WORLD BANK GROUP
Health, Nutrition & Population

2018 SKILLS BUILDING PROGRAM

BIG DATA, ARTIFICIAL INTELLIGENCE AND DECISION SCIENCE IN HEALTH AND NUTRITION

Implementation Cascades & Optimization

Welcome and Introductions

In partnership with

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Welcome Remarks

Introduction of Participants

Overview and Purpose

Plan for the Day

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BIG DATA, ARTIFICIAL INTELLIGENCE AND DECISION SCIENCE IN HEALTH AND NUTRITION

Introduction to Cascades

(C1)

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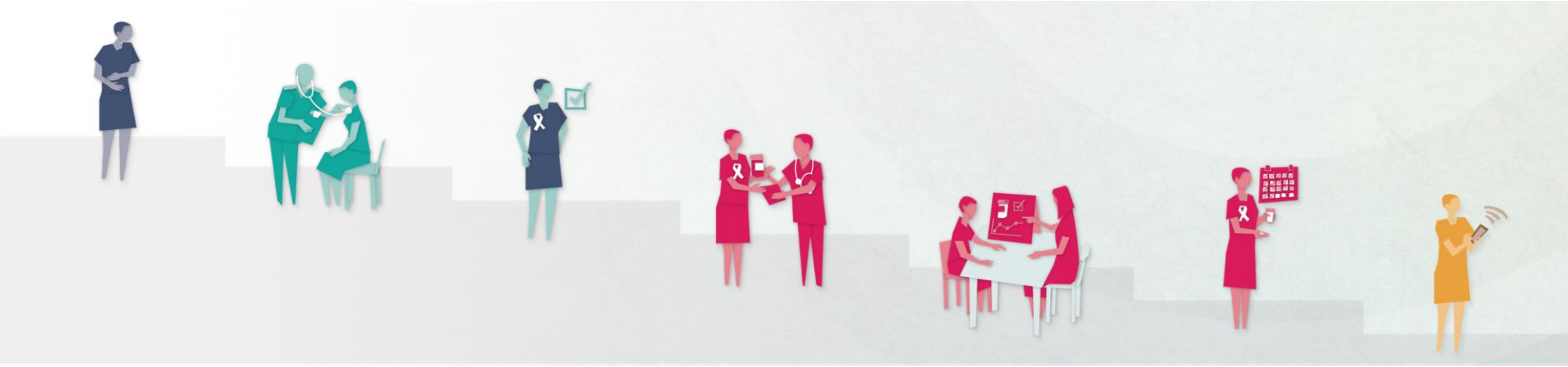
Takeaways from this Session

1. An overview of implementation cascades, their commonalities and differences
2. An understanding of how the “cascade lens” can be applied to service delivery processes
3. An introduction to the forces acting on implementation cascades – barriers and facilitators



Context: Measurements of Programmatic Outcomes

Effective program delivery and **how to measure:**

- Dominant theme in health and development (also Paris Declaration on Aid Effectiveness, Accra Agenda for Action)
- Focus on **results** and how they can be achieved **most efficiently**

Multitude of systems in operation to collect/aggregate program results

In theory, these data are intended to enable organizations to **assess implementation**

- *which strategies and programs are effective*
- *identify elements of programs associated with better results*
- *demonstrate accountability to external stakeholders*
- *make decisions about allocating further funding*

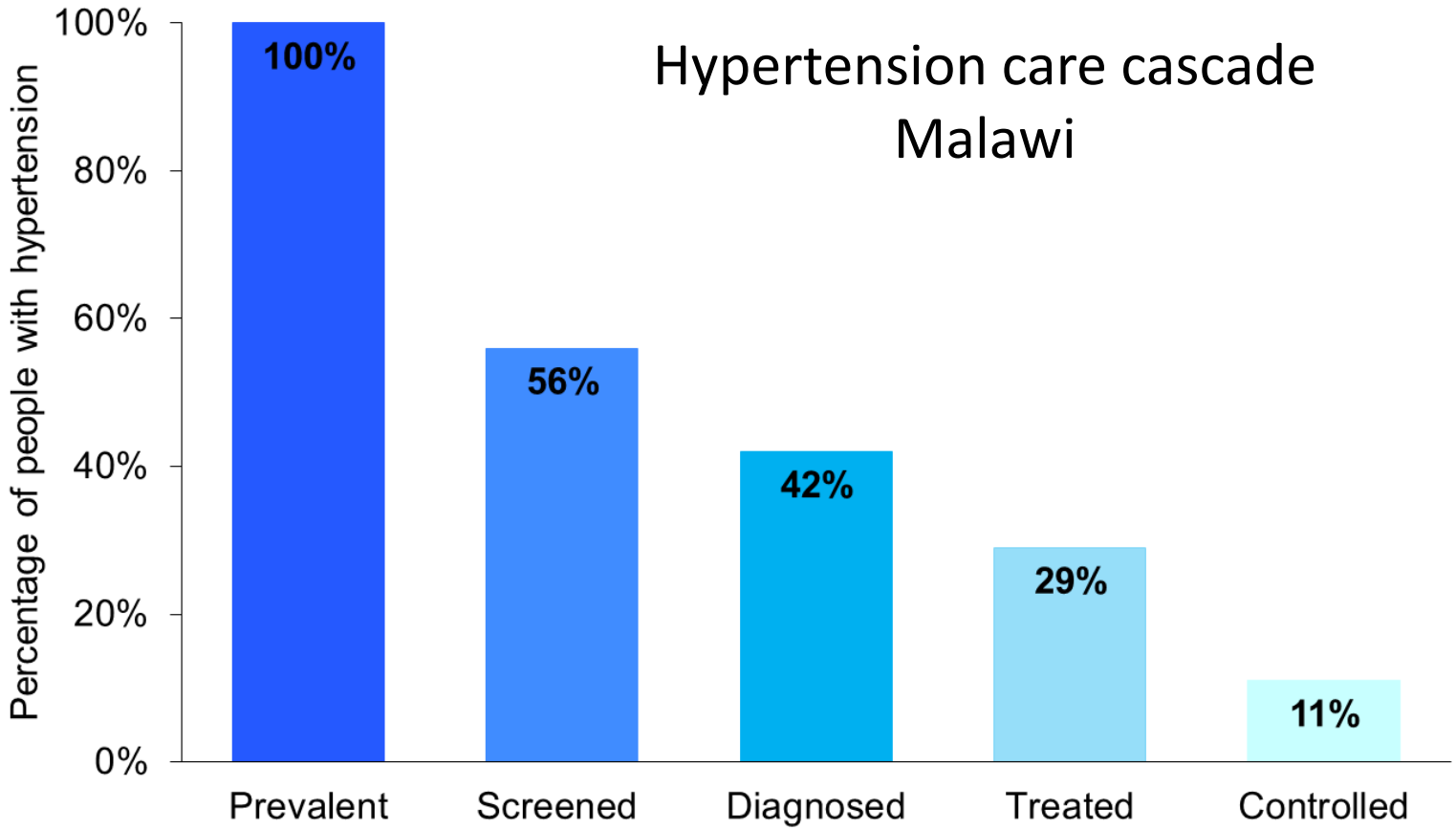
In practice, there is **a disconnect between the data being collected and the methods available for analyzing them**

Why "Cascades"?

- Many service delivery processes composed of sequence of actions to happen ("cascade")
- Cascade concept used to characterize **steps of engagement** involved in linking people into program/service
- Completion of cascade stages central to improved service delivery and health outcomes
  - *Success at each stage **increases pathway to success** at next step*
- Critical to identify effective approaches to **improve results at each step** in cascade
- Must remediate big **breakpoints** in cascade—where biggest improvements can be made

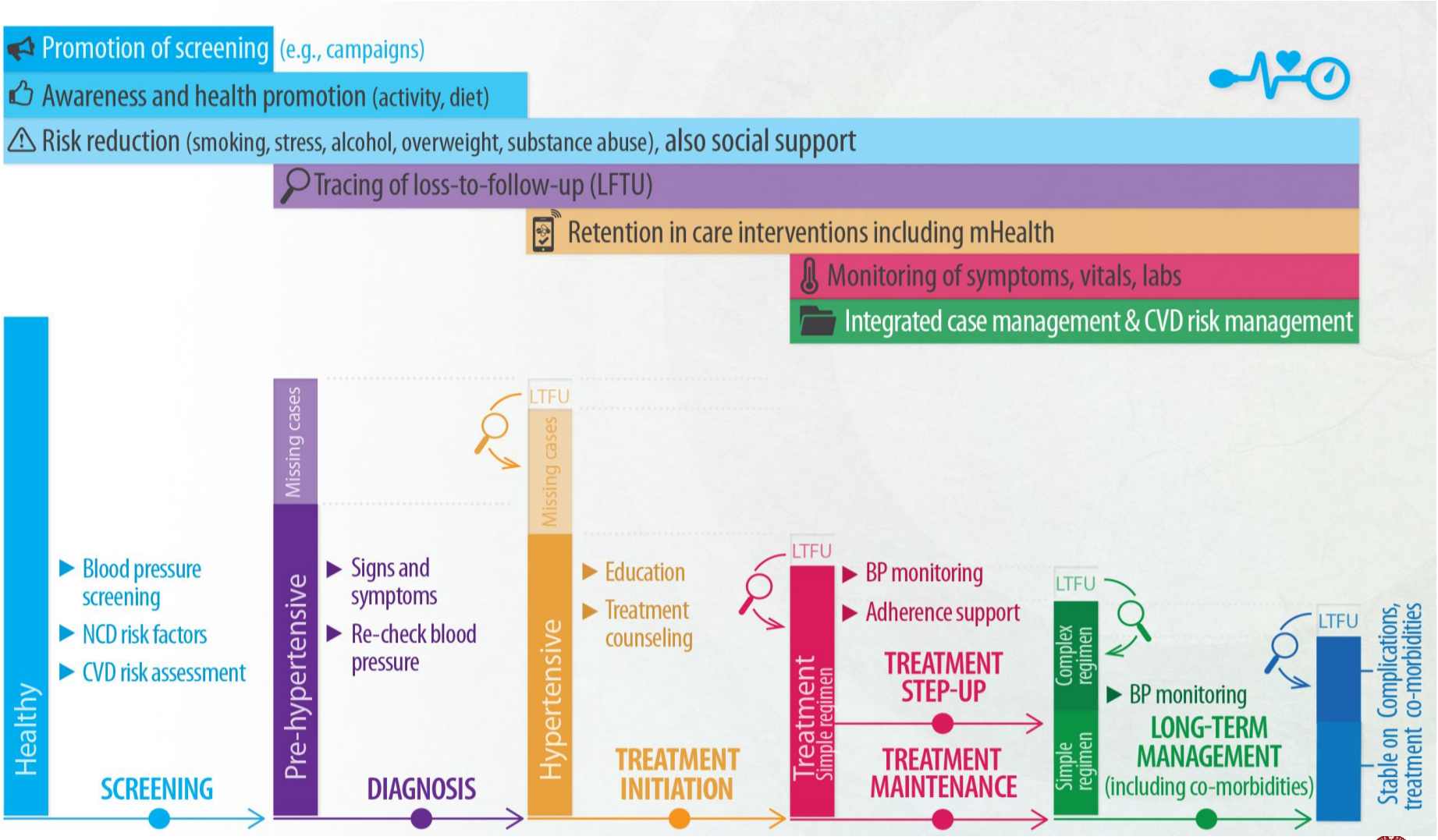
Questions we ask

Care Cascade: useful visual Tool



Source: Price et al. Lancet Diabetes Endocrinol 2018

But *Implementation Cascade* much more actionable



Importance of Breakpoints in Service Delivery?

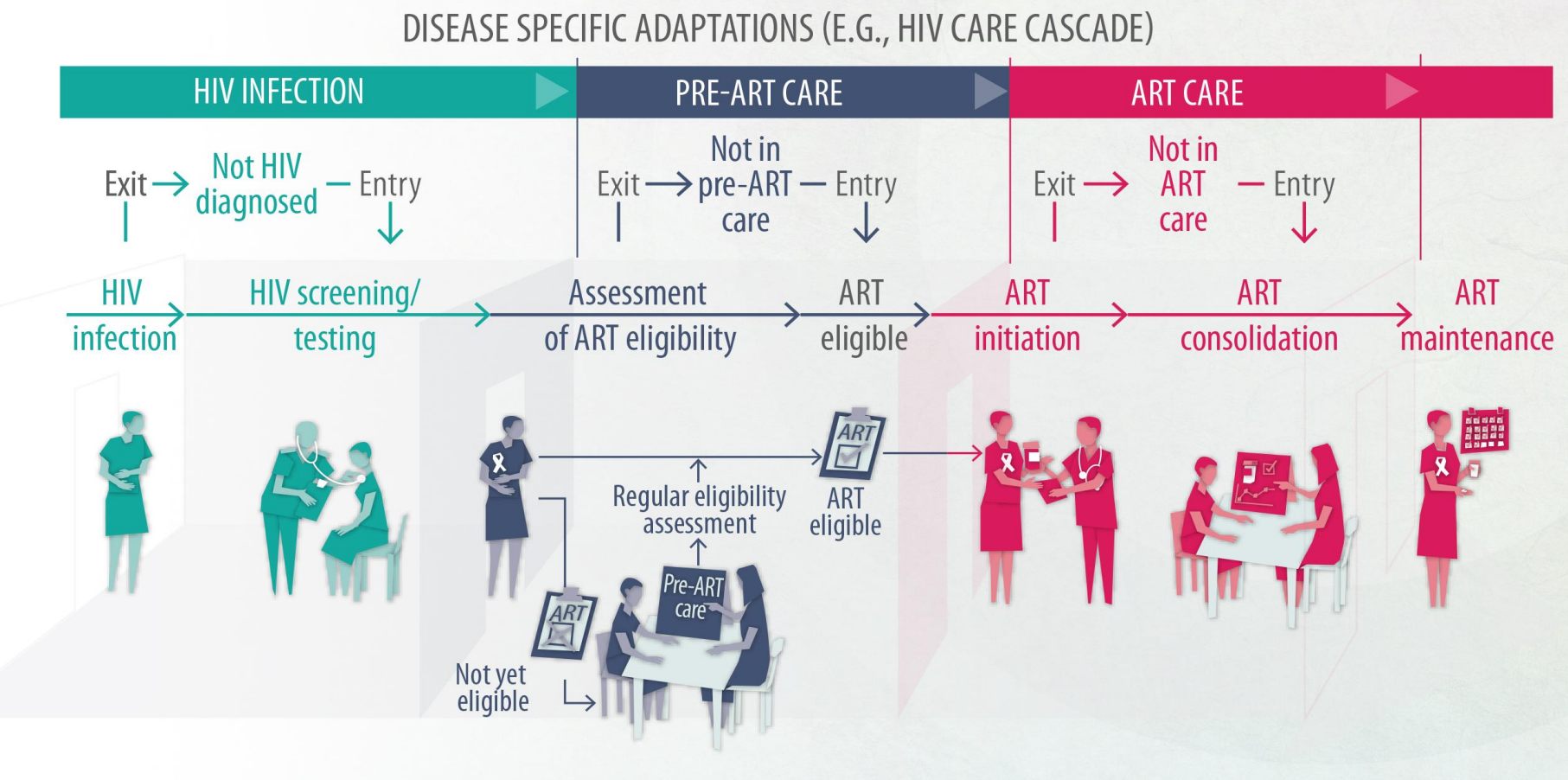
- Bottlenecks and chokepoints = points along critical path to effective service delivery and better health outcomes **where the system slows down, fails or stops**
- Identifying where bottlenecks and chokepoints happen and **fixing them vital for health system**
- The **implementation cascade framework is a tool** to find and identify solutions to fix bottlenecks and chokepoints

Service Delivery as a Continuum

- Service users' journey though sequential stages
- Program-specific key stages of engagement along a continuum
- Initially used for HIV services—now used for many other programs

Generic service continuum	Health service continuum
➢ Aware of need	➢ Diagnosed
➢ Aware of service	➢ Enrolled in care
➢ Linked to service	➢ Adherent to care
➢ Successful outcome	➢ Disease control achieved

Our best-known implementation cascade: HIV



What other Implementation Cascades can we think of?

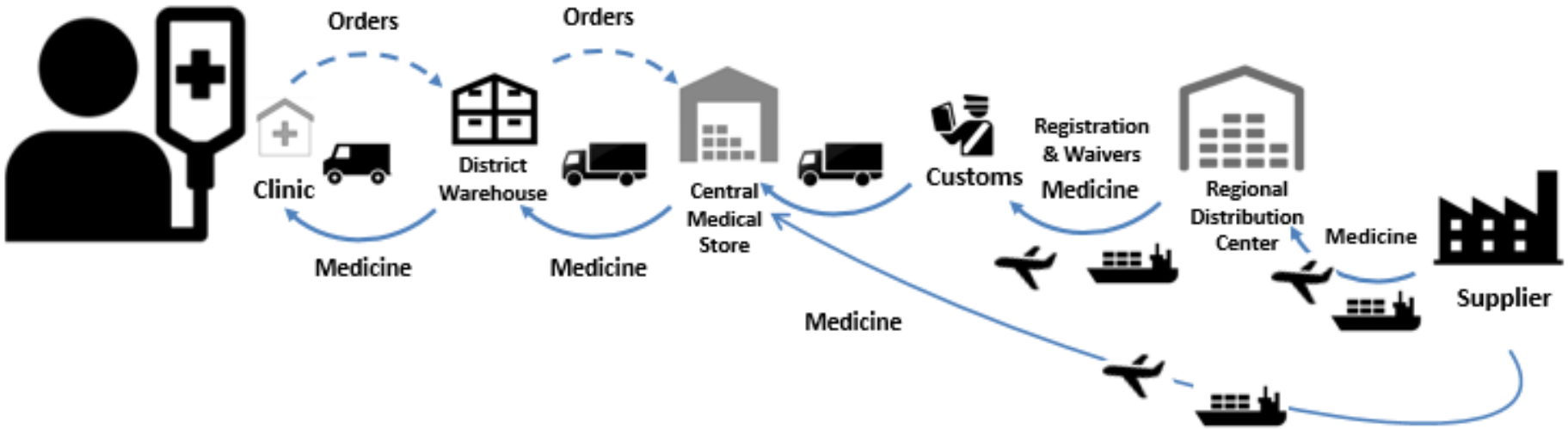
[AUDIENCE PARTICIPATION]

- Gather participant suggestions of examples and note on flipchart. Encourage to think ‘outside the box’.
- Follow up with question: What criteria should apply to a program or service for a *cascade approach to be suitable*?
- Check against flipchart-listed programs, discuss briefly

Is this "an implementation cascade"?

[AUDIENCE PARTICIPATION]

Why? Why not?



Source: Robert Ferris, Building reliable supply chains for non-communicable disease commodities: lessons learned from HIV and evidence needs. AIDS 2018, vol 32 suppl1

Cascades as diverse as Service Continua

Disease specific

- Infectious disease – HIV, TB, hepatitis C, ….
- NCDs – Diabetes, hypertension, mental conditions,….

Program/intervention specific

- Diagnosis – Cervical cancer, breast cancer
- Treatment – ART, cancers
- Prevention – VMMC, PreP, condoms, vaccination

Other delivery continua

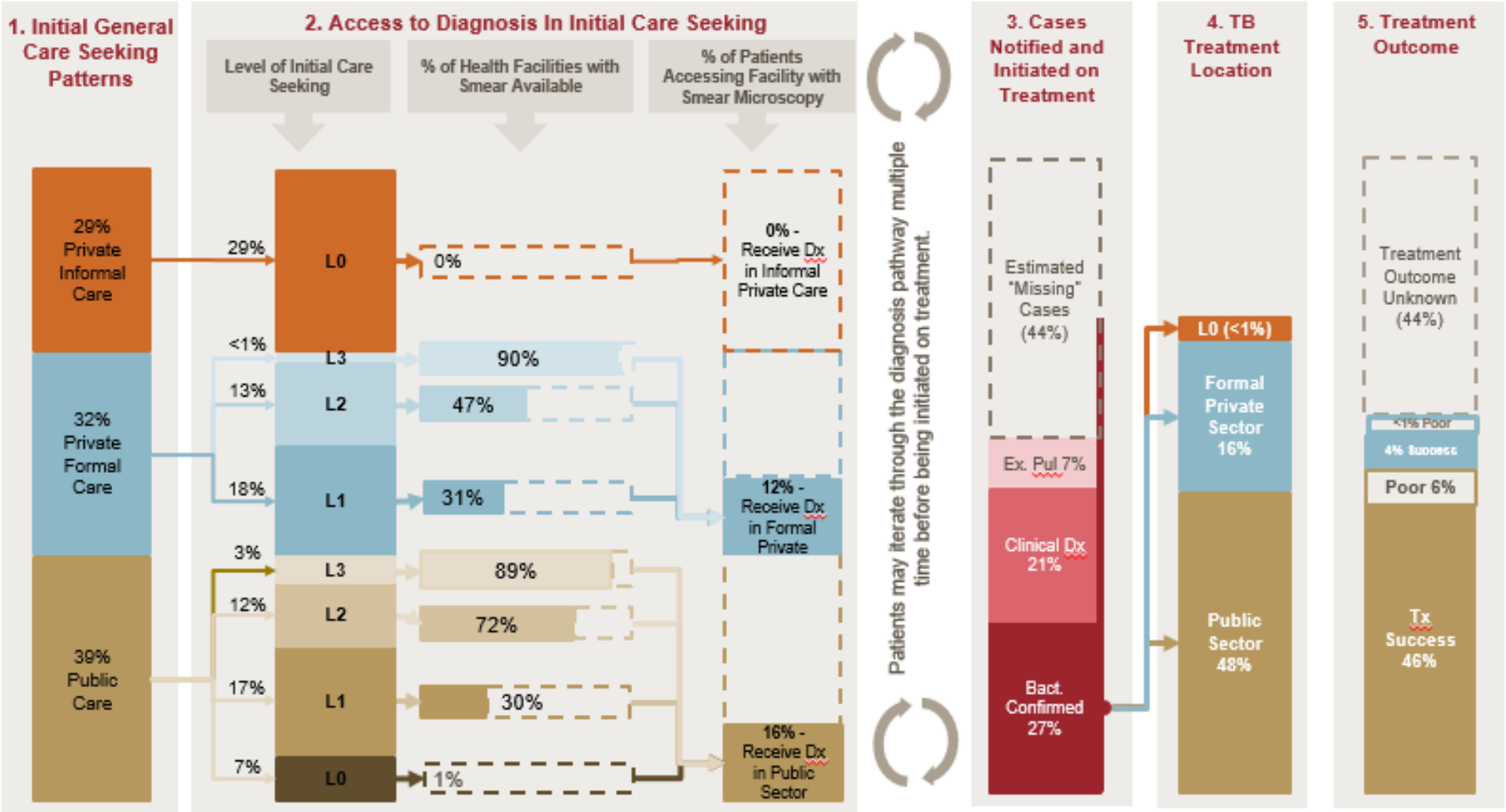
- Support services (e.g. agricultural outreach)
- Processes riddled by breakpoints (e.g. supply chains)

The question determines the cascade we construct

TB services in a multi-actor system

Where is "the TB cascade" here, from a public sector perspective?

PATIENT PATHWAY ANALYSIS: 11-COUNTRY SUMMARY



How can we overcome the Gaps?

Coverage

- Access (geographic, language, cultural competency)
- Demand (uptake by communities and clients)

Quality

- Technical quality (safety, evidence-based)
- Interpersonal quality (respectful care)

Efficiency

- For health system
- For clients

Based on El-Sadr, AIDS 2018 (Differentiated Service Delivery 2018: Innovations, Best Practices and Lessons Learned)

WHO framework: Integrated People-Centred Services

A call for fundamental shift **in way health services** are funded, managed and **delivered**

- Comprehensive, safe, effective, timely, efficient and acceptable services
- **Coordinated across the continuum of care**

Strategy 1: Engaging and empowering people & communities	Strategy 2: Strengthening governance & accountability	Strategy 3: Reorienting the model of care	Strategy 4: Coordinating services within and across sectors	Strategy 5: Creating an enabling environment

Strategic Approaches

1.1 Engaging and empowering individuals and families	2.1 Bolstering participatory governance	3.1 Defining service priorities based on life-course needs, respecting social preferences	4.1 Coordinating care for individuals	5.1 Strengthening leadership and management for change
1.2 Engaging and empowering communities	2.2 Enhancing mutual accountability	3.2 Revaluing promotion, prevention and public health	4.2 Coordinating health programmes and providers	5.2 Strengthening information systems and knowledge
1.3 Engaging and empowering informal carers		3.3 Building strong primary care-based systems	4.3 Coordinating across sectors	5.3 Striving for quality improvement and safety
1.4 Reaching the underserved & marginalized		3.4 Shifting towards more outpatient and ambulatory care		5.4 Reorienting the health workforce
		3.5 Innovating and incorporating new technologies		5.5 Aligning regulatory frameworks
				5.6 Improving funding and reforming payment systems

http://www.who.int/servicedeliverysafety/areas/people-centred-care/Overview_IPCHS_final.pdf

Framework talks to many Aspects of Care Continuum

Strategy 1: Engaging and empowering people & communities	Strategy 2: Strengthening governance & accountability	Strategy 3: Reorienting the model of care	Strategy 4: Coordinating services within and across sectors	Strategy 5: Creating an enabling environment
Potential policy options and interventions				
• Health education • Shared clinical decision making • Self-management • Community delivered care • Community health workers • Civil society, user and patient groups • Social participation in health • Training for informal carers • Peer support • Care for the carers • Equity goals into health sector objectives • Outreach programmes and services • Contracting out • Expansion of primary care	• Community participation in policy formulation and evaluation • National health plans promoting integrated people-centred health services • Donor harmonization and alignment with national health plans • Decentralization • Clinical governance • Health rights and entitlement • Provider report cards • Patient satisfaction surveys • Patient reported outcomes • Performance evaluation • Performance based financing and contracting • Population registration with accountable care providers	• Local health needs assessment • Comprehensive package of services • Strategic purchasing • Gender and cultural sensitivity • Health technology assessment • Population risk stratification • Surveillance, research and control of risks and threats to public health • Public health regulation and enforcement • Primary care with family and community-based approach • Multidisciplinary teams • Home and nursing care • Repurposing secondary and tertiary hospitals for acute complex care only • Outpatient surgery and day hospital • Shared electronic medical record • eHealth	• Care pathways • Referral and counter-referral systems • Case management • Care transition • Team-based care • Regional/district-based health service delivery networks • Integration of vertical programmes into national health system • Incentives for care coordination • Health in all policies • Intersectoral partnerships • Merging of health sector and social services • Integration of traditional medicine into health services • Coordinating preparedness and response to health crises	• Transformational and distributed leadership • Change management strategies • Information systems • Systems research and knowledge management • Quality assurance • Culture of safety • Continuous quality improvement • Workforce training • Multi-disciplinary teams • Improvement of working conditions and compensation • Provider support groups • Alignment of regulatory framework • Sufficient health system financing • Mixed payment models based on capitation • Bundled payments

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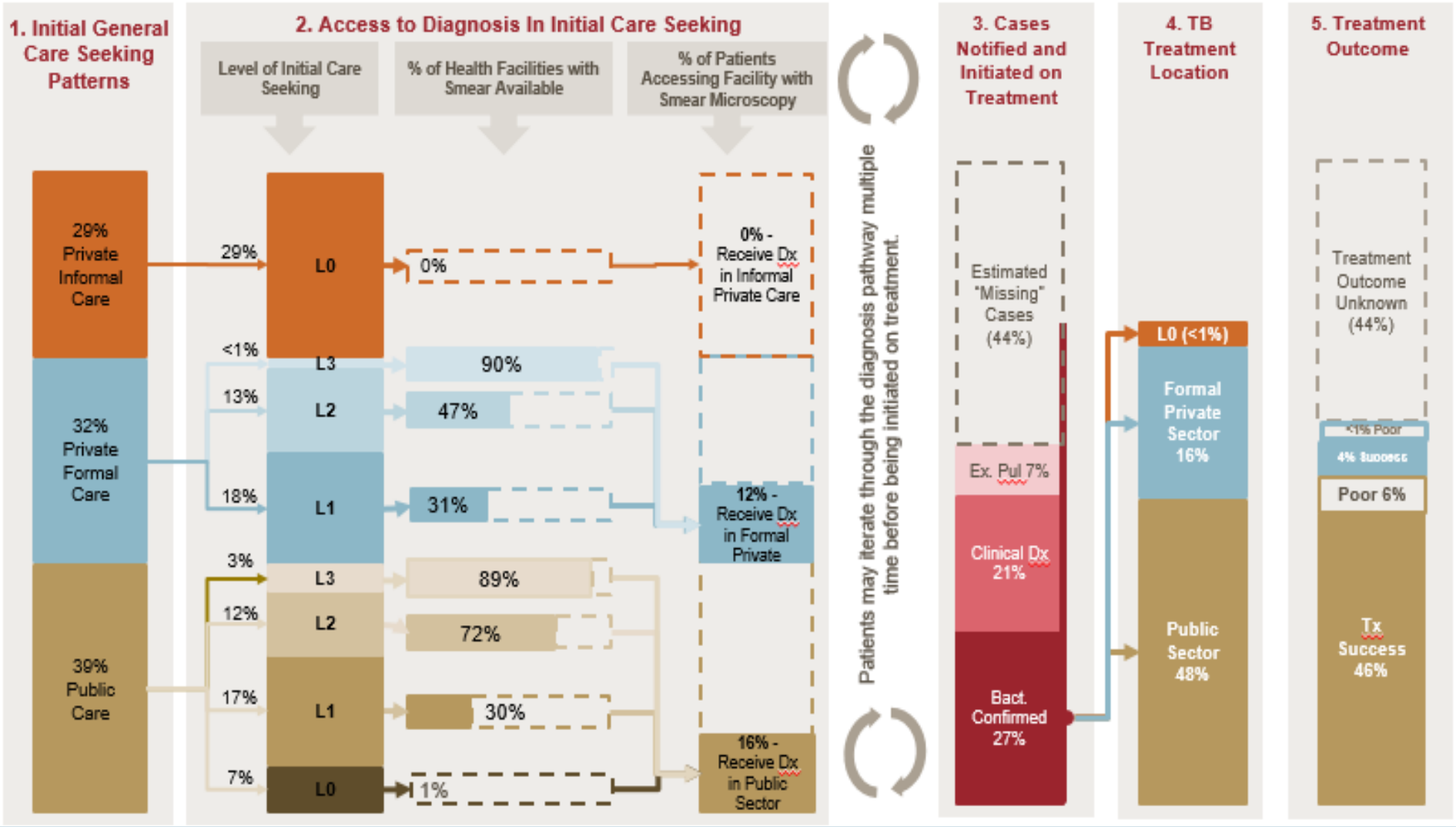
http://www.who.int/servicedeliverysafety/areas/people-centred-care/Overview_IPCHS_final.pdf

People's "continua of care"

What pathways do people choose?
Where might they get better diagnosis?
When does the "direction of travel" change?
Why is the "speed of travel" important?



Cross-sectional & Cohort based Cascades

Cross-sectional cascade

"Prevalence"

- Cross-sectional representation = status at a particular point of time
- Managers/policy makers get a snap-shot
- Outcome among those with condition
- Provides the big picture for monitoring the progress by the program
- Wider data availability
- Denominator often all with the condition/need

But:

- Less sensitive to reflect impact of programmatic changes in real time
- Estimations can be imprecise, final outcome can have small sample size
- Draws on multiple data sources with definitional challenges
- Reflects continuum as unidirectional
- Doesn't provide feedback on client specific care continuum
- May not distinguish important sub-groups

Cohort-based cascade

"Incidence"

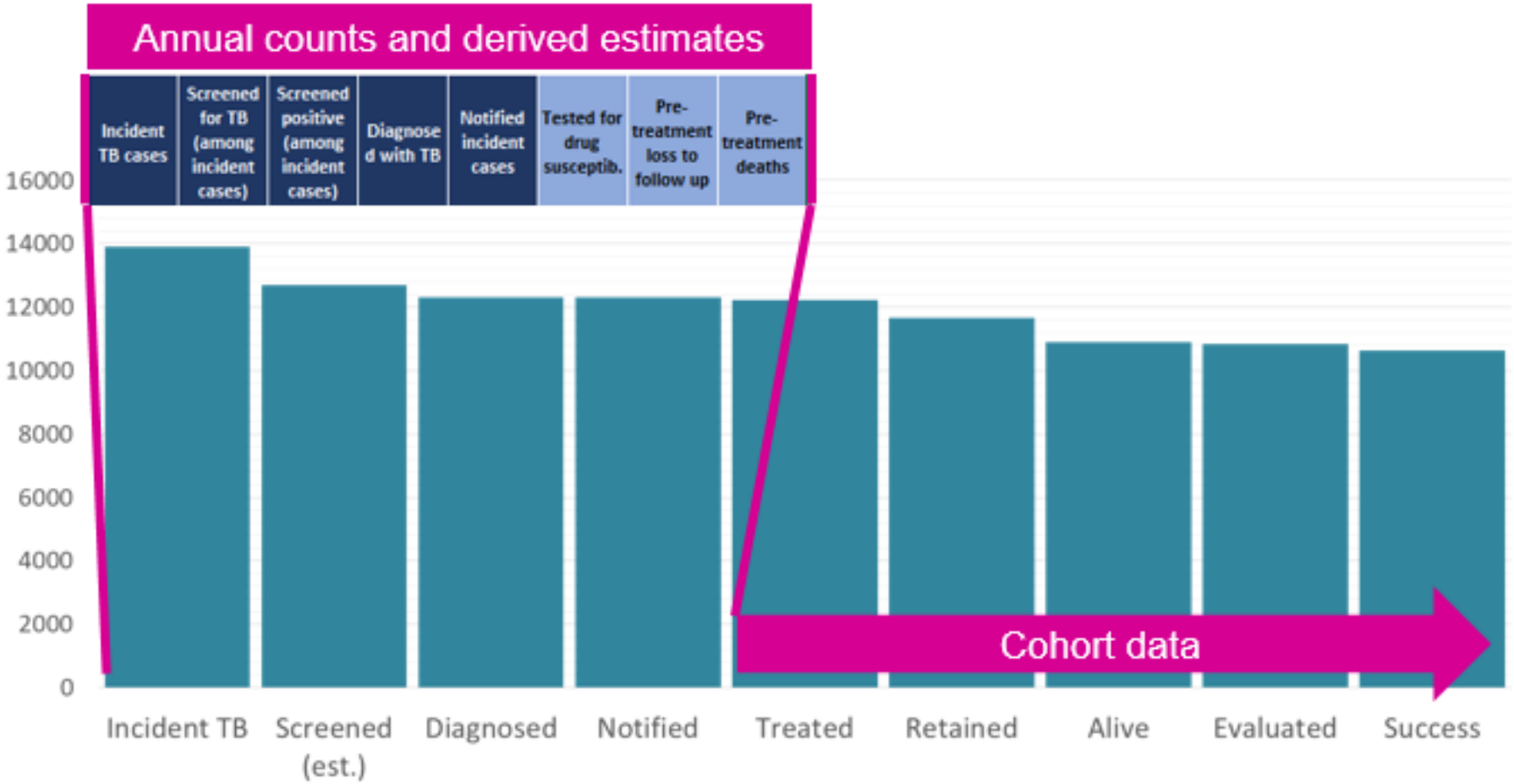
- Longitudinal representation = "true" continuum
- Outcome among those registered/diagnosed
- Can provides more granular information on continuum in sub-groups of individuals included in analysis, as we know more about them
- Is sensitive to programmatic change (across those stages captured in cascade)
- Can inform more targeted action

But:

- Un-diagnosed might not feature yet have the condition (and possibly the greatest health losses)
- Cohort data still less often available in routine systems
- Cascade re-entry by cohort members may remain a data challenge unless personal identifiers carried through

Cross-sectional & Cohort Cascades

In reality, may need to use cross-sectional & cohort data to develop cascade



Source: Author's own

When Cascade Concept useful to analyze and improve Implementation?

Where a **sequence of actions** need to happen to obtain programmatic outcome

- multiplication factor from tier to tier at work

Where each major step of **engagement** relies on action by both client & provider

- "demand meeting supply" situation

First step of engagement linked to "eligibility for service" aspects

- may be linked to screening, targeting, cost-effectiveness questions

Completion of cascade stages a prerequisite to desired **programmatic outcome**

- and health/development outcomes down the line

Each step will have losses, but there may be **priorities**

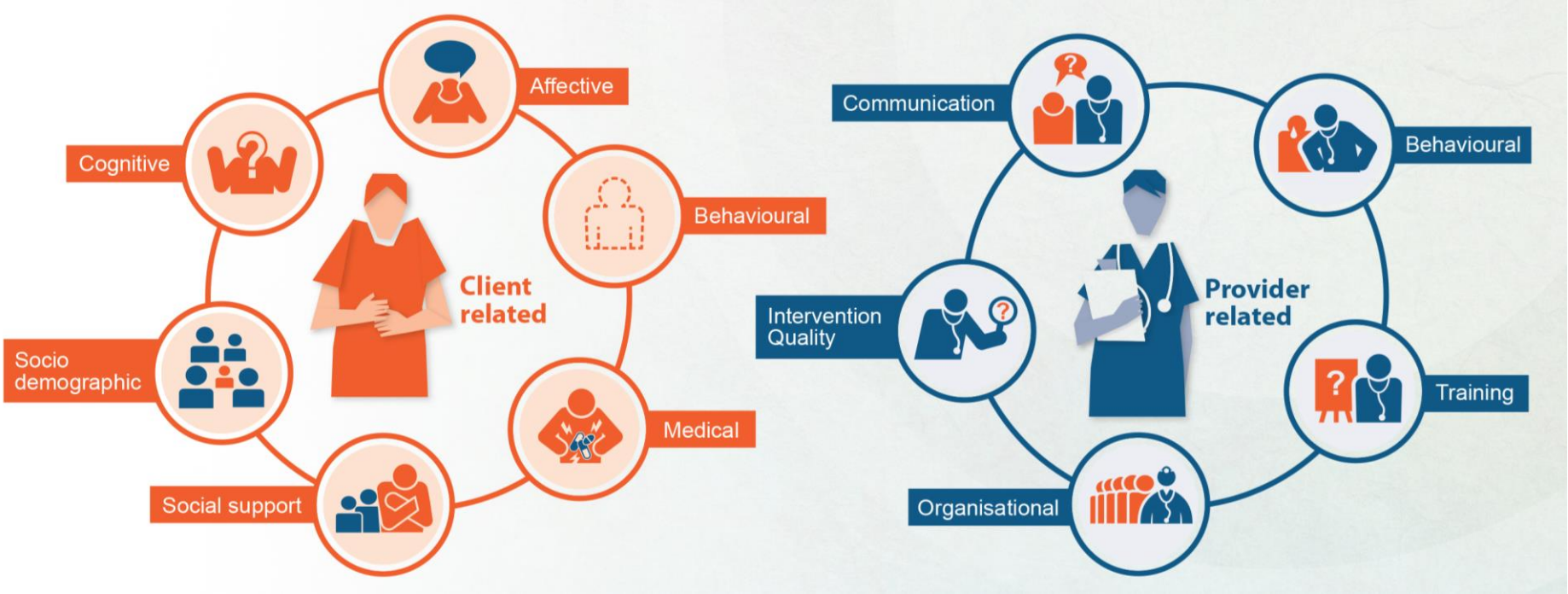
- early / major breakpoints in cascade
- "lowest hanging fruit"

Cascade analysis identifies breakpoints and can direct action to achieve improved programmatic outcomes

Cascade Analysis brings out Barriers to Continuum

- Individuals with medical condition need **continuum of services** for disease control—with each service in the cascade **conditional on having received the previous one**

- But: people experience **barriers** to getting tested, linking to care and starting/adhering to treatment



GROUP WORK P1

Aims:

- Identify and group barriers along an implementation cascade (framework provided)
- Consider interventions which could address certain barriers, and understand which barriers are harder to overcome by a program
- Discuss the possible effects on the flow of persons along the cascade if one specific barrier could be mitigated

Groups:

- Group 1- Diabetes
- Group 2 - HIV treatment
- Group 3 - Tuberculosis
- Group 4 – Hypertension

30 min, report back with flipchart or slides

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Conducting Descriptive Analytics with Cascades

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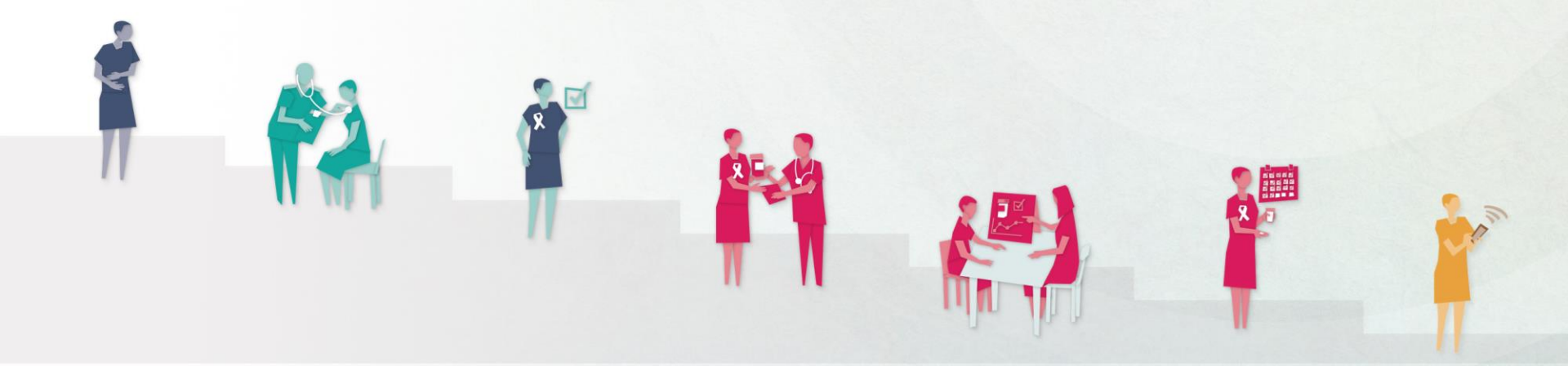
Takeaways from this Session

1. An understanding of how our questions and available data determine the cascade stages we define

2. An understanding of how to define programmatic outcomes in implementation cascade analysis

3. What flows our cascade stages may/may not represent in the pathways of service users



Stages in Cascades

The **result** of what happens between the stages

- Our interest lies in the in-between (implementation)

Exact **definition of stages** data-driven

- Programmatic outcome ("disease control") should be measurable and reported

Screening → Diagnosis → Treatment start → Monitoring → Disease control

Defining the Stages

CONDITION	→ TESTING/ DIAGNOSIS	→ LINKAGE TO CARE	→ TREATMENT	→ DISEASE CONTROL
HIV	**HIV test**	Routine pre-ART care (CD4, symptom management, TB check, IPT screen, FP), education/ counseling	ART	Viral suppression
TB	**First line TB test** (e.g., GenXpert, X-ray), drug sensitivity testing	Symptoms, weight, contact tracing, HIV test, education/ counseling	Drug-sensitive of drug-resistant TB treatment regimens	**Cure** (smear conversion) or **treatment completion**
DIABETES	**Random glucose,** and clinical signs and symptoms	Routine diabetes care (symptom managt, BP, foot screen, weight), education/counseling	Glucose-lowering drugs, also statins, CVD/hypertension prevention	**Random glucose < 8 or HbA1c ≤ 7%**
HYPERTENSION	**Repeat blood pressure** (BP) measurements	Routine hypertension care (symptom management, BP, weight), education/ counseling	BP-lowering drugs, also statins and CVD prevention	**BP < 140/90** (or 120/70–140/80 if diabetes, or <130/80 if CVD, heart failure, kidney disease)

Stages – Indicators – Calculations – Data sources

Example Key populations

Target population size?

Definition of "reached" with service

Size estimation very uncertain

Capturing 2 actions to occur?

Data fragmentation

Mobility, tracability?

Outcome in unmeasured not known

Cascade step		Percentage = Nu	Potential Data Sou
Identify key populations	Number of people in a specific KP group in a given locality (size estimation)	Not applicable	Size estimates of key populations in specific areas
Reach key populations	Number and percentage of individual KPs reached by community outreach workers or through other programming	**Numerator:** Number of individual, specific KPs reached by community outreach workers or through other programming **Denominator:** Number of people in a specific KP group estimated in a given locality (size estimation from previous indicator)	Databases of organizations providing outreach, e.g., community-based KP organizations
Test key populations		**Numerator:** Number of KPs who received HTC and their test results **Denominator:** Number of KPs reached by community outreach workers or through other programming	Databases o s, e.g., community and hospitals
Diagnose PLHIV	Number and percentage of KPs who received HIV-positive test results and post-test counseling	**Numerator:** Number of KPs who received HIV-positive test results and post-test counseling **Denominator:** Number of KPs who received HTC and their test results	Databases of organizations providing HIV testing services, e.g., community-based KP organizations, government clinics and hospitals
Enroll in care	Number and percentage of HIV-positive KPs enrolled in clinical care	**Numerator:** Number of HIV-positive KPs enrolled in clinical care (including pre-ART and ART) **Denominator:** Number of KPs who received HIV-positive test results and post-test counseling	Databases of community-based KP organizations and/or government clinics, hospitals
Initiate ART		**Numerator:** Number of HIV-positive KPs enrolled on ART in accordance with nationally approved protocol or WHO standards **D** rolled in clinical care	Local and national ARV client databases
Sustain on ART	Number and percentage of HIV-positive KPs known to be alive and on treatment 12 months after initiation of ART	**N** n to be alive and on treatment 12 months after i **D** eiving ART in accordance with nationally approved protocol or WHO ds	Local and national ARV client databases
Suppress viral load	Number and percentage of HIV-positive KPs on ART tested with suppressed viral load (<1000 copies/ml)	**Numerator:** Number of HIV-positive KPs on ART tested with suppressed viral load (<1000 copies/ml) **Denominator:** Number of HIV-positive KPs known to be alive and on treatment 12 months after initiation of ART	Local and national ARV client databases

https://www.fhi360.org/sites/default/files/media/documents/linkages-hiv-cascade-framework-oct15.pdf

Integrating Time Dimension in Stages

Timeliness directly links to service quality

- WHO framework on people-centered services

Delayed delivery of a service often negative consequences

- Health loss, disease transmission, complications, costs

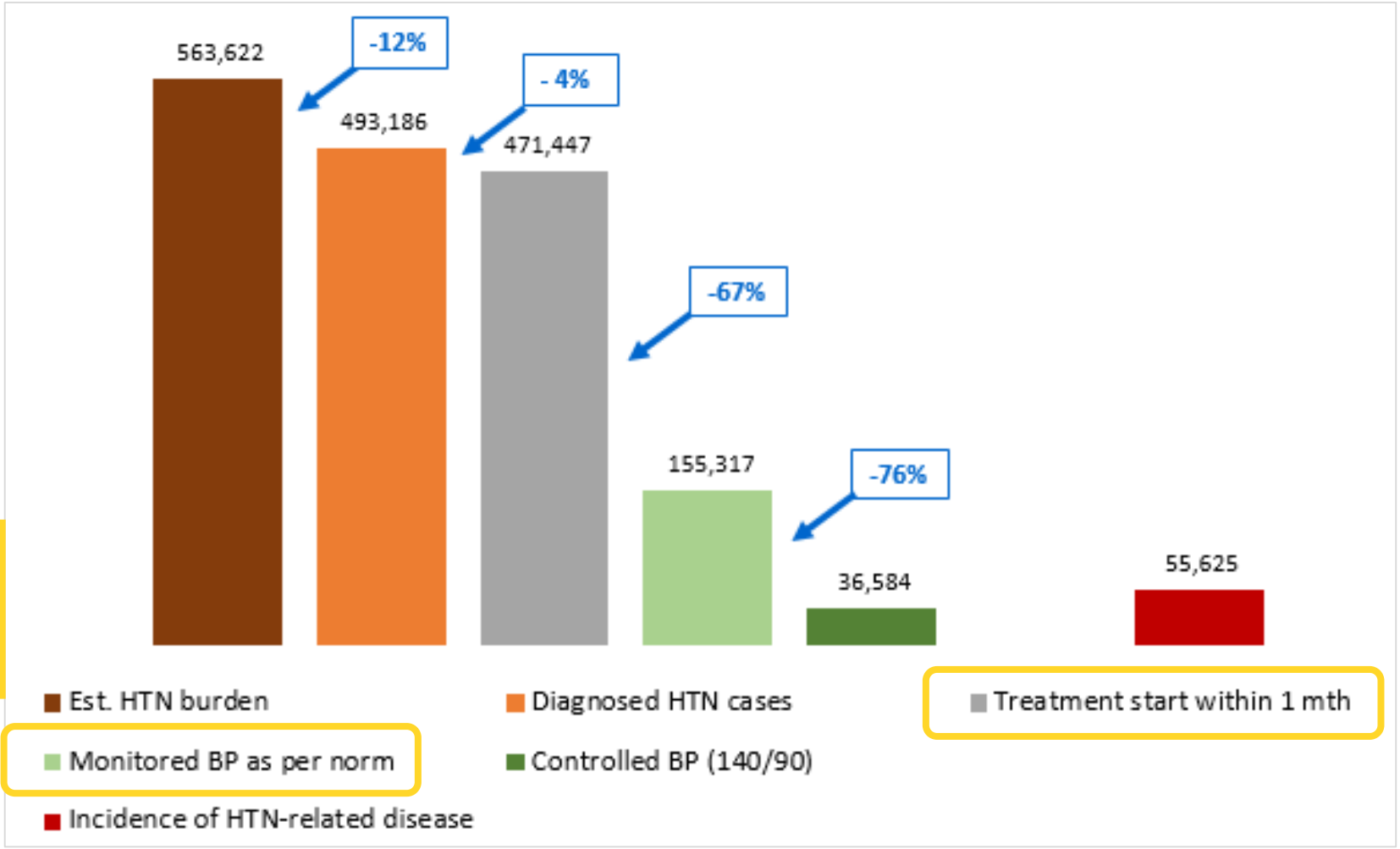
Express in cascade whether service was delivered **within the norm**

- Norms may vary by level of care

Define **time-sensitive stages:**

- % with **confirmatory test** within 1 week of positive screen
- % **linked to specialist care** after GP referral
- % initiated **treatment** within 3 days of receipt of lab result (MDR-TB)
- % starting treatment within 1 month of decision to treat (cancer)
- % **re-tested** BP within 1 week of having elevated BP result <u>or</u> within 6 months if normotensive (HTN)

Applying timeliness criteria to Treatment start and Monitoring intervals: Ukraine example



Interval results-dependent

Includes adults aged 18+ in Lviv Oblast. Incidence of HTN-related disease includes hypertensive disease, hypertension-related coronary heart disease/cerebrovascular disease/stroke, and acute myocardial infarction. Source: Lviv Region 2016 annual form #12 statistics, Lviv Cardiology 2016 screening campaign report, patient form 025 extract, demographic statistics

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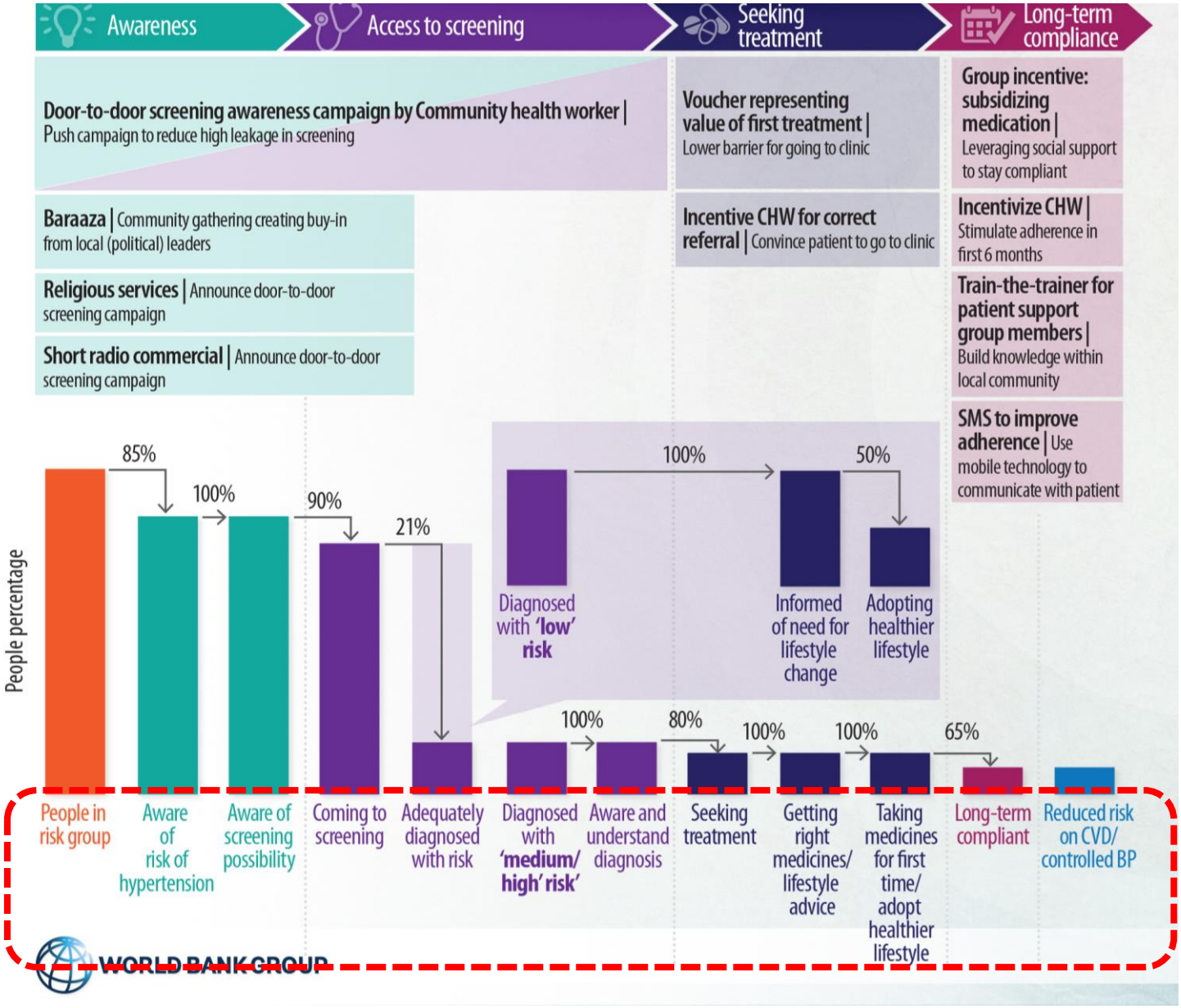
Define stages which are meaningful to ***full engagement process*** required (risk awareness, awareness of service, ….)



Hypertension/CDV model **in Nairobi slums**

- Integrates public health and private sector approaches
- Includes components that aim to improve community awareness:
  - a home-based screening service
  - patient and provider incentives to seek and deliver treatment specifically for hypertension
  - adherence support

Based on Steven van de Vijver et al.2013. Scale-up Study, Nairobi. https://www.researchgate.net/publication/258030576/figure/fig1/AS:216501727567893@1428629442691/Cascade-of-care-for-hypertension-and-CVD-risk-reduction.png

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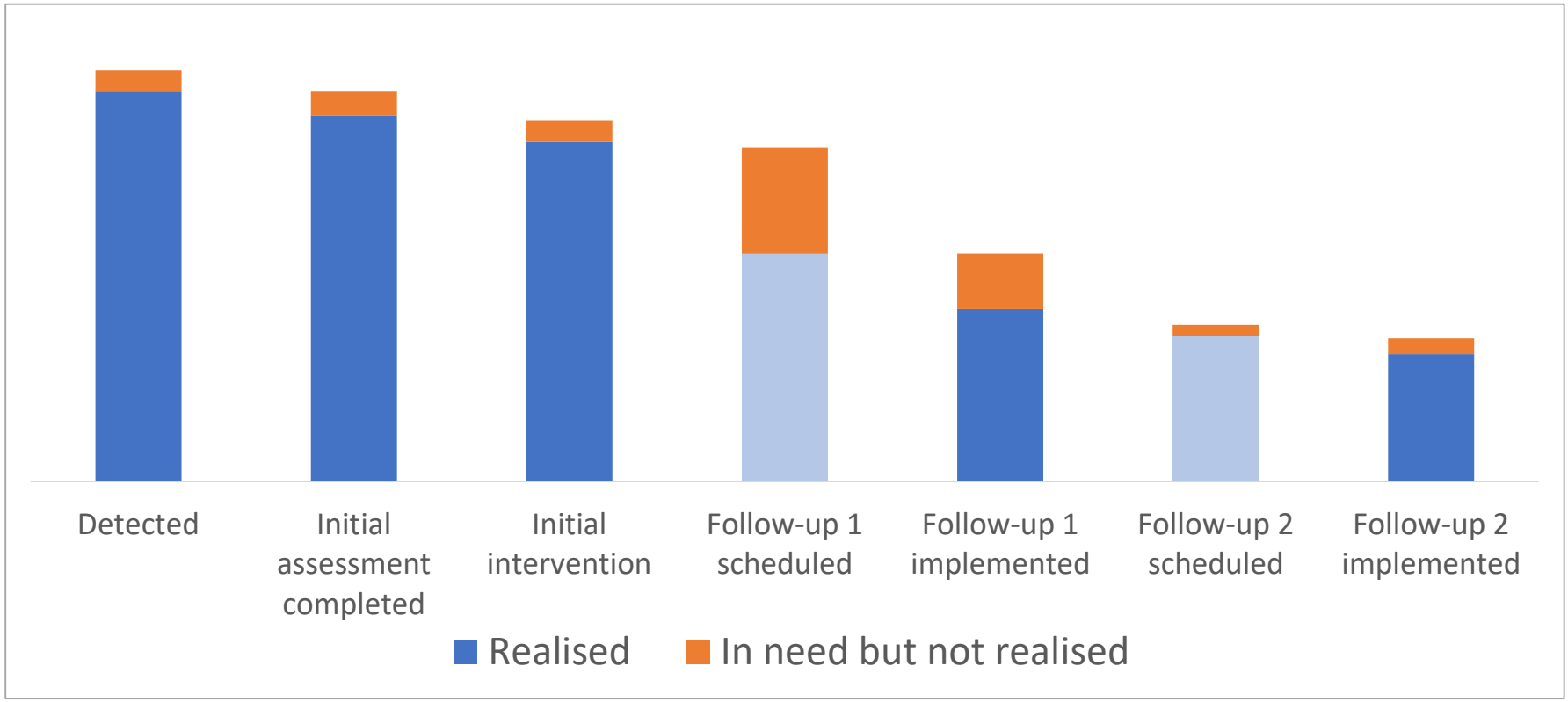
Break down service delivery into all necessary steps

- Cascade of care for individuals with a common mental disorder
- Overall, 62% of all episodes have no follow-up 2 implemented although required
- Lack of *follow-up 1 planning* responsible for largest breakpoint
- ➢ **Must focus on early retention in care**

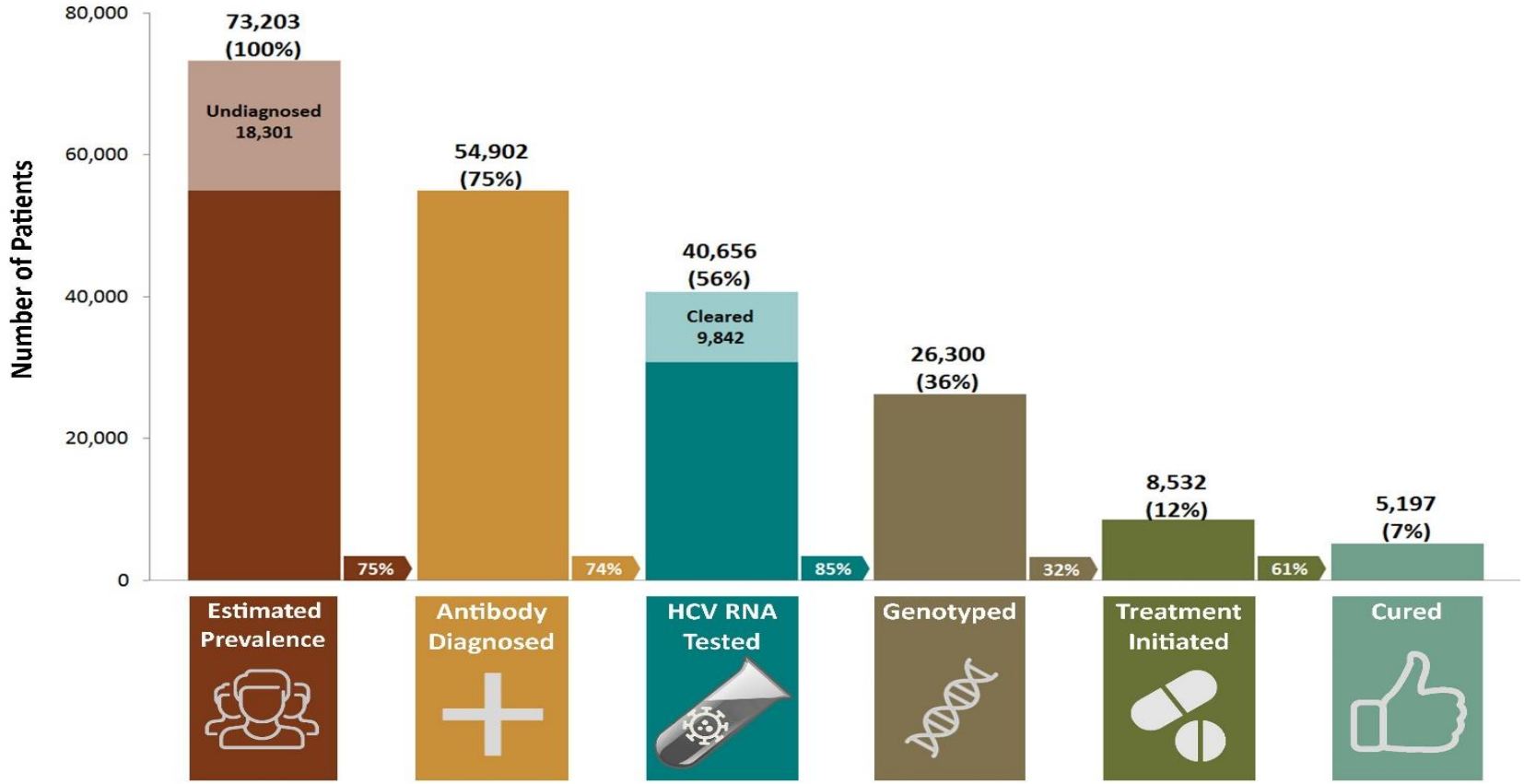


Source: Lessard et al. 2015 Continuum of care for persons with common mental health disorders in Nunavik. Int J Circumpolar Health 2015, 74: 27186

If diagnosis multi-stage, it may need to be represented

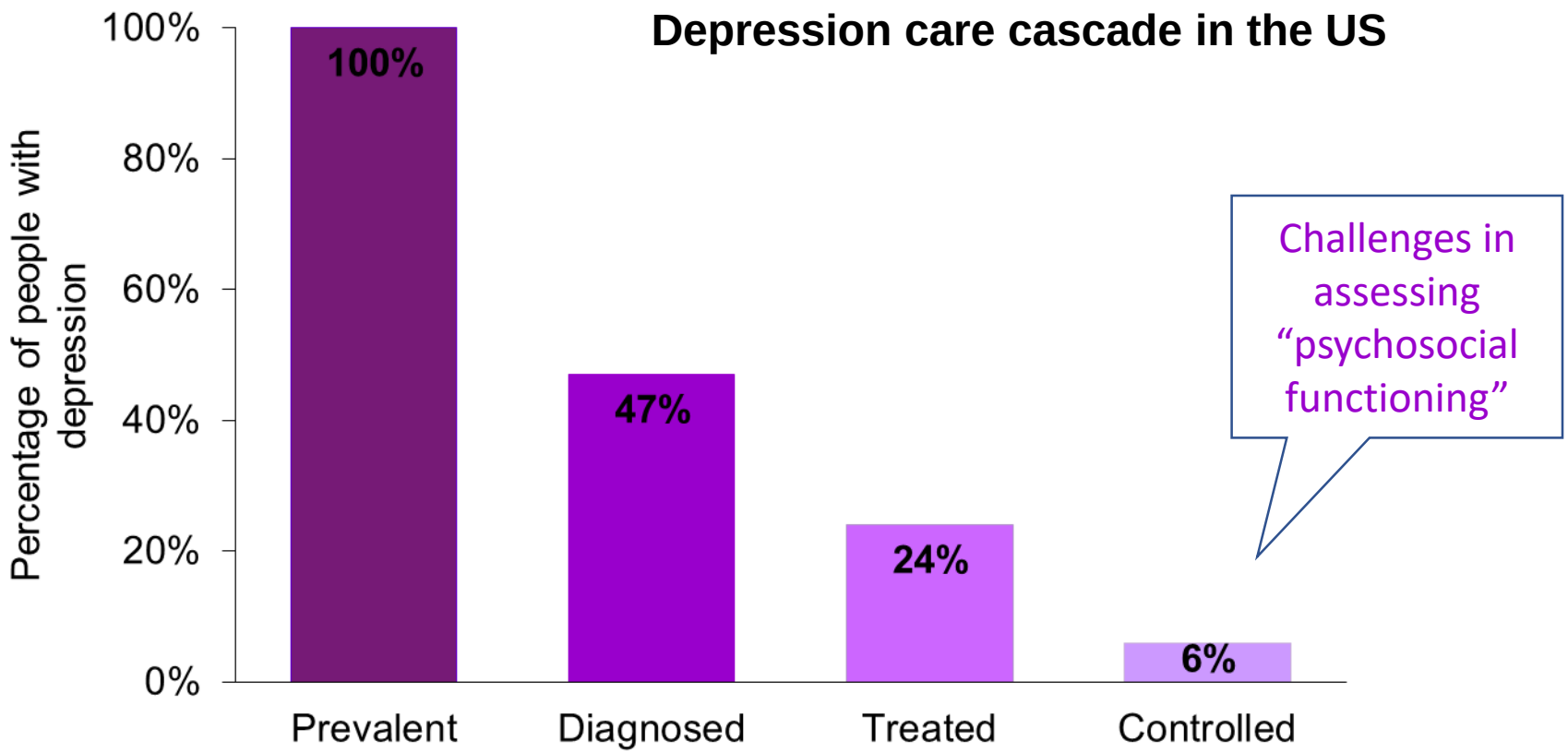
Hepatitis C treatment cascade (British Columbia, 2012)

- Major breakpoints at anti-HCV+, HCV RNA tested, genotyped



http://www.catie.ca/sites/default/files/hcv-cascade-of-care.jpg

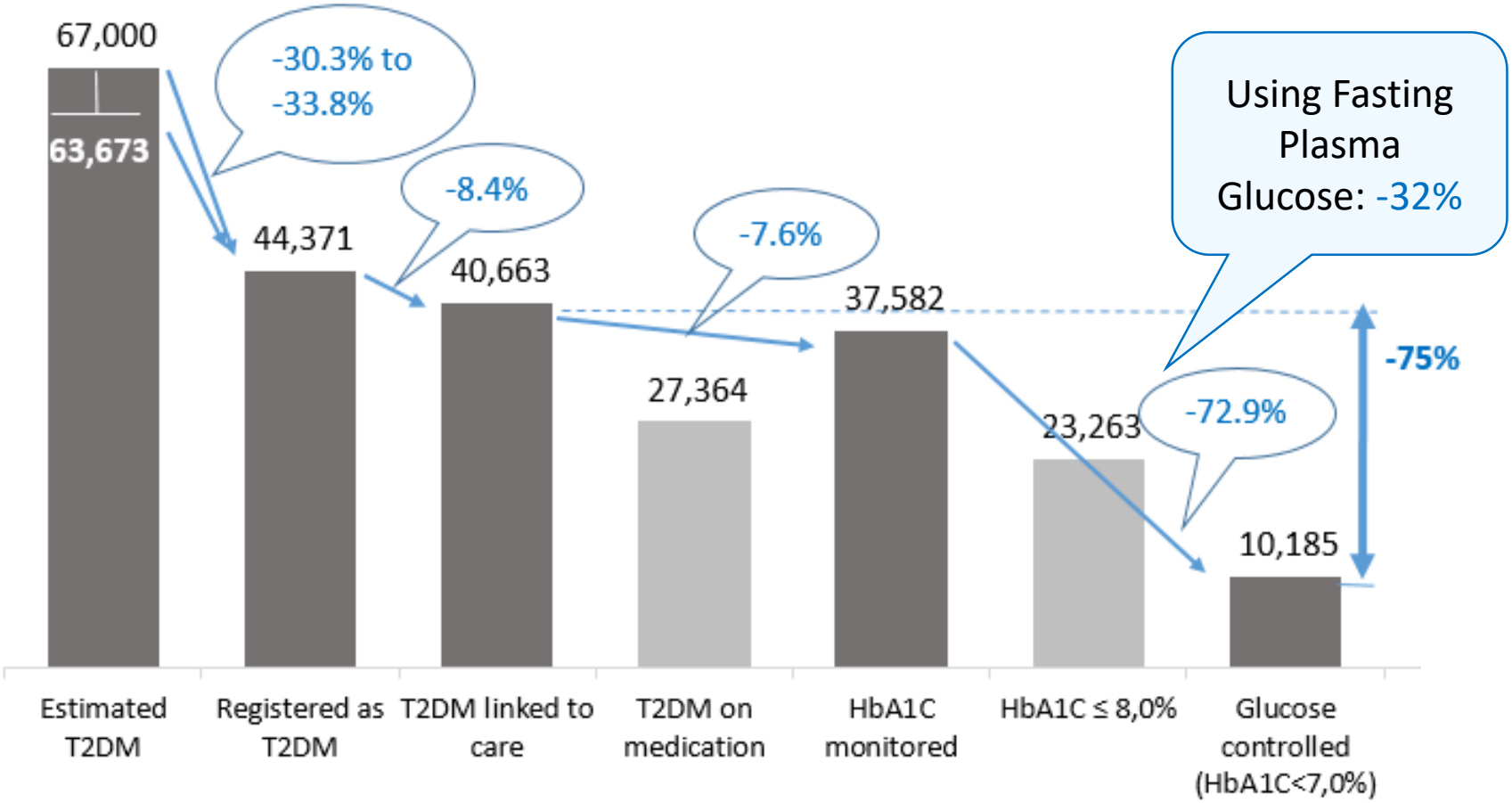
Disease outcome stage may be complex to measure



Source: Pence et al. Curr Psychiatry Rep 2012

Disease outcome stage may depend on how we measure

Poltava type-2 diabetes program



Sources: Poltava Region Diabetes statistics 2016 and annual form #12 statistics, Poltava 2016 diabetes campaign summary, Demographic statistics

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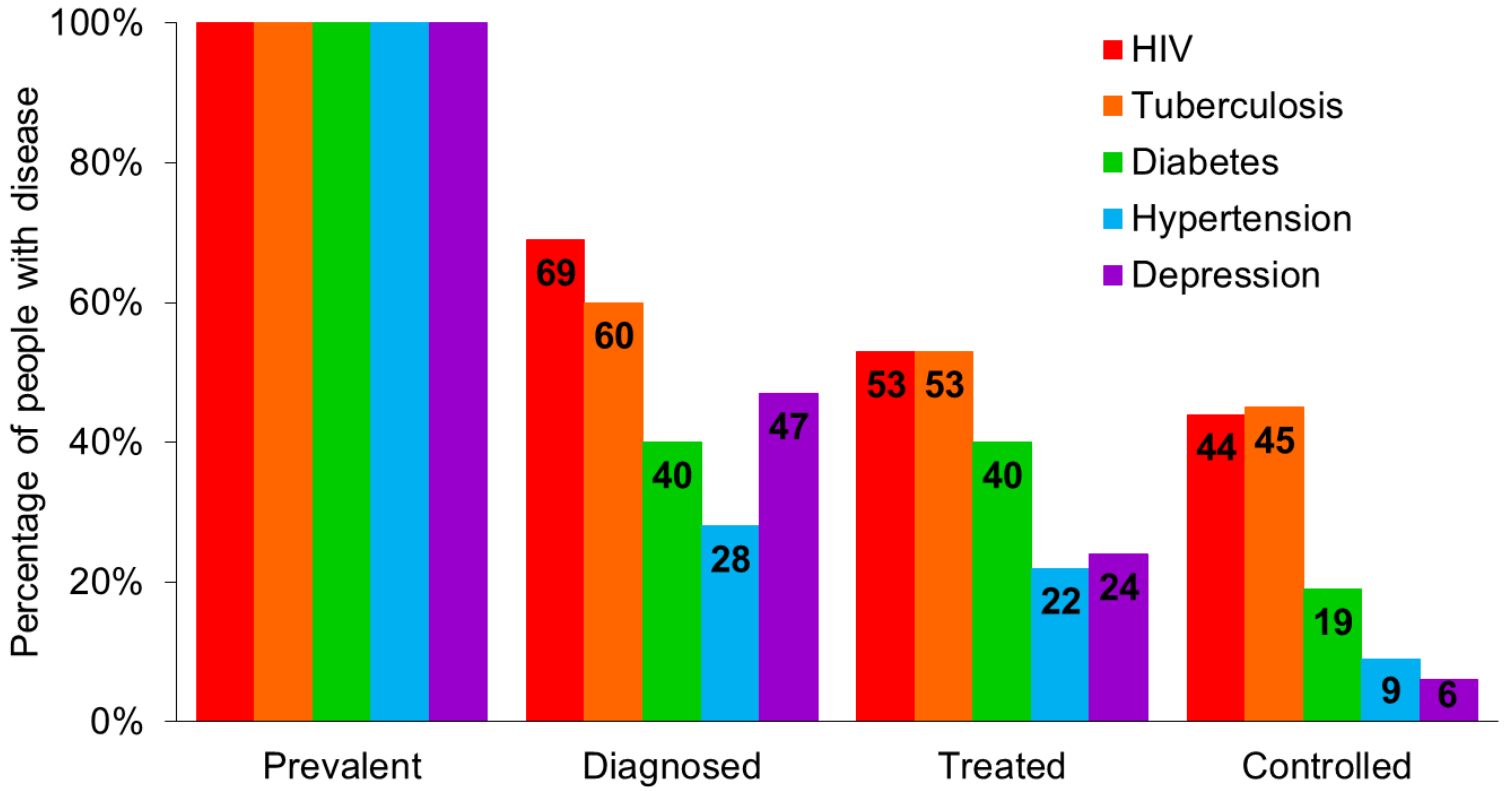
Using common stages allows comparison across programs

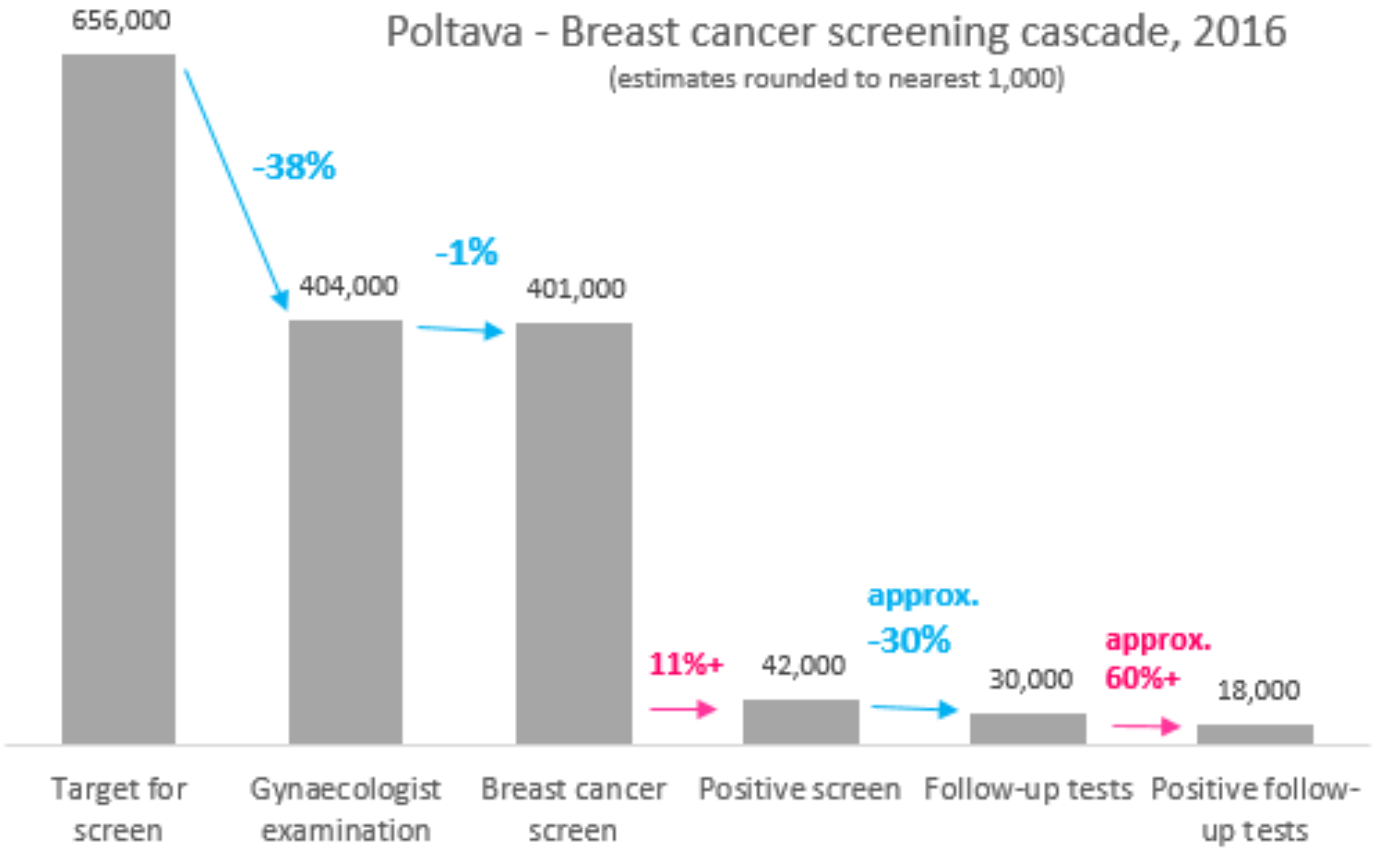
- Outcomes across chronic care services
- May highlight needs in integration of chronic care services



Source: Hyle et al. 2018 (IAC 2018, presentation on syndemics)

Treating screening and treatment stages separately

Screening



Sources: Poltava demographic statistics, Health Index 2016 (gynaecologist exam), ambulatory care data from women's consultation units form 025

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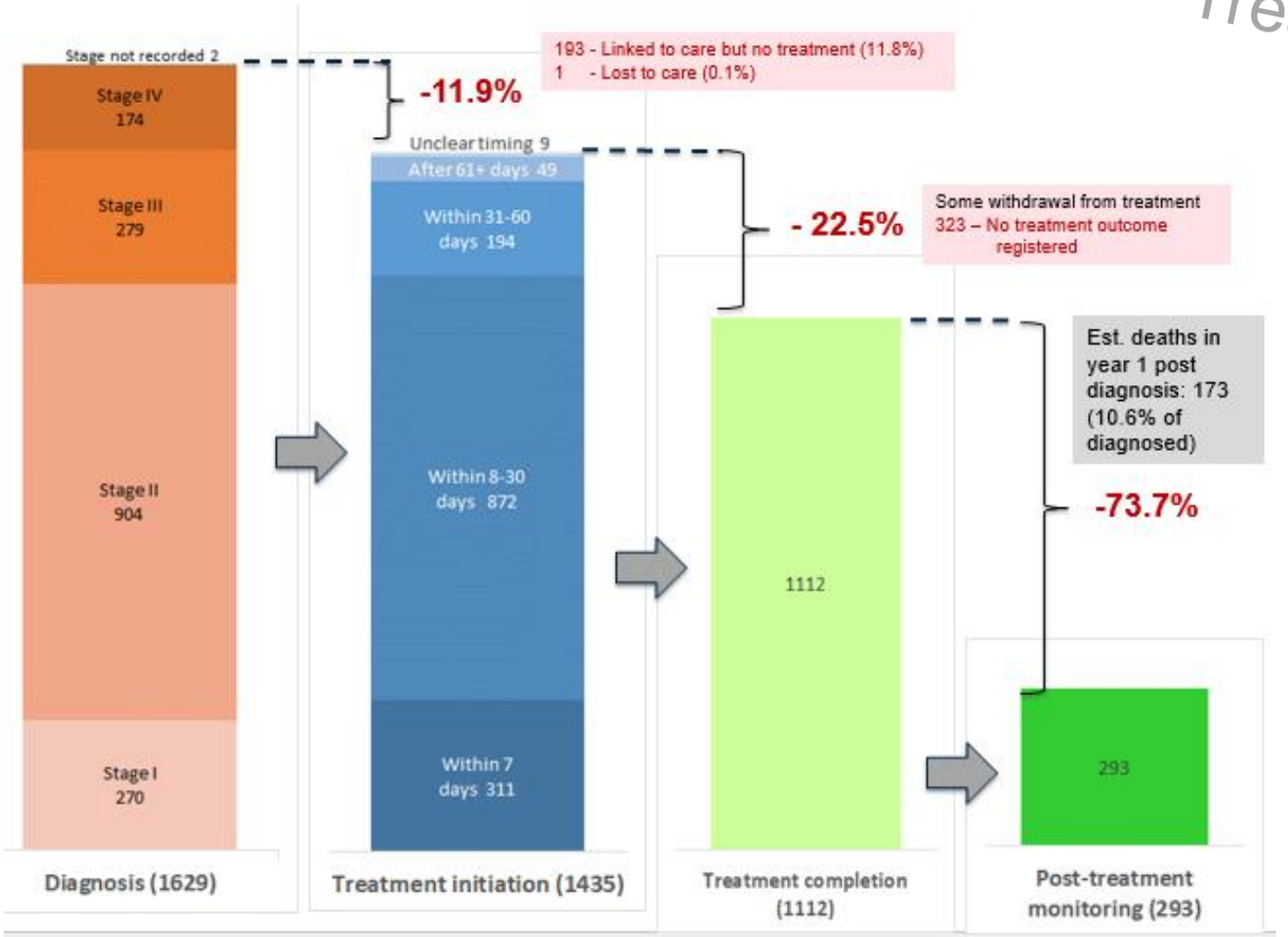
Treating screening and treatment stages separately

Poltava - Breast cancer treatment cascade

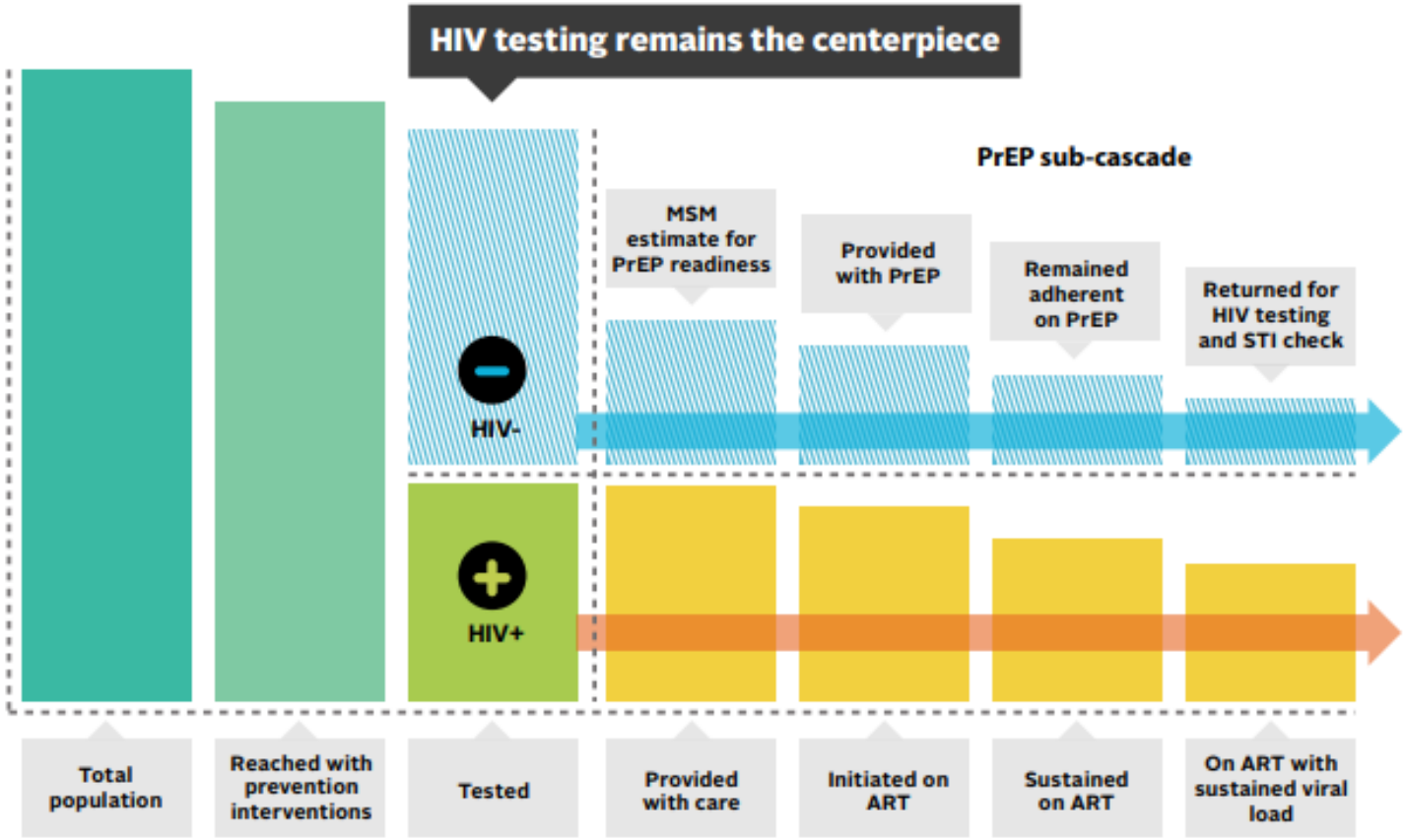
Treatment



Sources: Poltava demographic statistics, Health Index 2016 (gynaecologist exam), ambulatory care data from women's consultation units form 025

Combining HIV prevention and treatment

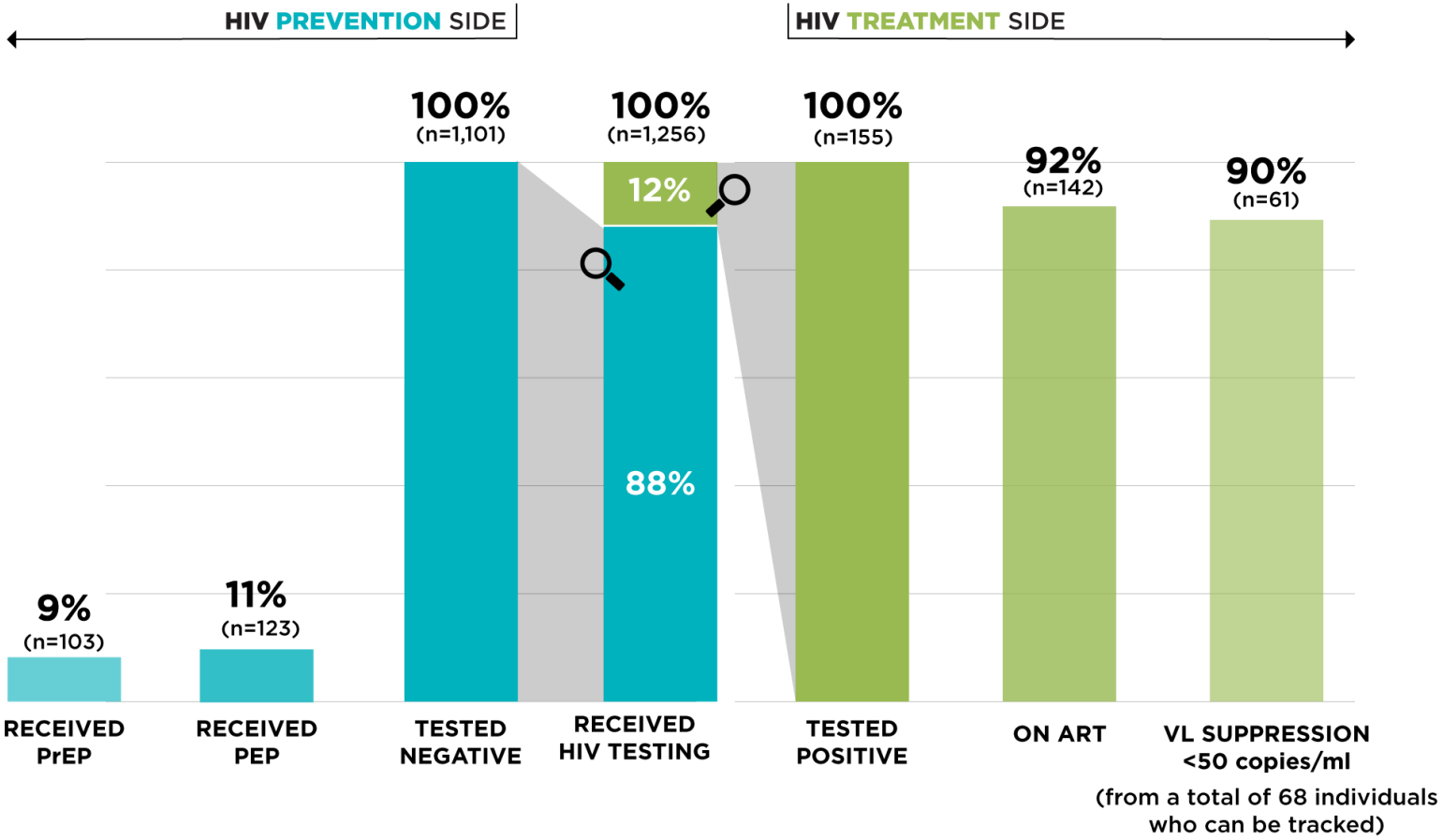
PrEP and ART implementation cascades in MSM



https://www.fhi360.org/sites/default/files/media/documents/linkages-hiv-cascade-framework-oct15.pdf

Combining HIV prevention and treatment

Thailand "double-sided" HIV cascade (key population)

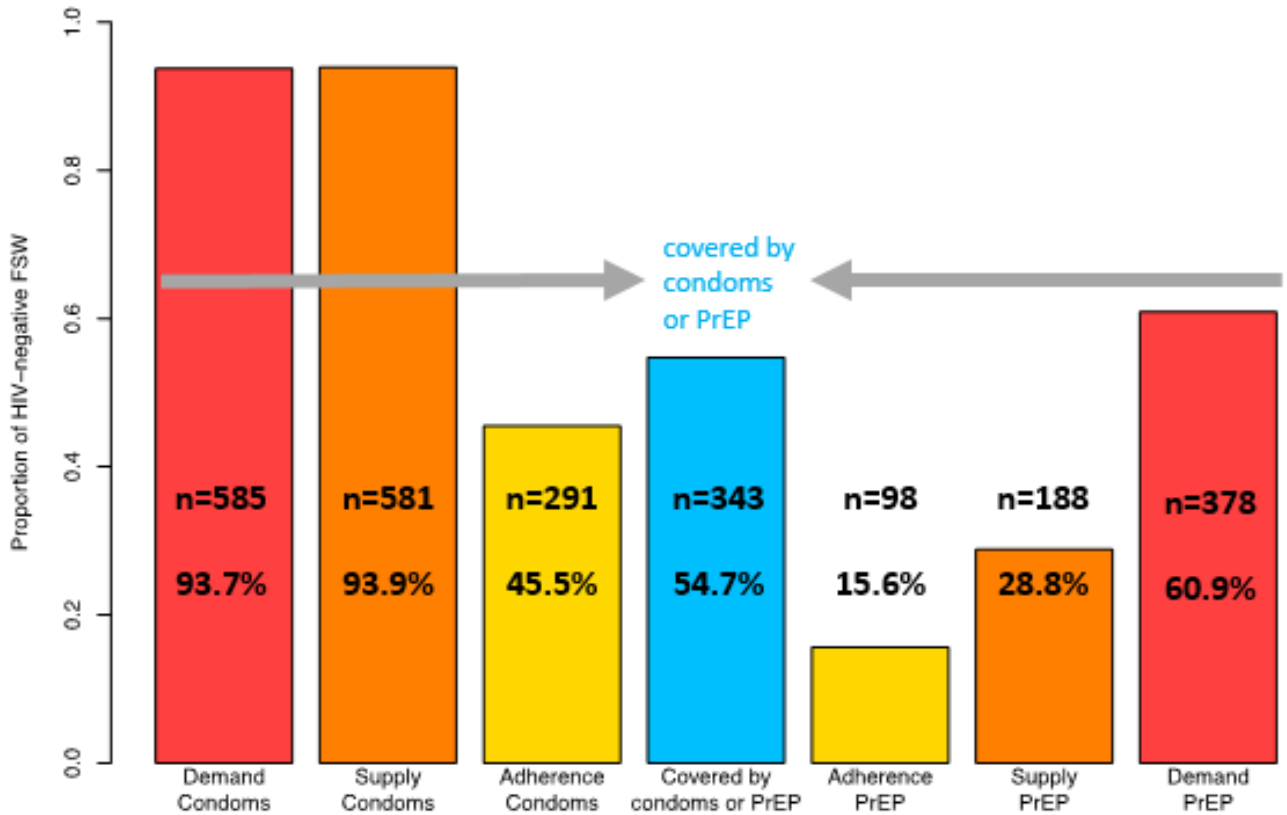


Source: Phanupak et al 2018 IAC presentation

Reflecting on Prevention Cascades…

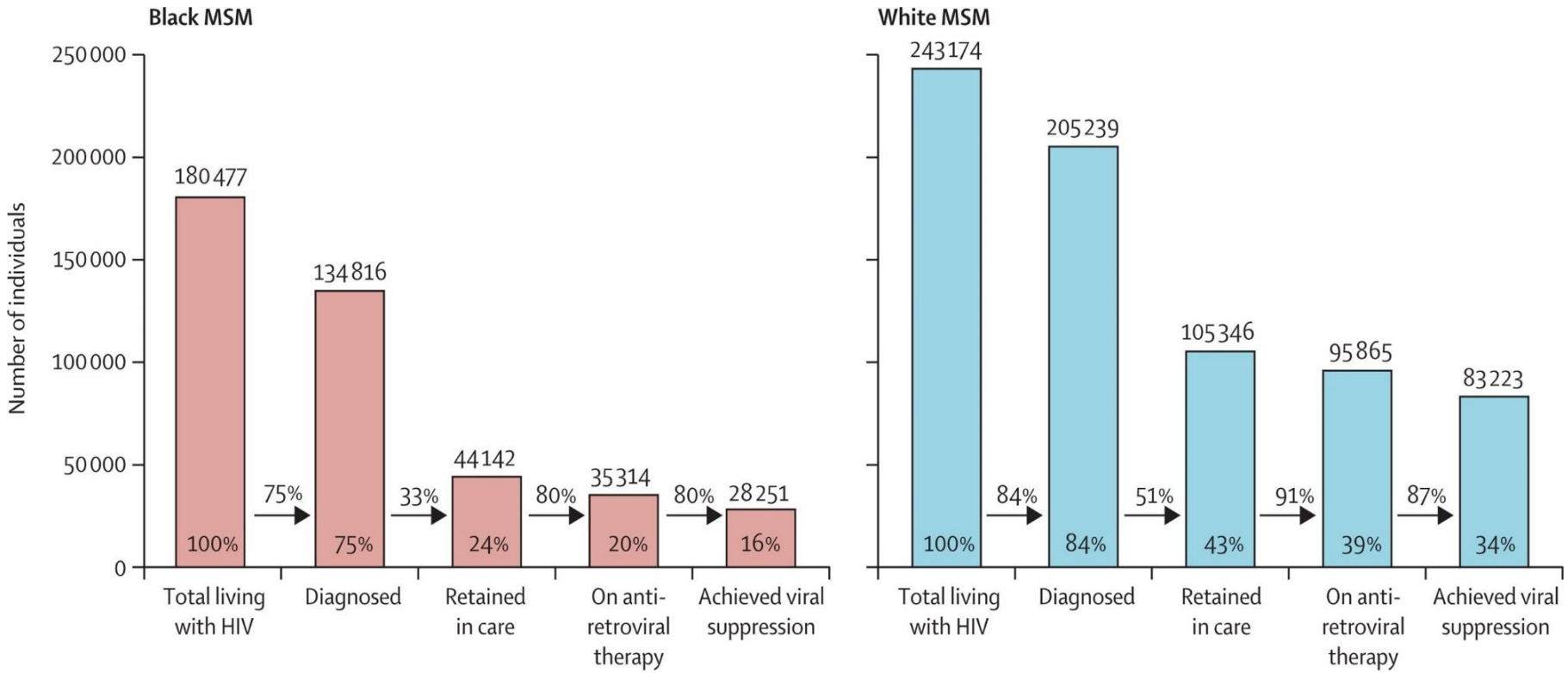
[AUDIENCE PARTICIPATION]

What can we learn from this Prevention Implementation Cascade amongst HIV-negative FSW? What are the limitations?



Heterogeneity by population and place

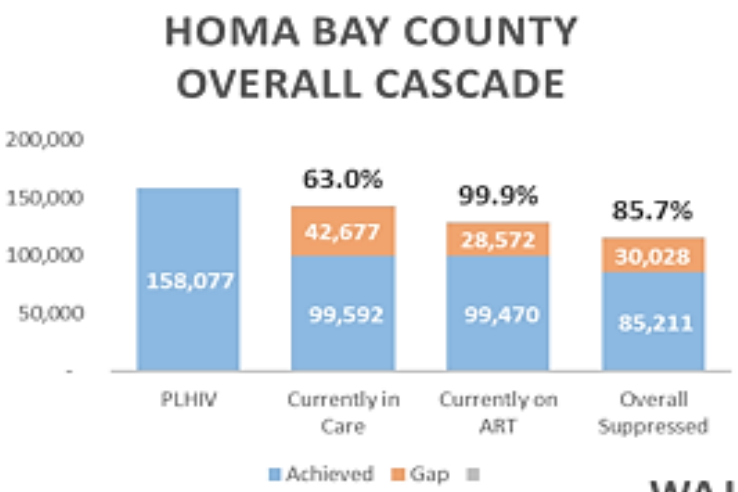
Implementation of HIV treatment with racial disparities at each stage

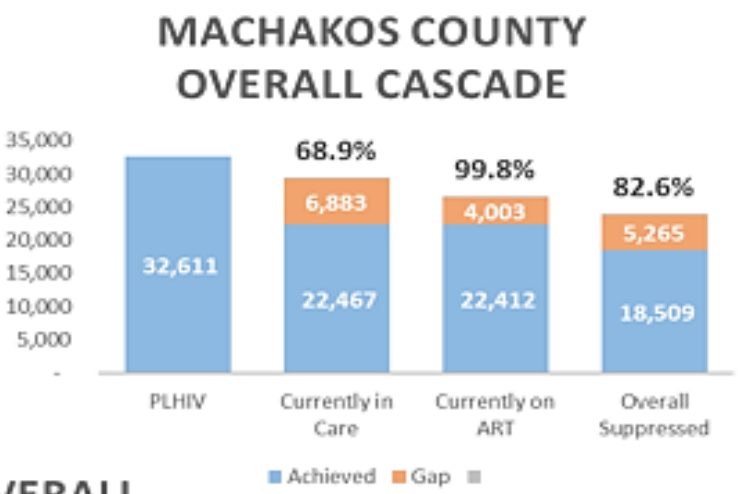


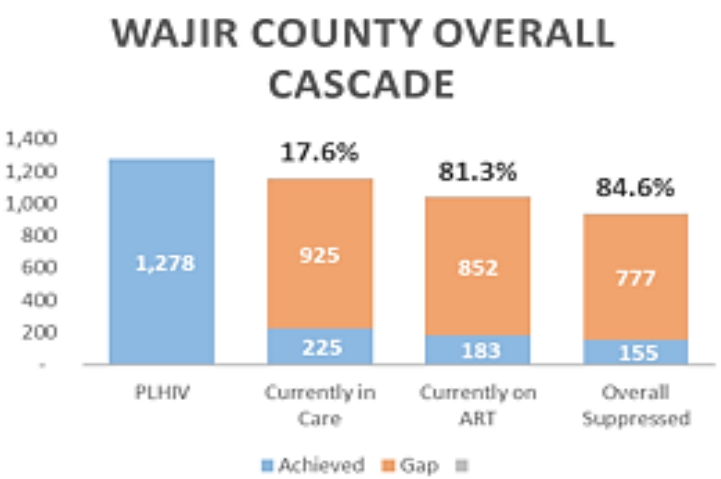
Rosenberg et al., 2014

Heterogeneity by population and place

Differential ART program implementation in three Kenya settings





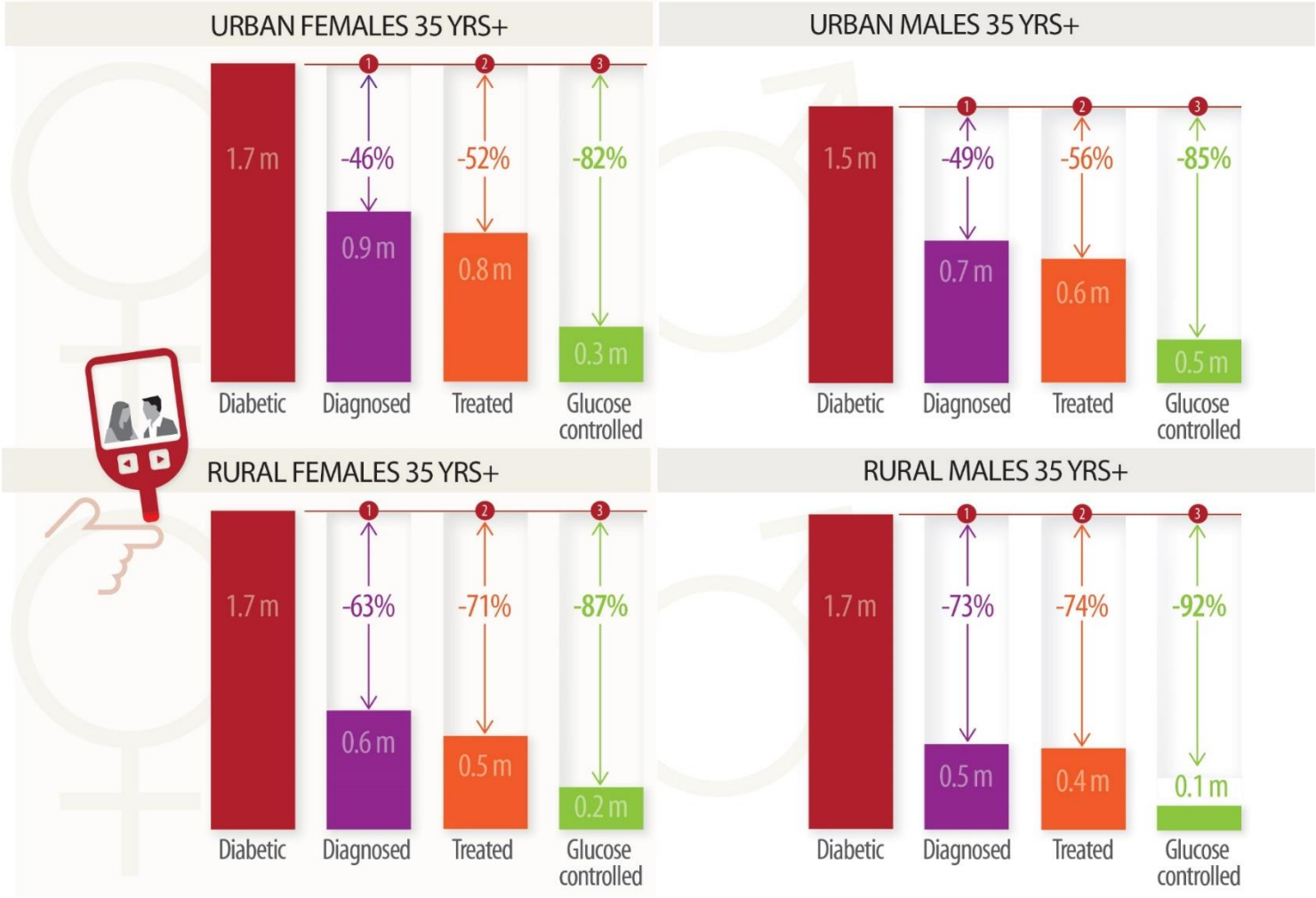


Kenya ACT Dashboard, 2017

Source: Wamicwe 2018 IAC

Heterogeneity by population and place

Population-level diabetes cascades Bangladesh



Pre-hypertensive = 120-139 SBP or 80-89 DSP; Hypertensive 140+ SBP or 90+ DBP
Source: World Bank analysis, using Rahman et al. 2017, BDHS 2011, 2016 UN population est.

Transitions in Cascades

- Service **implementation** leads to transitions between stages
- Barriers leads to **exit**, facilitators lead to **entry/re-entry**
- Each service affects the **flow of people** through the cascade ("flow rate"):
  - *It can also bringing people back into cascade*
- The more we understand the **movements between stages**, the better we can optimize service implementation

Screening → Diagnosis → Treatment start → Monitoring → Disease control

Flows between Cascade Stages

- Each service/intervention impacts on one or more cascade stages
- Flow of individuals through cascade
  - natural (e.g., through treatment eligibility), or
  - due to changes (e.g., funding allocations)
- Flow = sum of all services at cascade stage
- Flows restricted by low intervention coverage/low funding
- Conceptually, individual might only be able to benefit from one service per cascade stage
- Individual can only initiate their respective line of “treatment” (if treatment coverage allows)

Services can impact more than one Cascade Stage

Example: Testing modalities

Can have additional effects at later stages beyond diagnosis itself

- On laboratory monitoring compliance
- On treatment adherence

Example: Counselling/education intervention

Can influence behaviors 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..."*

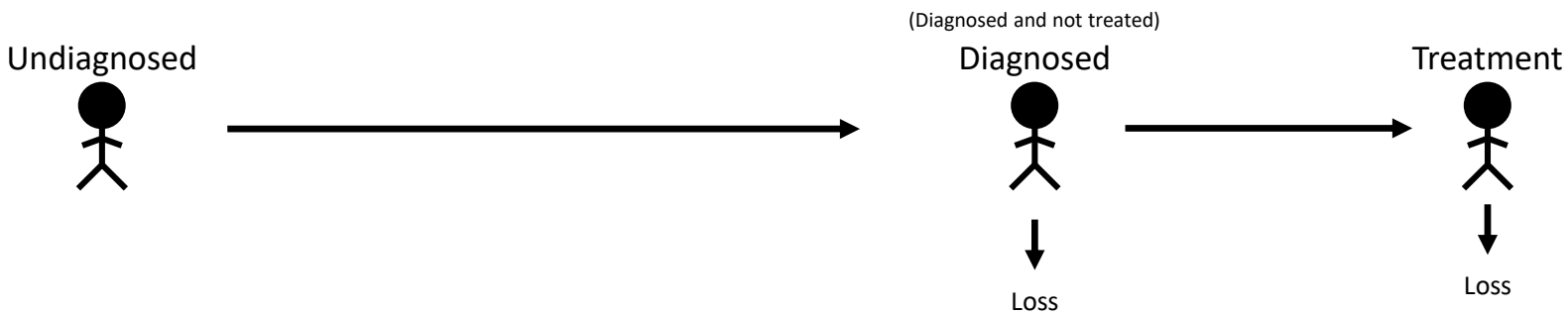
Key informant, Limpopo Province, South Africa

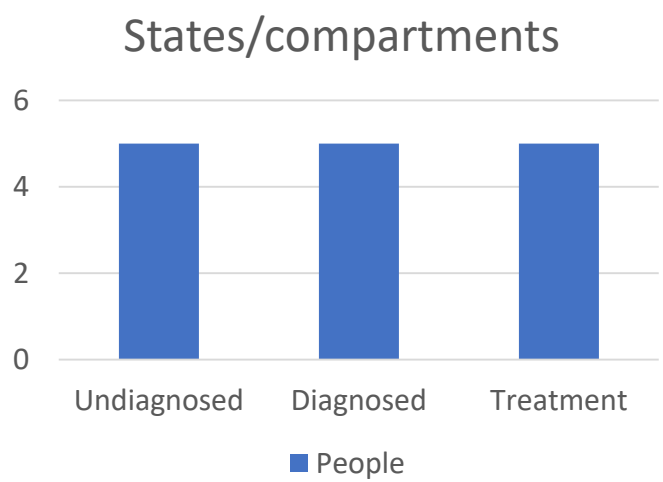
Summary

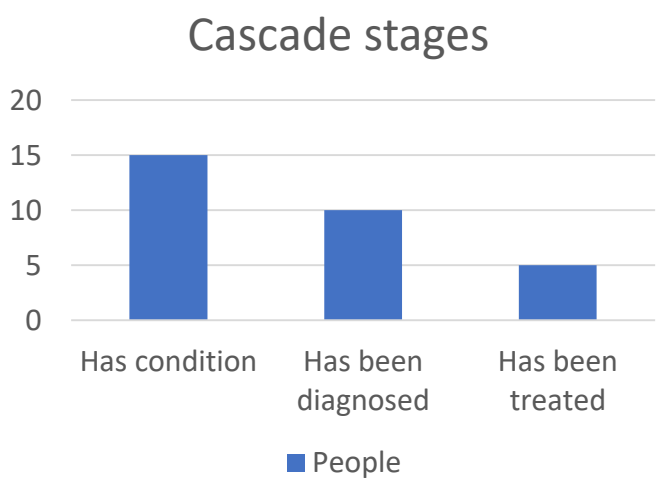
- Defining the stages
- Capturing the full engagement sequence
- Integrating “timing” of implementation of a service
- Measuring outcomes
- Separation of screening and treatment continua
- Meaningful cascade designs
- Differentials across populations, places
- Transitions between stages

Step 1 – Decide states for individuals

- **An individual can only be in one state at any given time**







Step 1 – Decide states for individuals

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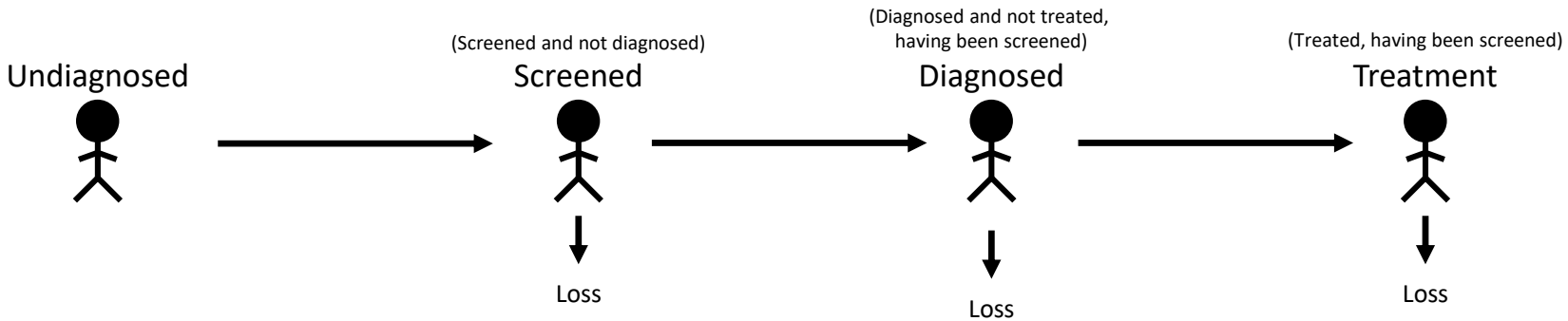

Step 1 – Decide states for individuals

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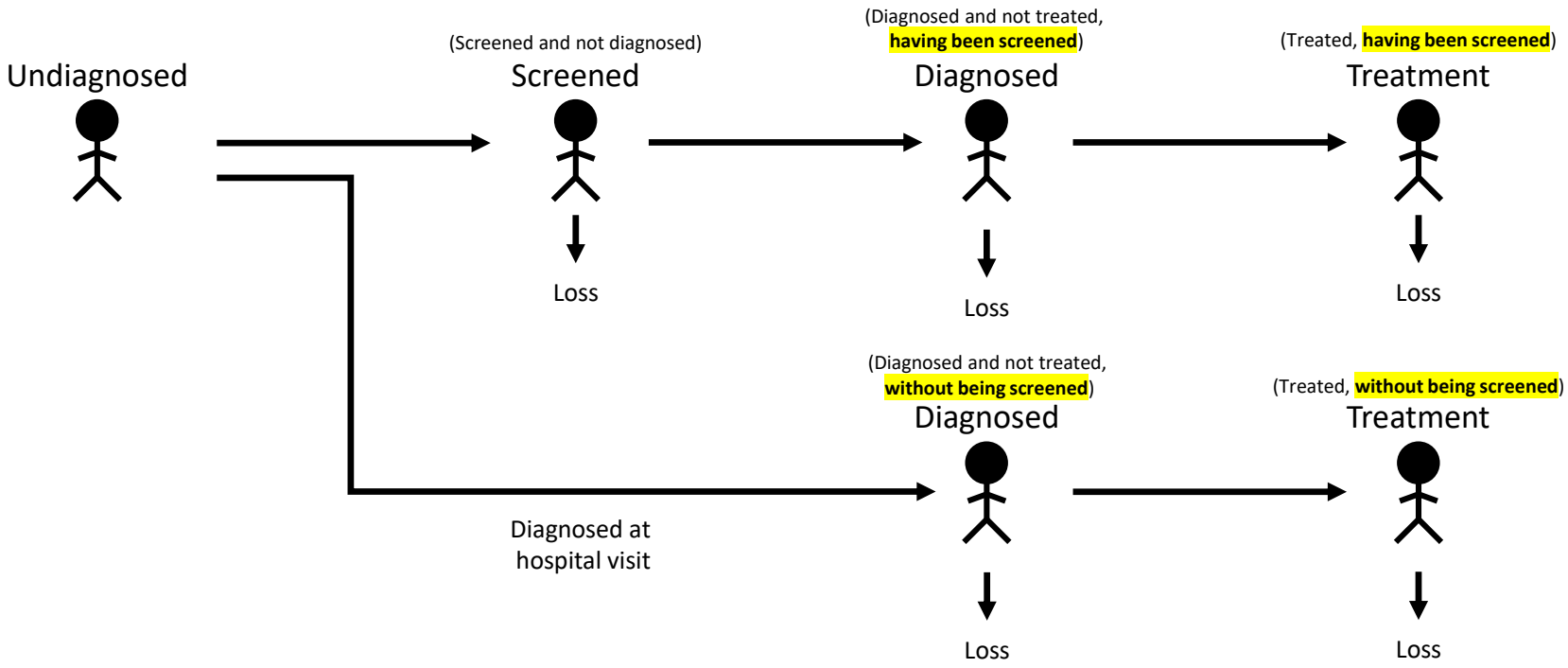
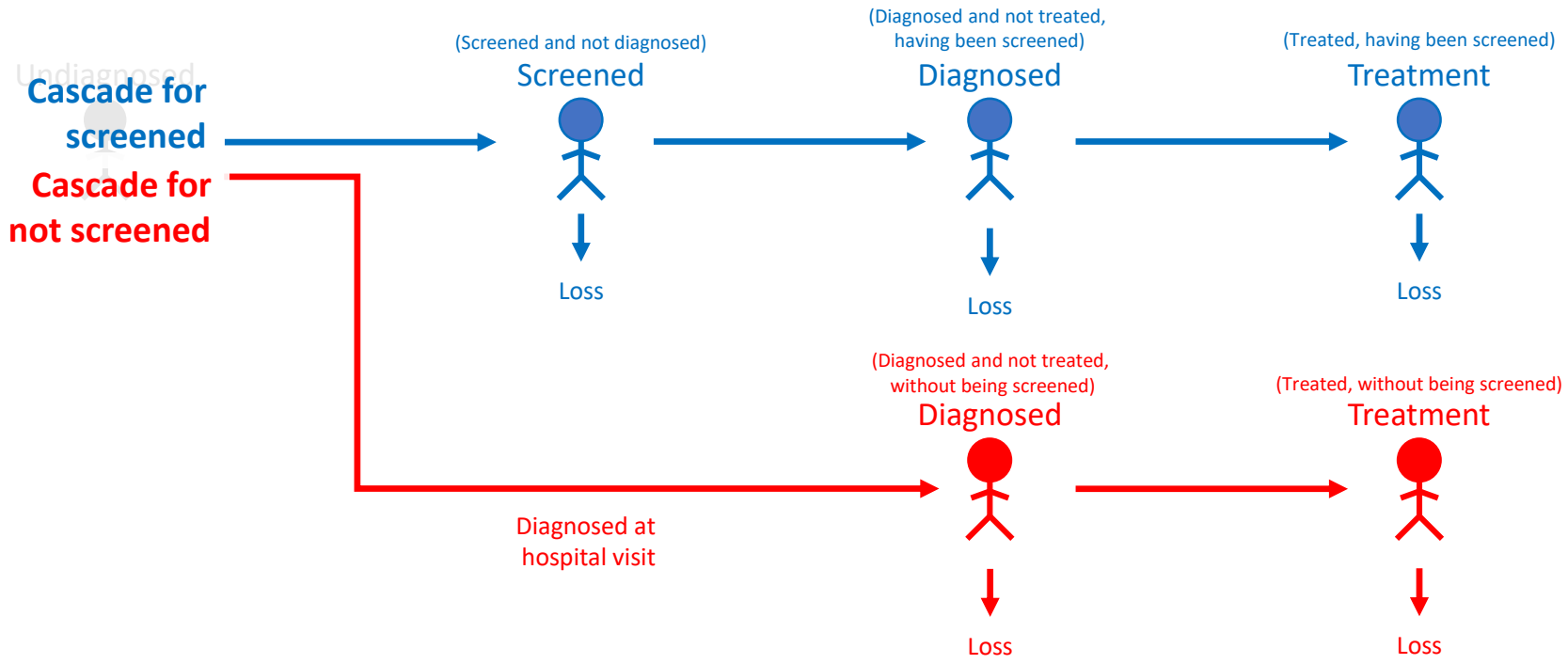
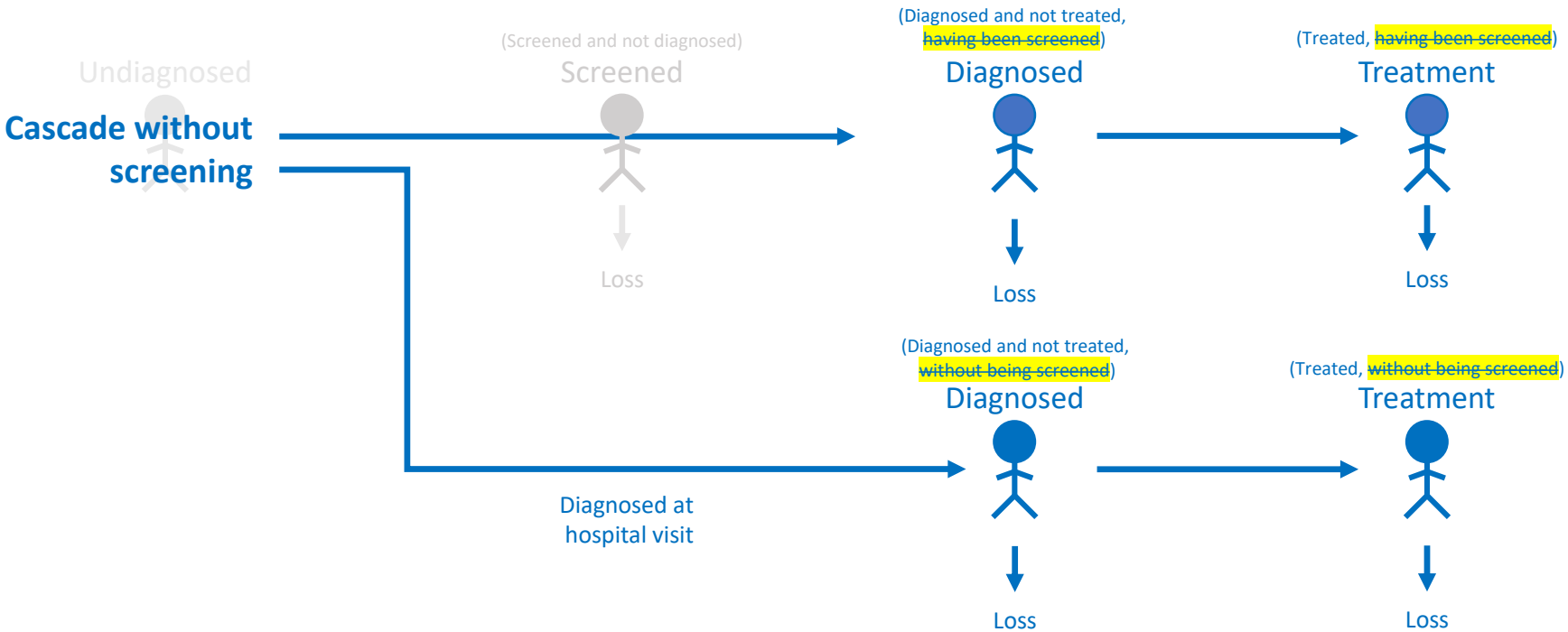


Step 2 – Form cascade from single path



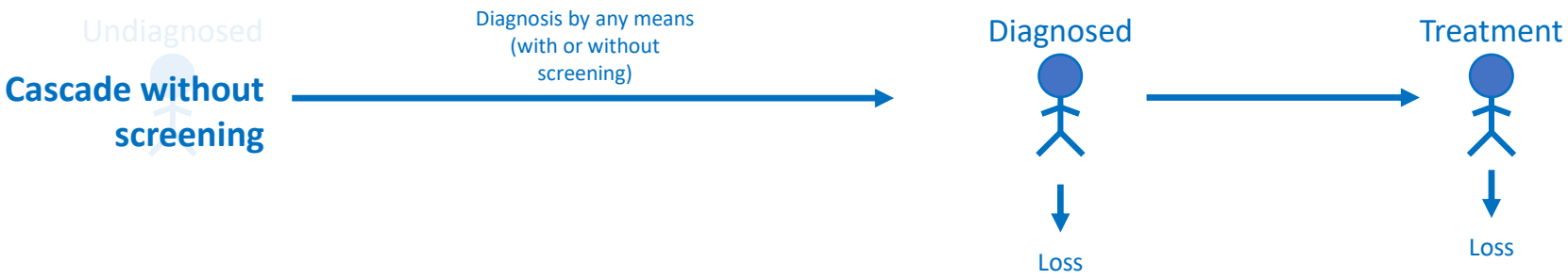
Step 2 – Can also group states ignoring history…



Grouping the diagnosed/treated across screening states means we can no longer include the screened state

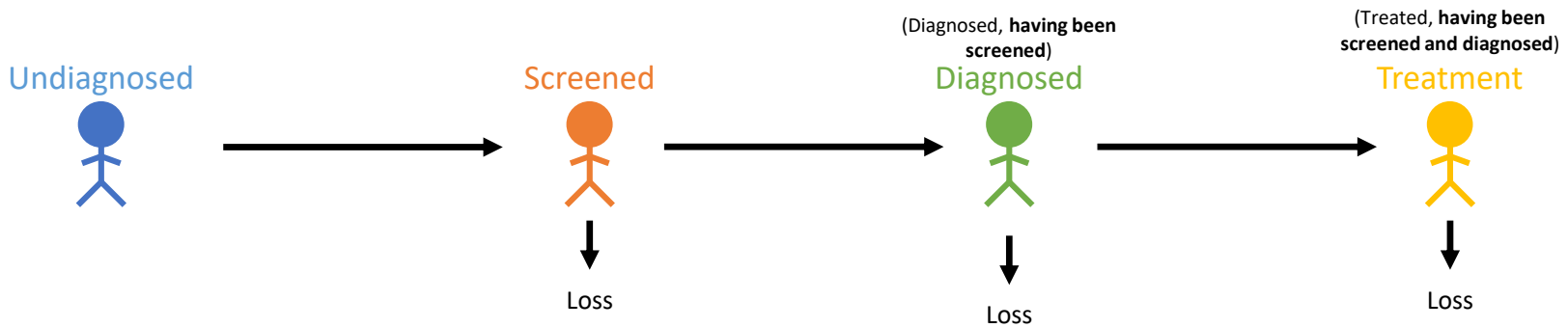
P2 Introduction: Compartments to Cascades

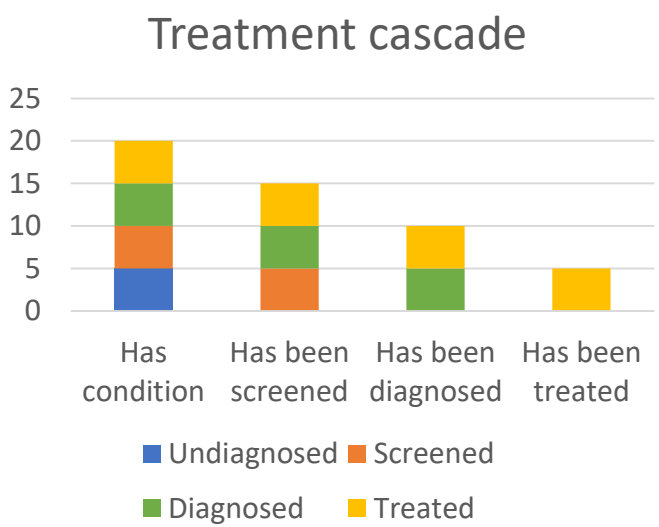
…which is identical to having a single path

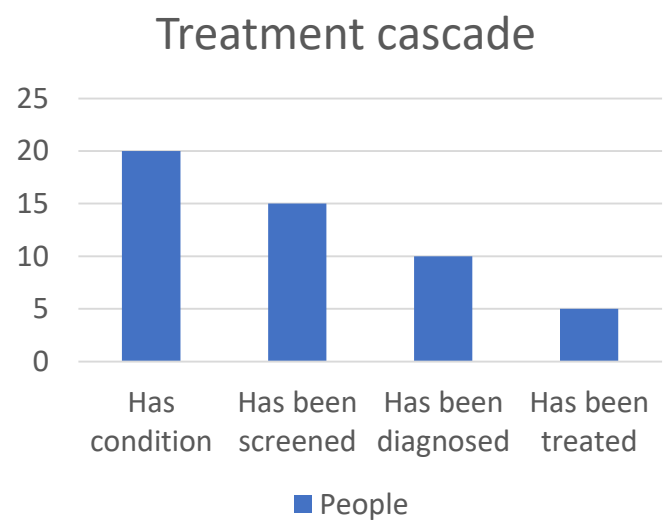


Step 3 – Construct cascade

It can be easiest to construct the cascade in reverse, starting at the final compartment and working backwards







States/compartments **are mutually exclusive, but** ***cascade stages*** **are not**
Every cascade stage includes the one that appears after it

GROUP WORK P2

Aims:

- Constructing a cascade
- Constructing a continuum

Groups:

- Group 1- Diabetes
- Group 2 - HIV treatment
- Group 3 - Tuberculosis
- Group 4 – Hypertension

(75 min total time, summary presented to plenary)

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2018 SKILLS BUILDING PROGRAM

BIG DATA, ARTIFICIAL INTELLIGENCE AND DECISION SCIENCE IN HEALTH AND NUTRITION

Linking Interventions

(C3)

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Machine Intelligence Institute of Africa
Transform Africa through Machine Intelligence

iDSI
Better decisions. Better health.

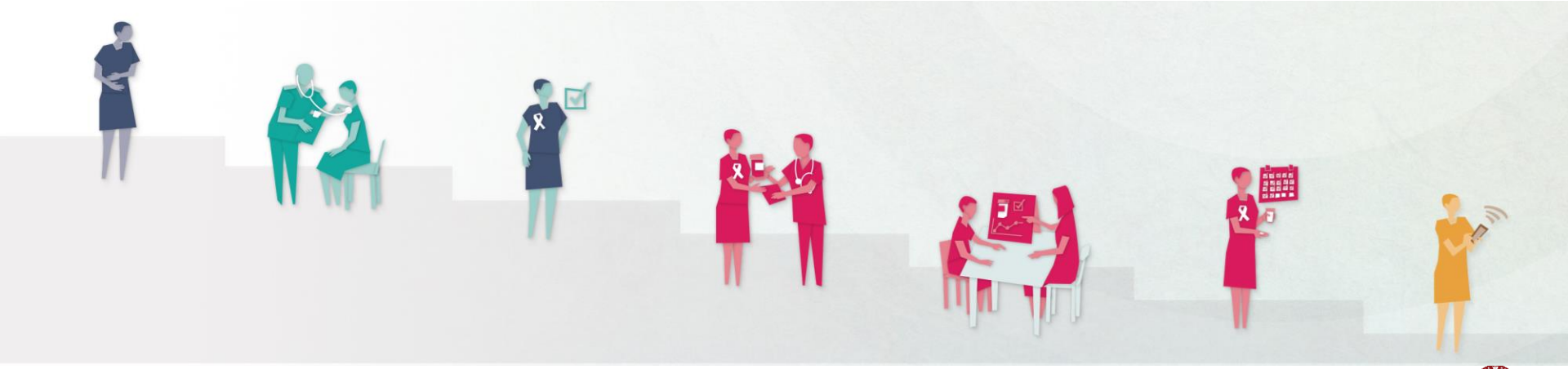
GHCC Global Health Cost Consortium

UNDP

BILL & MELINDA GATES foundation

Takeaways from this Session

- An understanding of service modalities and how they affect implementation cascades
- An understanding of how to conceptually distinguish service modalities, and how target groups, coverage and cost may vary across modalities
- An understanding of data needs on service modalities and what types of interactions we may need to be aware of



Which interventions and service delivery modalities ….

…. work **best and most efficiently** to close the gaps along the cascade?

Effective solutions will ultimately lead to **disease control in the population**

We need to reach urban men better with targeted NCD screening. How are we going to do this with the resources we have?

Manager Municipality Health Services

I need to improve the retention outcomes in long-term care in my rural areas

District Coordinator Chronic Care

Source of illustrations: IAS/BMGF (2016). Differentiated Care for HIV: A Decision Framework for ART Delivery

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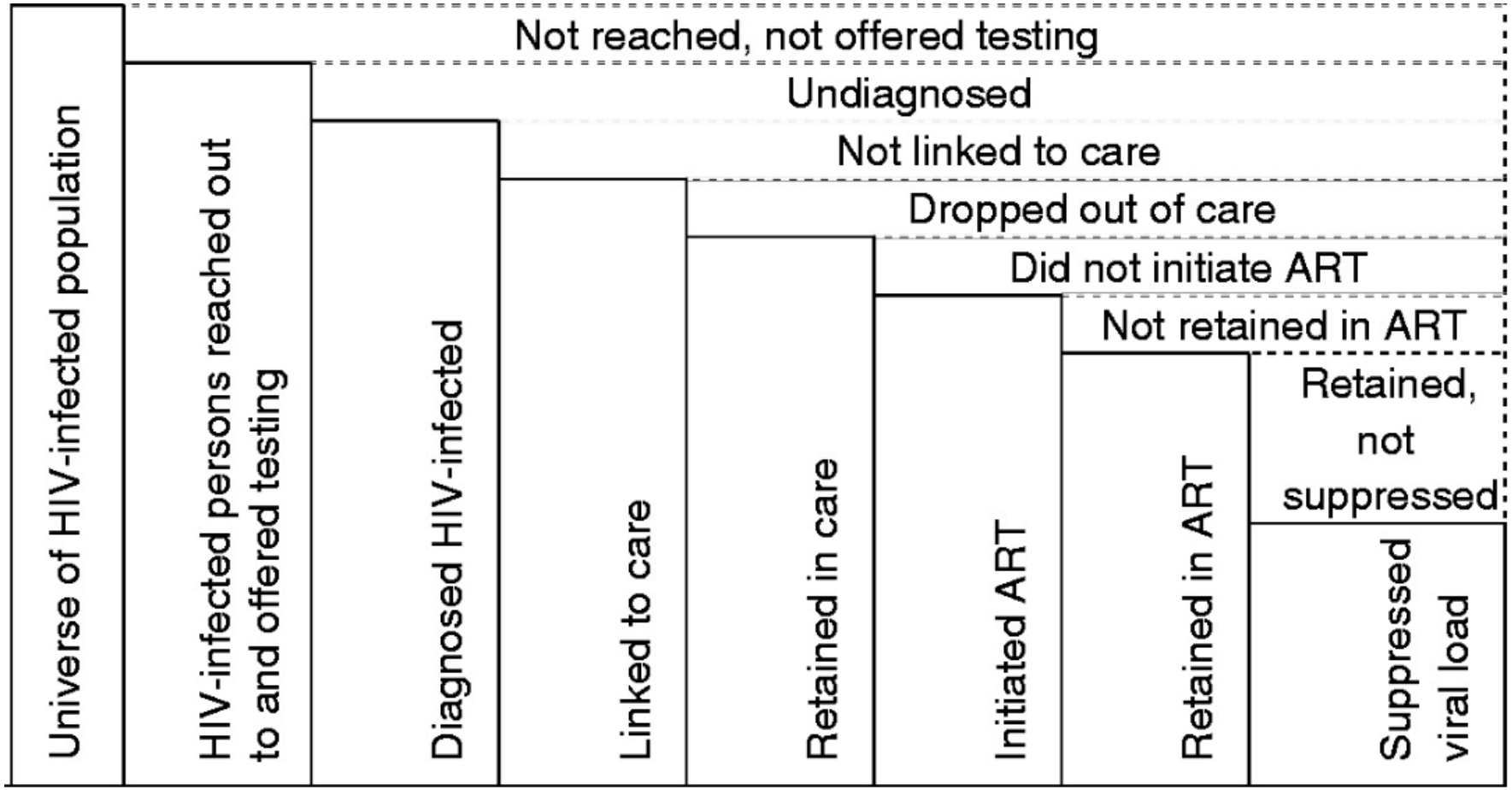
Cascade highlights Programmatic Action



Source: Hladik et al. 2016

Service Modalities to meet the different Needs

Make the best possible investment **decisions**

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

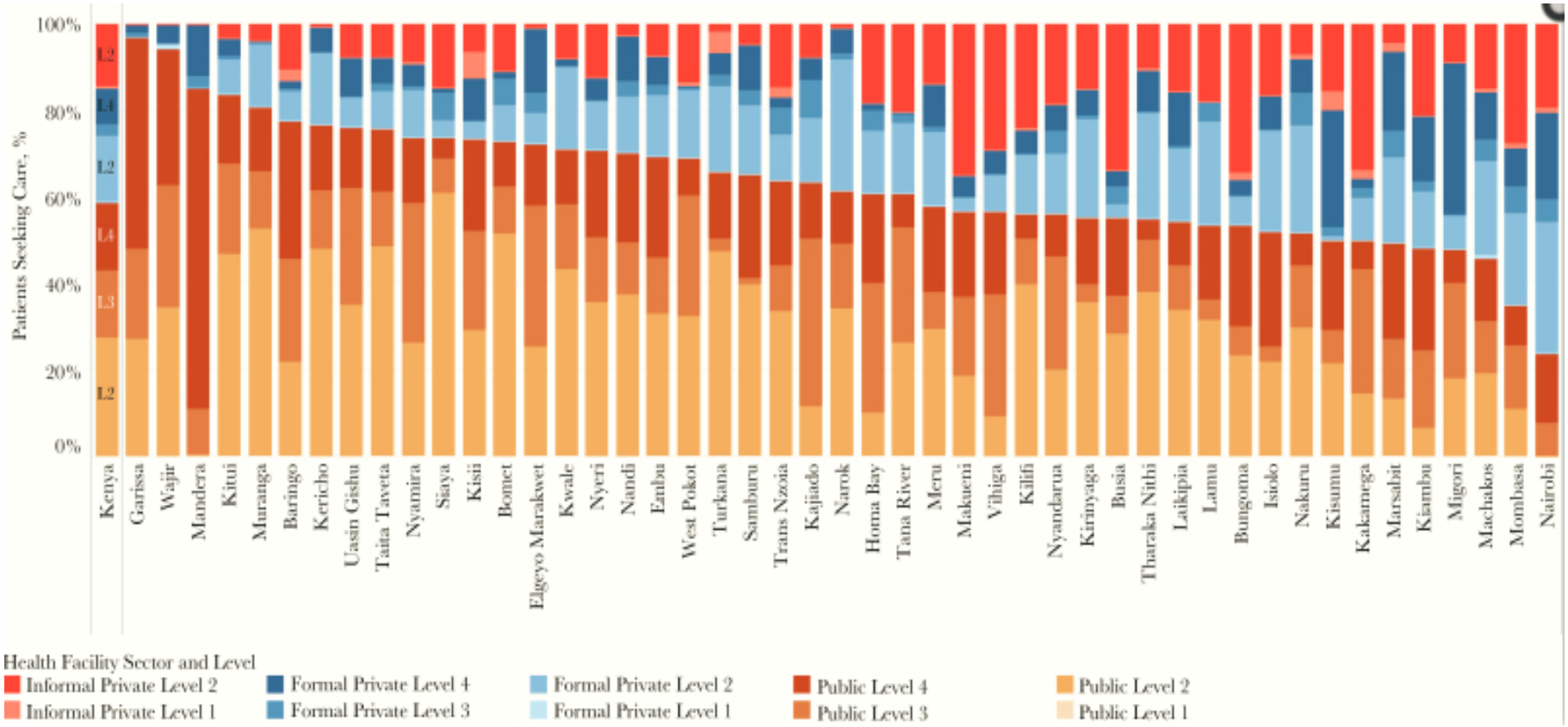
for the right **people**
in the right **places**
at the right **time**
in the right **ways**

Achieve the best possible **health impact**

Implementation cascade analysis helps us to deliver in the right places to the right populations, in the right ways

Understanding Population-level Gaps in Coverage critical to configuring Service Delivery

TB care provision across Kenya counties
– place determines patterns of service use



Source: Kenya TB patient pathway analysis, BMGF

Gaps/Challenges can be Service-specific and System-related …

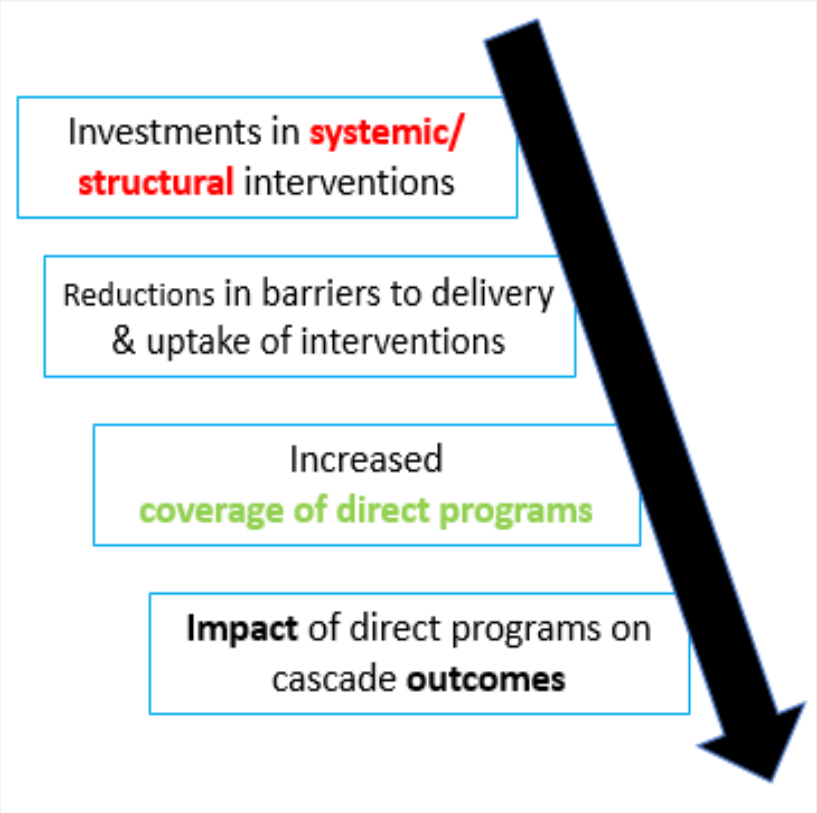
CASCADE	CHALLENGES
Find	▶ Identify those at risk/ill ▶ Make diagnostics accessible ▶ Confidence in health services
Link	▶ Awareness of risk ▶ Asymptomatic illness ▶ Affordability of care ▶ Psychosocial factors ▶ Distance from health services ▶ Quality/confidence in health services
Treat	▶ Affordability of care ▶ Physical infrastructure/equipment ▶ Human resources ▶ Medicine stock-outs/unaffordability ▶ Integrated electronic records ▶ Quality/confidence in health services
Retain	▶ Awareness of risk ▶ Affordability of care ▶ Asymptomatic illness ▶ Psychosocial factors ▶ Integrated electronic records ▶ Health system capacity
Disease Control	▶ Improved health outcomes

Solutions?

Solutions may lie within the **Intervention** or wider **Delivery System** (or both in combination)

CASCADE	CHALLENGES	OPTIONS
Find	▶ Identify those at risk/ill	☑ Community-based screening
	▶ Make diagnostics accessible	☑ Strengthen laboratory equipment, logistics, POC
	▶ Confidence in health services	☑ Strengthen community engagement
Link	▶ Awareness of risk	☑ Strengthen community outreach/communication
	▶ Asymptomatic illness	☑ Promote awareness and health seeking behavior
	▶ Affordability of care	☑ Reduce out-of-pocket expenses (OOP)
	▶ Psychosocial factors	☑ Understand/address psychosocial barriers
	▶ Distance from health services	☑ Decentralize/strengthen primary care services
	▶ Quality/confidence in health services	☑ Improve engagement/quality
Treat	▶ Affordability of care	☑ Reduce out-of-pocket (OOP) expenses
	▶ Physical infrastructure/equipment	☑ Strengthen decentralized, primary infrastructure
	▶ Human resources	☑ Improve chronic management capacity
	▶ Medicine stock-outs/unaffordability	☑ Ensure drug availability/affordability reduce OOP
	▶ Integrated electronic records	☑ Establish integrated electronic medical records
	▶ Quality/confidence in health services	☑ Strengthen training/quality/supervision
Retain	▶ Awareness of risk	☑ Strengthen community outreach/communication
	▶ Affordability of care	☑ Reduce out-of-pocket (OOP) expenses
	▶ Asymptomatic illness	☑ Increase awareness/health seeking
	▶ Psychosocial factors	☑ Understand/address psychosocial retention barriers
	▶ Integrated electronic records	☑ Establish integrated electronic medical records
	▶ Health system capacity	☑ Strengthen management capacity for follow-up
Disease Control	▶ Improved health outcomes	☑ Strengthen measurement of improved health outcomes

Solutions may lie within the Intervention of wider Delivery System (or both in combination)



OPTIONS

- ☑ Community-based screening
- ☑ Strengthen laboratory equipment, logistics, POC
- ☑ Strengthen community engagement

- ☑ Strengthen community outreach/communication
- ☑ Promote awareness and health seeking behavior
- ☑ Reduce out-of-pocket expenses (OOP)
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- ☑ Increase awareness/health seeking
- ☑ Understand/address psychosocial retention barriers
- ☑ Establish integrated electronic medical records
- ☑ Strengthen management capacity for follow-up

- ☑ Strengthen measurement of improved health outcomes

Romania example:
Addressing break point "Adherence" with Service Modalities

Current intervention		Addition of Modalities/Service enhancements
Standard services	→	**Material support to patients** (incentives, food, transport…) 7% higher treatment success, lower mortality, 26% lower loss to follow up
Standard services	→	**Patient education** 71% high treatment completion (1 RCT), higher cure, adherence
Standard services	→	**Psychological support** 20% higher completion (1 RCT) and lower failure
Standard services	→	**Phone call or SMS reminders** 71% higher cure (1 RCT), higher sputum conversion, lower failure, LTFU
Centralized MDR treatment	→	**Decentralized MDR treatment** 13% higher treatment success

Source: all based on Nguyen: Progress on updating WHO guidance on support to treatment adherence and model of care. Presentation. Union Conference, Liverpool 2016

A Focus on the "How" of Implementation

Service Frequency

Monthly
Bimonthly
Every 6 months
Every 12 months

Service Intensity

ART initiation and refills
OI prevention and treatment
Clinical monitoring
Laboratory monitoring
Psychosocial support

Service Location

Hospital (inpatient or outpatient)
HIV clinic
Primary care clinic
Community
Home

Service Provider

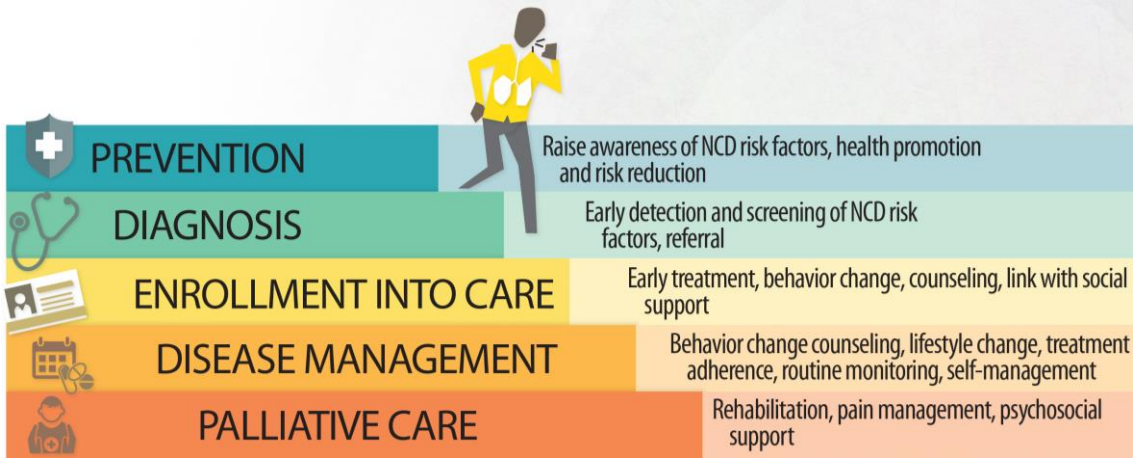
Physician	Clinical Officer
Nurse	CHW
Pharmacist	Laboratorian
Peer	Family

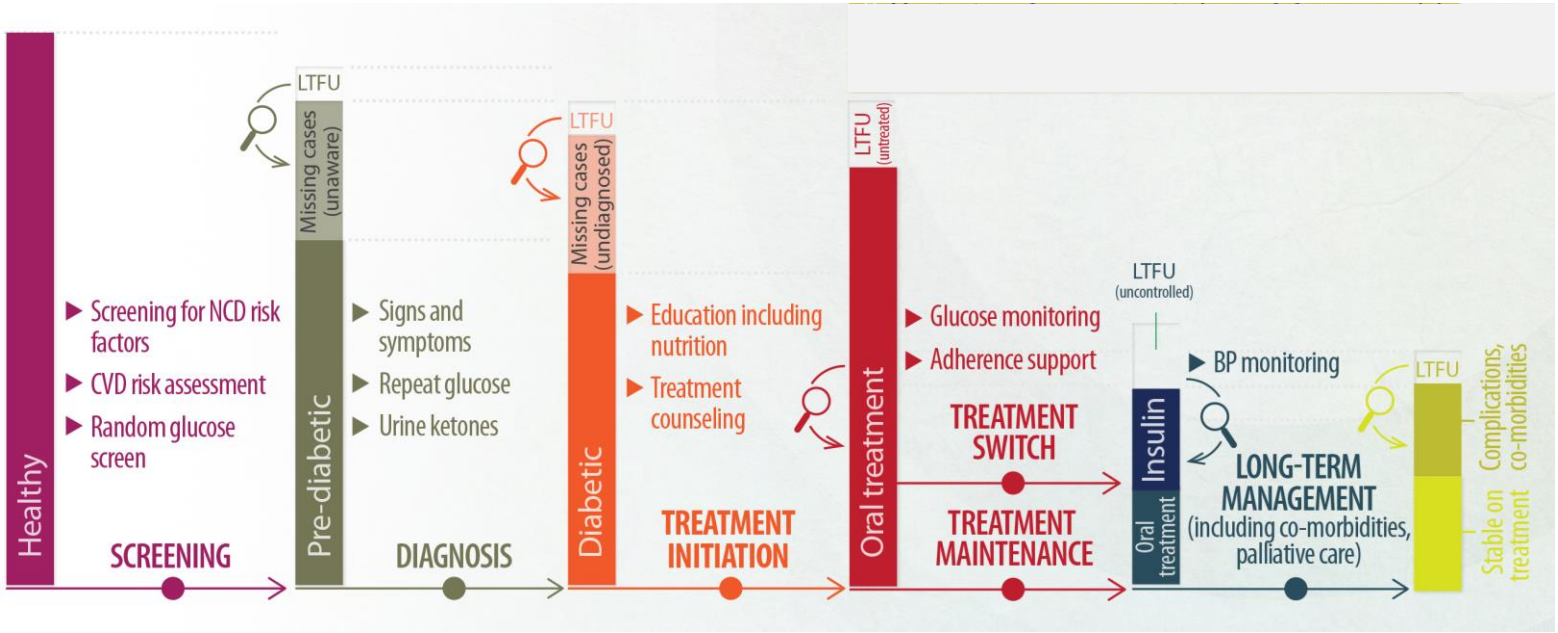
- 90:90:90
- Quality of Life
- Efficiency
- Equity
- Epidemic Control

Source: El-Sadr, AIDS 2018 (Differentiated Service Delivery 2018: Innovations, Best Practices and Lessons Learned)

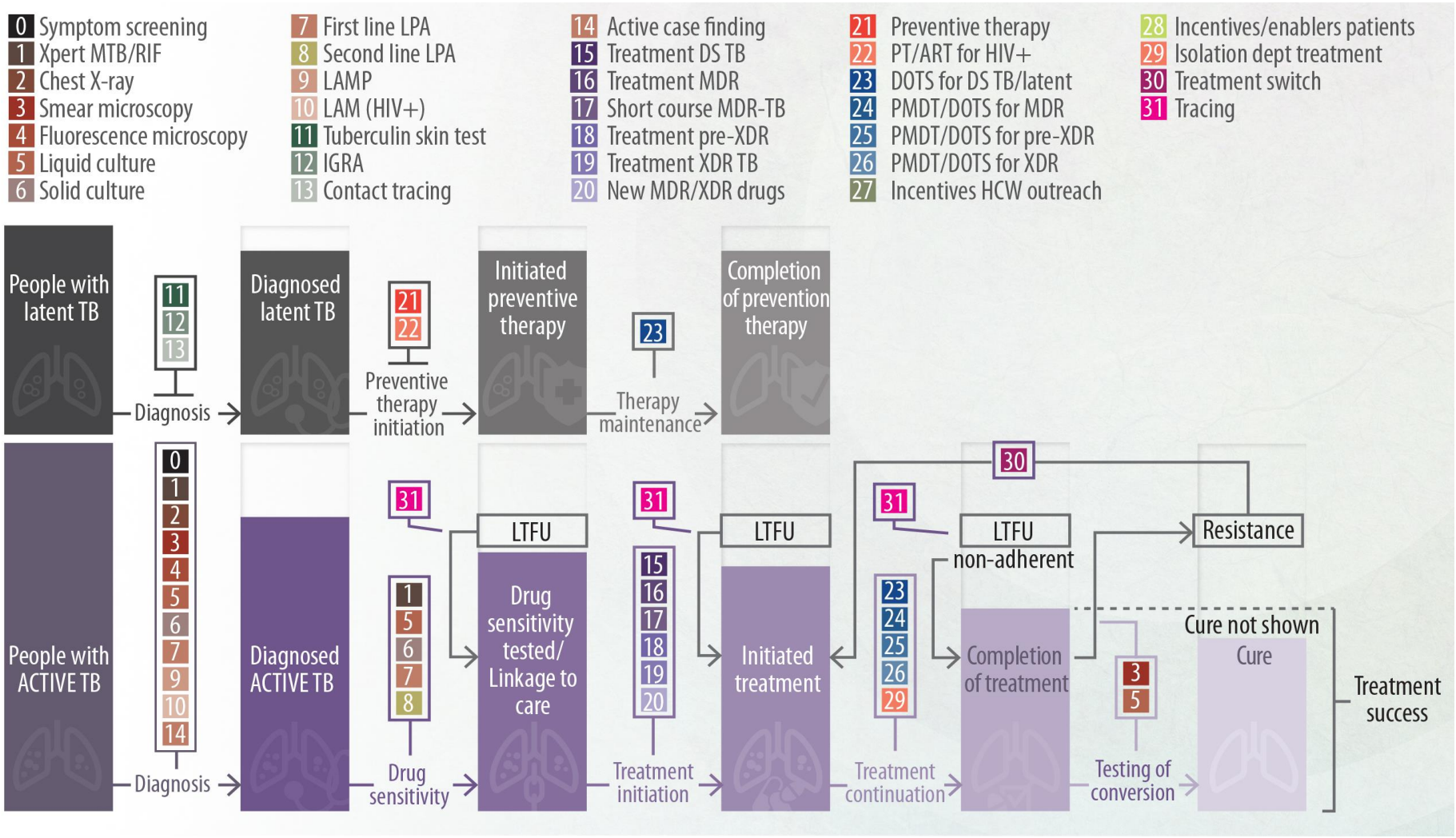
Move from the **broad** Picture …

… to the **detailed, disease-specific implementation** analysis

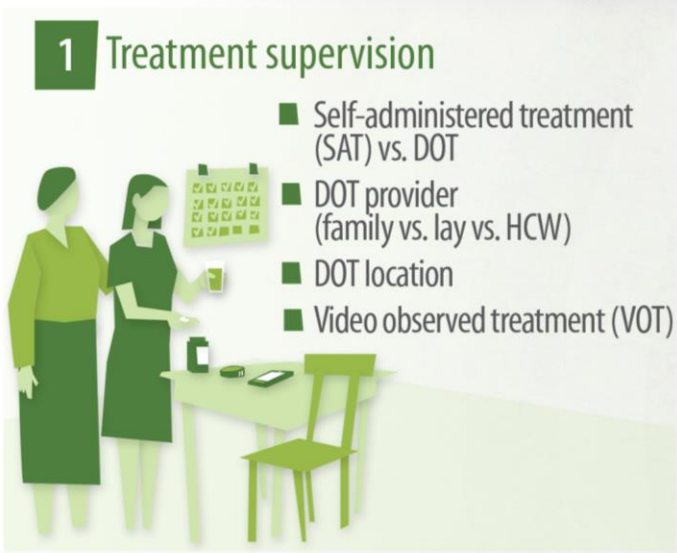


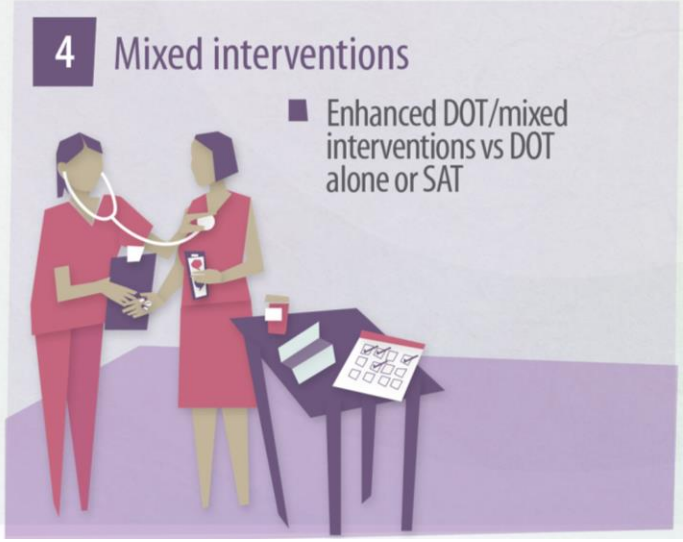


TB Implementation Cascade



Homing in on TB Treatment Adherence Services

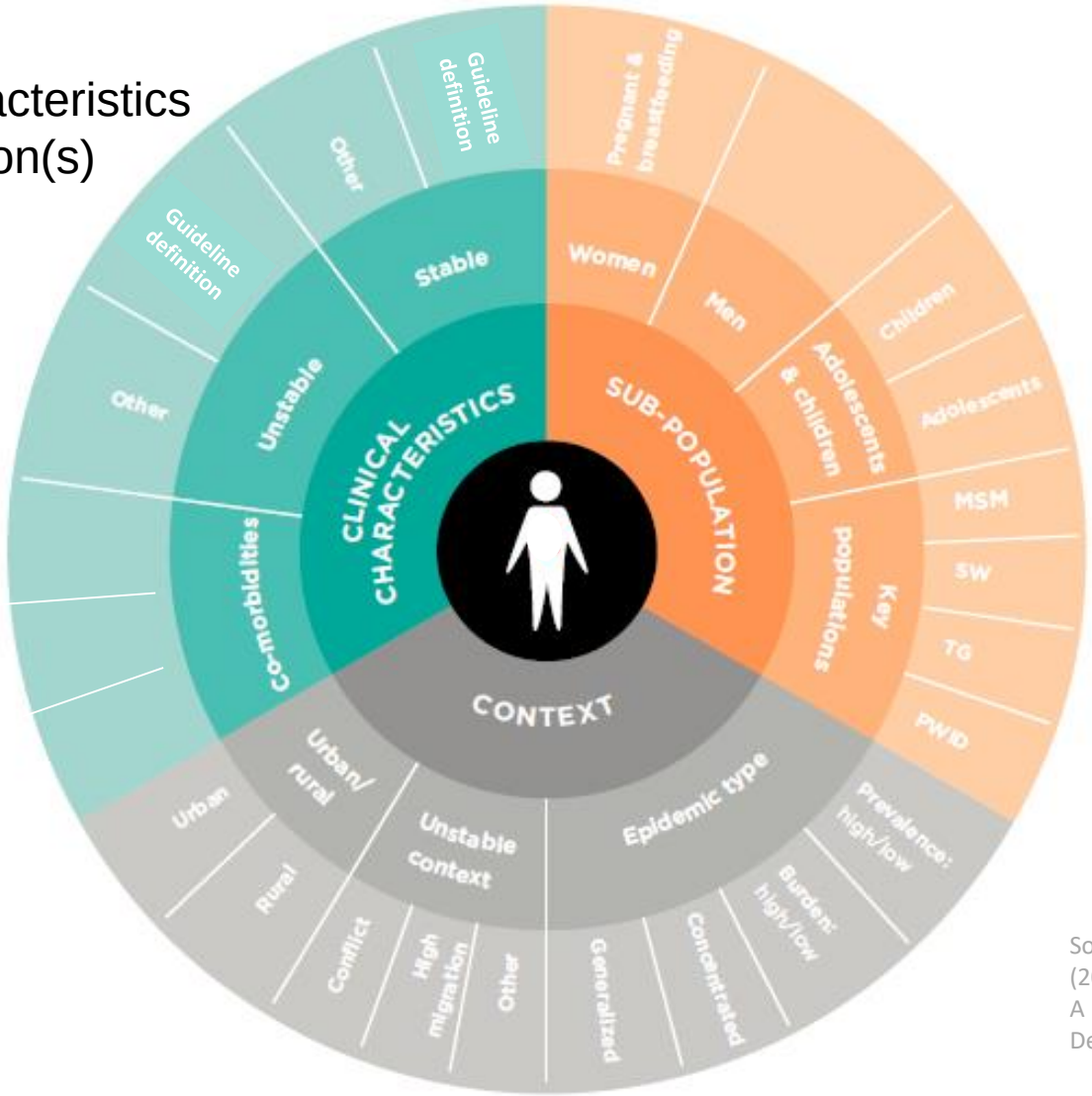




The three Dimensions for Client-centred Care

Consider the
- Clinical characteristics
- Sub-population(s)
- Context

of your clients



Source: Adapted from : IAS/BMGF (2016). Differentiated Care for HIV: A Decision Framework for ART Delivery

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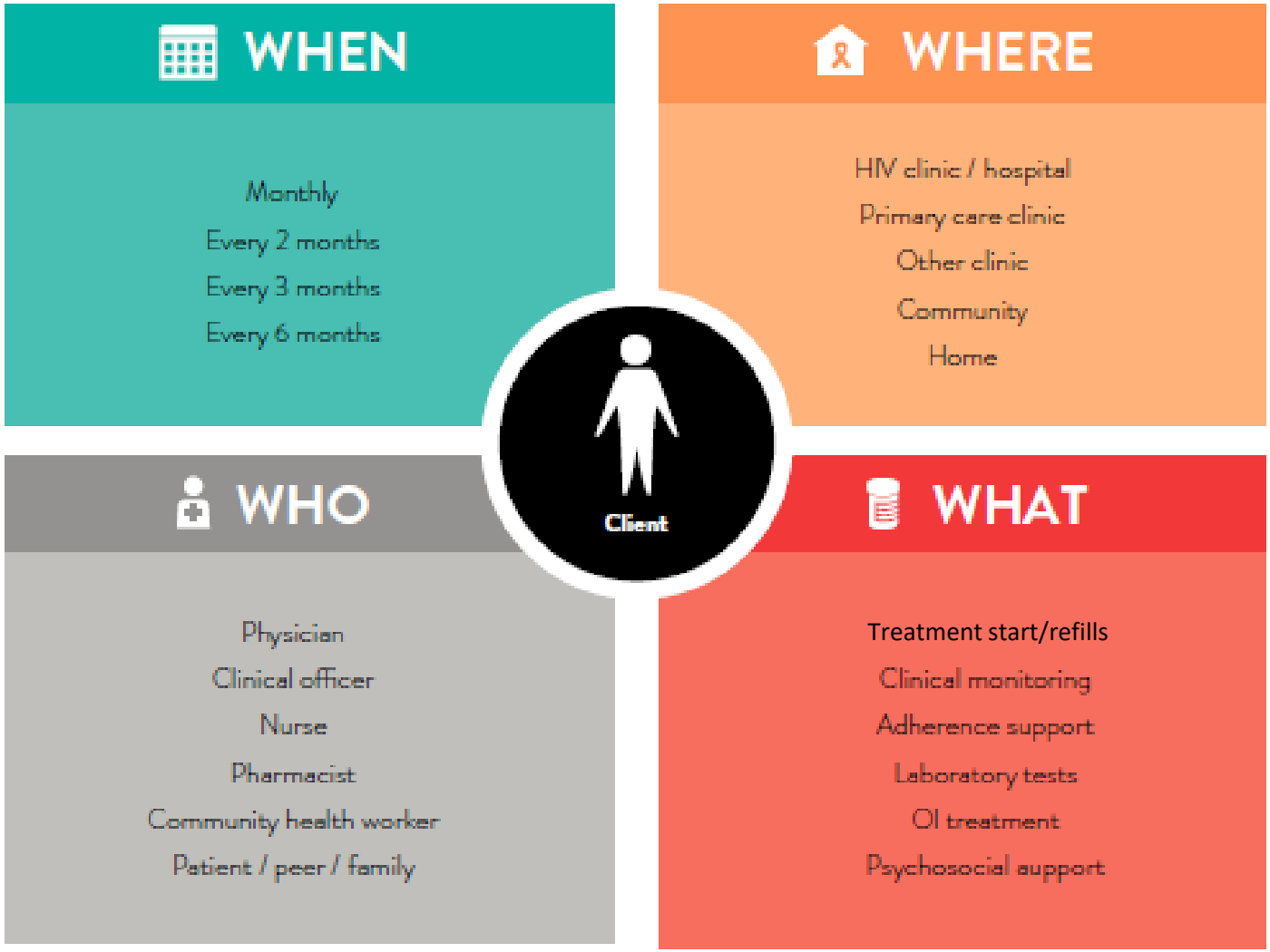
The Building Blocks to define Modalities



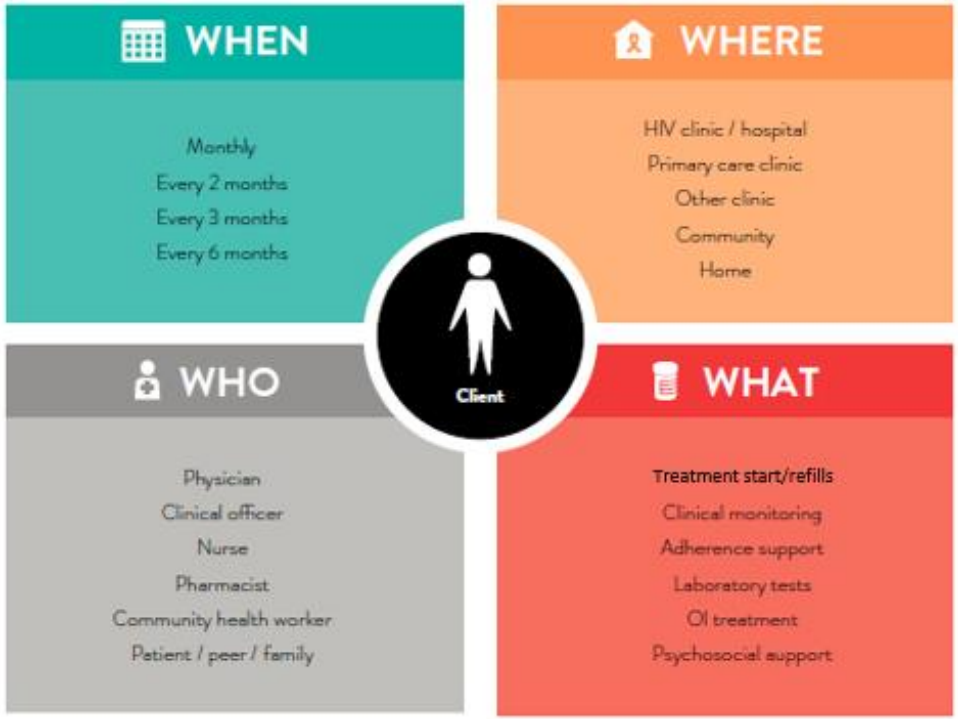
Source: Adapted from : IAS/BMGF (2016). Differentiated Care for HIV: A Decision Framework for ART Delivery

Different Modalities = Different Costs

[AUDIENCE PARTICIPATION]

How might costs differ across modalities?

(use the when-where-who-what framework)



Illustrative Example: HIV Implementation Cascade Analysis *(ongoing)*

CASE STUDY

South Africa

Collaborative work with:

UNSW AUSTRALIA

Burnet Institute
Medical Research. Practical Action.

health
Department:
Health
REPUBLIC OF SOUTH AFRICA

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Illustrative Example: Approach

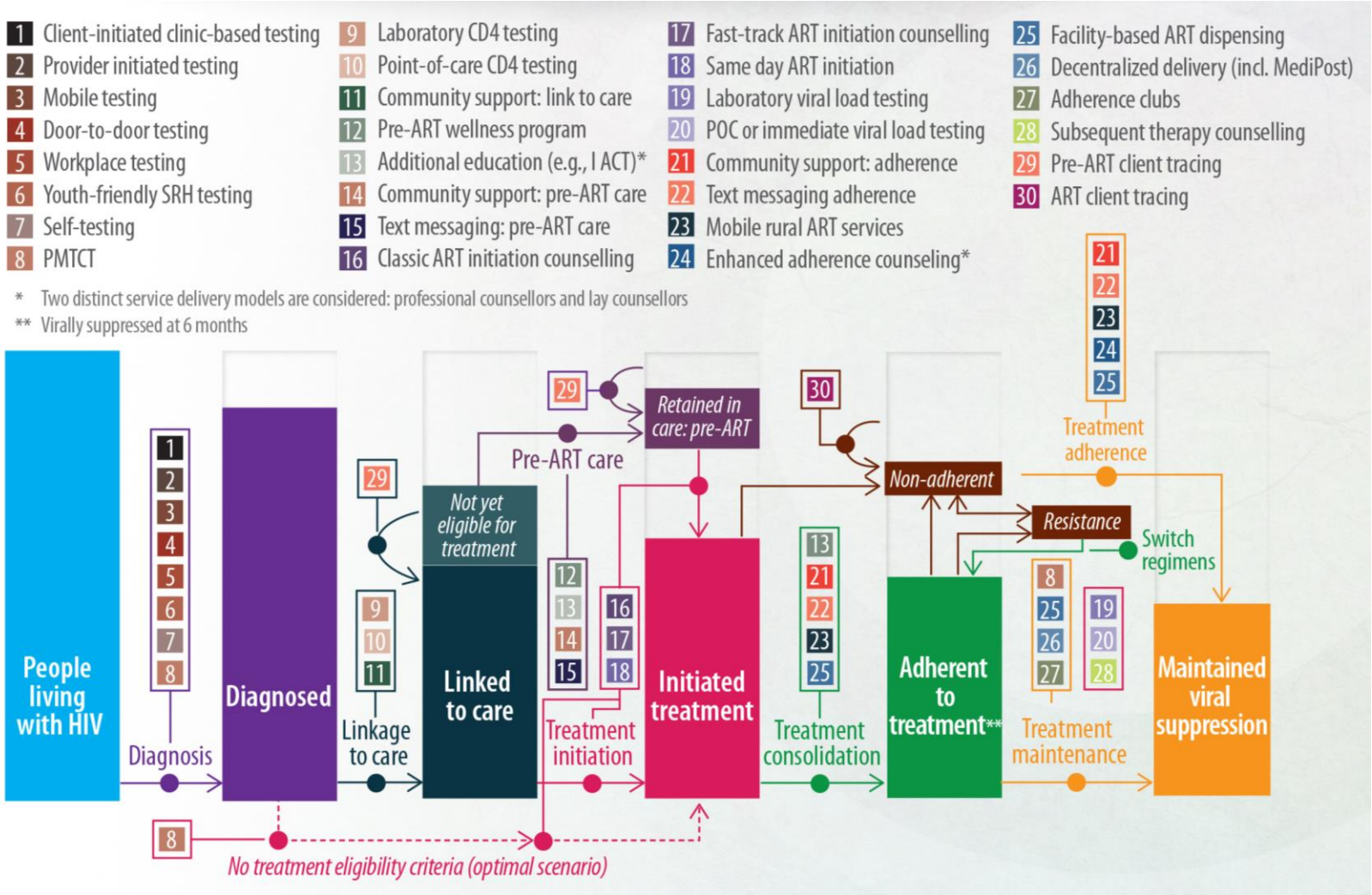
- Collated **costing and outcome data** of 30 separate HIV testing, linkage, retention, care and treatment services
- Service delivery modalities:
  - Urban versus rural locality
  - Facility versus community-based delivery
  - Laboratory versus point-of-care test
  - Provision by professionals versus lay persons

Hypothesis:

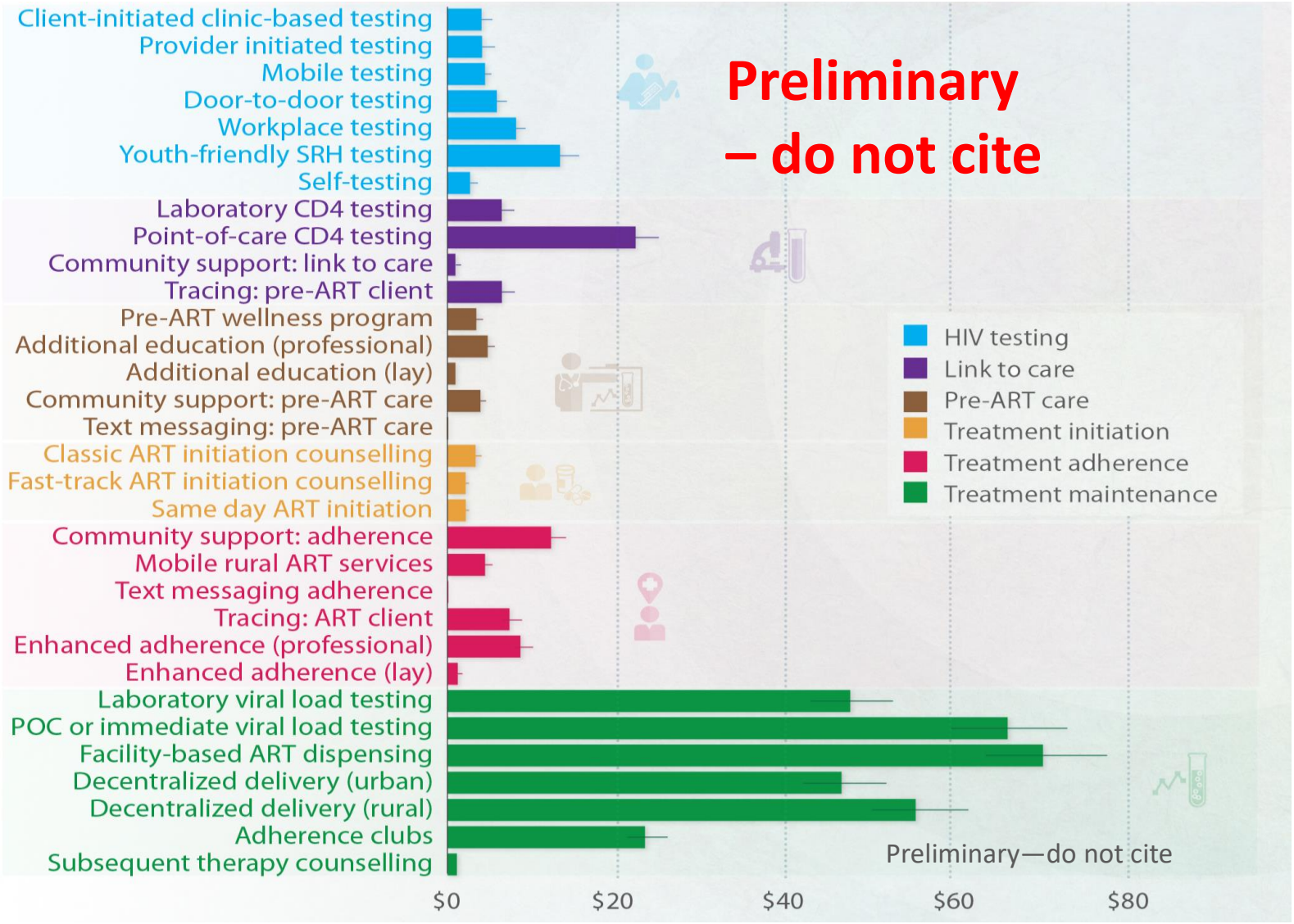
"Optimal allocation of projected future resources across the 30 services could potentially yield better results towards 90-90-90 targets over the NSP compared to current allocations"

Example – HIV Implementation Cascade

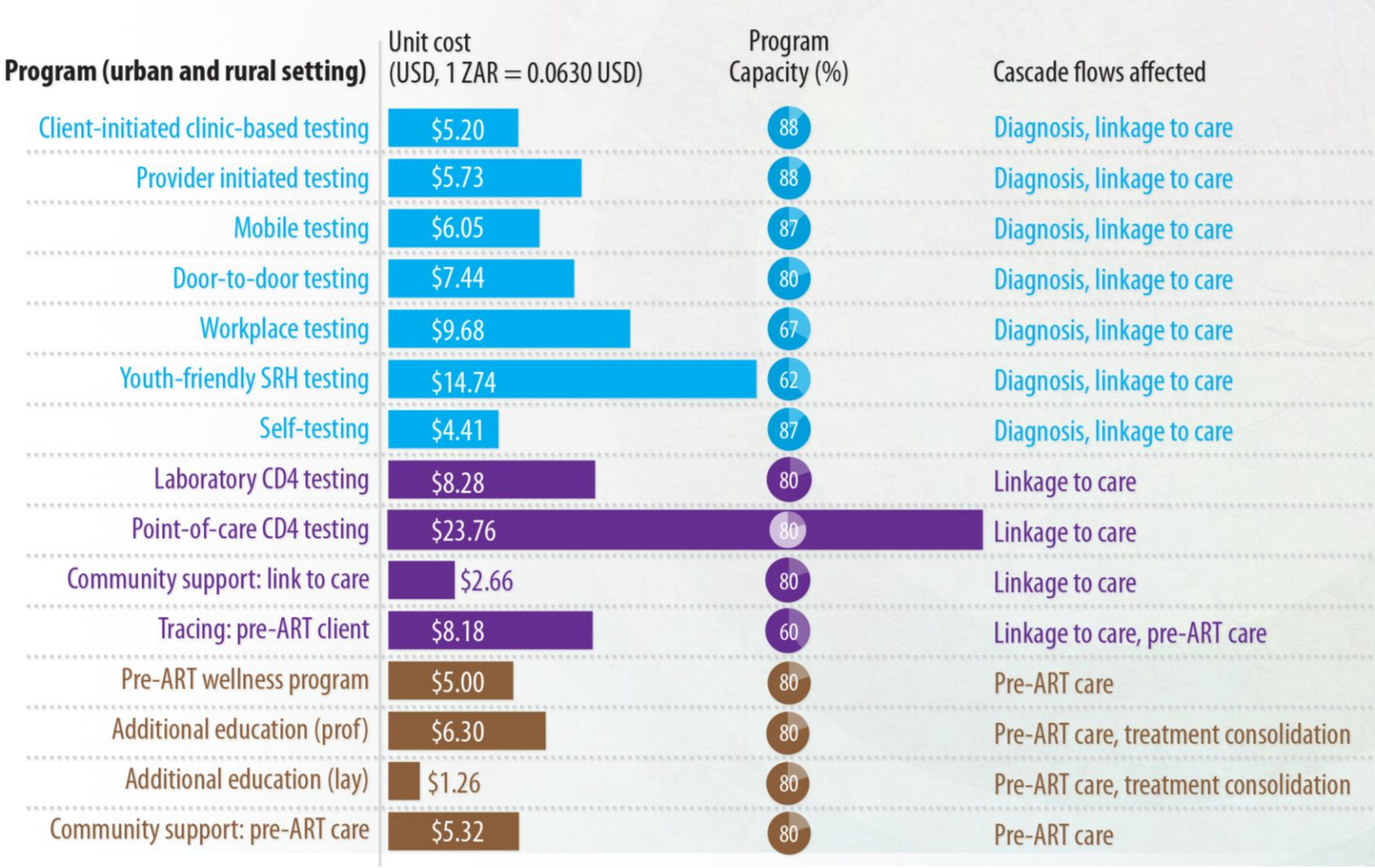
Differentiated service delivery in HIV program South Africa, 2016



Example - Estimated annual Cost of each Intervention Modality



Example - Linked unit cost with data on program capacity, geographical settings and cascade stages that the services directly impact



Systemic/structural Interventions

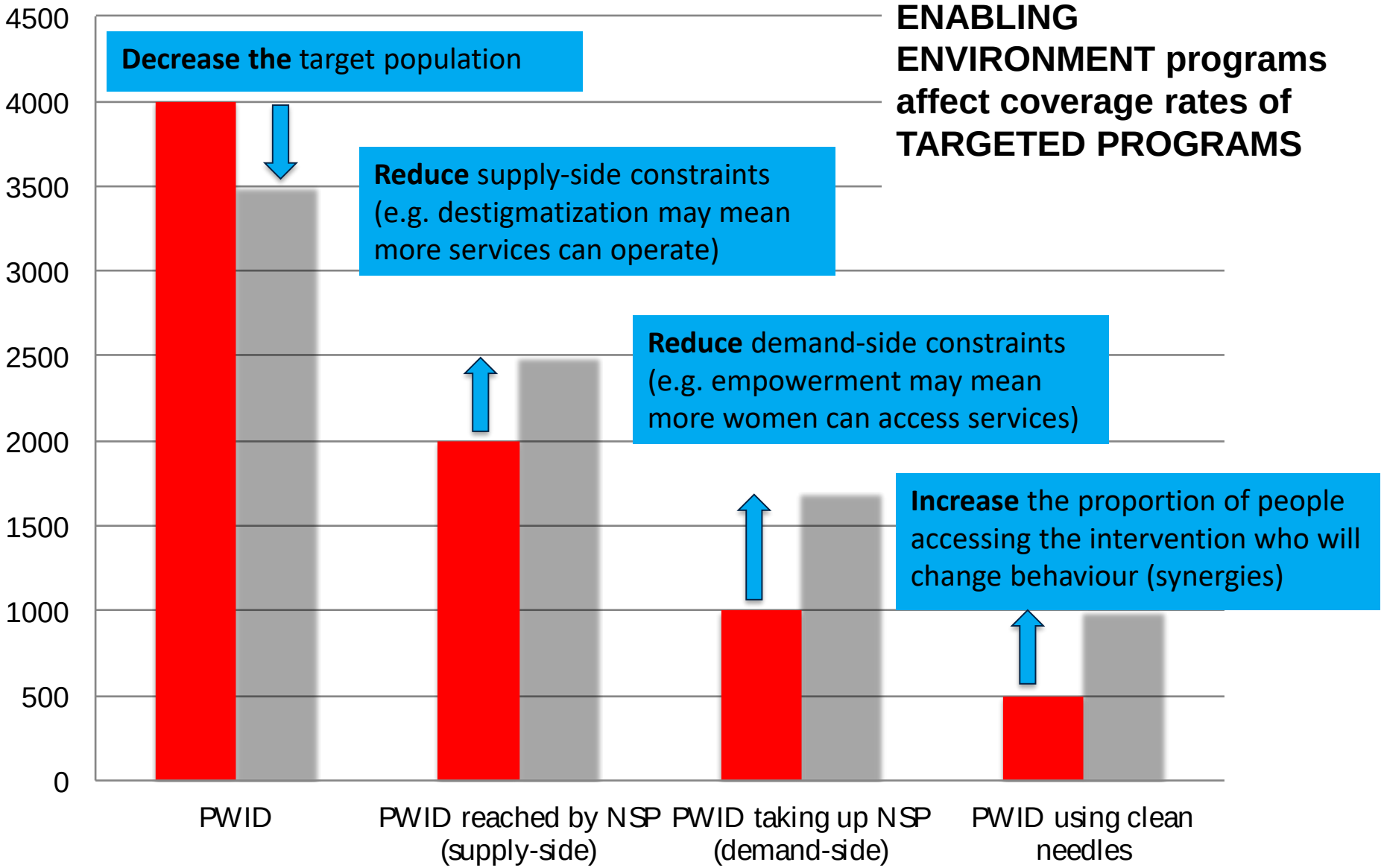
"Enabling environment", "facilitators"…

Can be included as "**indirect interventions"** if data is available:

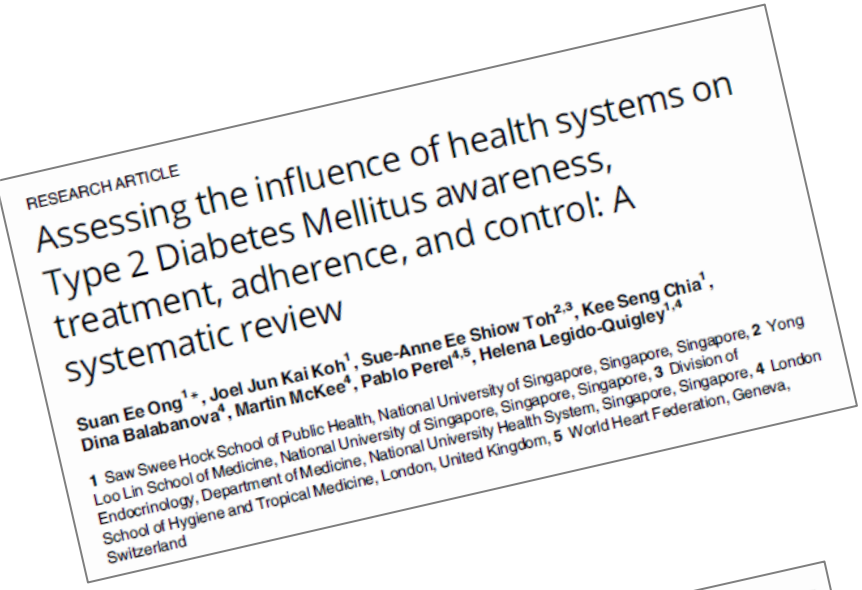
- **evidence of impact** on the *rate of uptake of direct programs* (e.g. proportion of PWID accessing needle-syringe programs) or on the *behaviour of those accessing direct interventions*
- **cost** data
- data on **current coverage** of the intervention

This data is context-specific and may be scarce

Impact of enabling environment programs



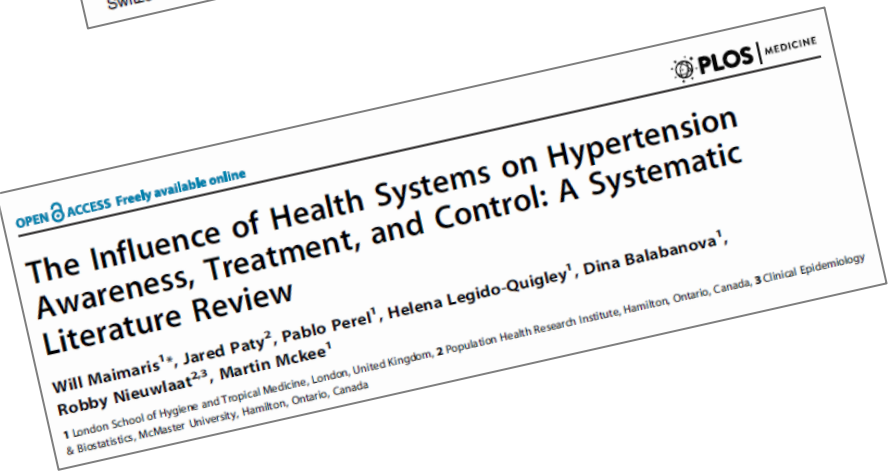
Drawing on Systematic Review Evidence


RESEARCH ARTICLE

Assessing the influence of health systems on Type 2 Diabetes Mellitus awareness, treatment, adherence, and control: A systematic review

Suan Ee Ong[1]*, Joel Jun Kai Koh[1], Sue-Anne Ee Shiow Toh[2,3], Kee Seng Chia[1], Dina Balabanova[4], Martin McKee[4], Pablo Perel[4,5], Helena Legido-Quigley[1,4]

1 Saw Swee Hock School of Public Health, National University of Singapore, Singapore, Singapore, 2 Yong Loo Lin School of Medicine, National University of Singapore, Singapore, Singapore, 3 Division of Endocrinology, Department of Medicine, National University Health System, Singapore, Singapore, 4 London School of Hygiene and Tropical Medicine, London, United Kingdom, 5 World Heart Federation, Geneva, Switzerland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The Influence of Health Systems on Hypertension Awareness, Treatment, and Control: A Systematic Literature Review

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Diabetes: 93 studies included (7 LMICs)

- Three health system factors that facilitate effective T2DM care and management:
- Use of innovative care models,
- Increased pharmacist involvement in care delivery,
- Education programmes led by healthcare professionals
- Importance of reducing/eliminating, out-of-pocket costs for DM medication and self-monitoring
- Potential of adopting more integrated models of care
- Value of task-sharing of care esp. with pharmacists

Hypertension: 53 studies included (11 LMICs)

- Most evidence on health system financing
- Only 4 evaluations on human, physical, social, intellectual resources on HT outcomes
- Reduced medication co-payments associated with improved HT control and tx adherence
- Health insurance coverage associated with improved HT outcomes
- Routine place of care or physician associated with improved HT care
- Supports minimization of medication co-payments in health insurance plans
- Largely US evidence, but principle might apply widely

GROUP WORK P3

Aims:

- Identify interventions applying to a cascade
- Understand data requirements and shortfalls

Groups:

- Group 1- Diabetes
- Group 2 - HIV treatment
- Group 3 - Tuberculosis
- Group 4 – Hypertension

45 min, report back to plenary

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Health, Nutrition & Population

2018 SKILLS BUILDING PROGRAM

BIG DATA, ARTIFICIAL INTELLIGENCE AND DECISION SCIENCE IN HEALTH AND NUTRITION

Case Study: Feeding Analysis into Policy and Resource allocation Dialogue -

NCD/Tobacco Investment Case

(C4 - UNDP)

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Machine Intelligence Institute of Africa
Transform Africa through Machine Intelligence

iDSI
Better decisions. Better health.

GHCC Global Health Cost Consortium

UNDP

BILL & MELINDA GATES foundation

What-Ifs?

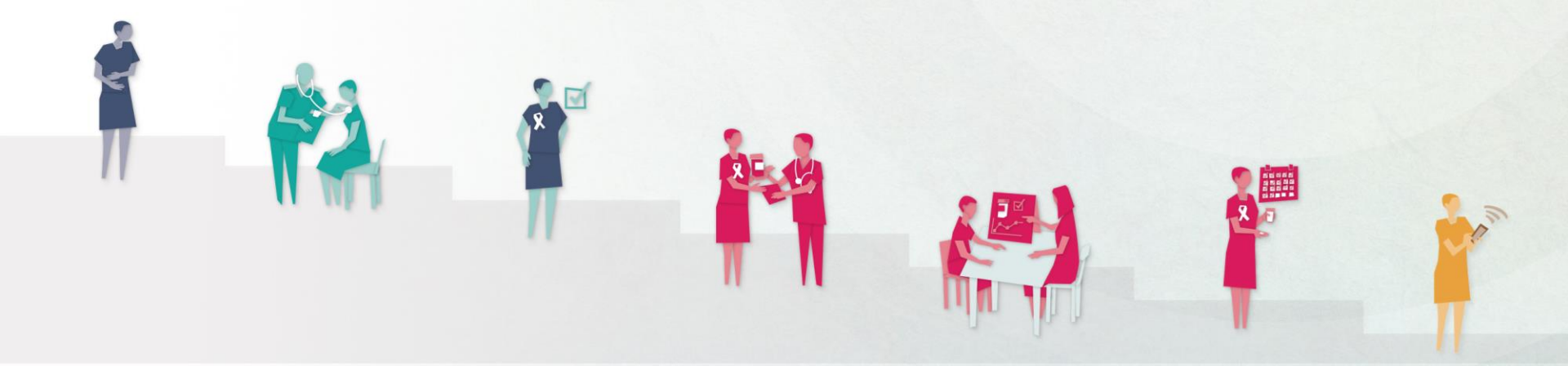
(C5)

Takeaways from this session

1. An understanding of how the cascade is affected by changes in the response

2. An understanding of how to quantify these effects

3. An introduction to the idea of finding the “best” cascade

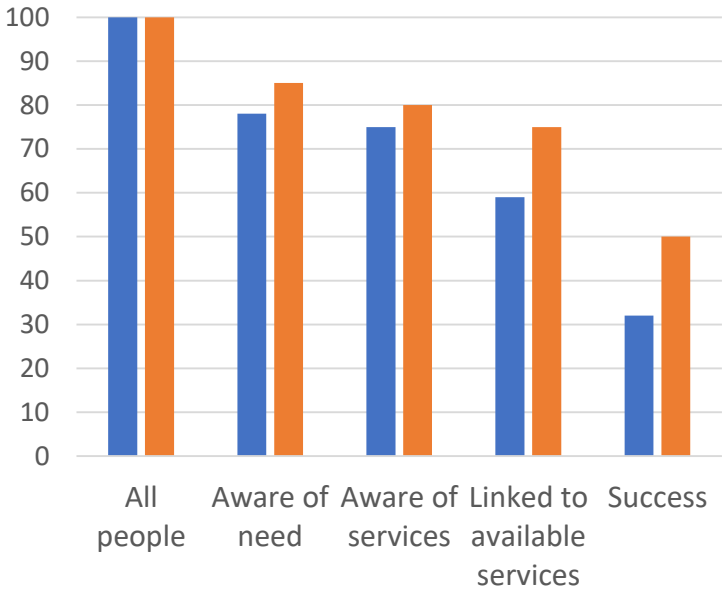


Refresher and Introduction

- This morning's session focused on descriptive cascades
  - Implementation cascades for programmatic outcomes
  - Analysis of barriers and facilitators
  - Different interventions in place

- This session: scenarios
  - Changing coverage → changes in the cascade

- This session: optimizations
  - What conditions lead to the "best" cascade?



Background

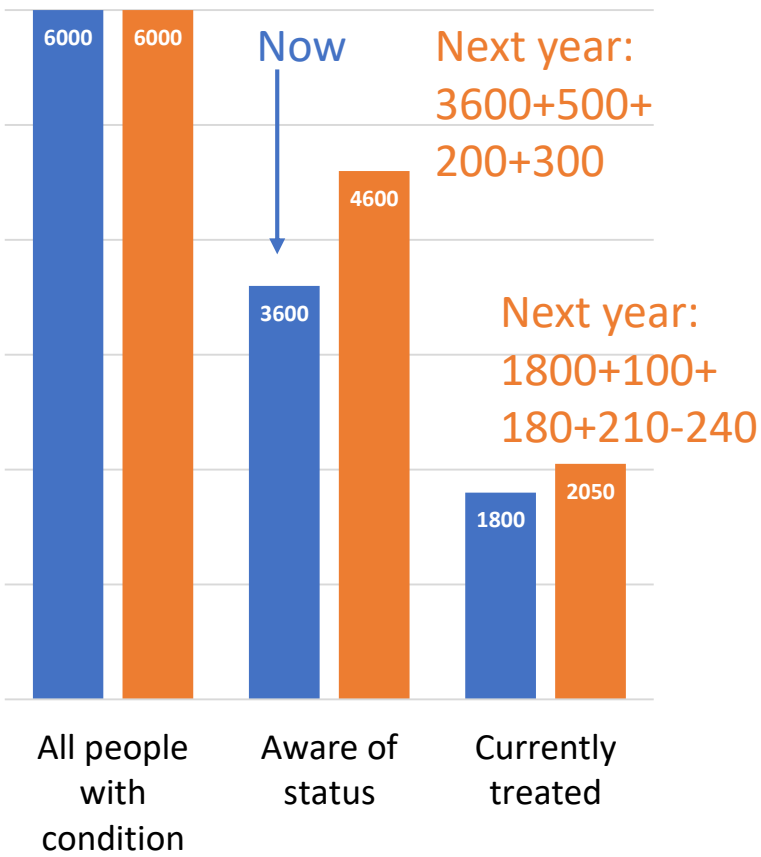
- A great deal of evidence supports the claim that funds are often poorly allocated, and that re-allocating them can lead to improved outcomes

- In order to quantify how changes in interventions propagate to the cascade, we need to understand the relationships between:
  1. Intervention expenditure
  2. Intervention coverage levels
  3. Intervention "outcomes" (i.e., the rates at which people flow through the cascade)

A Motivating Example

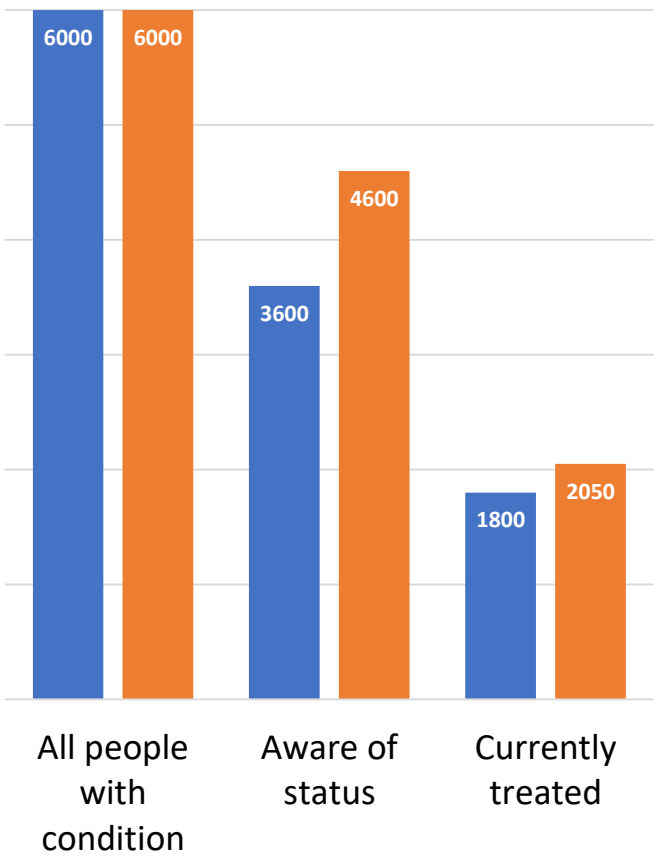
Undiagnosed, Diagnosed, Treated

	Unit cost	Spend (000's)	Covered	Impact
Pharmacy test	$5	$50	10,000	• 10,000 tested, 500 diagnosed (5%) • 20% start treatment (100)
Clinic test	$20	$100	5,000	• 5,000 tested, 200 diagnosed (4%) • 90% start treatment (180)
Outreach	$15	$30	2,000	• 2,000 tested, 300 diagnosed (15%) • 70% start treatment (210)
Adherence	$25	$20	800	• 5% loss-to-follow-up vs 20% among those not covered (240)



A Motivating Example

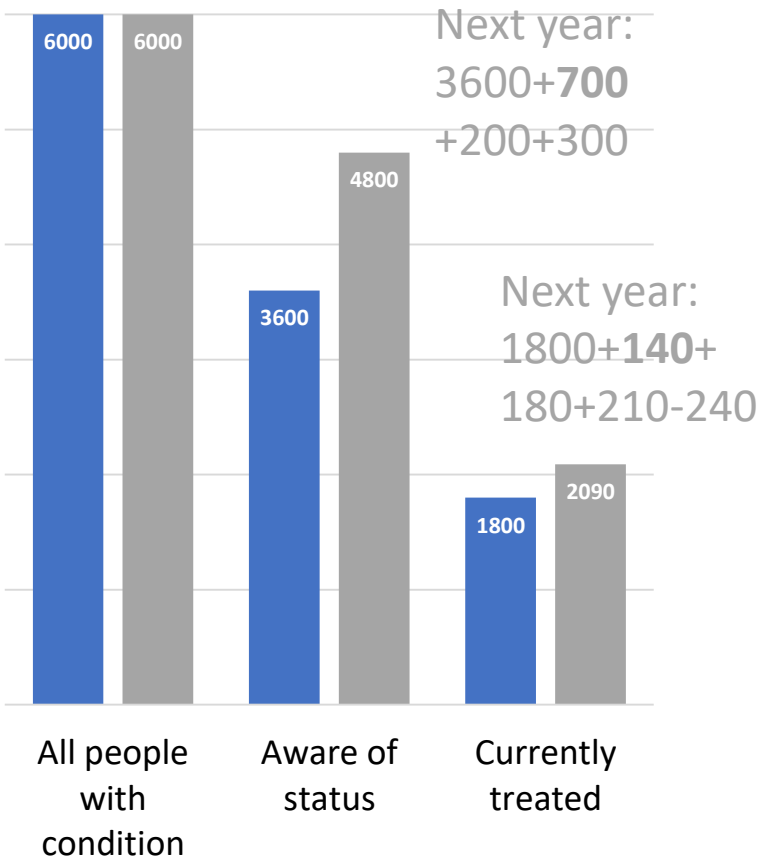
- If you maintain these coverage levels, your cascade will evolve to the orange bars
- Suppose that you want to spend another **$20,000**
- We will construct 4 scenarios, where you allocate these funds to one of the interventions
- Note, it is not clear which intervention is best!
  - Pharmacy test cheapest, but low yield and low linkage
  - Clinic test more costly, has best linkage, but lowest yield
  - Outreach has moderate cost, moderate linkage, best yield
  - Adherence prevents loss-to-follow-up



A Motivating Example

Undiagnosed, Diagnosed, Treated

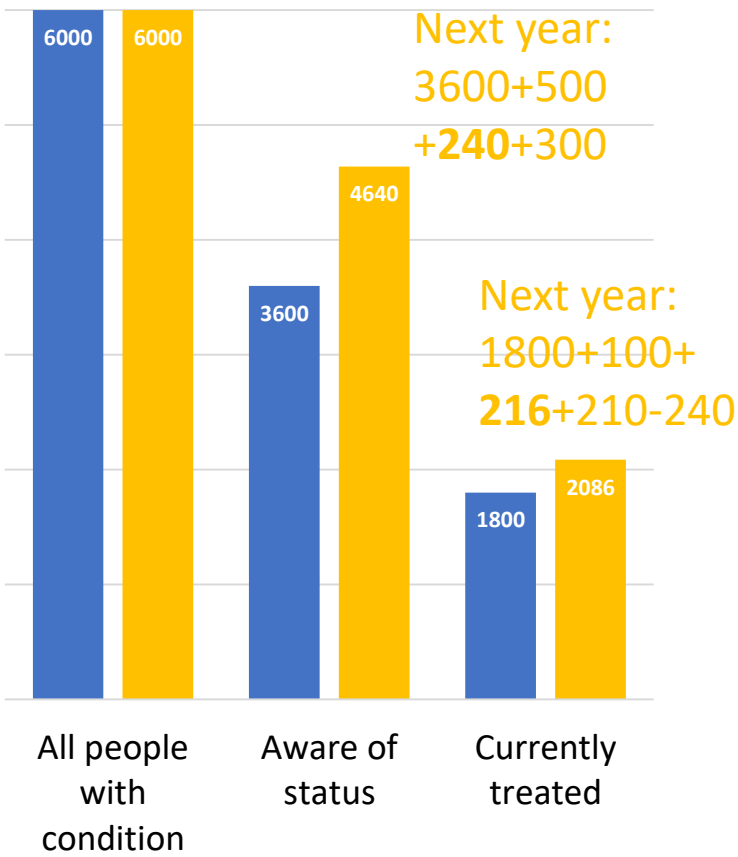
	Unit cost	Spend (000's)	Covered	Impact
Pharmacy test	$5	$50 + **$20**	**14,000**	• **14,000** tested, **700** diagnosed (5%) • 20% start treatment (**140**)
Clinic test	$20	$100	5,000	• 5,000 tested, 200 diagnosed (4%) • 90% start treatment (180)
Outreach	$15	$30	2,000	• 2,000 tested, 300 diagnosed (15%) • 70% start treatment (210)
Adherence	$25	$20	800	• 5% loss-to-follow-up vs 20% among those not covered (240)



A Motivating Example

Undiagnosed, Diagnosed, Treated

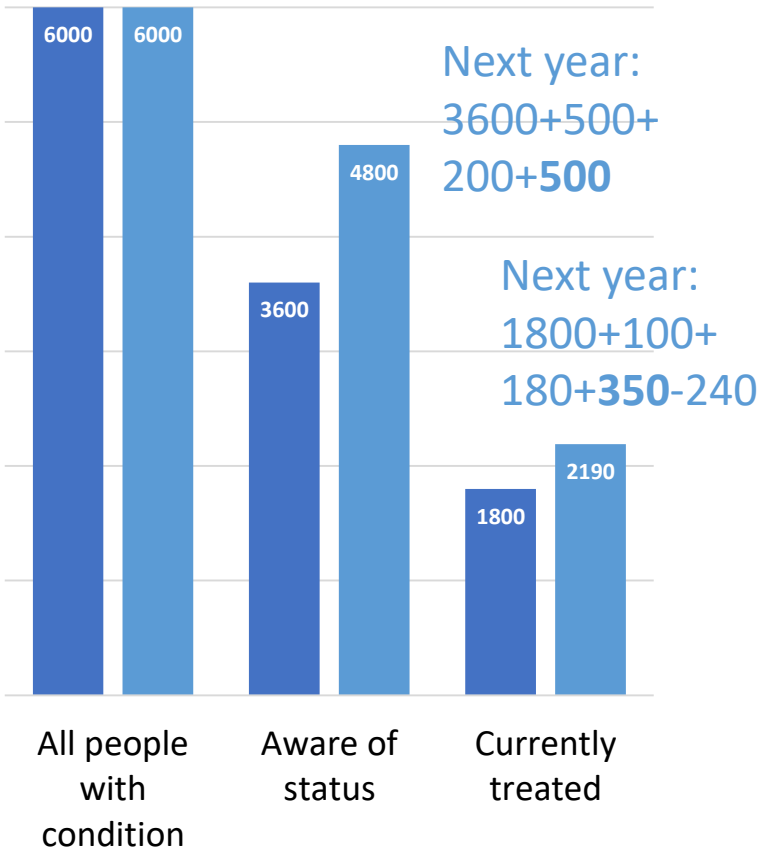
	Unit cost	Spend (000's)	Covered	Impact
Pharmacy test	$5	$50	10,000	• 10,000 tested, 500 diagnosed (5%) • 20% start treatment (100)
Clinic test	$20	$100 + **$20**	**6,000**	• **6,000** tested, **240** diagnosed (4%) • 90% start treatment (**216**)
Outreach	$15	$30	2,000	• 2,000 tested, 300 diagnosed (15%) • 70% start treatment (210)
Adherence	$25	$20	800	• 5% loss-to-follow-up vs 20% among those not covered (240)



A Motivating Example

Undiagnosed, Diagnosed, Treated

	Unit cost	Spend (000's)	Covered	Impact
Pharmacy test	$5	$50	10,000	• 10,000 tested, 500 diagnosed (5%) • 20% start treatment (100)
Clinic test	$20	$100	5,000	• 5,000 tested, 200 diagnosed (4%) • 90% start treatment (180)
Outreach	$15	$30+ **$20**	**3,333**	• **3,333** tested, **500** diagnosed (15%) • 70% start treatment (**350**)
Adherence	$25	$20	800	• 5% loss-to-follow-up vs 20% among those not covered (240)



A Motivating Example

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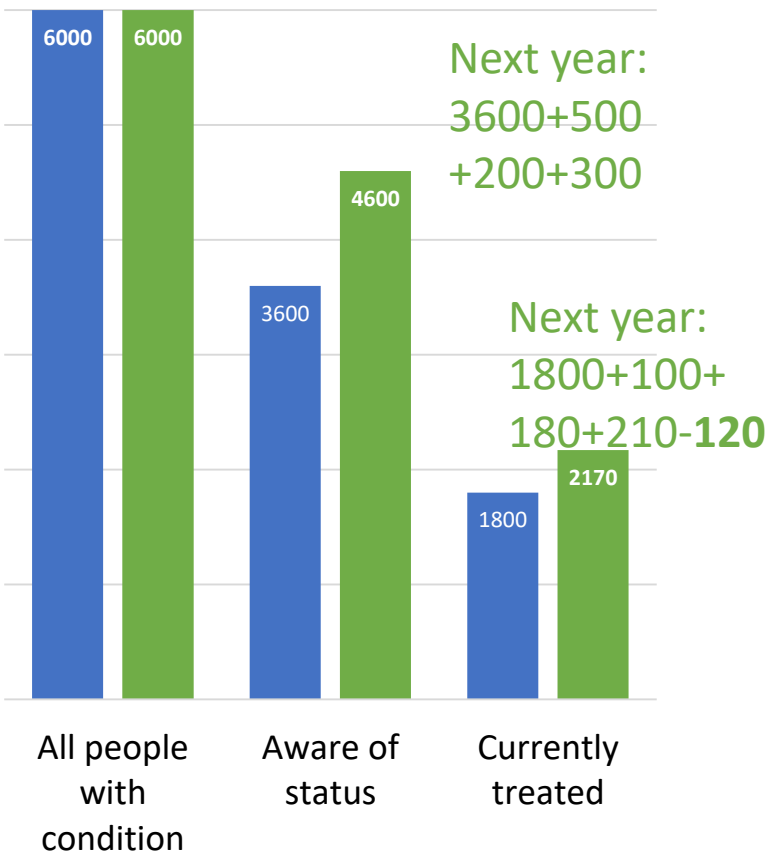
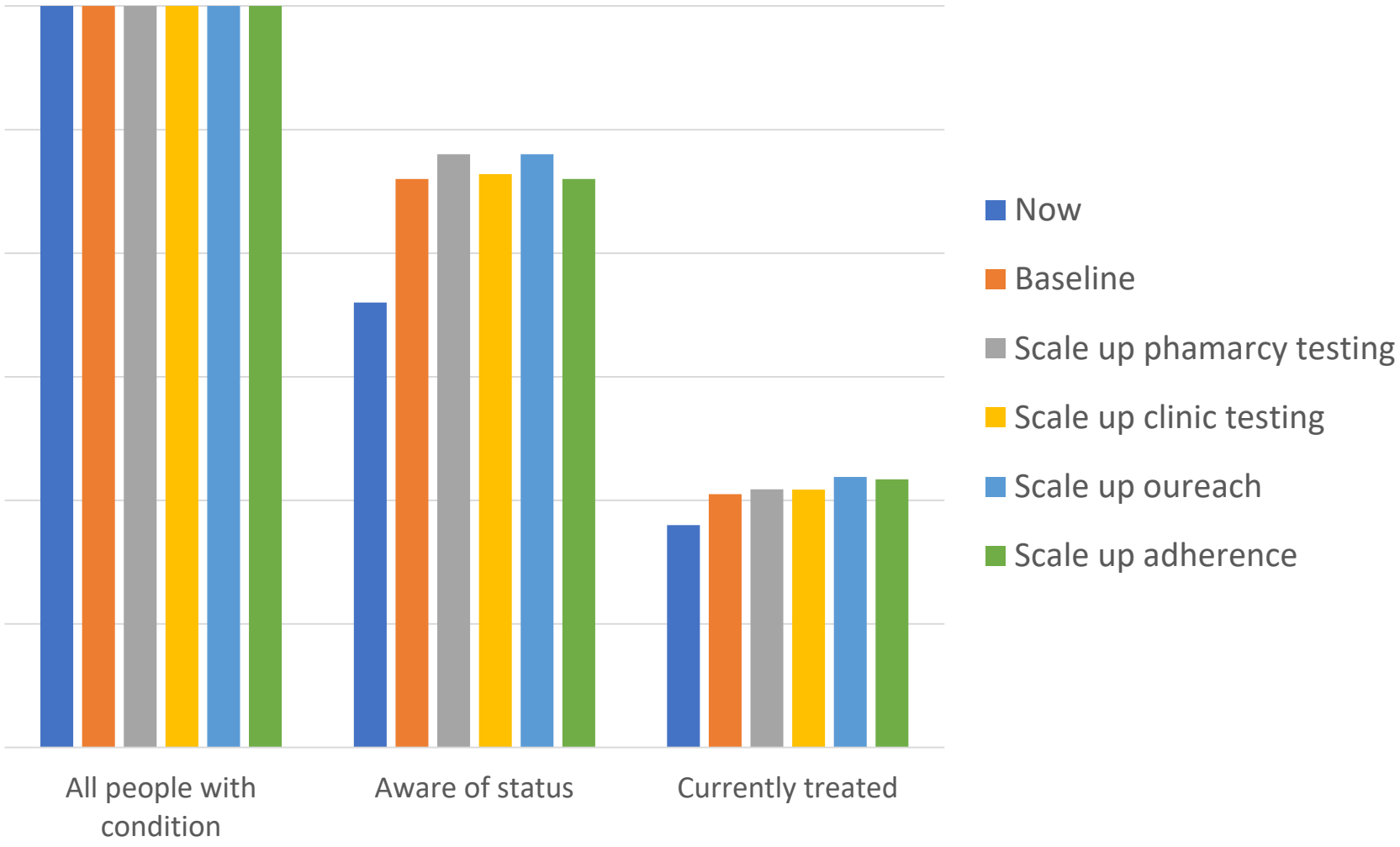
Clinic test	$20	$100	5,000	• 5,000 tested, 200 diagnosed (4%) • 90% start treatment (180)
Outreach	$15	$30	2,000	• 2,000 tested, 300 diagnosed (15%) • 70% start treatment (210)
Adherence	$25	$20 + **$20**	1,600	• 5% loss-to-follow-up vs 20% among those not covered (**120**)



Comparing Options



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Takeaways from the Example

- Different intervention scale-up options lead to different cascades
- Comparing these is the purpose of **scenario analysis**
- Finding the ”best” option among the set of all possible options is the purpose of **optimization analysis**

GROUP WORK P4

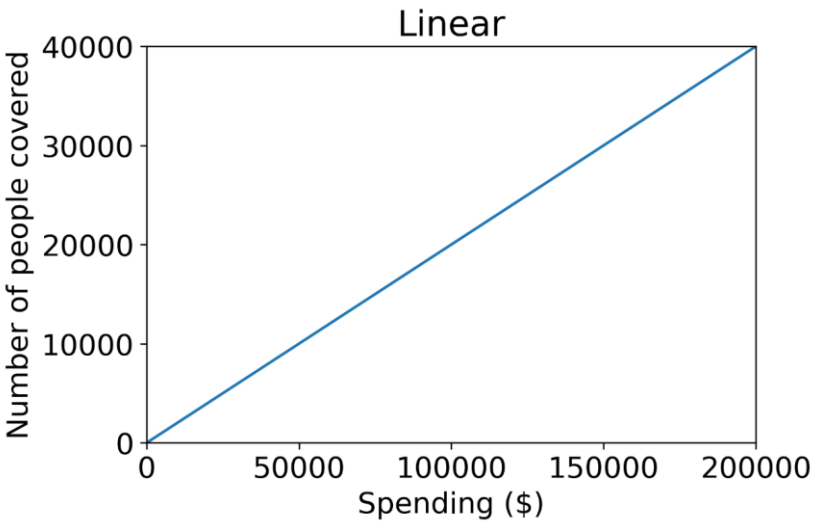
Aims:

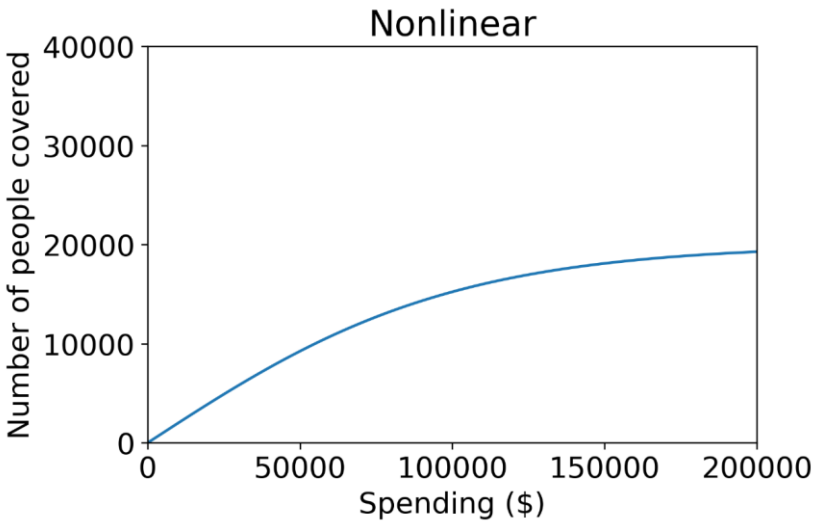
- Manually construct a scenario for a simple example
- Manually construct an optimization for a simple example
- Discuss: What is best? What does this depend on?

Groups:

- All groups: work with the undiagnosed-diagnosed-treated example presented in session C5

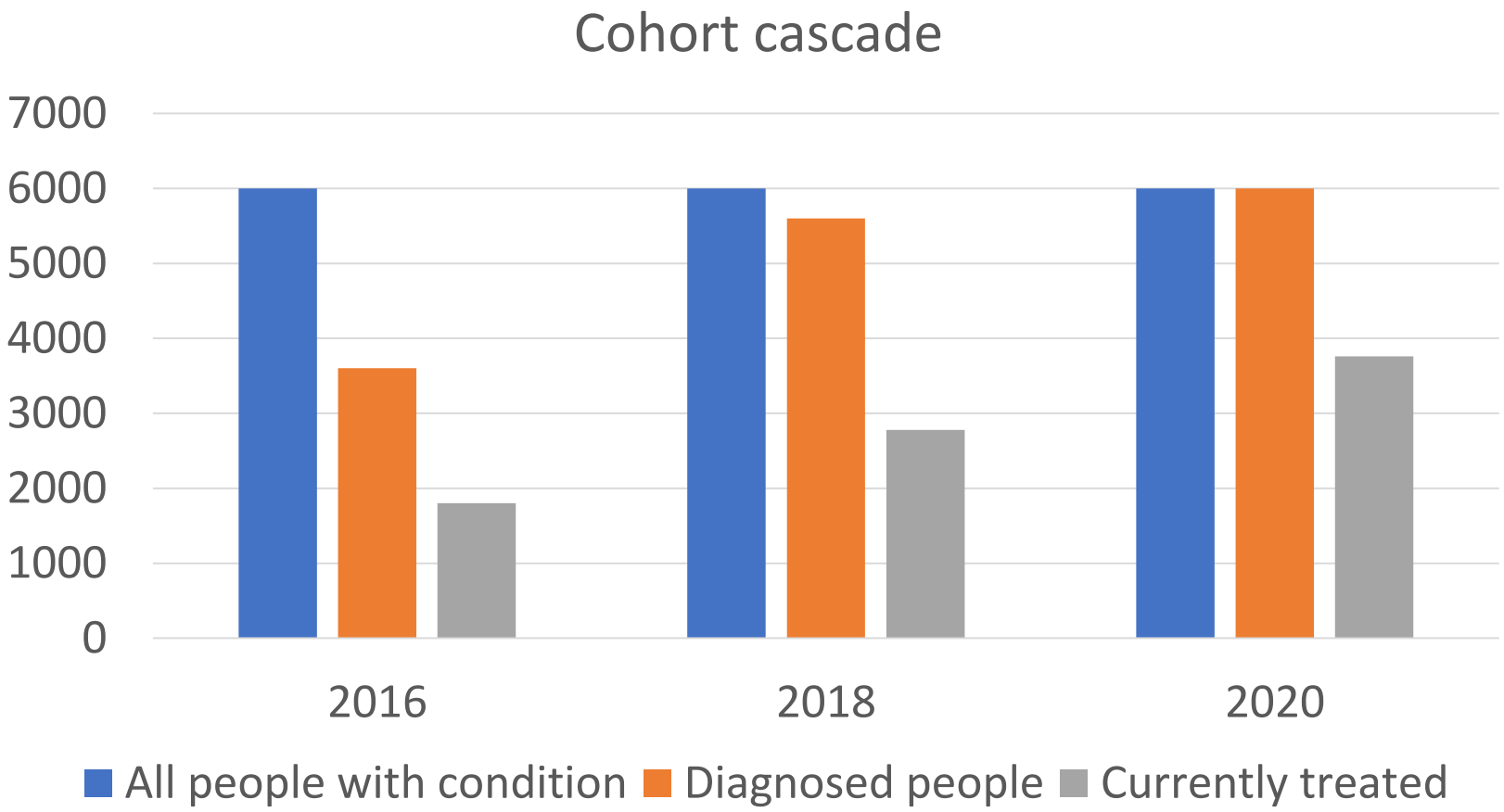
Cost coverage: linear vs nonlinear



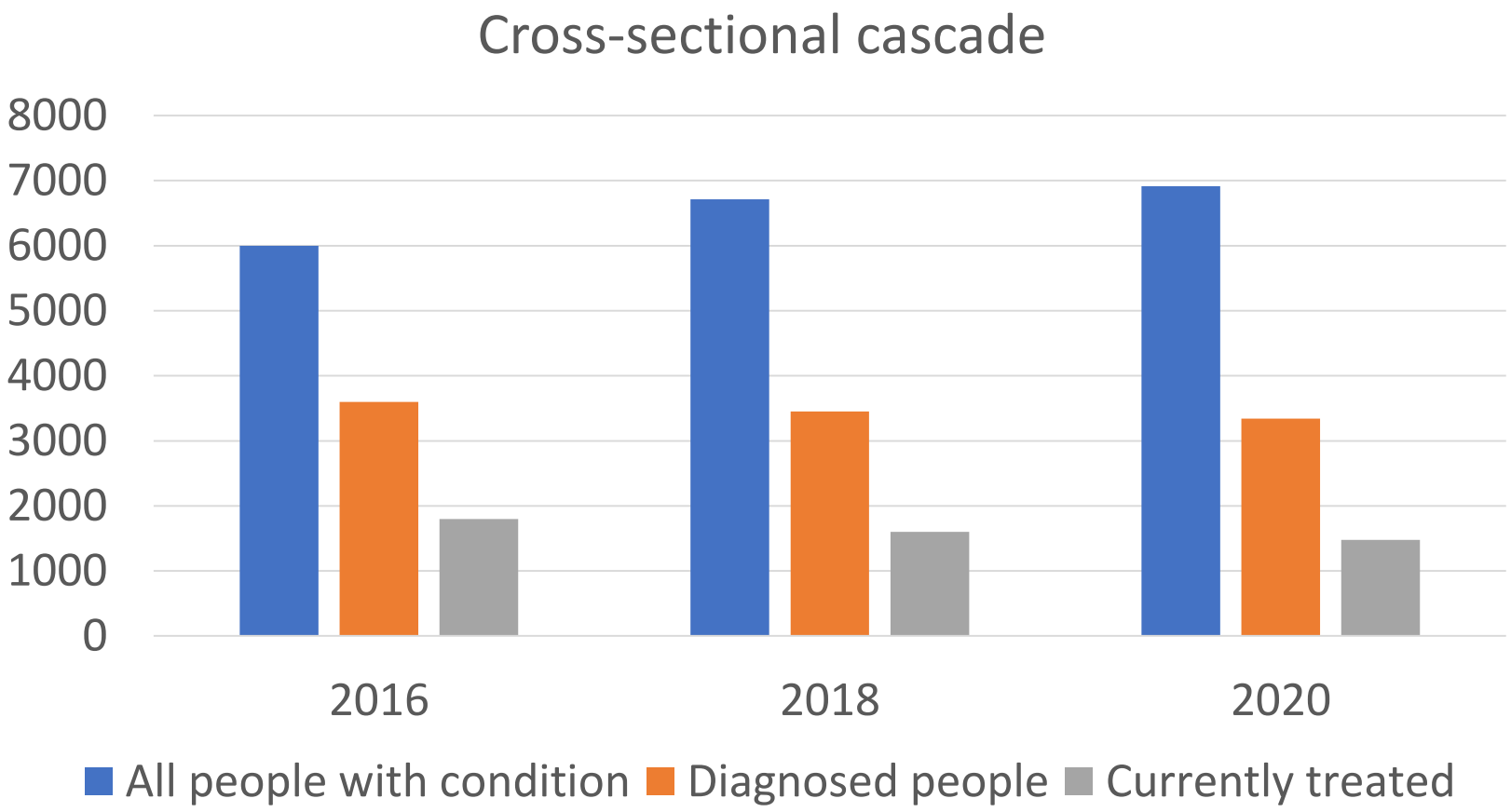


- Linear function, scales up indefinitely (often suitable suitable for low coverage)
- Nonlinear saturation – useful if considering very large scale up (e.g. whole population)
- Nonlinear initially starts out the same as linear, but then smoothly saturates

Cohort cascades vs Cross-sectional cascades



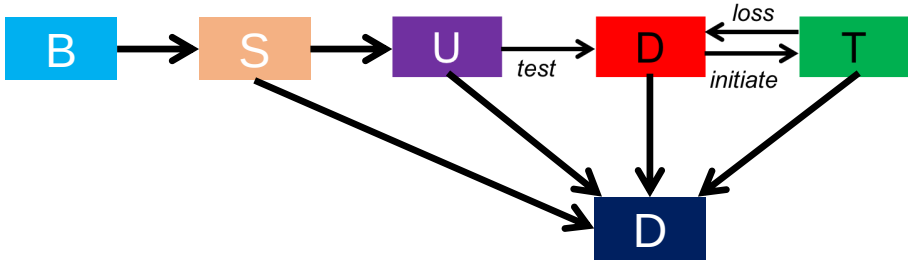
Cross-sectional cascade



Compartment representation

Cohort

Cross-sectional

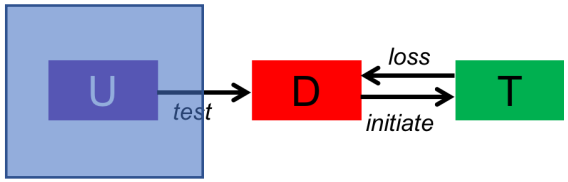


Screening yield and unit cost

Compartments

Cohort

Screening – cost per positive case identified



Cross-sectional

Screening – cost per test