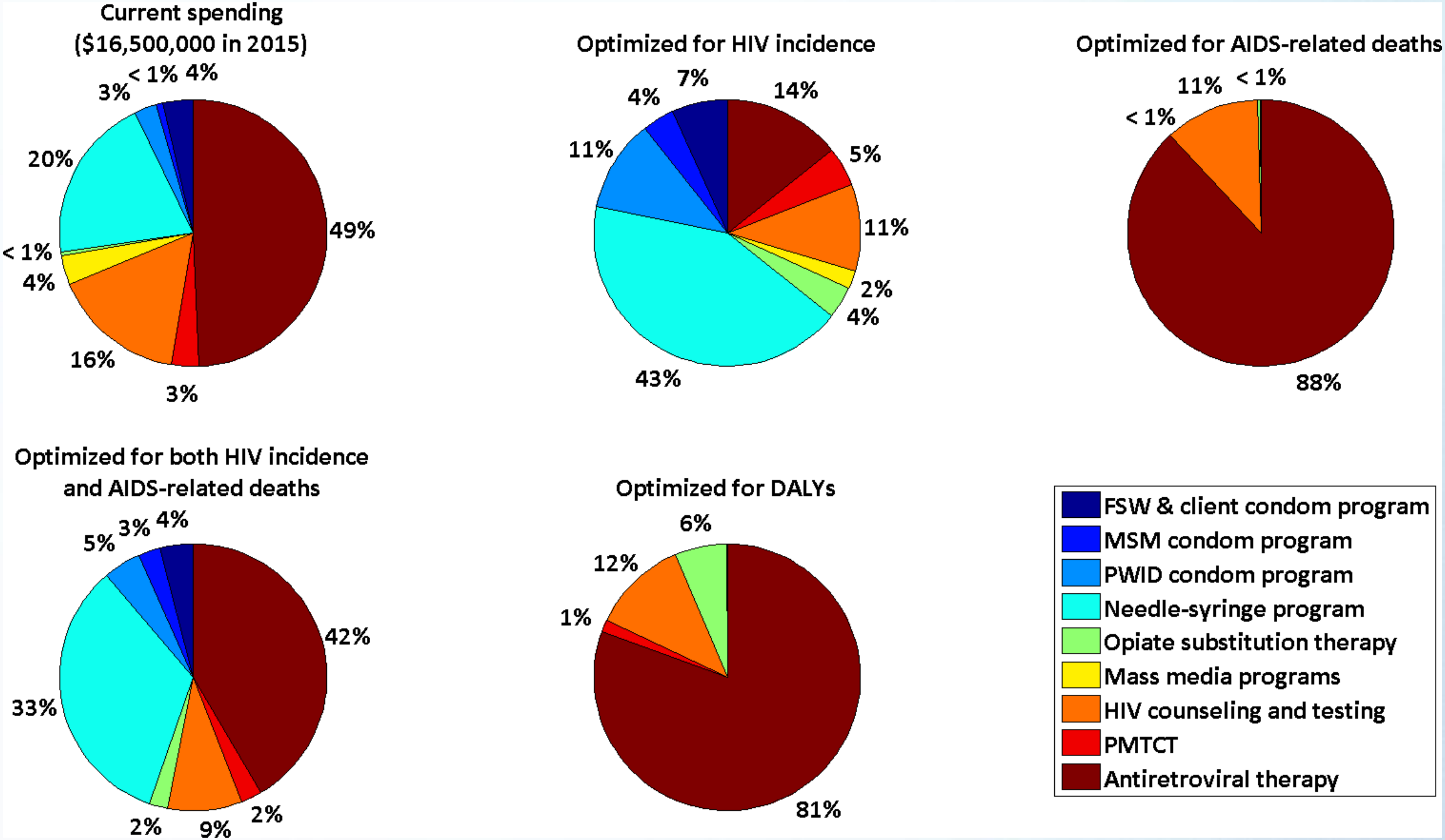
Optima HIV

Example: Optima HIV optimization for Sudan



Optima HIV

Example: Optima HIV optimization Kazakhstan



Optima HIV

Recommendation: single objective to ease interpretation

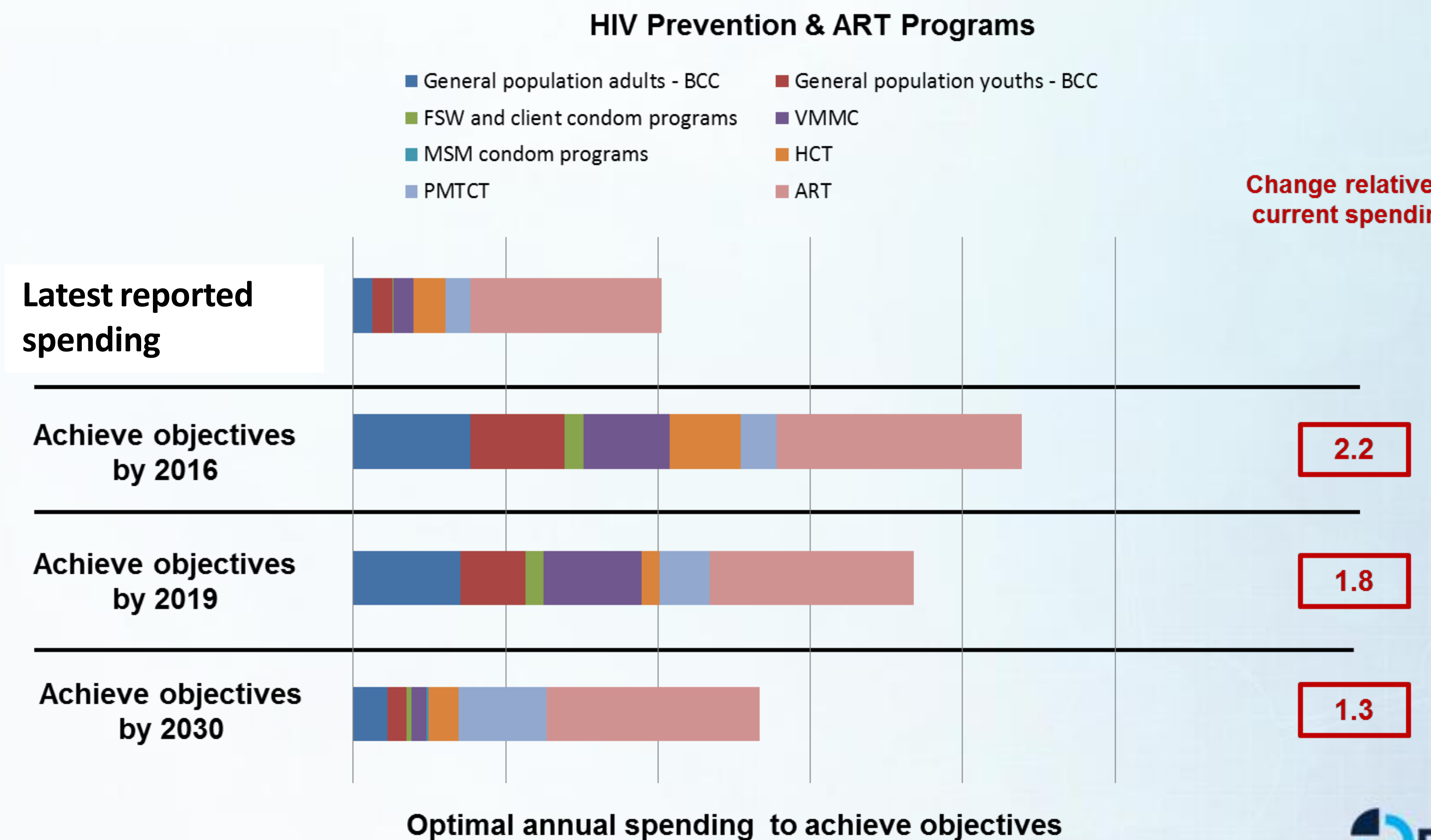
- Recommend selecting a single objective with multiple outcomes
  - Identify allocation to minimize **incidence**
  - Identify allocation to minimize **deaths**
  - Identify allocation to minimize **DALYs**

- Highlight or present the optimal allocation for a single objective for a single outcome, e.g. by 2030 reduce HIV incidence by 90% compared with 2010 (End AIDS target)

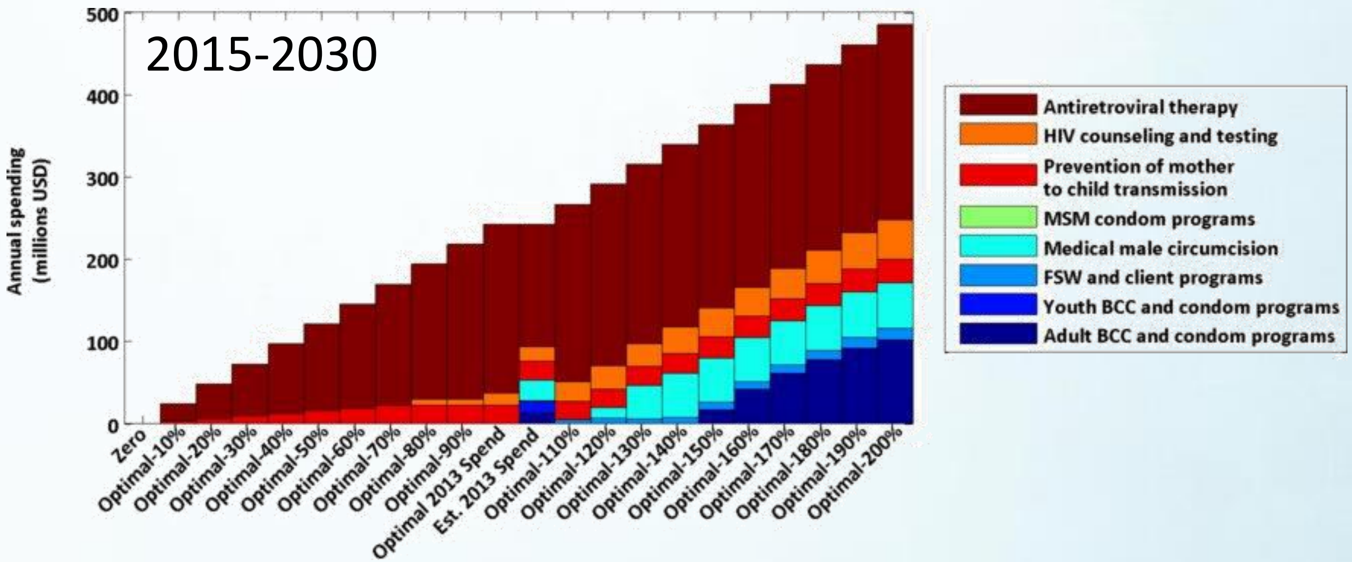
Optima HIV

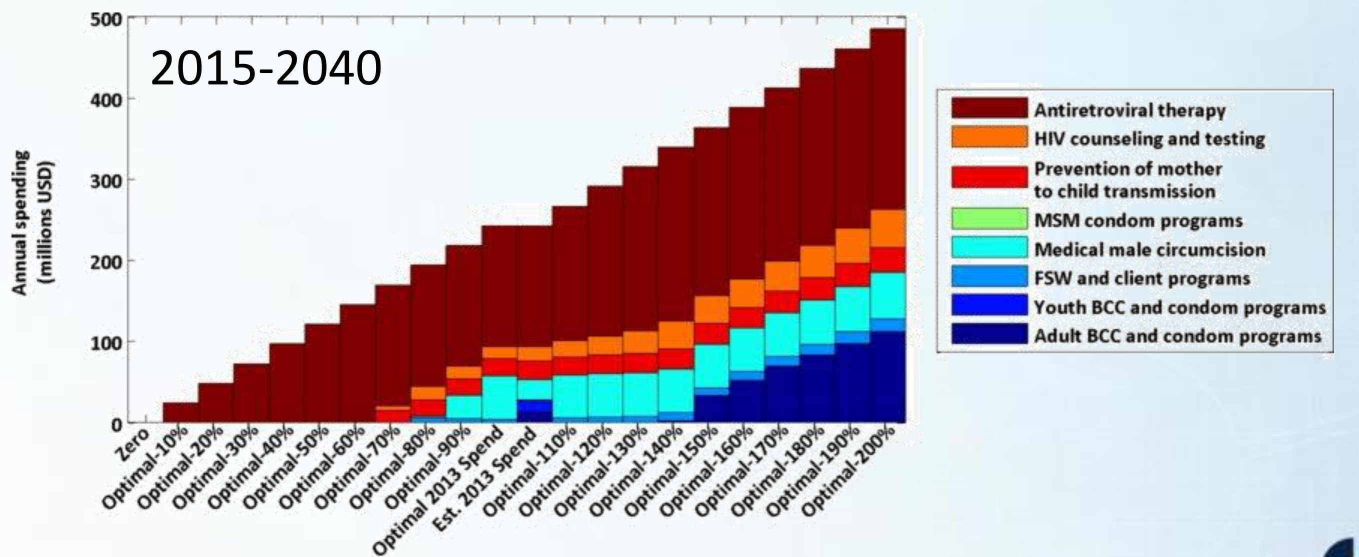
Time horizons matter

The greatest long-term impacts are affected by different short-term allocations



Time horizons matter





QUESTIONS?

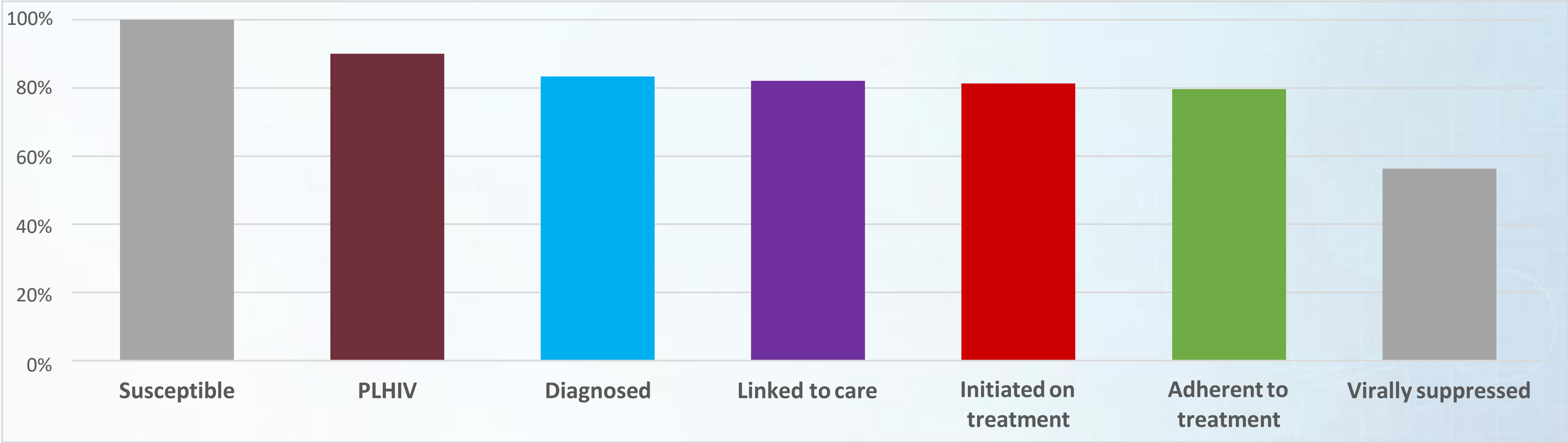
Introduction to cascades

Learning objectives

- The HIV care cascade
- Interventions along the care cascade
- Optima modeling the cascade

HIV care cascade

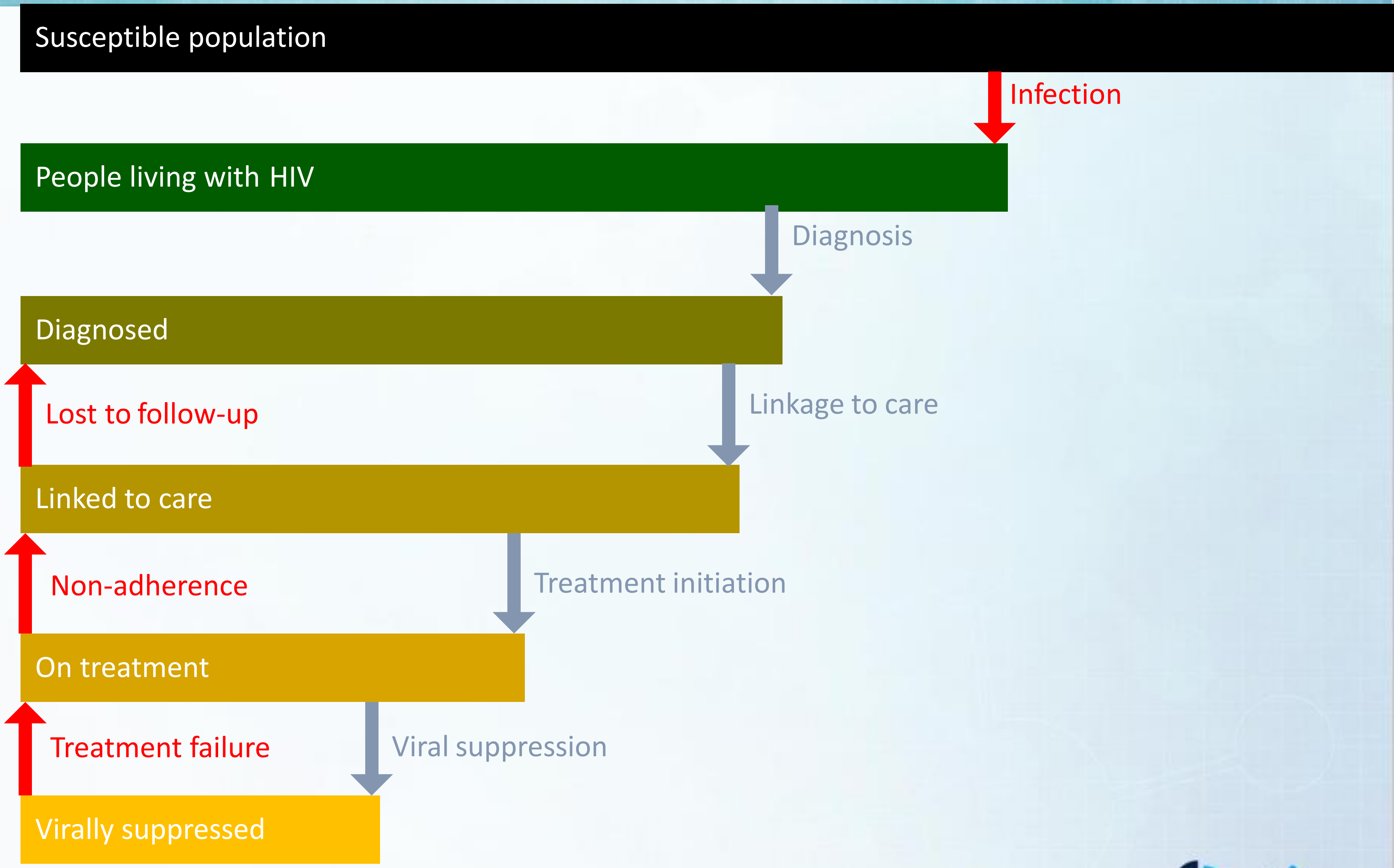
- The HIV care cascade is used to represent the proportion of people at the different stages of HIV: diagnosis, care, treatment, adherence, and treatment success.
- Various interventions exist to move people across the care cascade to:
  - increase the proportion of PLHIV aware of their status, initiated and retained on treatment, and achieving viral suppression



Optimization of **service delivery cascade** in HIV

Optima HIV

Optima HIV care cascade compartments



Optima HIV

Optima cascade modelling

- The model does not track individuals, so the traditional cohort cascade can not be generated.

- Displays the outcomes for people who are at each stage of the cascade over each year

- Optima HIV can be used to determine the optimal resource allocation across these intervention modalities to achieve best results across the HIV care cascade

How can cascade optimization be done?

Main components*

- Dynamic epidemiological model
- Calibration process
- Optimization function
- Characterized services along cascade
- Understanding of their service delivery modalities
- Understanding of their impact on cascade stages
- Annual per patient cost of each service/intervention
- Target populations for each service/intervention
- Understanding of relationship between cost and coverage

* Based on methodology developed by Shattock, Fraser, Shubber, Muzah, Barron, Pillay, Görgens, Gray & Wilson in: Optimising resources across service delivery modalities to improve the HIV continuum of care in South Africa (draft manuscript)

Examples of service modalities and outcomes along cascade

	SERVICE/MODALITY	EXPECTED OUTCOME (MODEL)
Testing/ Diagnosis	▪ Testing (lab vs. point-of-care) ▪ Testing (workplace/home/self)	Receipt of test results
Linkage/ Enrolment	▪ Community support for linkage ▪ Tracing new cases	Increased linkage to care
Linkage to care	▪ Text messaging ▪ Tracing of lost-to-care ▪ Education/counselling (lay vs. professional counsellors)	Increased retention in care
Treatment	▪ Treatment initiation counselling (conventional vs. fast-track vs same-day)	Timely treatment initiated
Disease control	▪ Treatment initiation counselling ▪ Adherence community support ▪ Text messaging ▪ Enhanced adherence counselling (lay vs. professional) ▪ Drug refill (clinic vs. community)	Treatment adherence (consolidation/maintenance phase)

Methodology: Optimization across a cascade

INTERVENTIONS CAN IMPACT MORE THAN ONE CASCADE STAGE

- **Example: Testing modalities**
  Can have additional effects at latter stages of cascade beyond diagnosis itself
  - On laboratory monitoring compliance (such as post-diagnosis CD4 testing, viral load testing
  - On treatment adherence
- **Example: Counselling/education intervention**
  Can influence behaviours across cascade stages

*The thing that works, that helps people **progress through the cascade** is proper counselling, on everything, from HIV to their treatment to the side effects…"*

Key informant, Limpopo Province, South Africa

CASE STUDY
South Africa

Collaborative work with:

UNSW AUSTRALIA

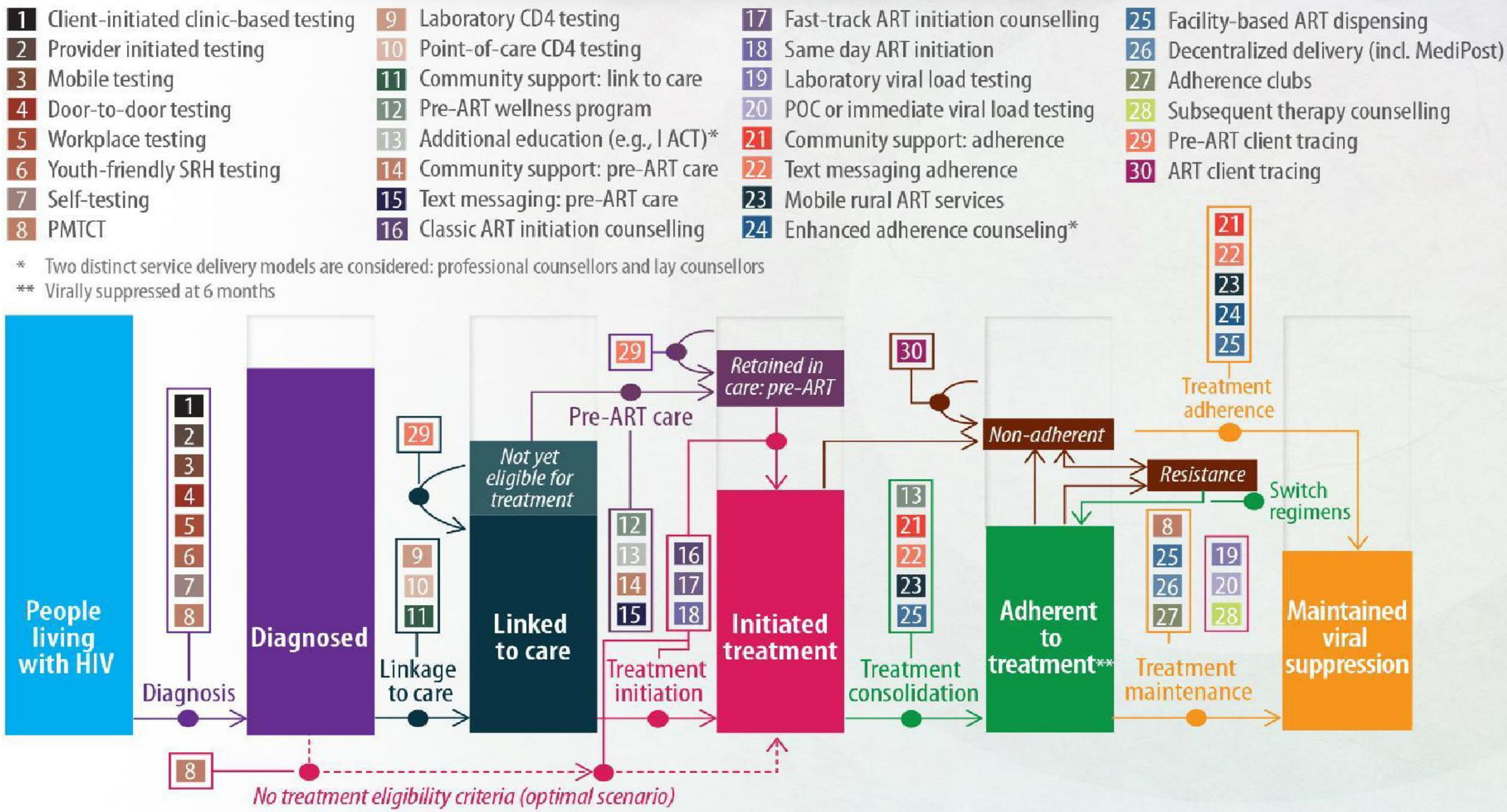
Burnet Institute
Medical Research. Practical Action.

health
Department:
Health
REPUBLIC OF SOUTH AFRICA

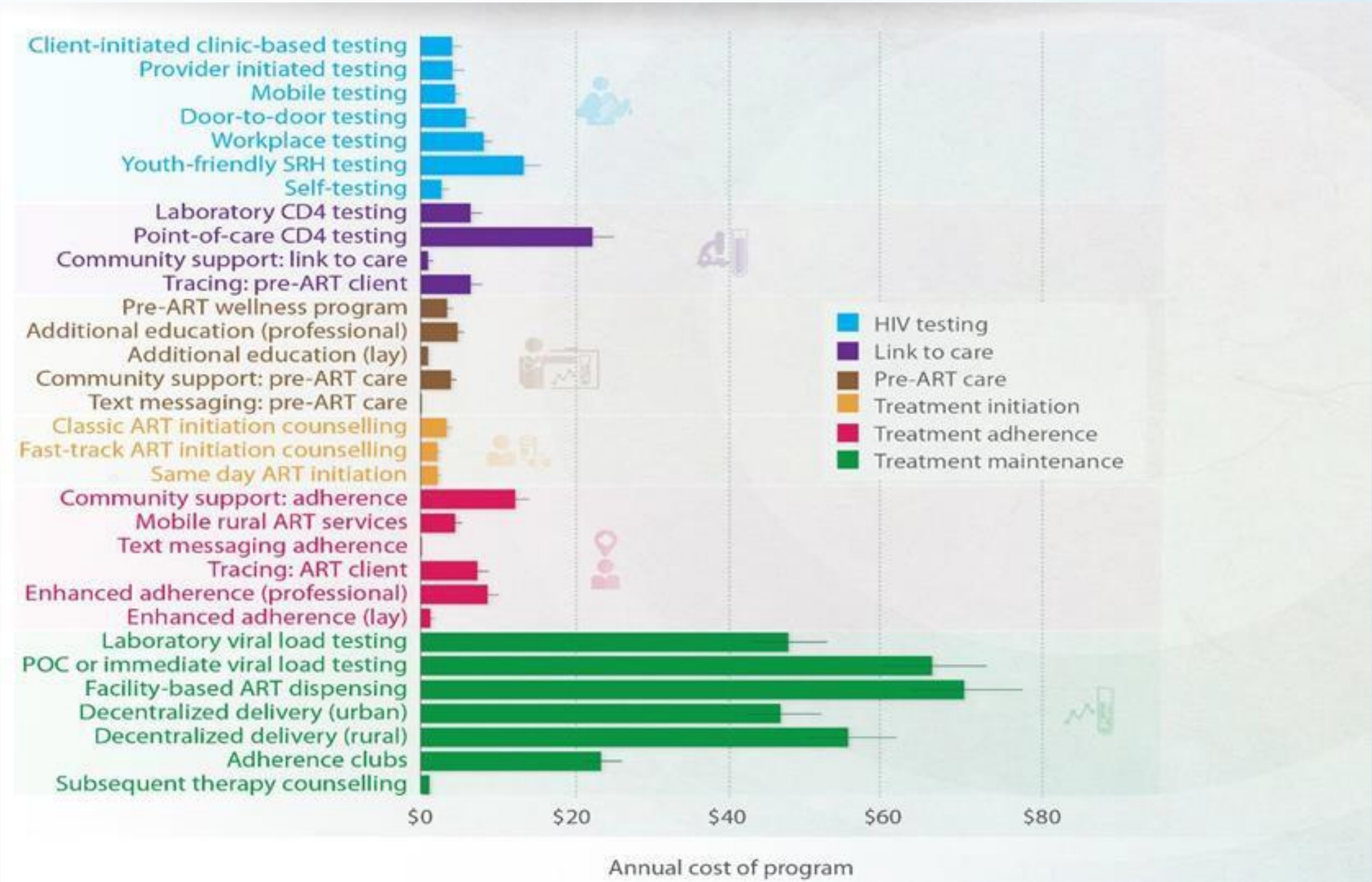
WORLD BANK GROUP
Health, Nutrition & Population

Optima HIV

Treatment implementation efficiency in South Africa



Estimated annual cost of each intervention



Linked unit cost with data

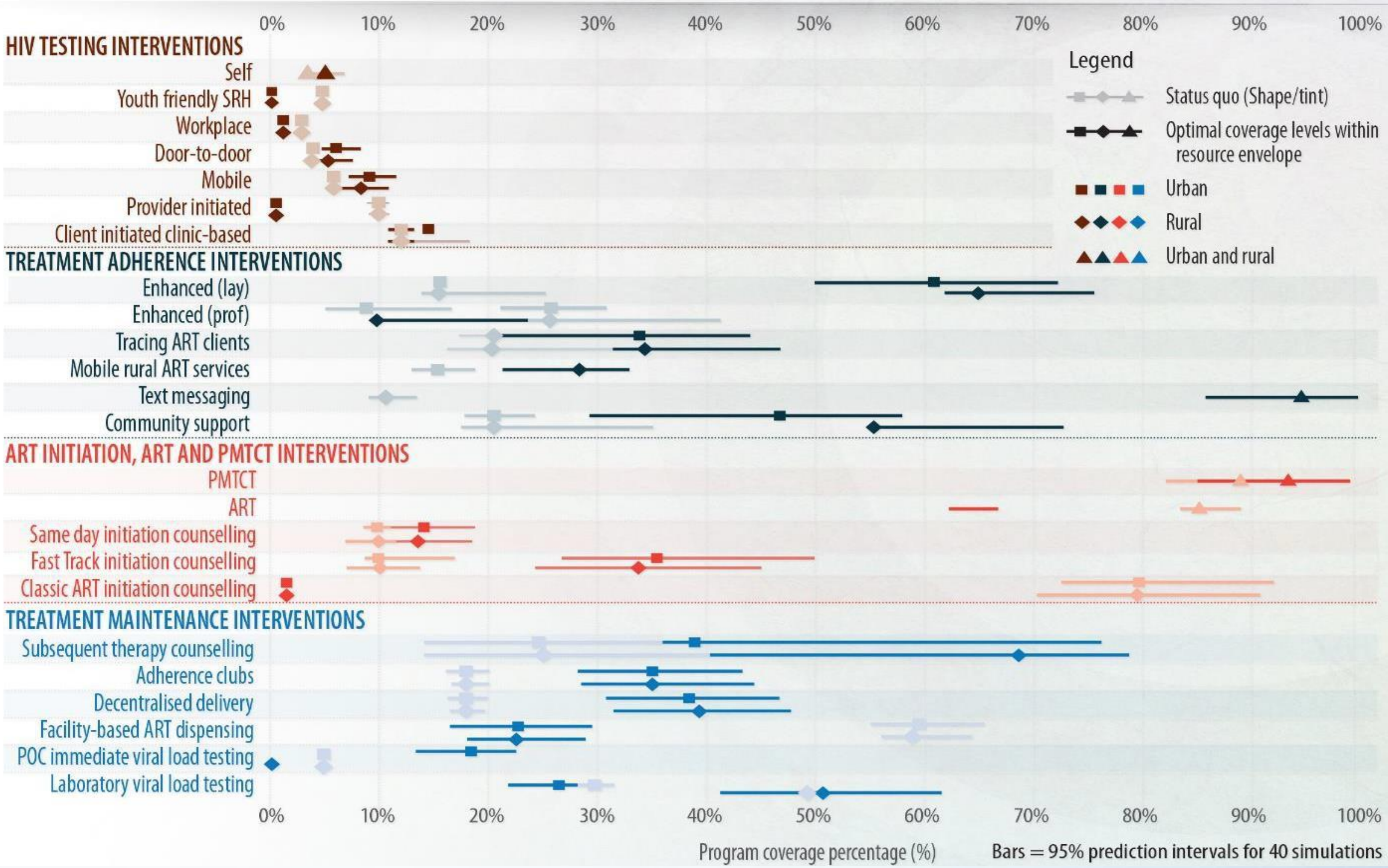
- Linked unit cost with data on program capacity, geographical setting(s) and cascade stages that the services directly impact*

* Excerpt from a longer table

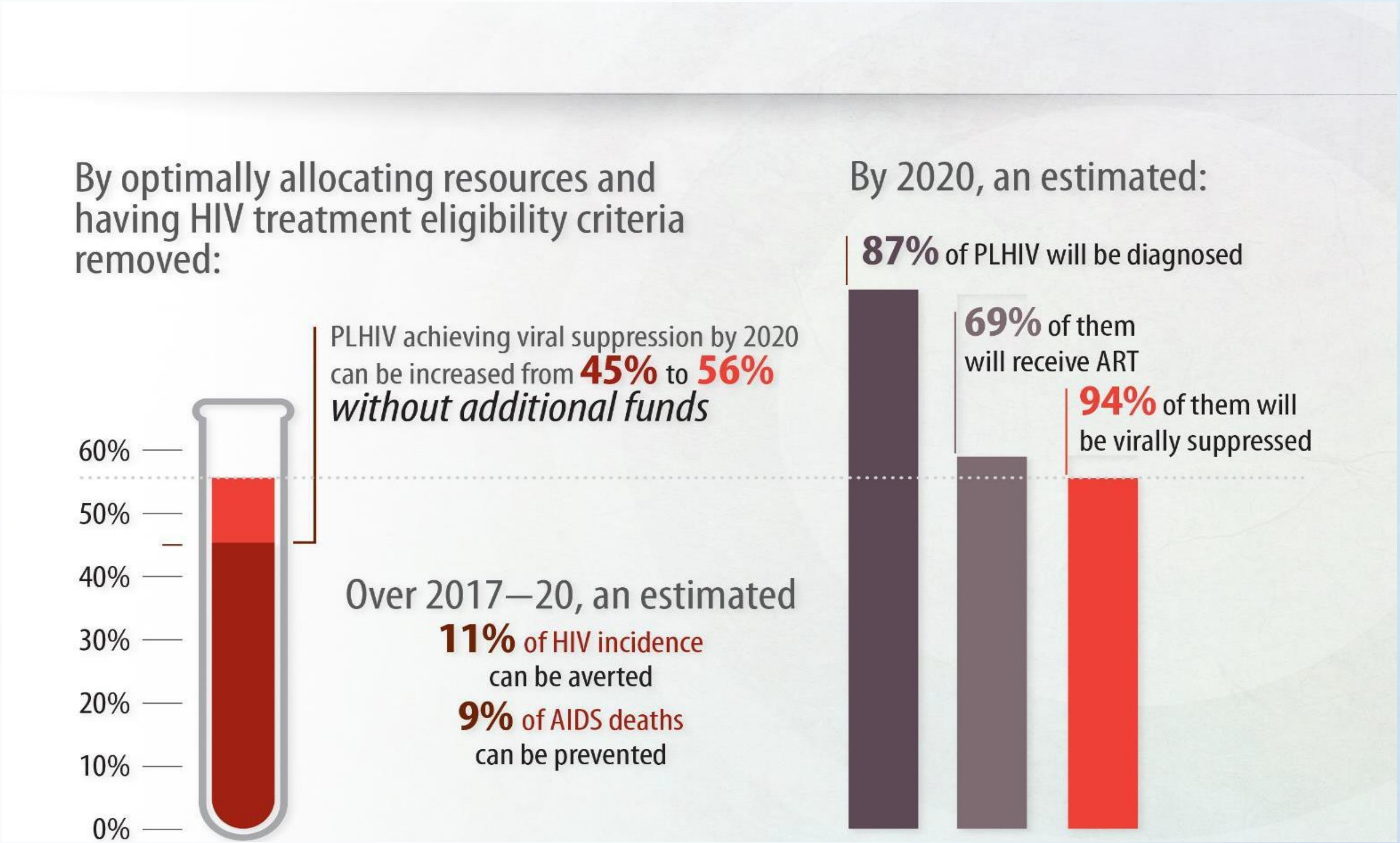
Program (urban and rural setting)	Unit cost (USD, 1 ZAR = 0.0630 USD)	Program Capacity (%)	Cascade flows affected
Client-initiated clinic-based testing	$5.20	88	Diagnosis, linkage to care
Provider initiated testing	$5.73	88	Diagnosis, linkage to care
Mobile testing	$6.05	87	Diagnosis, linkage to care
Door-to-door testing	$7.44	80	Diagnosis, linkage to care
Workplace testing	$9.68	67	Diagnosis, linkage to care
Youth-friendly SRH testing	$14.74	62	Diagnosis, linkage to care
Self-testing	$4.41	87	Diagnosis, linkage to care
Laboratory CD4 testing	$8.28	80	Linkage to care
Point-of-care CD4 testing	$23.76	80	Linkage to care
Community support: link to care	$2.66	80	Linkage to care
Tracing: pre-ART client	$8.18	60	Linkage to care, pre-ART care
Pre-ART wellness program	$5.00	80	Pre-ART care
Additional education (prof)	$6.30	80	Pre-ART care, treatment consolidation
Additional education (lay)	$1.26	80	Pre-ART care, treatment consolidation
Community support: pre-ART care	$5.32	80	Pre-ART care

Service coverage over 2017–20

* Excerpt from a longer table



Findings



By optimally allocating resources and having HIV treatment eligibility criteria removed:
PLHIV achieving viral suppression by 2020 can be increased from 45% to 56% *without additional funds*
60%
50%
40%
30%
20%
10%
0%
Over 2017—20, an estimated
11% of HIV incidence
can be averted
9% of AIDS deaths
can be prevented
By 2020, an estimated:
87% of PLHIV will be diagnosed
69% of them will receive ART
94% of them will be virally suppressed

QUESTIONS?

Defining objectives and constraints in Optima HIV

Learning objectives

- How objectives, constraints, and time horizons are incorporated in Optima
- Specifying settings in Optima to meet objectives and set constraints
- Understanding and interpreting results with respect to objectives, time horizons, constraints, and cost functions

Objectives: achieving maximum impact

What objective is desired?

- *Minimizing new infections*
  - Funding allocated to most effective HIV prevention interventions
- Minimizing HIV-related deaths
  - All funding would go to saving lives (treatment/care) for a short time horizon
- Minimizing longer-term financial commitments
- Obtain equality in access or impact across groups

Optima HIV

Multiple objectives

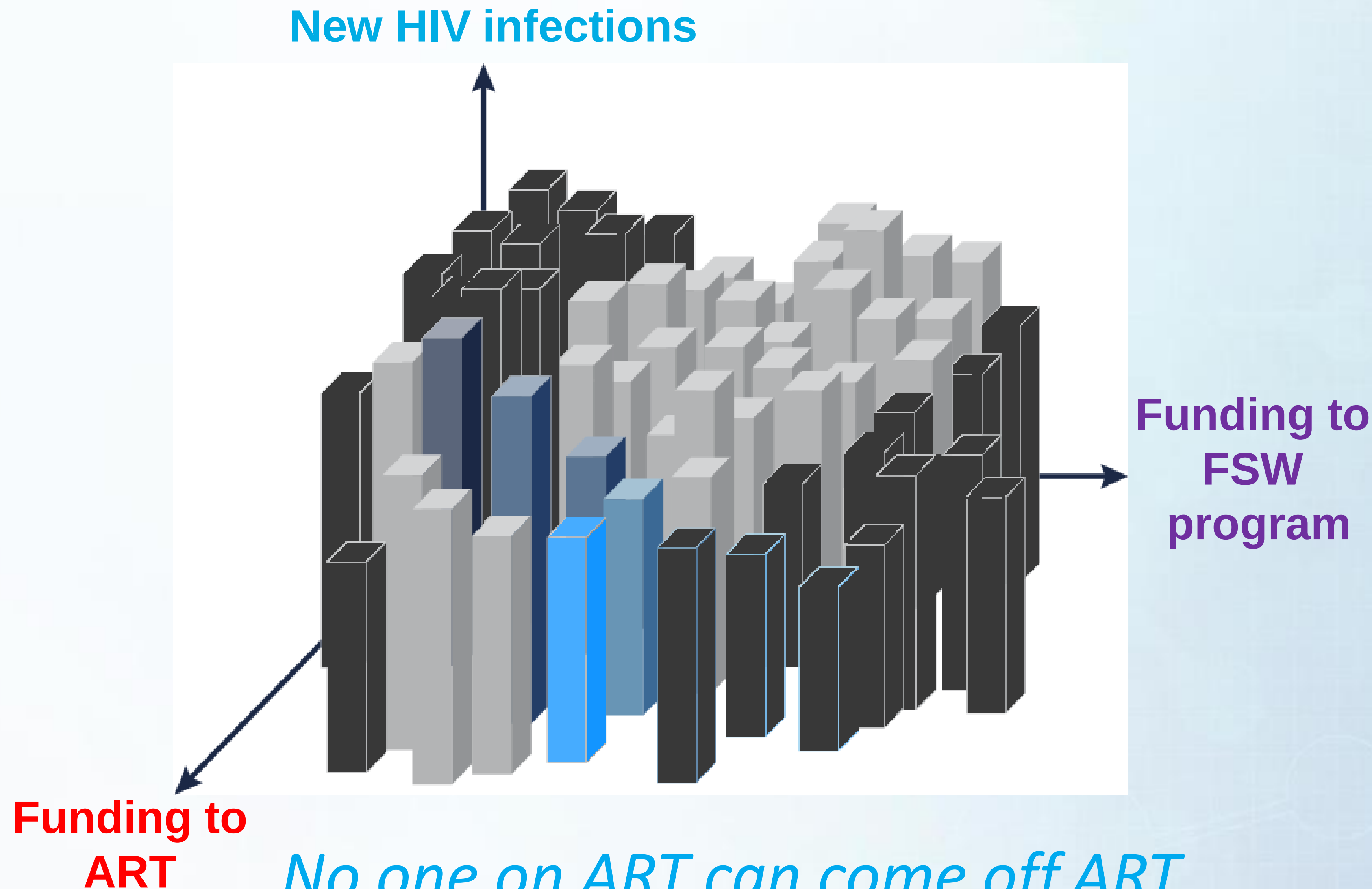
- National strategic plans can have multiple objectives by end of the strategy timeframe

  - For example:
    - 60% reduction in HIV incidence
    - 50% reduction in HIV-related deaths
    - Virtual elimination of mother-to-child transmission
    - Attain universal treatment coverage

- Simultaneously get as close as possible to all NSP targets with the funding available

Optima HIV

Constraints: ethical, economic, logistic, political

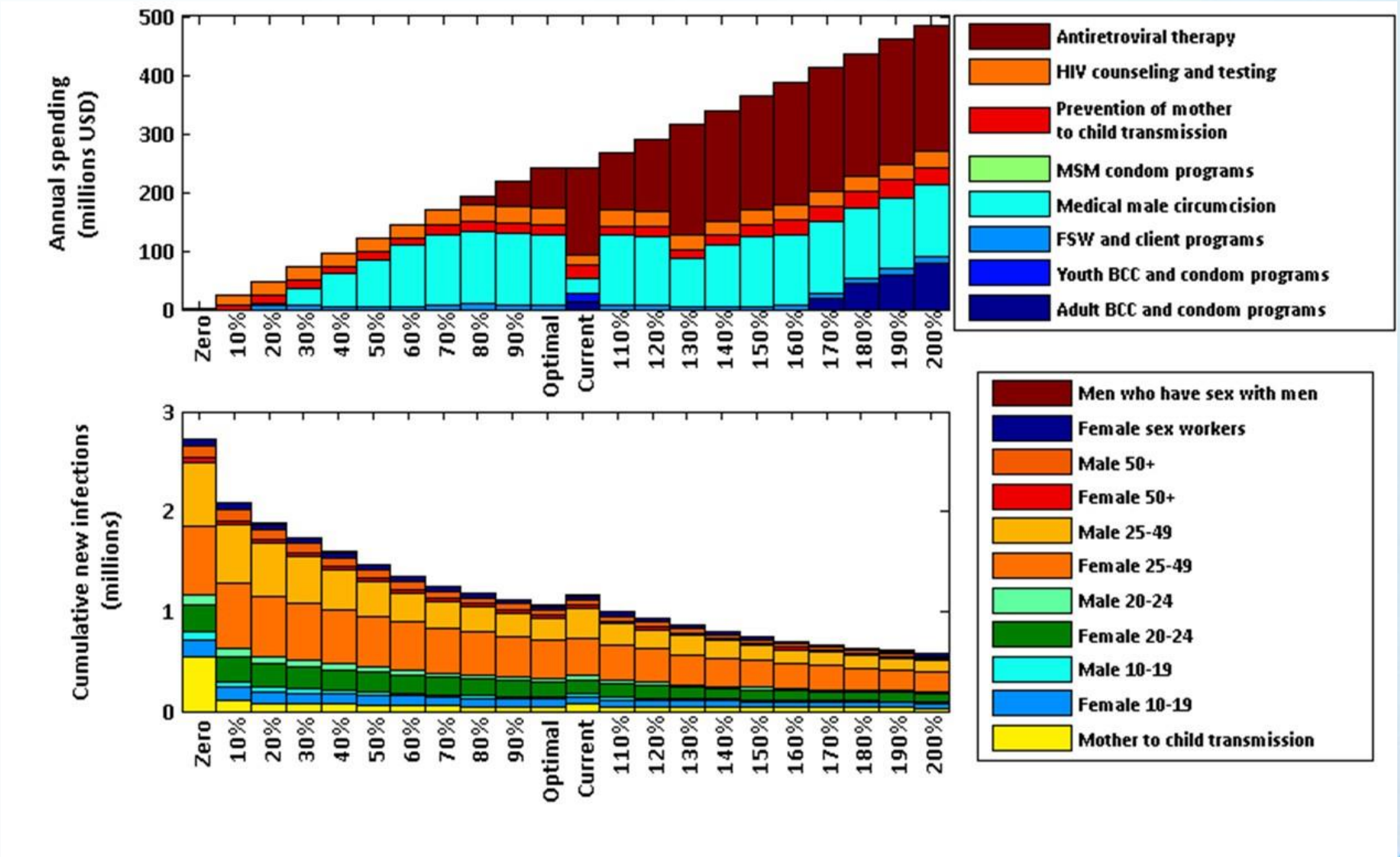


No one on ART can come off ART

Constraints are important, but should be limited

No constraints

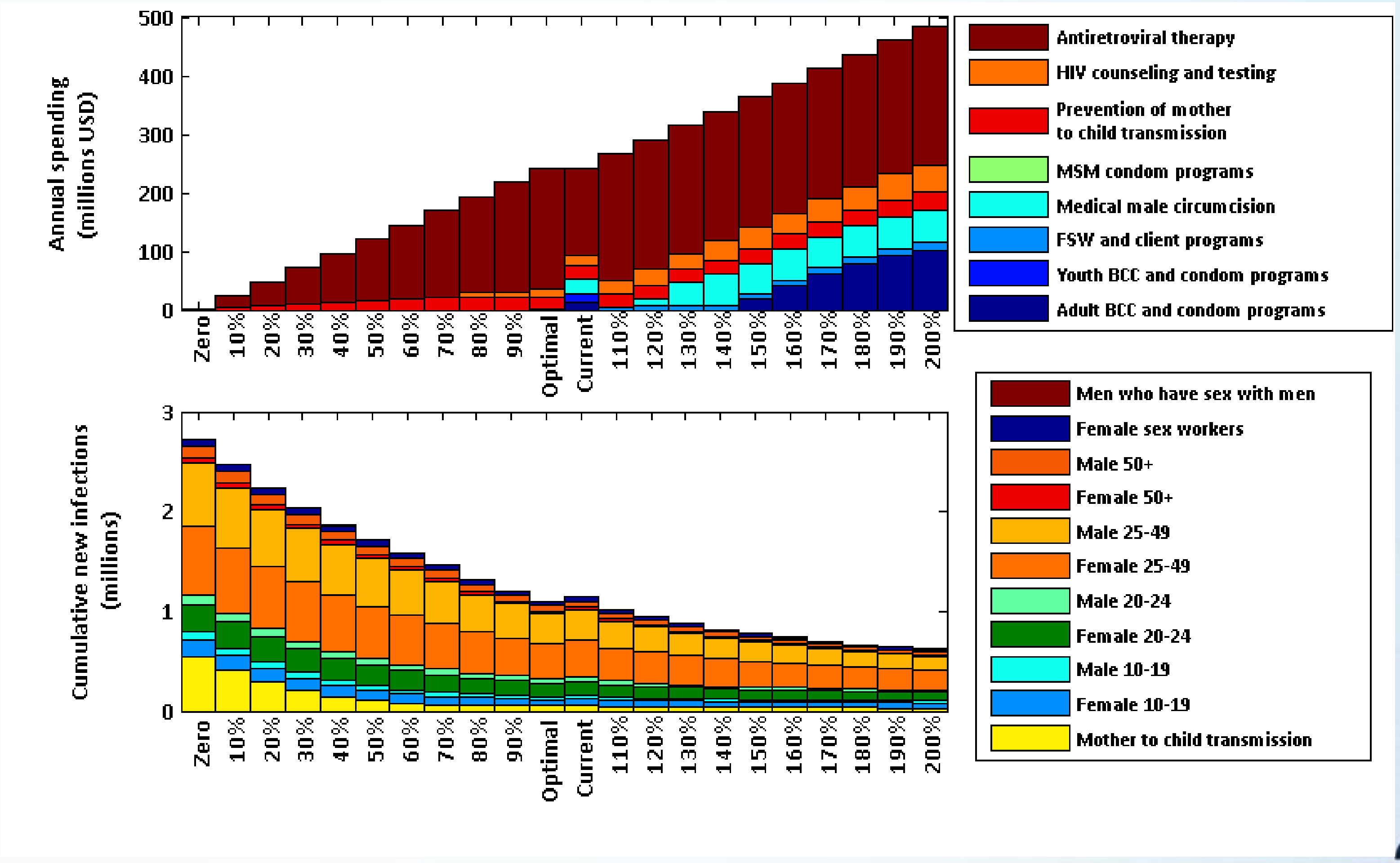
Objective: to minimize new HIV infections



Constraints are important, but should be limited

With constraint

No one who commences ART should be removed from ART



Optima HIV

Constraints are important, but should be limited

Most commonly requested constraints:

- No one who commences ART should be removed from ART
- PMTCT is important to retain
- OST has many important multi-sectoral benefits and funding must not be decreased
- Programs cannot be scaled up faster than 20% per year
- Programs should not lose more than 30% funding per year in a scale-down period
- Important to maintain some prevention for all populations
- Non-targeted program costs cannot be touched and are not included in the optimization
  - no evidence to affect outcomes
- Keep some programs which are mandatory for the key populations

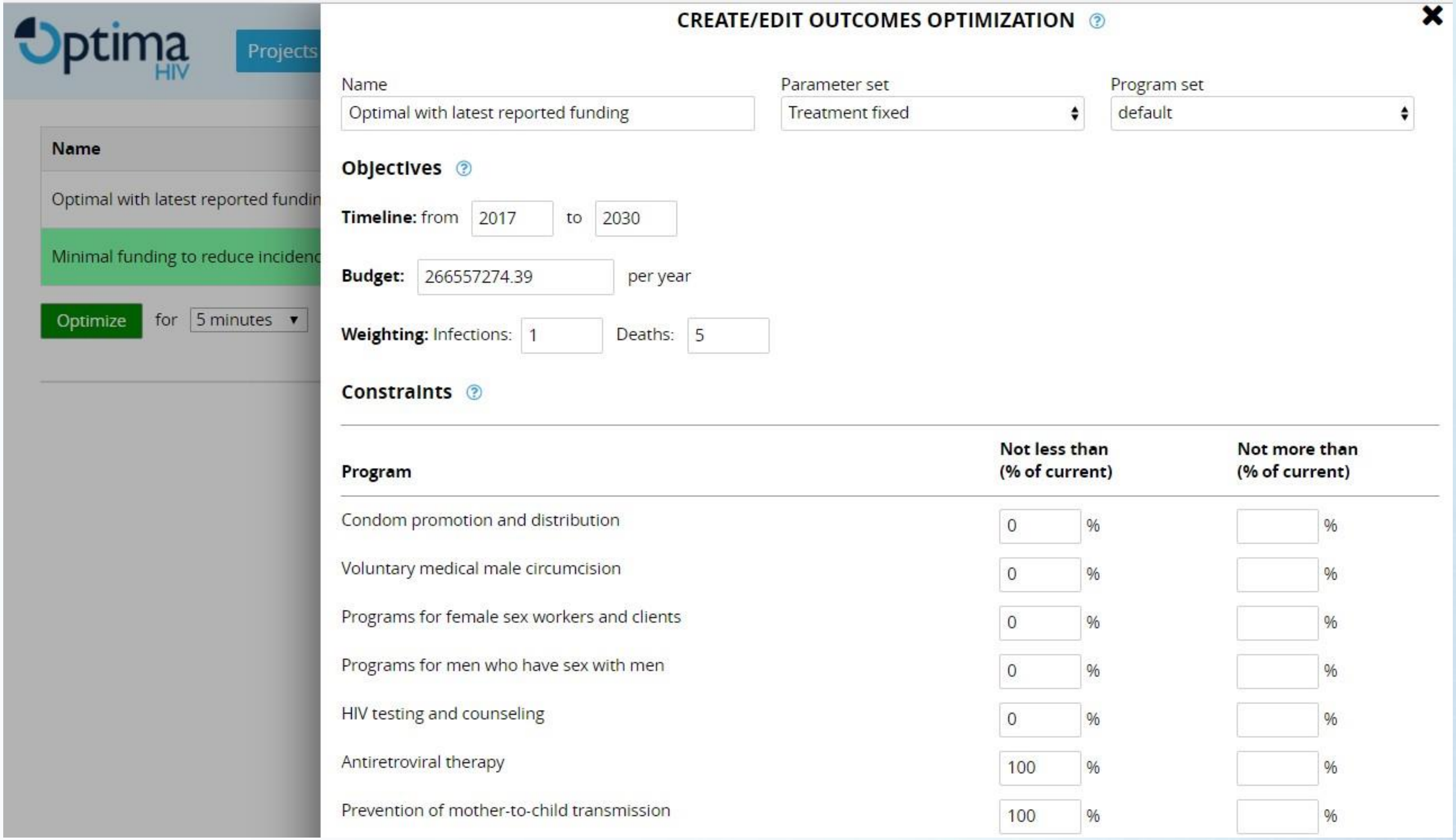
Optima HIV

Constraints are important, but should be limited

- If all commonly requested constraints were incorporated, there would be limited or no change in funding allocation
  - Little to no change towards achieving the objective

- **Recommendations**
  - Analyses be as unconstrained as possible
  - No one on treatment be removed from treatment (ART, PMTCT, OST)
  - Add constraints around funding mechanisms
    - Donor-based program targeting policies
  - Reasonable scale-up/down periods (with allowance for as large changes as possible)

Setting up optimization in Optima HIV including constraints



Practice

Defining objectives and constraints in Optima and performing an optimization analysis, including cascades

QUESTIONS?

Integrating implementation efficiency within allocative efficiency

Learning objectives

- Different service delivery modalities
- Cost-coverage outcome relationships
  - Per modality
- Modeling optimized results with reduced non-targeted costs

Modeling implementation efficiency (IE)

- How can services be delivered differently?
  - Define mechanisms
  - Define intervention modalities as new ‘programs’ for allocative efficiency analyses
- How to represent IE in the cost functions?
  - Change marginal costs to reflect different scales
  - Change in coverage by service modality
  - For testing modalities, consider yield
- Does it influence the quality of the covered service?
  - Change in outcome per person reached

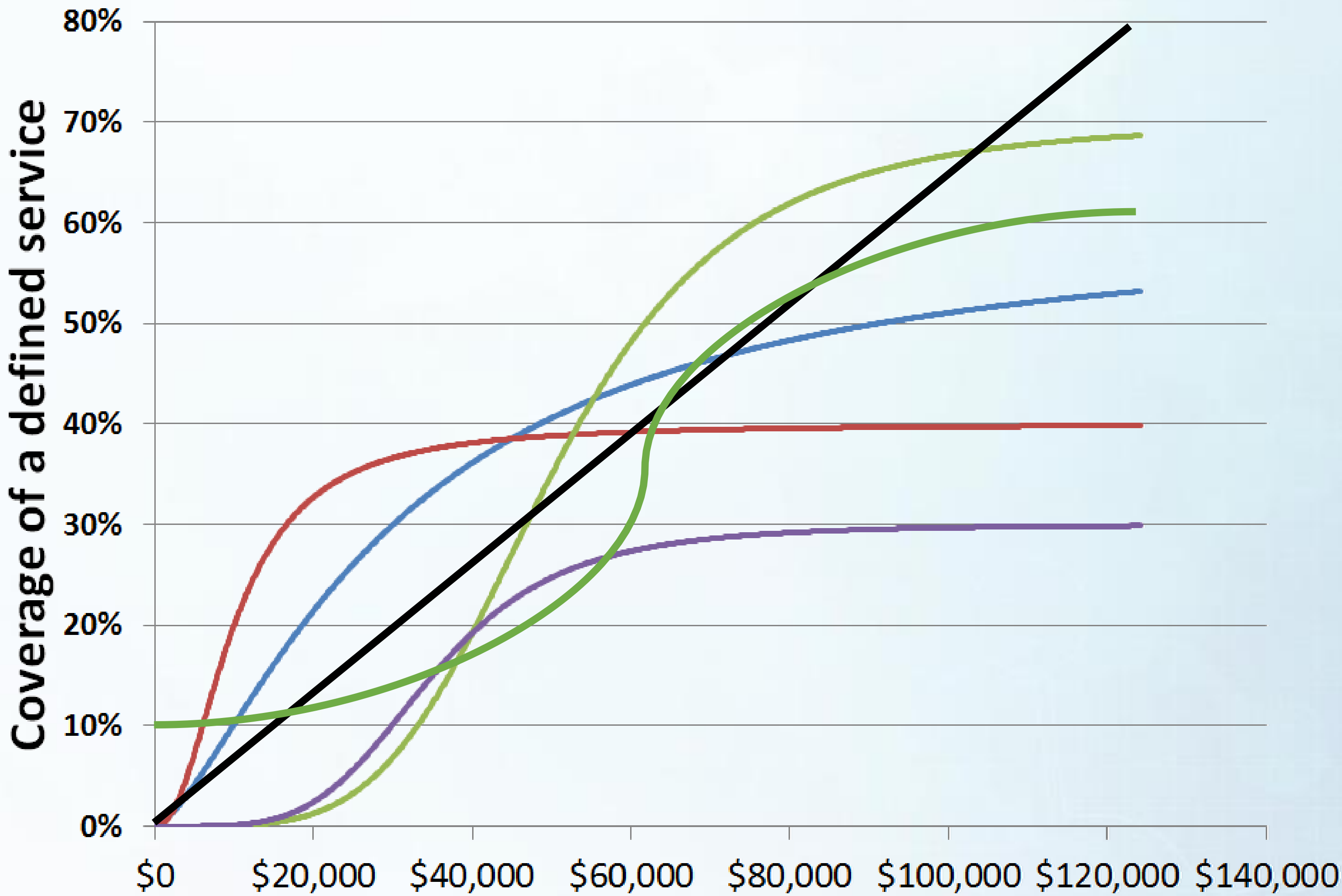
Optima HIV

Cost-coverage-outcome relationships

- For each program (representing an intervention modality):
  - Define **cost-coverage** and **coverage-outcome** relationships
    - **Coverage** is % of population reached (or number of people)
    - **Outcome** described as relationship mapping
    - “Change in outcome per person” for
    - “Change in coverage per person”
      - e.g., for every person reached by a testing program, their chance of being tested is x%
- Map vector of anticipated spending to outcomes
  - $[\$_0, \$_1, \ldots, \$_N] \rightarrow [Out_0, Out_1, \ldots, Out_N]$
- For allocative efficiency assessment, ideally want to map to single outcome: $[\$_0, \$_1, \ldots, \$_N] \rightarrow Out_X$

Optima HIV

Cost functions for each program or modality

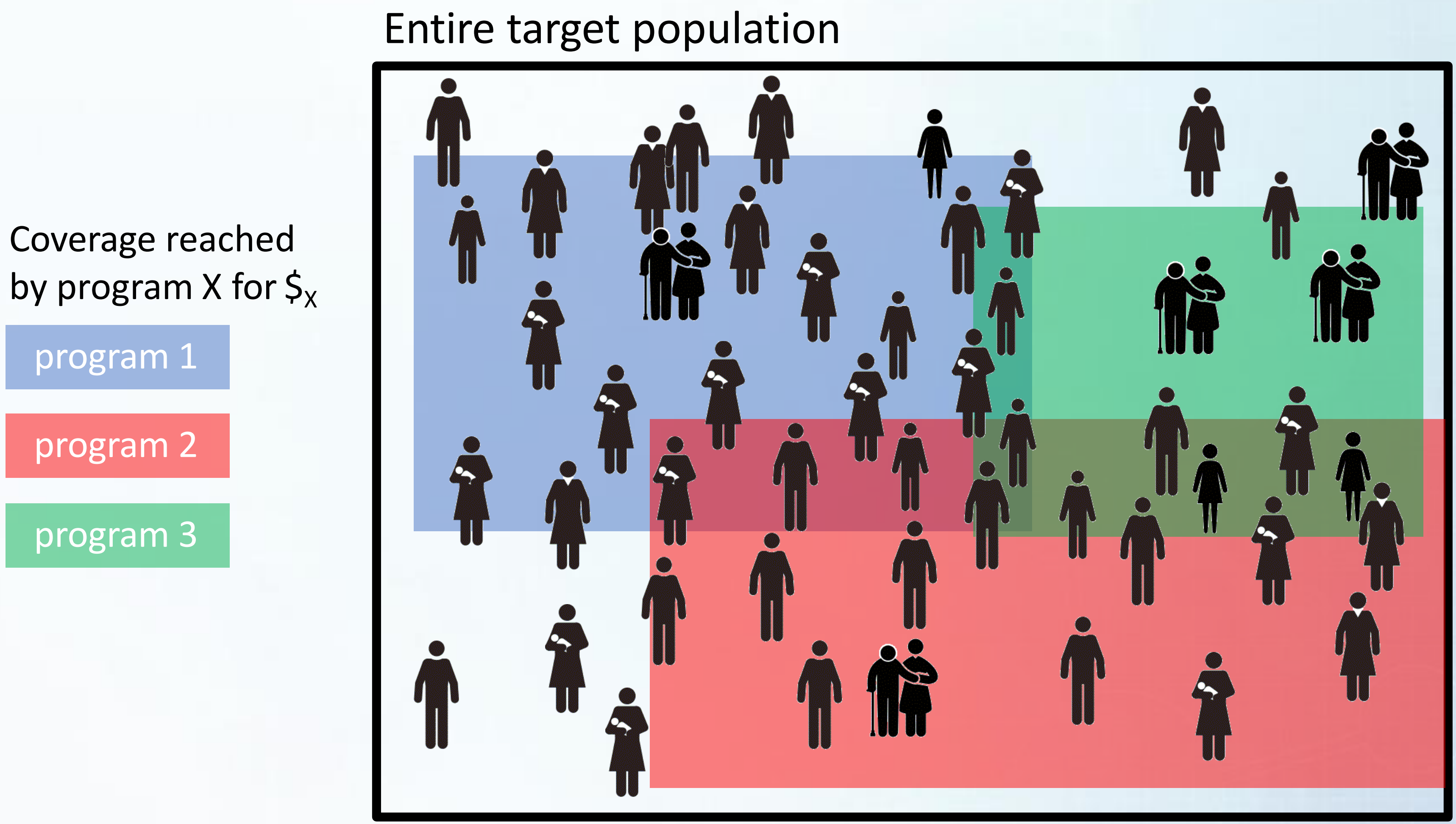


Each program/service modality has it's own **cost-outcome** curve

Optima HIV

Spending on different programs/modalities mapped to coverage

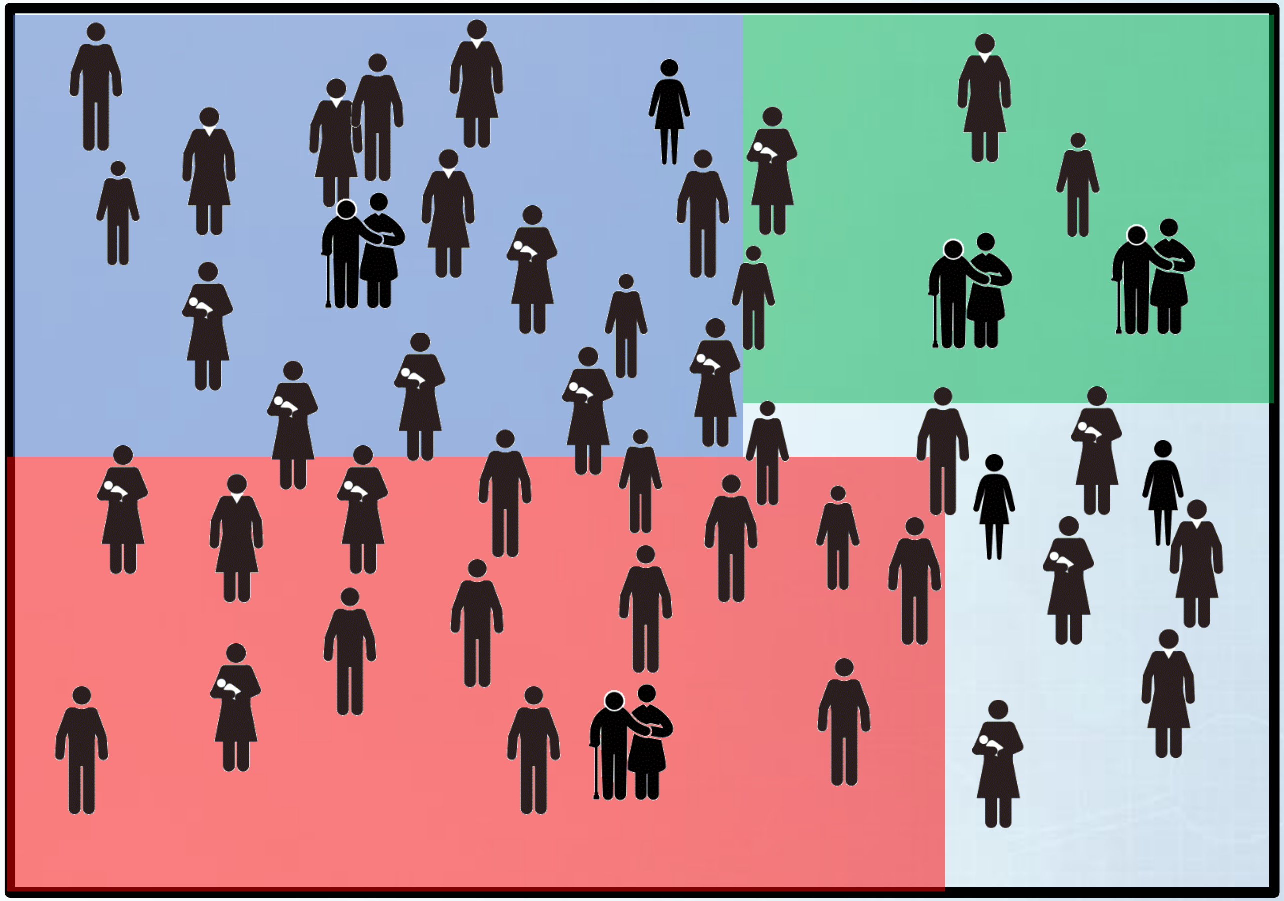
$[\$_0, \$_1, \ldots, \$_N] \text{ -> } [C_0, C_1, \ldots, C_N]$ ($ maps to coverage)



For every parameter, the type of program interaction is set

Option 1: **additive** (optional)

Entire target population



Coverage reached by program X for $\$_X$

program 1

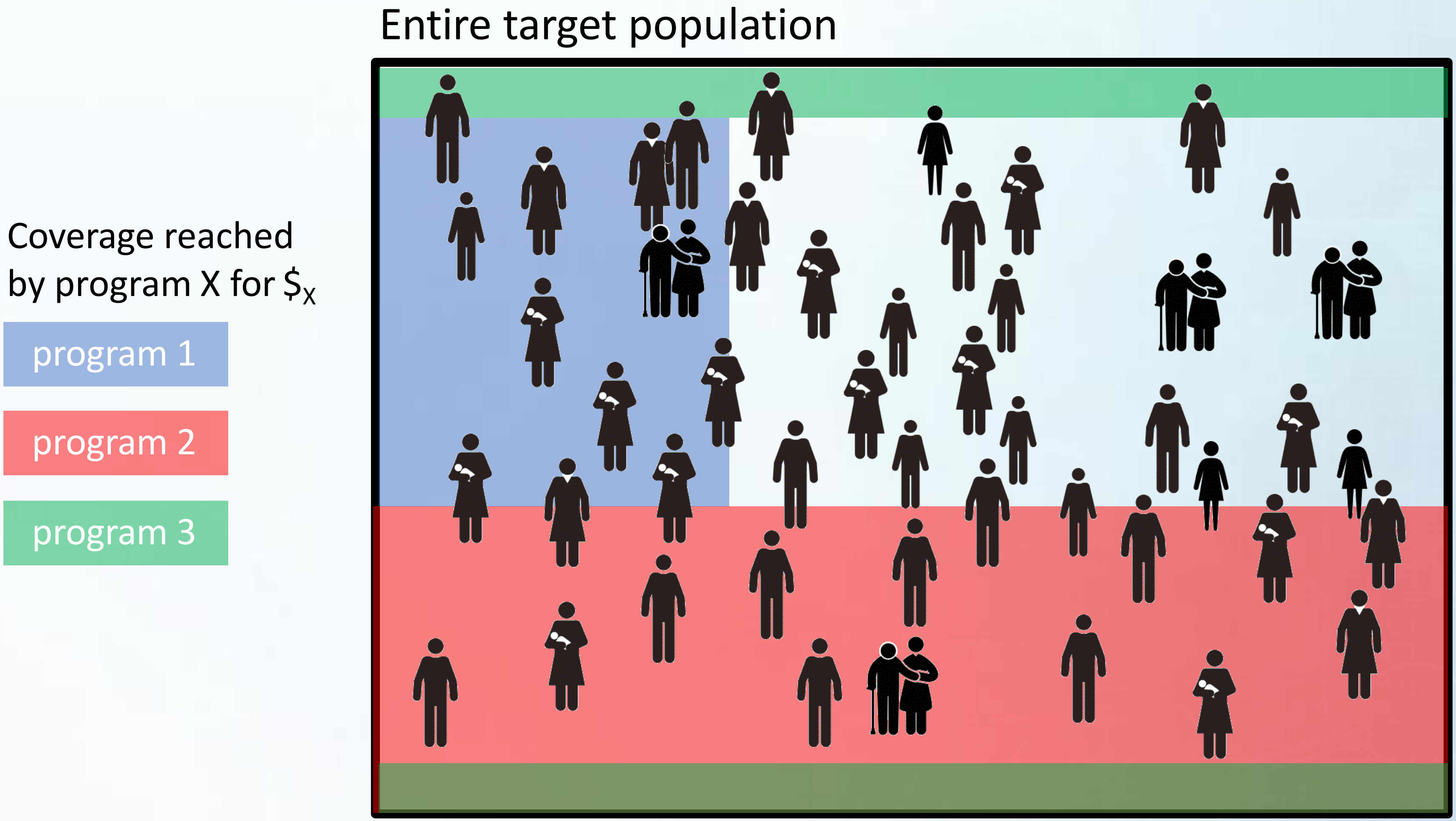
program 2

program 3

For every parameter, the type of program interaction is set

Option 2: **random** (default)

Coverage reached by program X for $\$_X$



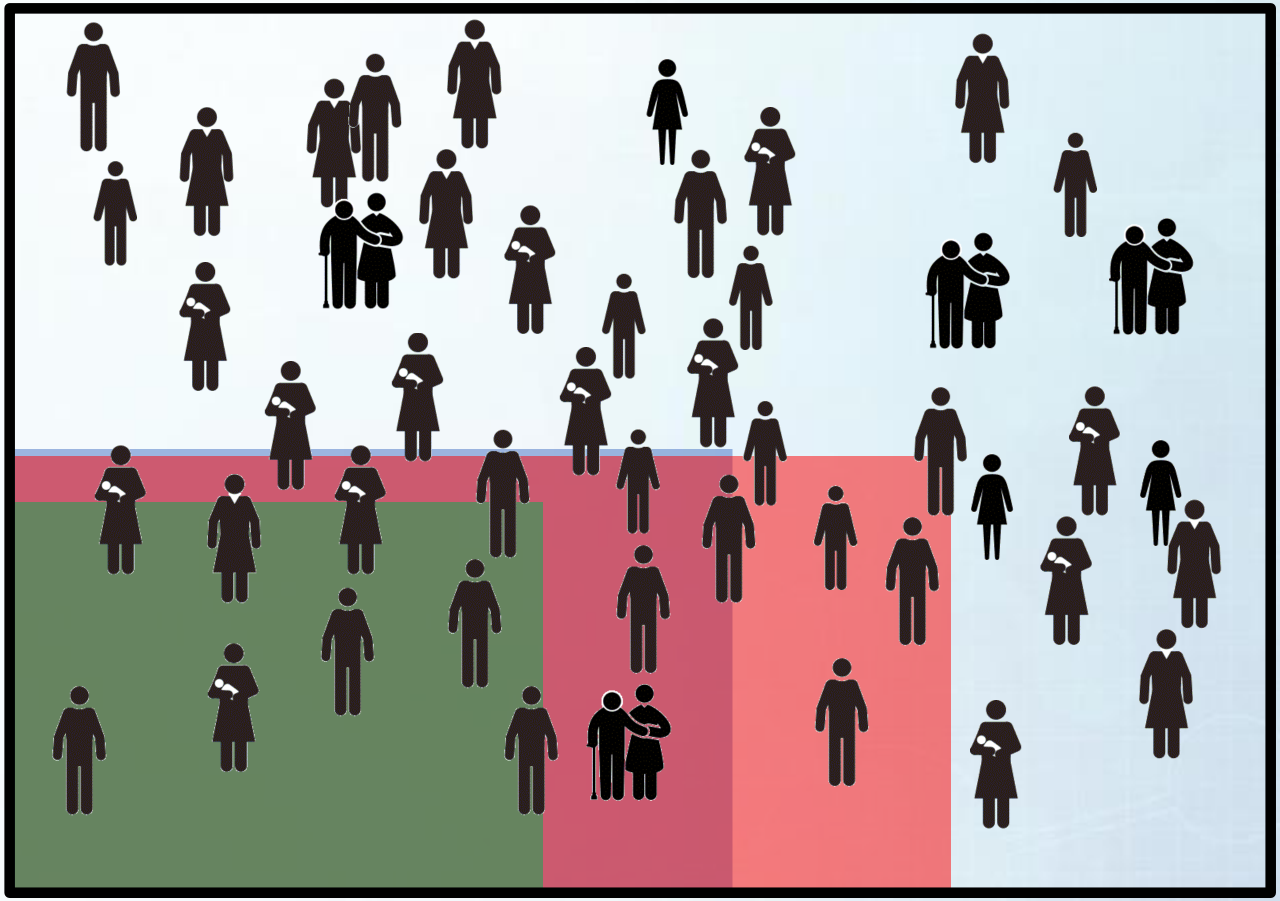
For every parameter, the type of program interaction is set

Option 3: **nested** (optional)

Coverage reached by program X for $\$_X$

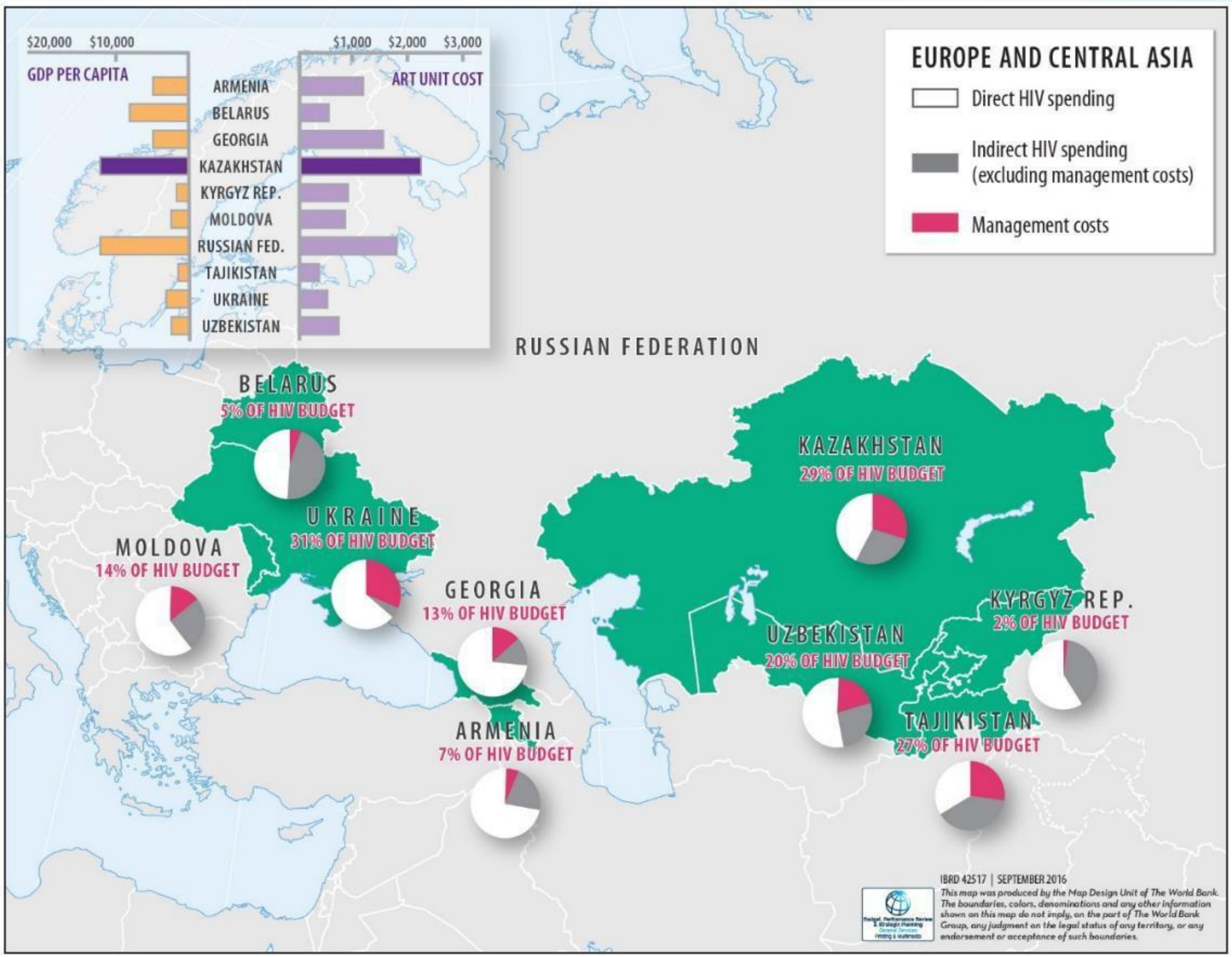
- program 1
- program 2
- program 3

Entire target population



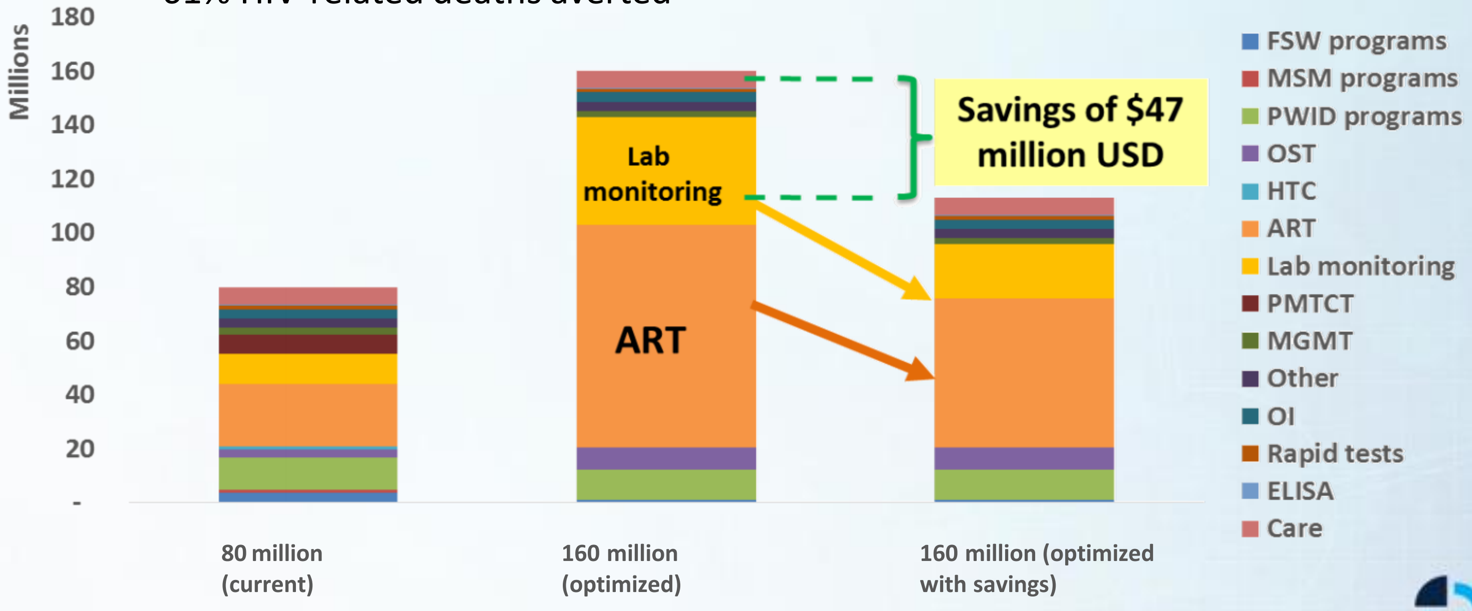
One step further: modeling optimized results with reduced TARGETED & NON-TARGETED costs

‘X’-Inefficiency in HIV programmes



Example - Combining optimized allocations with cost savings for targeted programs

- In Ukraine, service delivery cost savings combined with optimized allocation analysis could result in potential annual savings of US$47 million between 2015 and 2030:
  1. Assumed reduced ARV costs following procurement of generic drugs and
  2. Assumed reduced viral load monitoring costs due to new negotiation of lower prices
  3. By 2030 (cumulatively)
     - 48% new infections averted
     - 61% HIV-related deaths averted

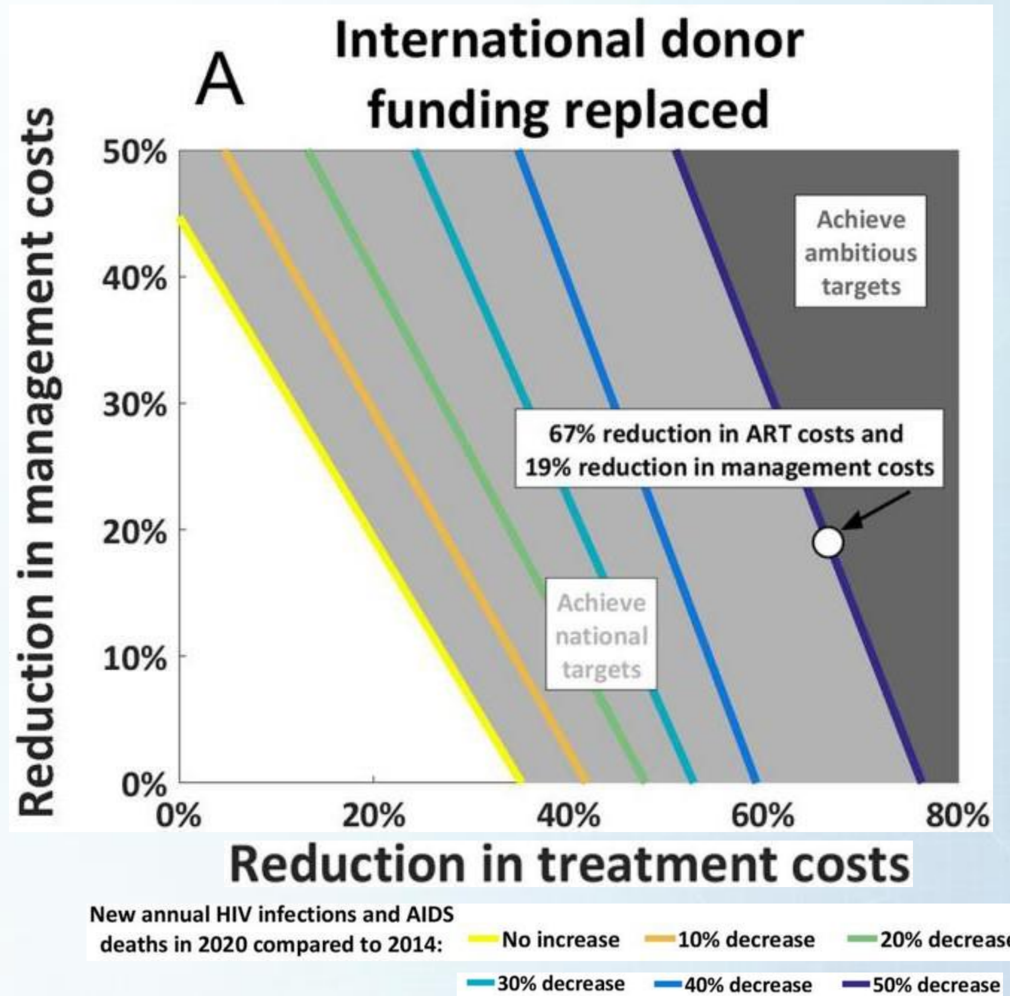


Source: The World Bank. 2015. Value for Money in Ukraine's HIV Response: Strategic Investment and Improved Efficiency

Example - Combining optimized allocations with cost savings for targeted and non-targeted programs

- Kazakhstan – additional analysis suggested a
  - 67% reduction in ARV unit costs and
  - 19% reduction in management costs

  could potentially lead to a reduction of new HIV infections and HIV-related deaths by 50% by 2020



Source: Shattock et al. 2017. Kazakhstan can achieve ambitious HIV targets despite expected donor withdrawal by combining improved ART procurement mechanisms with allocative and implementation efficiencies

Practice: representing intervention modalities

Choosing intervention modalities

Defining intervention (program) interactions

Understanding how intervention interactions work in the Optima HIV model

QUESTIONS?

Interpreting findings and extracting key recommendations from modeling analyses

Learning objectives

- Review of different analysis and outputs with a focus on interpretation
- Extracting key messages or lessons from the analysis
  - Considerations when interpreting results
- Structuring recommendations
- Other key considerations when writing report and policy briefs

Review model outputs and other results obtained

1. **What findings** - review, from the descriptive to the analytical/modelling outputs – sometimes a large amount of different types of results
   - *Simple descriptive findings might be as valuable as model outputs*
   - *Order findings by research question/objective – most important results?*
   - *Useful "by-products" - assessment of guidelines, benchmarking, unit costs…*

2. **Do findings hold up** - review and consider them carefully
   - *Plausibility - Do they make epidemiological sense? Match understanding of what interventions work and their effects? Concur with any findings from comparable studies or real-world experiences?*
   - *Are any results sensitive for dissemination? E.g. potentially undermining an important program, or clash with political reality?*

3. **Are findings supported** by solid data?
   - *Disclaimers need?*

Optima HIV

Priority Findings

1. Findings which directly answer the study questions
   - ***Answers***
2. Findings which support change, reform, innovation
   - ***Action***
3. Findings which resonate with general policy environment and wider ongoing processes (decentralization, cost-sharing, integration, etc.)
   - ***Traction***
4. Findings in line with best practice evidence (DCP3, systematic reviews, etc.)
   - ***Compatibility***
5. Findings which represent important new insights
   - ***Novelty***

Optima HIV

Understanding the Outputs/Results

1. **Consider the limitations**
   - *Data gaps and assumptions?*
   - *Simplifications?*
   - *Covering up important heterogeneities?*
   - *Effects of time horizons?*
2. **What might drive the results?**
   - *Can a simple deterministic sensitivity analysis be done (scenario type)?*
3. **Capturing current?**
   - *Do the results describe the current situation, or draw on past data – how might it effect conclusions*
   - *Is there a need for re-analysis, maybe because policy has moved on, or new data has come out?*
4. **Representativeness**
   - *For a setting, a population, an area*

REMEMBER: All model projections are subject to uncertainty. Estimates are indicative of trends rather than exact values

Optima HIV

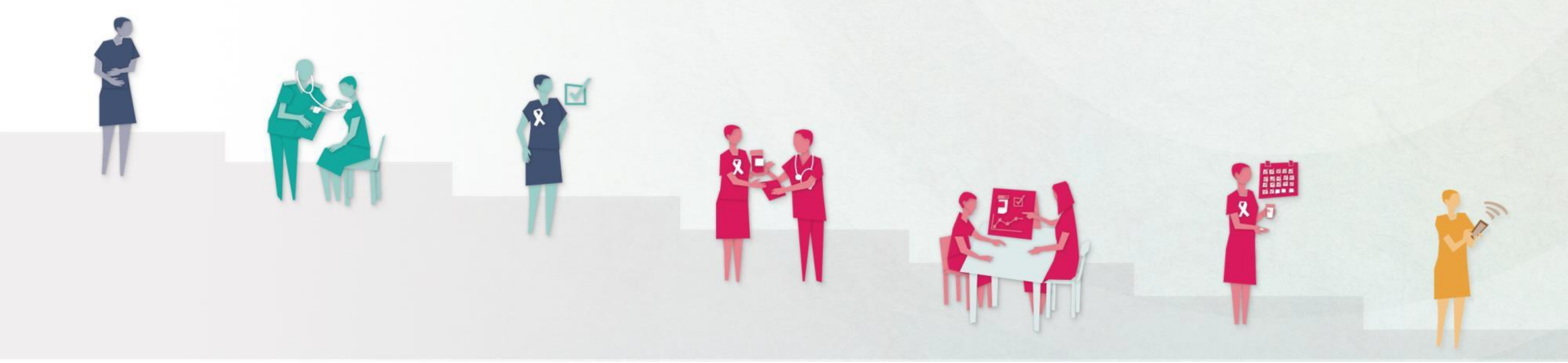
Remaining and Emerging Questions?

Consider important unanswered questions

- Reasons why?
- Consequences for what we recommend

Emerging new questions?

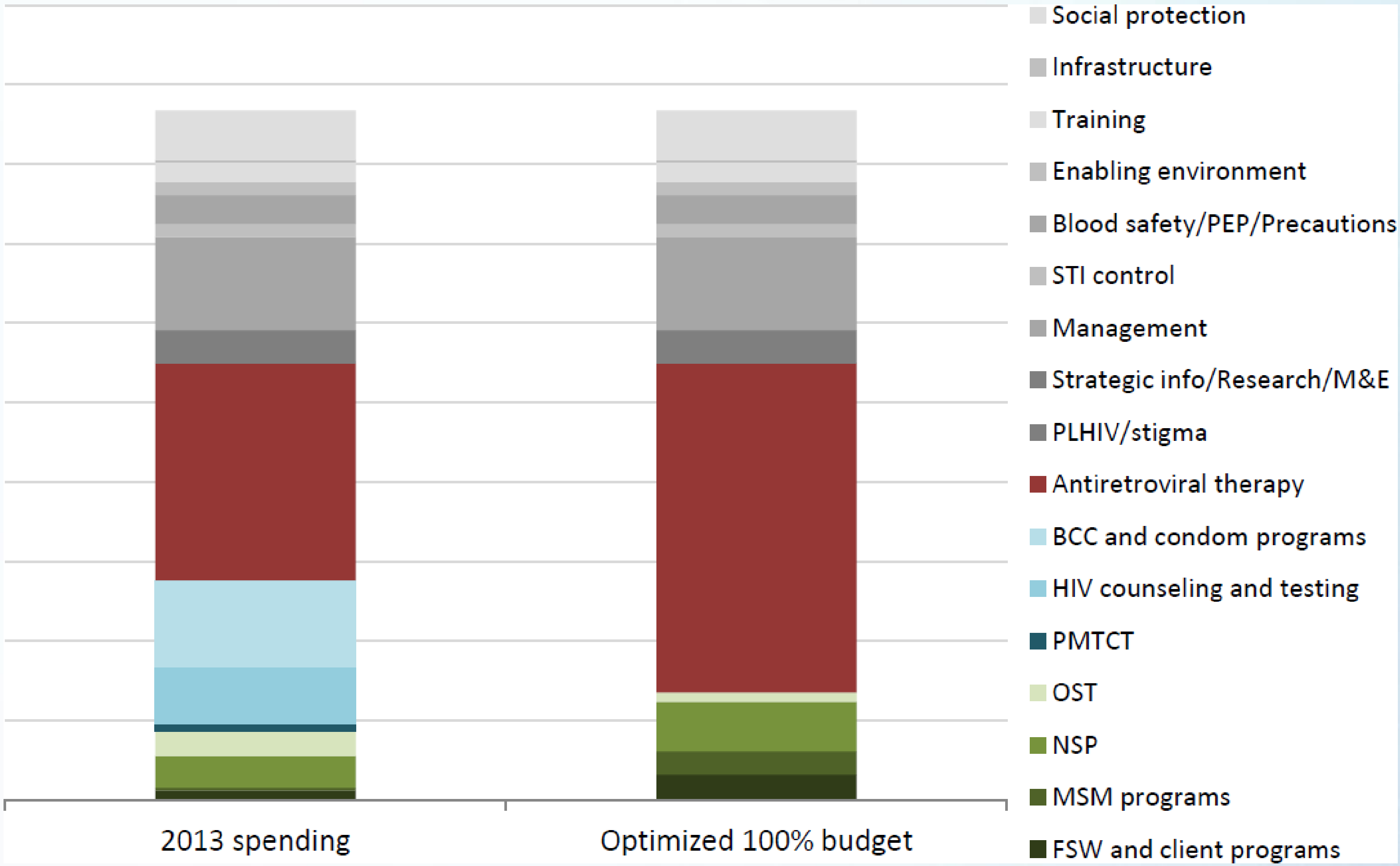
- Propositions on how to address them



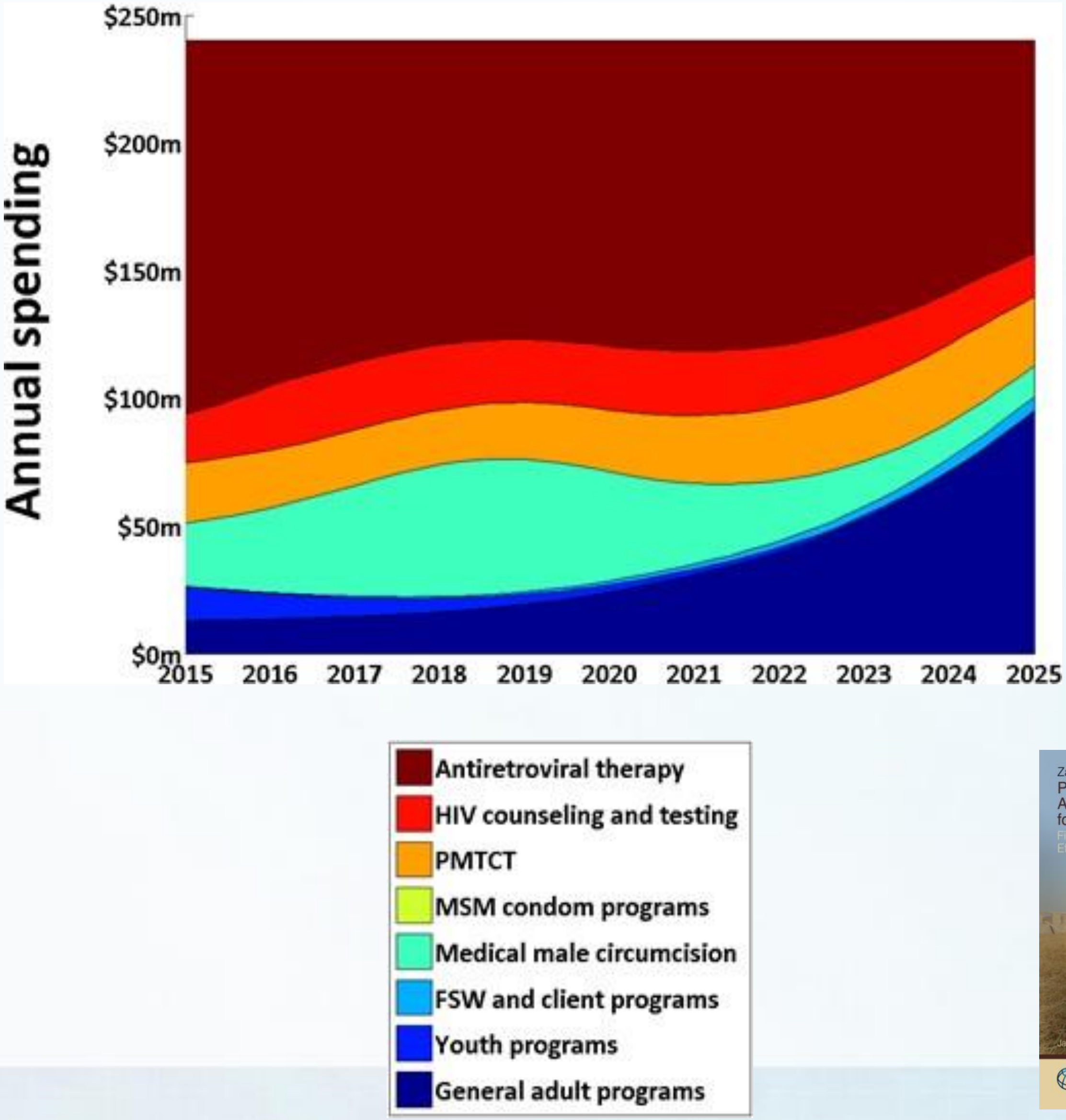
Key findings - how will they differ between analyses?

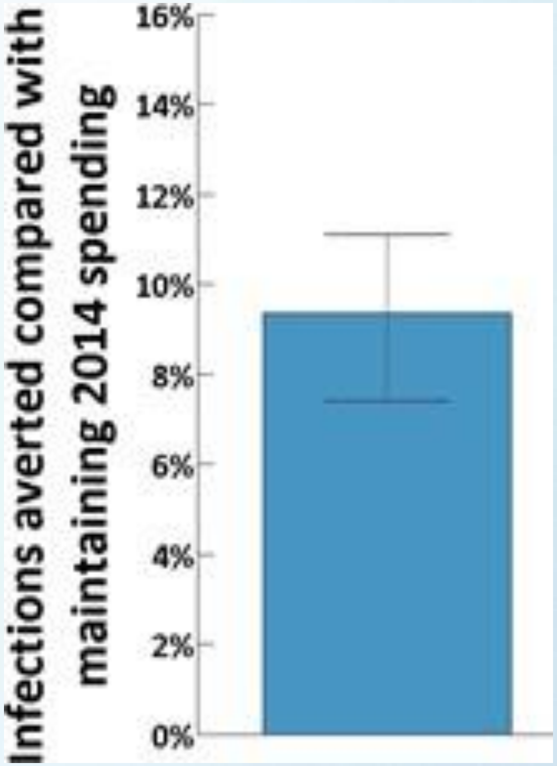
- Optimization results and recommendations will differ depending on
  1. Type of HIV epidemic
     - Generalized or
     - Concentrated
       - Which key populations are affected?
  2. Time horizon, eg, 2018 to 2020 or to 2030
  3. Budget level
  4. Programs
     - Parameters which get influenced by particular programs
     - Unit costs
     - Cost function values, eg, saturation, outcome in the absence of or under maximum coverage of programs

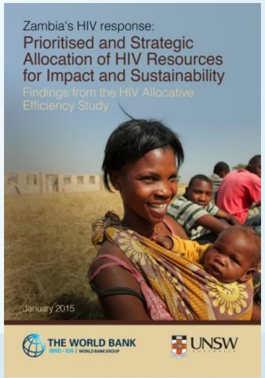
What type of epidemic? Possible recommendations?



Time-varying optimisation – key messages?







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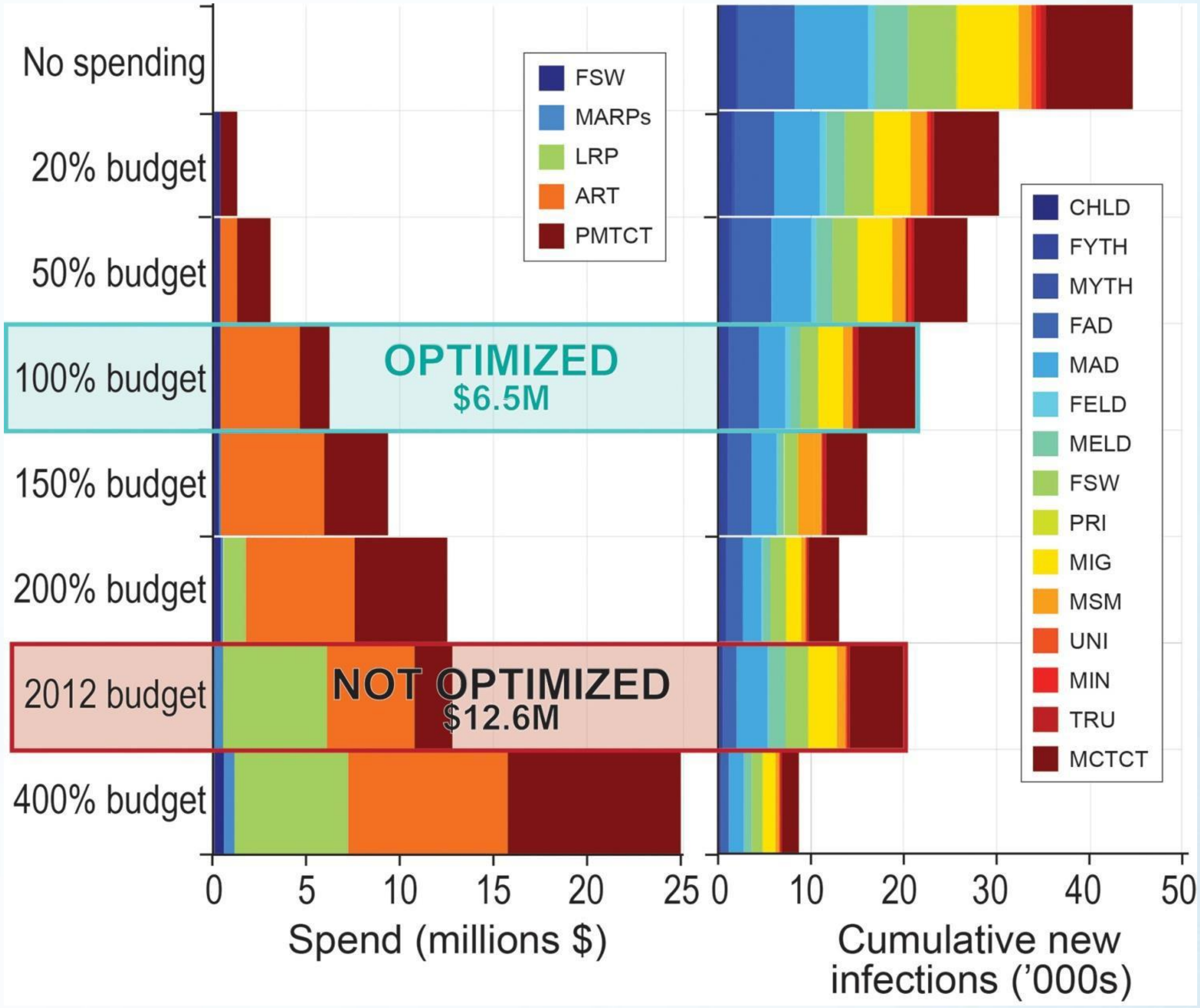
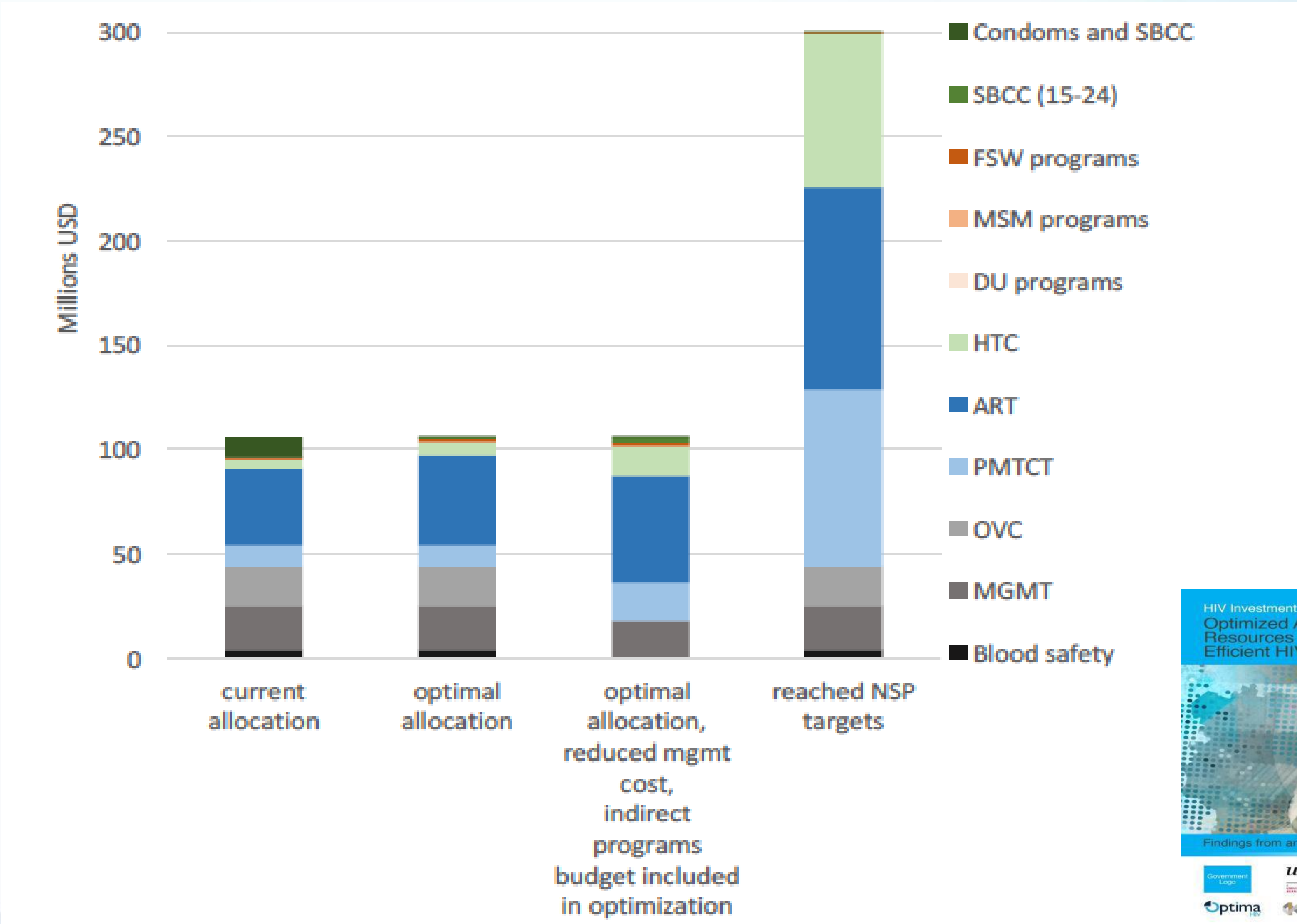
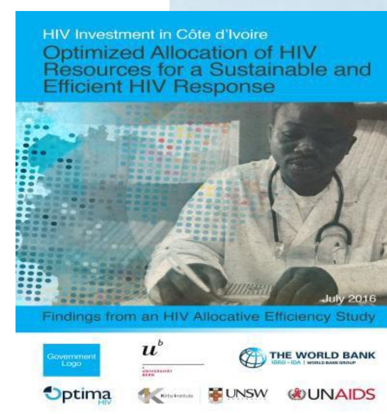
Different budgets – key messages?



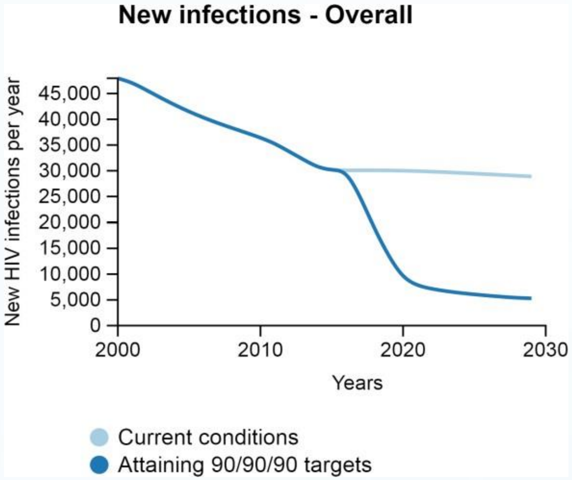
Optima HIV

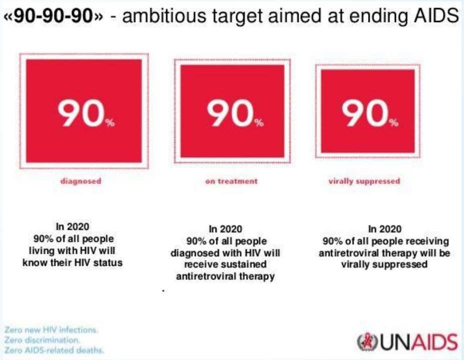
Reaching strategic targets – key messages?

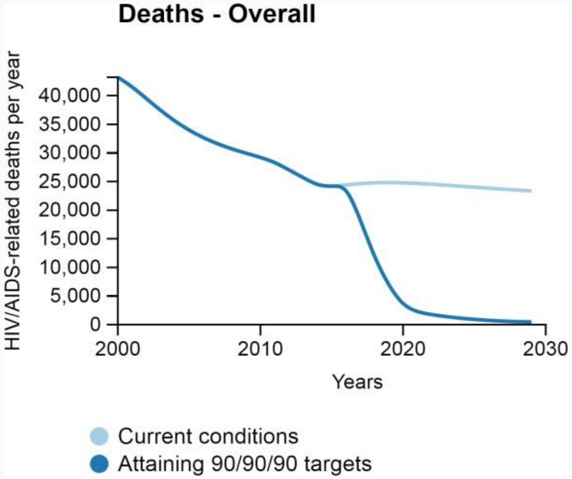


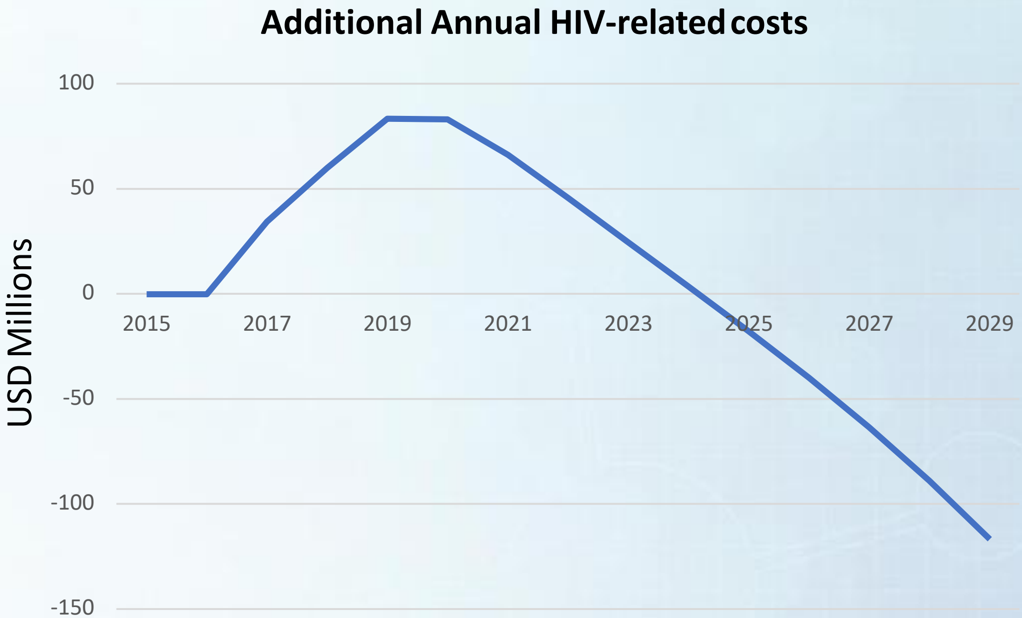


Reaching 90/90/90 – key messages?









Documentation and Reporting

Important: Express the **uncertainty** of modelled estimates

- Describe model-related and data related limitations

Follow a clear sequence

- *Description of outputs (Results section)*
- *Interpretation and contextualisation of these findings (Discussion)*
- *Drawing policy-relevant lessons on how HIV response can be improved (Recommendations)*

Lack of clarity minimises the usefulness of the results

- For policy-makers in deciding which allocative changes to make
- For implementers to change practice

Principles of Good HIV Epidemiology Modelling for Public Health Decision-Making in All Modes of Prevention and Evaluation

- Clear Rationale, Scope, and Objectives
- Explicit Model Structure and Key Features
- Well-Defined and Justified Model Parameters
- Alignment of Model Output with Data
- Clear Presentation of Results, Including Uncertainty in Estimates
- Exploration of Model Limitations
- Contextualisation with Other Modelling Studies
- Application of Epidemiological Modelling to Health Economic Analyses
- Clear Language

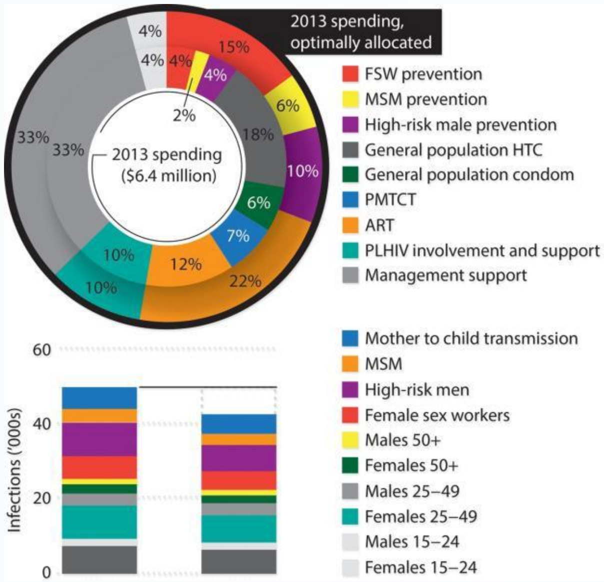
SOURCE: Delva W, Wilson DP, Abu-Raddad L, Gorgens M, Wilson D, et al. (2012) HIV Treatment as Prevention: Principles of Good HIV Epidemiology Modelling for Public Health Decision-Making in All Modes of Prevention and Evaluation. PLOS Medicine 9(7): e1001239.

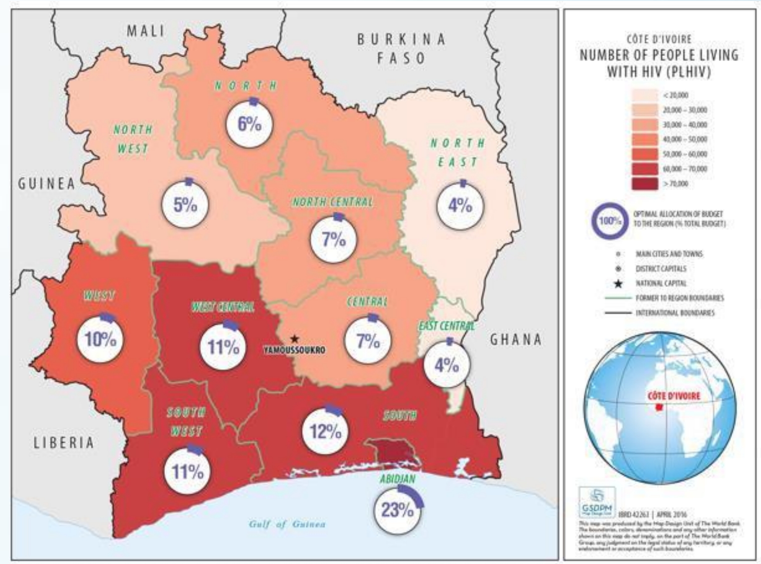
Optima HIV

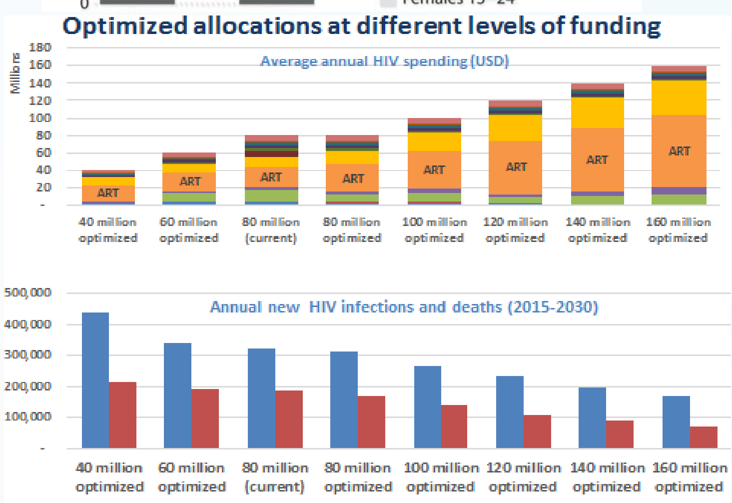
Report: Remind the bigger as well as local, national or regional policy context

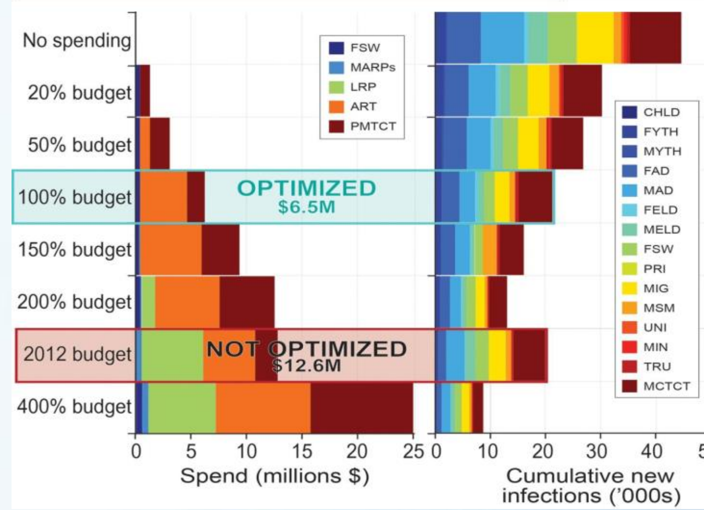
SOURCE: UNAIDS

Report: Visuals to Summarize Data









Report: Implications and Recommendations

- Implications are what could happen
- Recommendations are what should happen
- Both flow from conclusions
- Both must be supported by evidence and context-relevant

Implications: If…then…

- Describe what may be the consequences
- Useful when advice not requested
- Softer approach but still can be persuasive

Recommendations: Call to action

- Describe clearly what should happen next
- State as precise steps
- Ensure they are actionable and feasible
- Structure

Writing to reach Policy-Makers: Pointers

- How knowledgeable are they about the topic?
- How open are they to the message?
- What are their interests, questions, concerns?
- Consider implication of recommendations (e.g. ethical, economic, political considerations, feasibility)

  - *Describe the urgency of the situation*
  - *Speak in terms of benefits and advantages*
  - *Use economic, productivity, human development arguments*
  - *Place in current policy and planning context*
  - *Structure, brevity, readability*

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Policy Briefs

1. Start by painting a general picture, move from general to specific
2. Focus on 3-5 key messages
3. Define your purpose
4. Identify salient points that support the aim
5. Distil points to essential info, avoid too much jargon and statistics
6. Use presentation methods (side bars, call-outs,....)

"I have made this letter longer only because I have not had the time to make it shorter" Blaise Pascal, French philosopher, 1623 -1662

"I try to leave out the parts that people skip" Elmore Leonard, American novelist, 1925-2013

Getting Change in Resource Allocation and Programming

… the *raison d'etre* of the analysis

- Work closely with local champions, use existing TWG/Steering Committee
- Ensure report provides basis for change (allocations, coverage levels, etc.)
- Conduct study at the right time – also making use of procurement cycles, medium term expenditure budgeting etc.
- Identify low hanging fruit – changes that can swiftly be implemented
- Develop action plan with defined timelines and responsibilities
- Make recommendations within the reality of budgets and funding priorities
- Realize that change will be incremental

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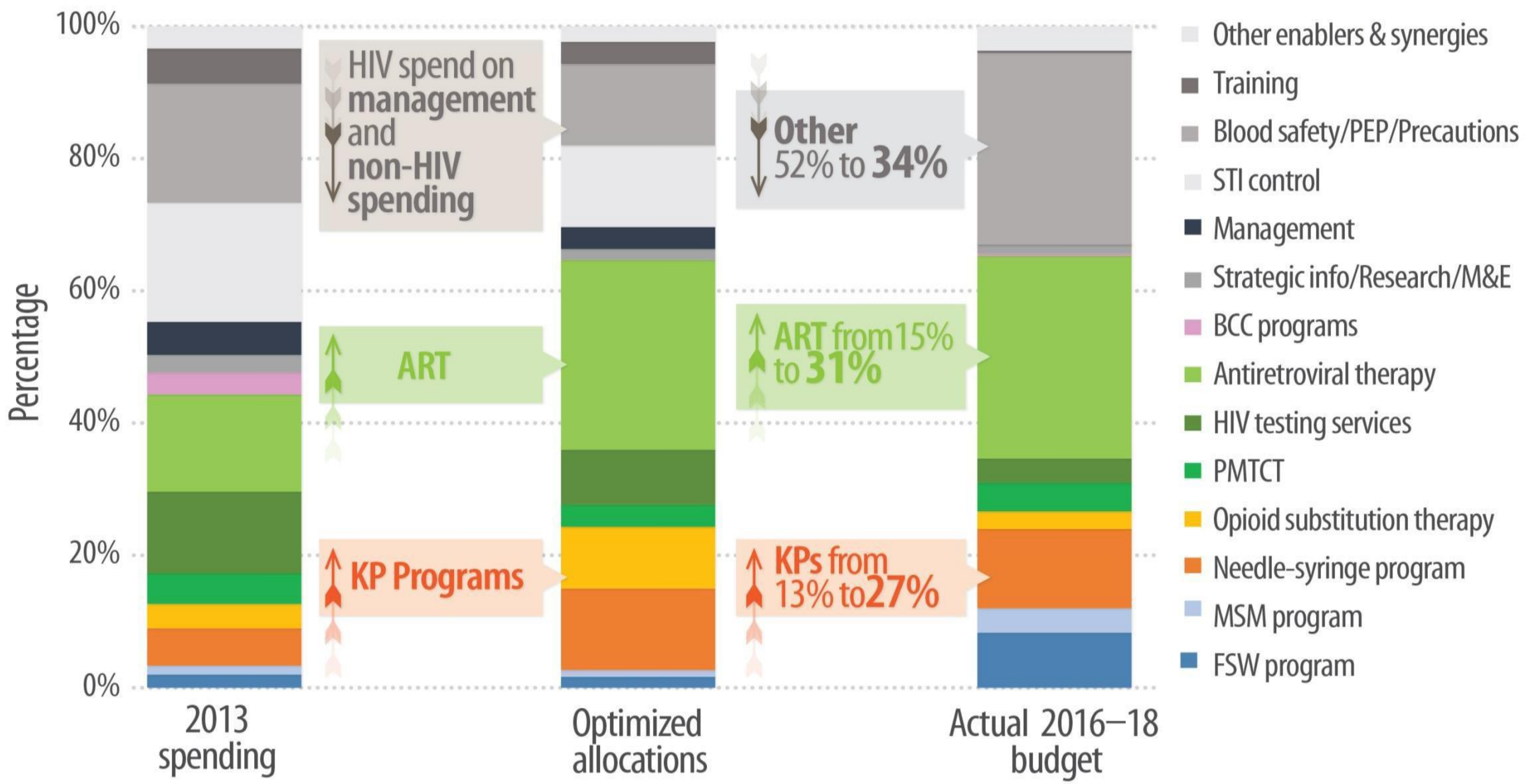
But remember that models CAN bring **real change**…

Case study - Sudan



WORLD BANK GROUP

Practice

Structure key recommendations from an allocative efficiency analysis using Optima HIV model

QUESTIONS?

Next steps

Next steps for conducting an Optima HIV analysis or investment case

- Contact the World Bank to discuss options for conducting an investment case analysis

- Contact our team at info@optimamodel.com

- A contract and scope of work, including objectives and questions to be addressed, will be developed

- Following investment case analyses, Optima HIV models can be updated thereafter, and analysis results regenerated in consultation with the Optima Consortium for Decision Science

Overview of steps for Optima HIV modelling

1. Access & resources: login and logout, user guide, demo project instructions, and help
2. Projects: start a new project and define programs
3. Data: create project & download spreadsheet
    a. Enter data in spreadsheet: ensure completeness, model needs *at least one* data *or* assumption value for each population for: population size, prevalence, behaviour, etc.)
4. Upload complete spreadsheet to project
5. Calibration
    a. Automatic calibration
    b. Manual calibration: adjust as necessary
6. Define programs and enter costs and coverage
7. Cost functions
    a. Define cost functions
    b. Define outcome functions
8. Analyses
    a. Scenario
    b. Optimization
9. Analyze results, generate slides and report, disseminate results
10. In future: update the project & regenerate results in consultation with the Optima team