Implementation Cascades & Optimization

Welcome and Introductions

In partnership with
Welcome Remarks

Introduction of Participants

Overview and Purpose

Plan for the Day
Introduction to Cascades
(C1)
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
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

1. **First**, am I diagnosed if I have a health condition?

2. **Second**, am I linked to proper care?

3. **Third**, do I adhere to the needed care?

4. **Fourth**, do I achieve disease control?

Failure at each stage **precludes a successful outcome at the next**, so the cascade tumbles rapidly.
**Care Cascade**: useful visual Tool

Hypertension care cascade Malawi

- Prevalent: 100%
- Screened: 56%
- Diagnosed: 42%
- Treated: 29%
- Controlled: 11%

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

<table>
<thead>
<tr>
<th>Generic service continuum</th>
<th>Health service continuum</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Aware of need</td>
<td>➢ Diagnosed</td>
</tr>
<tr>
<td>➢ Aware of service</td>
<td>➢ Enrolled in care</td>
</tr>
<tr>
<td>➢ Linked to service</td>
<td>➢ Adherent to care</td>
</tr>
<tr>
<td>➢ Successful outcome</td>
<td>➢ Disease control achieved</td>
</tr>
</tbody>
</table>
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

1. Initial General Care Seeking Patterns
   - 29% Private Informal Care
   - 32% Private Formal Care
   - 30% Public Care

2. Access to Diagnosis In Initial Care Seeking
   - Level of Initial Care Seeking
     - L0
     - L1
     - L2
     - L3
   - % of Health Facilities with Smear Available
     - 90%
     - 47%
     - 31%
     - 3%
   - % of Patients Accessing Facility with Smear Microscopy
     - 0%
     - 0%
     - 12%
     - 16%
   - 0% - Receive Dx in Informal Private Care
   - 12% - Receive Dx in Formal Private Care
   - Patients may iterate through the diagnosis pathway multiple times before being initiated on treatment.

3. Cases Notified and Initiated on Treatment
   - Estimated “Missing” Cases (44%)
   - Ex. Pul 7%
   - Clinical Dx 21%
   - Bact. Confirmed 27%

4. TB Treatment Location
   - L0 (<1%)
   - Formal Private Sector 16%
   - Clinical Dx 21%
   - Bact. Confirmed 27%
   - Public Sector 48%
   - Ex. Pul 7%
   - Poor 6%

5. Treatment Outcome
   - Tx Success 46%
   - 4% success
   - <1% Poor

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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

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**
Framework talks to many Aspects of Care Continuum

**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

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 cascade

- 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

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

Source: Author’s own
When 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
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
Conducting Descriptive Analytics with Cascades

(C2)
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

![Stages in Cascades Diagram](image-url)
## Defining the Stages

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

<table>
<thead>
<tr>
<th>Cascade step</th>
<th>Percentage = Numerator / Denominator</th>
<th>Potential Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify key popula</td>
<td>Number of people in a specific KP group in a given locality (size estimation)</td>
<td>Size estimates of key populations in specific areas</td>
</tr>
<tr>
<td>Reach key populations</td>
<td>Number and percentage of individual KPs reached by community outreach workers or through other programming</td>
<td>Databases of organizations providing outreach, e.g., community-based KP organizations</td>
</tr>
<tr>
<td>Test key populations</td>
<td>Number of KPs who received HTC and their test results</td>
<td>Databases of organizations providing HTC services, e.g., community-based KP organizations, government clinics and hospitals</td>
</tr>
<tr>
<td>Diagnose PLHIV</td>
<td>Number of KPs who received HIV-positive test results and post-test counseling</td>
<td>Databases of organizations providing HIV testing services, e.g., community-based KP organizations, government clinics and hospitals</td>
</tr>
<tr>
<td>Enroll in care</td>
<td>Number of HIV-positive KPs enrolled in clinical care</td>
<td>Databases of community-based KP organizations and/or government clinics, hospitals</td>
</tr>
<tr>
<td>Initiate ART</td>
<td>Number of HIV-positive KPs enrolled on ART in accordance with nationally approved protocol or WHO standards</td>
<td>Local and national ARV client databases</td>
</tr>
<tr>
<td>Sustain on ART</td>
<td>Number of HIV-positive KPs known to be alive and on ART 12 months after initiation of ART</td>
<td>Local and national ARV client databases</td>
</tr>
<tr>
<td>Suppress viral load</td>
<td>Number of HIV-positive KPs on ART tested with suppressed viral load (&lt;1000 copies/ml)</td>
<td>Local and national ARV client databases</td>
</tr>
</tbody>
</table>

- **Target population size?**
- **Definition of “reached” with service**
- **Size estimation very uncertain**
- **Capturing 2 actions to occur?**
- **Mobility, tracability?**
- **Data fragmentation**
- **Outcome in unmeasured not known**

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 or within 6 months if normotensive (HTN)
Applying timeliness criteria to Treatment start and Monitoring intervals: Ukraine example

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
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

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
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

Depression care cascade in the US

- Prevalent: 100%
- Diagnosed: 47%
- Treated: 24%
- Controlled: 6%

Challenges in assessing “psychosocial functioning”

Disease outcome stage may depend on how we measure

**Poltava type-2 diabetes program**

Using Fasting Plasma Glucose: **-32%**

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

**Poltava - Breast cancer screening cascade, 2016**

(estimates rounded to nearest 1,000)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target for screen</td>
<td>656,000</td>
</tr>
<tr>
<td>Gynaecologist examination</td>
<td>404,000</td>
</tr>
<tr>
<td>Breast cancer screen</td>
<td>401,000</td>
</tr>
<tr>
<td>Positive screen</td>
<td>approx. 42,000</td>
</tr>
<tr>
<td>Follow-up tests</td>
<td>approx. 30,000</td>
</tr>
<tr>
<td>Positive follow-up tests</td>
<td>approx. 18,000</td>
</tr>
</tbody>
</table>

Sources: Poltava demographic statistics, Health Index 2016 (gynaecologist exam), ambulatory care data from women’s consultation units form 025
Treating screening and treatment stages separately

Poltava - Breast cancer treatment cascade

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

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
Differential ART program implementation in three Kenya settings

HOMA BAY COUNTY OVERALL CASCADE

PLHIV | 158,077
Currently in Care | 42,677
Currently on ART | 28,572
Overall Suppressed | 30,028

MACHAKOS COUNTY OVERALL CASCADE

PLHIV | 32,611
Currently in Care | 6,883
Currently on ART | 4,003
Overall Suppressed | 5,265

WAJIR COUNTY OVERALL CASCADE

PLHIV | 1,278
Currently in Care | 925
Currently on ART | 852
Overall Suppressed | 777

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

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
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
• 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

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

- Undiagnosed
- Screened (Screened and not diagnosed)
- Diagnosed (Diagnosed and not treated, having been screened)
- Treatment (Treated, having been screened)
Step 1 – Decide states for individuals

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

Undiagnosed → Screened → Diagnosed → Treatment

Undiagnosed → Loss

Screened → Loss

Diagnosed → Loss

Treatment → Loss

Diagnosed at hospital visit

(Screened and not diagnosed)

(Diagnosed and not treated, having been screened)

(Treated, having been screened)

(Diagnosed and not treated, without being screened)

(Treated, without being screened)
Step 2 – Form cascade from single path

Cascade for screened

Cascade for not screened

Unscreened

Screened

(Diagnosed and not treated, having been screened)

(Diagnosed and not treated, without being screened)

(Treated, having been screened)

(Treated, without being screened)

Loss

Loss

Loss

Loss

Diagnosed at hospital visit

Diagnosed

Treatment

Treatment

P2 Introduction: Compartments to Cascades
Step 2 – Can also group states ignoring history...

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

- Undiagnosed
- Screened
- Diagnosed
- Treated

(Step 1: Introduce compartments)

(Step 2: Introduce screening)

(Step 3: Introduce diagnosis)

(Step 4: Introduce treatment)

States/compartments are mutually exclusive, but cascade stages are not.

Every cascade stage includes the one that appears after it.
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)
Linking Interventions
(C3)
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
.... 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?

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

Manager Municipality Health Services

District Coordinator Chronic Care

Cascade highlights Programmatic Action

<table>
<thead>
<tr>
<th>Universe of HIV-infected population</th>
<th>HIV-infected persons reached out to and offered testing</th>
<th>Diagnosed HIV-infected</th>
<th>Linked to care</th>
<th>Retained in care</th>
<th>Initiated ART</th>
<th>Not retained in ART</th>
<th>Retained, not suppressed</th>
<th>Suppressed, viral load</th>
</tr>
</thead>
</table>

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...

<table>
<thead>
<tr>
<th>CASCADE</th>
<th>CHALLENGES</th>
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<tbody>
<tr>
<td>Find</td>
<td>Identify those at risk/ill</td>
</tr>
<tr>
<td></td>
<td>Make diagnostics accessible</td>
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<td>Confidence in health services</td>
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<tr>
<td>Link</td>
<td>Awareness of risk</td>
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<td>Asymptomatic illness</td>
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<td>Affordability of care</td>
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<td>Psychosocial factors</td>
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<td>Distance from health services</td>
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<td></td>
<td>Quality/confidence in health services</td>
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<tr>
<td>Treat</td>
<td>Affordability of care</td>
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<td>Physical infrastructure/equipment</td>
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<td>Human resources</td>
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<td>Medicine stock-outs/unaffordability</td>
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<td></td>
<td>Integrated electronic records</td>
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<tr>
<td></td>
<td>Quality/confidence in health services</td>
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<tr>
<td>Retain</td>
<td>Awareness of risk</td>
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<td>Psychosocial factors</td>
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<tr>
<td></td>
<td>Integrated electronic records</td>
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<tr>
<td></td>
<td>Health system capacity</td>
</tr>
<tr>
<td>Disease Control</td>
<td>Improved health outcomes</td>
</tr>
</tbody>
</table>
Solutions may lie within the **Intervention** or wider **Delivery System** (or both in combination)

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

- ✓ Reduce out-of-pocket (OOP) expenses
- ✓ Strengthen decentralized, primary infrastructure
- ✓ Improve chronic management capacity
- ✓ Ensure drug availability/affordability reduce OOP
- ✓ Establish integrated electronic medical records
- ✓ Strengthen training/quality/supervision

- ✓ Strengthen community outreach/communication
- ✓ Reduce out-of-pocket (OOP) expenses
- ✓ 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

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

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
- Nurse
- Pharmacist
- Peer
- Clinical Officer
- CHW
- Laboratorian
- Family

Move from the **broad** Picture ...

... to the **detailed**, disease-specific implementation analysis
TB Implementation Cascade
Homing in on TB Treatment Adherence Services

1. **Treatment supervision**
   - Self-administered treatment (SAT) vs. DOT
   - DOT provider (family vs. lay vs. HCW)
   - DOT location
   - Video observed treatment (VOT)

2. **Social support**
   - Material support
   - Patient education
   - Psychological support
   - Staff education

3. **Tracers and digital health interventions**
   - Phone call
   - Text messaging
   - Home visit
   - Medication monitor

4. **Mixed interventions**
   - Enhanced DOT/mixed interventions vs DOT alone or SAT
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
The Building Blocks to define Modalities

**WHEN**
- Monthly
- Every 2 months
- Every 3 months
- Every 6 months

**WHERE**
- HIV clinic / hospital
- Primary care clinic
- Other clinic
- Community
- Home

**WHO**
- Physician
- Clinical officer
- Nurse
- Pharmacist
- Community health worker
- Patient / peer / family

**WHAT**
- Treatment start/refills
- Clinical monitoring
- Adherence support
- Laboratory tests
- OI treatment
- Psychosocial support

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
Republic of South Africa

WORLD BANK GROUP
Health, Nutrition & Population
• 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

Preliminary – do not cite
Example - Linked unit cost with data on program capacity, geographical settings and cascade stages that the services directly impact.

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

ENABLING ENVIRONMENT programs affect coverage rates of TARGETED PROGRAMS

- **Decrease the** target population
- **Reduce** supply-side constraints (e.g. destigmatization may mean more services can operate)
- **Reduce** demand-side constraints (e.g. empowerment may mean more women can access services)
- **Increase** the proportion of people accessing the intervention who will change behaviour (synergies)

| PWID | PWID reached by NSP (supply-side) | PWID taking up NSP (demand-side) | PWID using clean needles | PWID |
**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

**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
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
Case Study: Feeding Analysis into Policy and Resource allocation Dialogue - NCD/Tobacco Investment Case (C4 - UNDP)
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 \(\rightarrow\) 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**

<table>
<thead>
<tr>
<th></th>
<th>Unit cost</th>
<th>Spend (000’s)</th>
<th>Covered</th>
<th>Impact</th>
</tr>
</thead>
</table>
| **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)             |

**Now**

- All people with condition: 6000
- Aware of status: 6000
- Currently treated: Next year: 3600+500+200+300

**Next year:**

- All people with condition: 1800+100+180+210-240
- Currently treated: 1800+2050
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

<table>
<thead>
<tr>
<th>All people with condition</th>
<th>Aware of status</th>
<th>Currently treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>6000</td>
<td>3600</td>
<td>1800</td>
</tr>
<tr>
<td>6000</td>
<td>4600</td>
<td>2050</td>
</tr>
</tbody>
</table>
### Undiagnosed, Diagnosed, Treated

<table>
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<tr>
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<th>Spend (000’s)</th>
<th>Covered</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pharmacy test</strong></td>
<td>$5</td>
<td>$50 + $20</td>
<td>14,000</td>
<td>• <strong>14,000</strong> tested, <strong>700</strong> diagnosed (5%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• 20% start treatment (140)</td>
</tr>
<tr>
<td><strong>Clinic test</strong></td>
<td>$20</td>
<td>$100</td>
<td>5,000</td>
<td>• <strong>5,000</strong> tested, <strong>200</strong> diagnosed (4%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• 90% start treatment (180)</td>
</tr>
<tr>
<td><strong>Outreach</strong></td>
<td>$15</td>
<td>$30</td>
<td>2,000</td>
<td>• <strong>2,000</strong> tested, <strong>300</strong> diagnosed (15%)</td>
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<td>$25</td>
<td>$20</td>
<td>800</td>
<td>• 5% loss-to-follow-up vs 20% among those not covered (240)</td>
</tr>
</tbody>
</table>

**Next year:**

- All people with condition: 3600
- Aware of status: 4800
- Currently treated: 1800

**Next year:** 1800+140+180+210-240
### A Motivating Example

#### Undiagnosed, Diagnosed, Treated

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Unit Cost</th>
<th>Spend (000’s)</th>
<th>Covered</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmacy test</td>
<td>$5</td>
<td>$50</td>
<td>10,000</td>
<td>- 10,000 tested, 500 diagnosed (5%)&lt;br&gt;- 20% start treatment (100)</td>
</tr>
<tr>
<td>Clinic test</td>
<td>$20</td>
<td>$100 + $20</td>
<td>6,000</td>
<td>- 6,000 tested, 240 diagnosed (4%)&lt;br&gt;- 90% start treatment (216)</td>
</tr>
<tr>
<td>Outreach</td>
<td>$15</td>
<td>$30</td>
<td>2,000</td>
<td>- 2,000 tested, 300 diagnosed (15%)&lt;br&gt;- 70% start treatment (210)</td>
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<td>$25</td>
<td>$20</td>
<td>800</td>
<td>- 5% loss-to-follow-up vs 20% among those not covered (240)</td>
</tr>
</tbody>
</table>

Next year:
- **All people with condition**: 3600 + 500
- **Aware of status**: 1800 + 100 + 216
- **Currently treated**: 2086 + 210 - 240
## A Motivating Example

### Undiagnosed, Diagnosed, Treated

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| **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)              |

Next year: 3600+500+200+500

Next year: 1800+100+180+350-240
# A Motivating Example

## Undiagnosed, Diagnosed, Treated

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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)          |

**Next year:**
- All people with condition: 3600 + 500 + 200 + 300 = 6300
- Aware of status: 1800 + 100 + 180 + 210 = 2390
- Currently treated: 1800 + 210 = 2010

---

[Graph showing the flow from undiagnosed to diagnosed to treated with corresponding costs and impact numbers.]
Comparing Options

- All people with condition
- Aware of status
- Currently treated

Options:
- Now
- Baseline
- Scale up pharmacy testing
- Scale up clinic testing
- Scale up outreach
- Scale up adherence
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
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 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

Cohort cascade

- All people with condition
- Diagnosed people
- Currently treated

Years: 2016, 2018, 2020
Cross-sectional cascade

- **2016**
  - All people with condition: 6000
  - Diagnosed people: 3000
  - Currently treated: 1500

- **2018**
  - All people with condition: 7000
  - Diagnosed people: 3500
  - Currently treated: 2000

- **2020**
  - All people with condition: 8000
  - Diagnosed people: 4000
  - Currently treated: 2500
Compartment representation

**Cohort**

**Cross-sectional**
Screening yield and unit cost

Compartments

Cohort

Screening – cost per positive case identified

Cross-sectional

Screening – cost per test