TB Modelling and Analysis Consortium

ECONOMICS IN TB MAC

ACTIVITIES AND EXTERNAL LINKS

Session overview

To present both activities within TB MAC and external links/resources

- Global Health Cost Consortium
  - Reference case
  - Data
  - Tools
- WHO-TB activities
  - Catastrophic costs surveys
  - Other data – healthcare provider
- Equity considerations in model-based economic evaluations: workshop
- Global Health CEA registry and DALY calculation tools

TB Modelling and Analysis Consortium

GHCC Global Health Cost Consortium

Reference Case for estimating the Costs of Global Health Services and Interventions

Anna Vassall, Sedona Sweeney, James G. Kahn, Gabriela B Gomez, Lori Bollinger, Elliot Marseille, Ben Herzel, Willyanne DeCormier Plosky, Lucy Cunnama, Edina Sinanovic, Sergio Bautista, GHCC Technical Advisory Group, GHCC Stakeholder Group, Kate Harris, Carol Levin

University of Washington Department of Global Health
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London School of Hygiene & Tropical Medicine
Instituto Nacional de Salud Pública

Our aim - what do we want to achieve?

*What do we mean by **good costing**?*

Costing is a process of estimation

Example characteristics of a good estimate:

- Precision
- Accuracy

But how accurate and precise is good enough?

Not a gold standard

‘Cost of getting it right compared to the cost of getting it wrong’

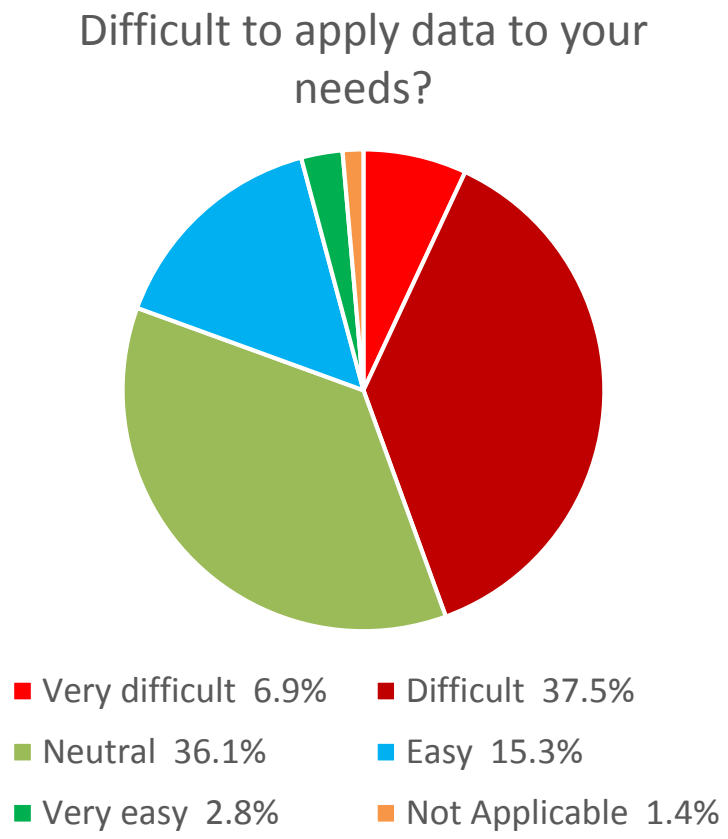
But other ‘desirable’ characteristics

Generalisability and transferability

- Can we apply the cost to other settings?
- *More important to be relevant to context?*

Comparability, reliability and standardisation

- Are cost estimates comparable with one another?
- *Innovation?*



Our aim

To improve the relevance, use and quality of cost estimates by:

Ensuring that the process of cost estimation is transparent, so that those using the data can apply estimates widely and appropriately

Framework for producers of cost data to consider how their methodological choices influence the quality and relevance of their estimates, and present data in way that maximises the extent of its use

Reference Case approach and content

IDSi reference case for economic evaluations

1. Set of ‘acceptable’ principles
2. Methodological guidance on how to achieve those principles (theory and evidence based)
3. Reporting standards
4. Standardisation for specific interventions with additional guidance where available

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Achieves our aim by:

- Not a tool, but complements
  - Reference case compatible guidelines/tools
- Context specific
- Rooted in economic *and* statistical principles *and* empirically supported methods
  - Understanding bias and precision
  - Comparing ways of measuring service/ resource use
  - Valuing resources

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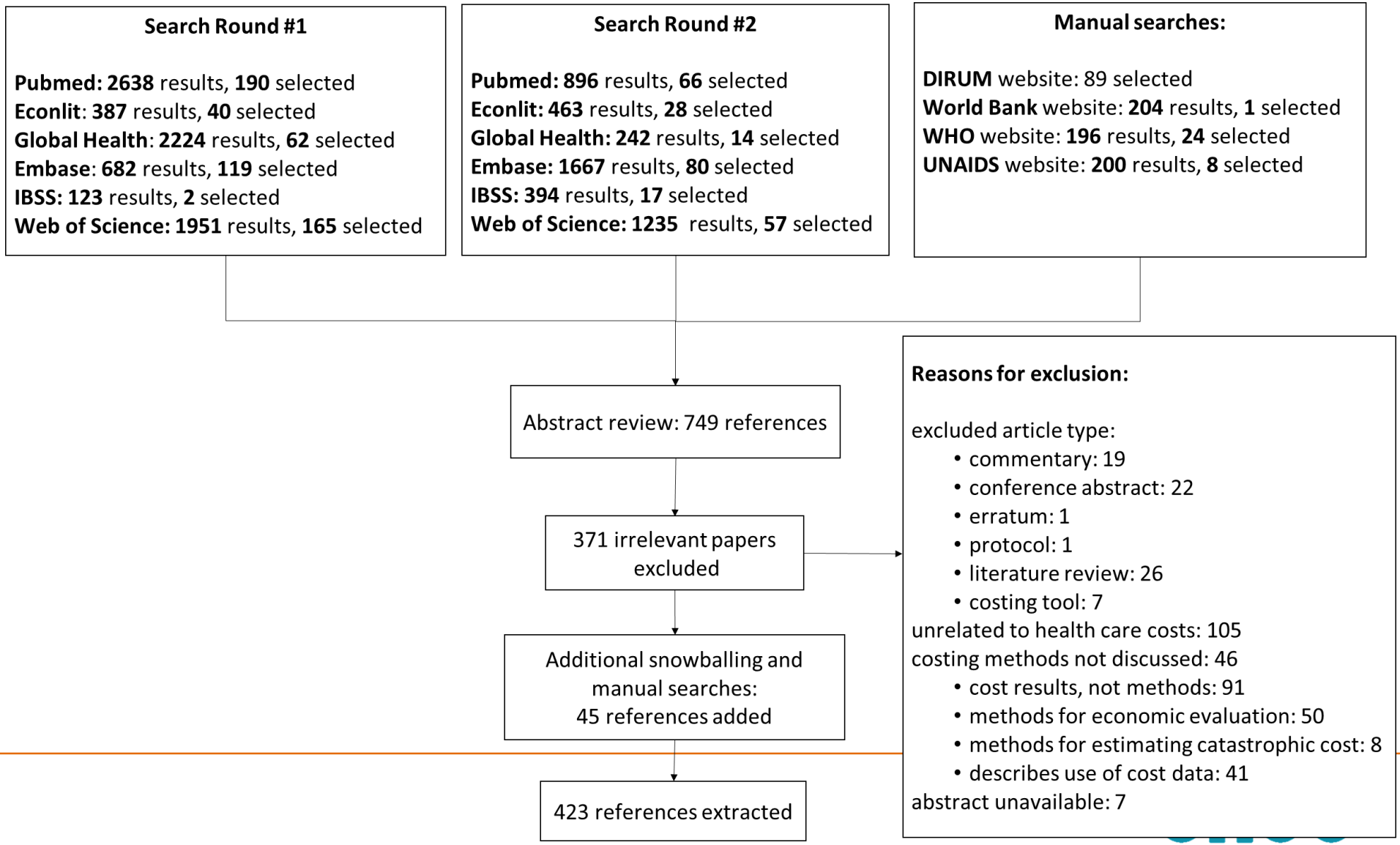
Bibliometric review: Search Strategy



Costing Tools – not included in the review

HIV tools

- Goals
- Resource Needs Module
- Decision-Makers' Program Planning Tool (DMPPT)
- Future ART Costs
- PMTCT
- Optima
- ASAP HIV/AIDS Costing Tool
- VCT Costing checklist
- AIDS Impact Model for Business (AIM-B)
- Antiretroviral Therapy Unit Cost Spreadsheet
- HIV Testing and Counseling Service Delivery Costing Model (HSDC)
- Key Populations Costing Workbook
- Medication-Assisted Therapy Costing Worksheet
- PMTCT and Pediatric ART Costing Tools (PMTCT/Peds)

TB tools

- TB Impact Model and Estimates (TIME)
- Planning and Budgeting for TB

Other tools

- DemProj
- AIDS Impact Mode (AIM)
- Lives Saved Tool
- OneHealth Tool
- Marginal Budgeting for Bottlenecks
- Integrated Healthcare Technology Package (iHTP)
- Costing and Financing Tool for Childhood Immunization
- Integrated Health Model
- Pipeline Monitoring and Procurement Planning
- Supply Chain Manager
- ProQ Quantification Software for HIV Tests
- Assessment tool for Laboratory Services and Supply Chains Database (ATLAS)
- Cost Revenue Analysis Tool
- Reproductive Health (RH) Costing Tool
- Planning, Costing and Budgeting Framework (PCBF)
- CORE Plus

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Survey: recruitment strategy

Mailing Lists
- IHEA
- IAEN
- healthecon-all (Bruce Hollingsworth)

Regional associations
- African Health Economics and Policy Association
- Asociacion de Economia de la Salud Latinoamerica y Caribe (AES LAC)

Country associations
- Associação Brasileira de Economia da Saúde
- China Health Economics Association
- Colombian Health Economics Association
- Health Economics Association of India
- Indian Health Economics and Policy Association
- Indonesian Health Economics Association
- Nepal Health Economics Association
- Singapore Health Economics Association
- Turkish Health Economics and Policy Association
- Asociacion de Economia de la Salud del Uruguay
- Vietnam Health Economics Association

Modelling Consortia
- TB-MAC
- HIV Modelling Consortium

Individual contacts
- GHCC stakeholders
- OneHealth tool consultants
- GFATM consultants
- National Health Accounts reference points (individual emails)

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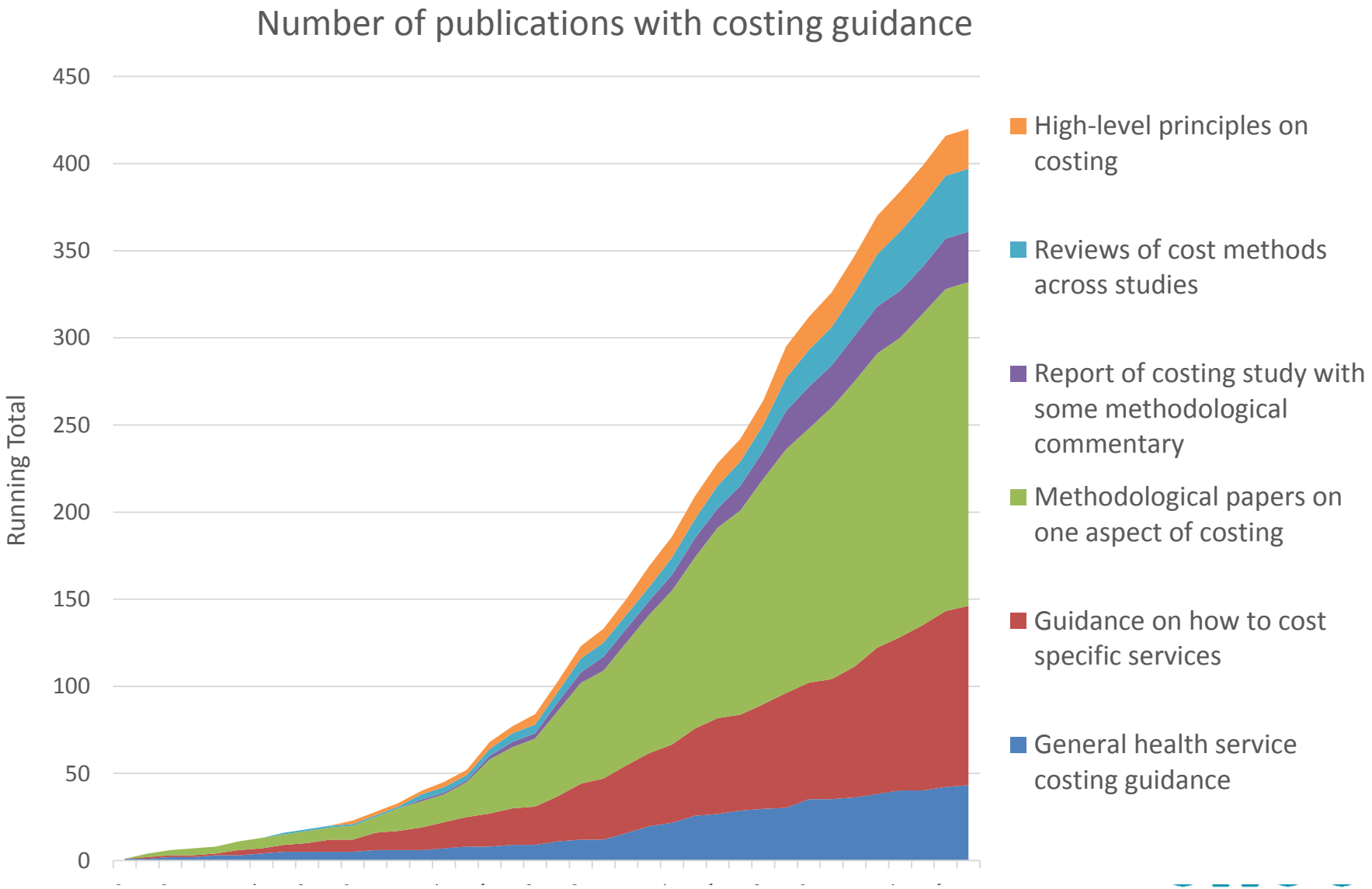
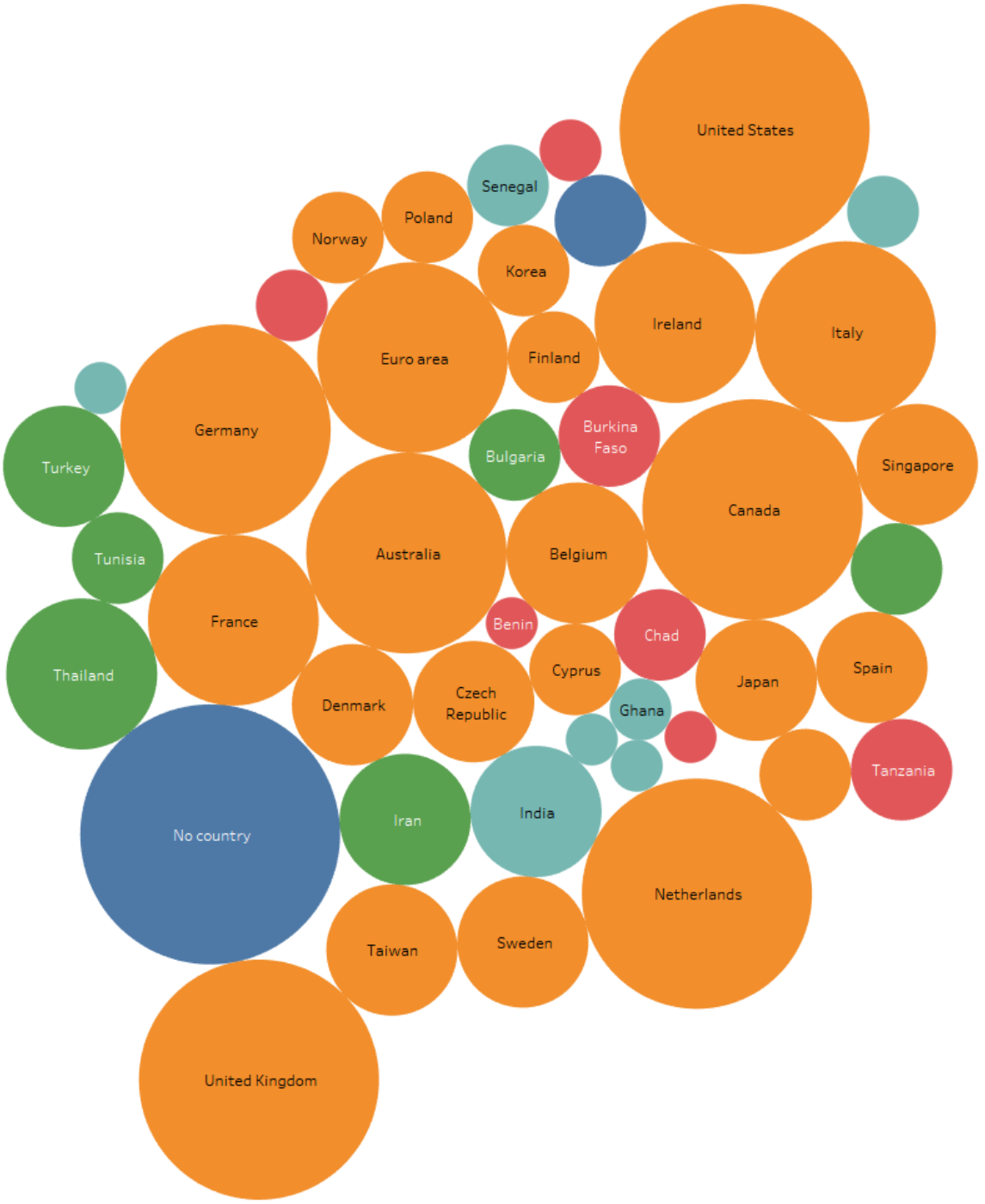
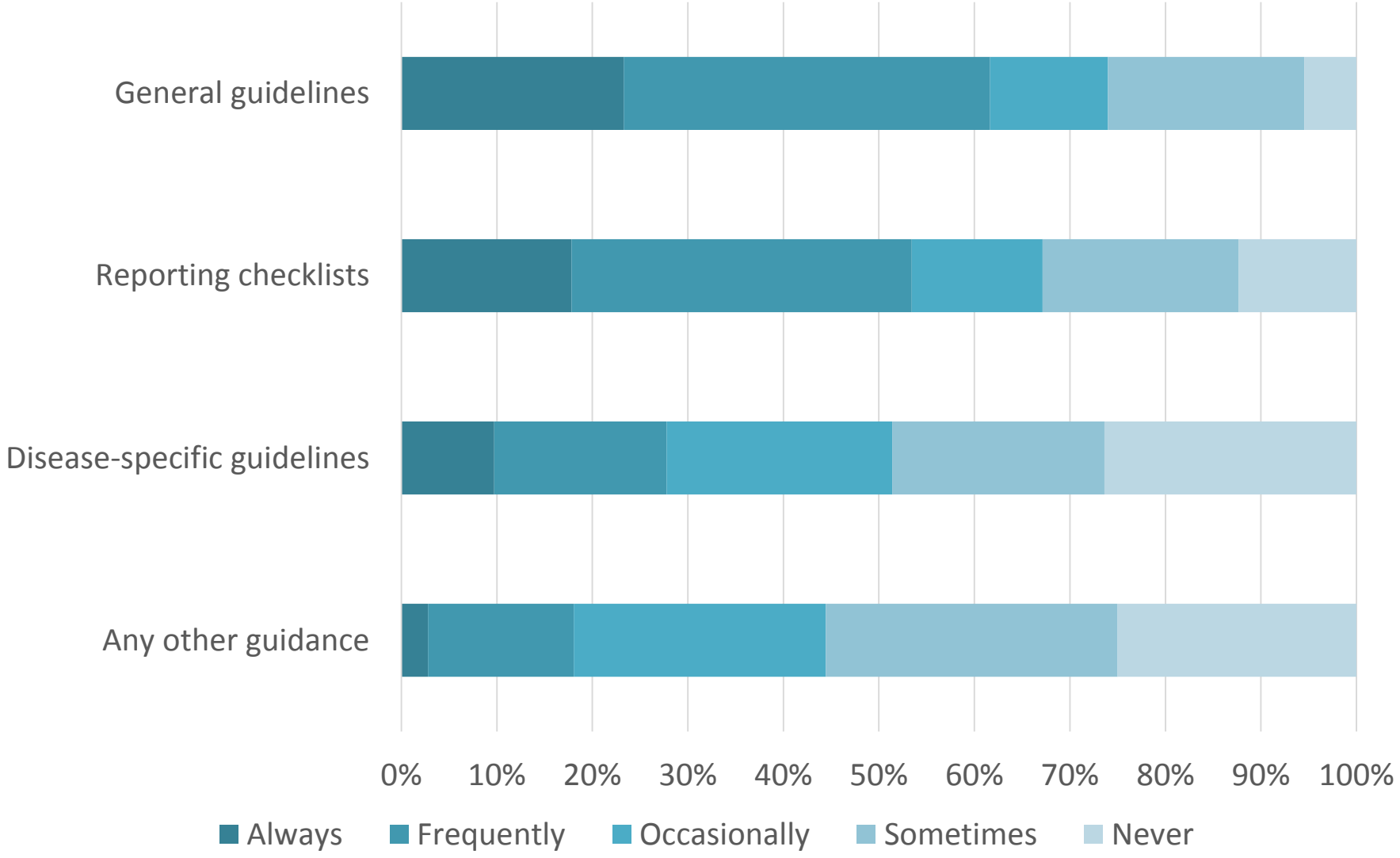
When has guidance been published?



What countries/ areas does the existing guidance concern?



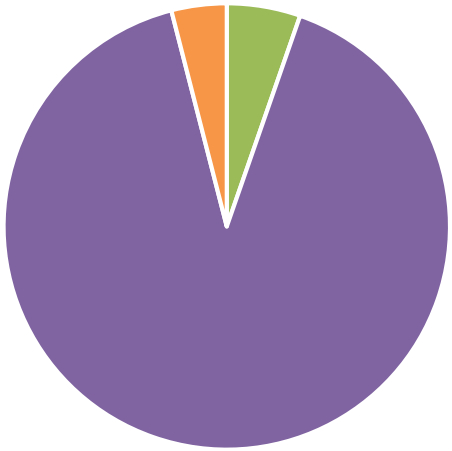
Survey: “To what degree do these methodological resources influence your costing methods?”



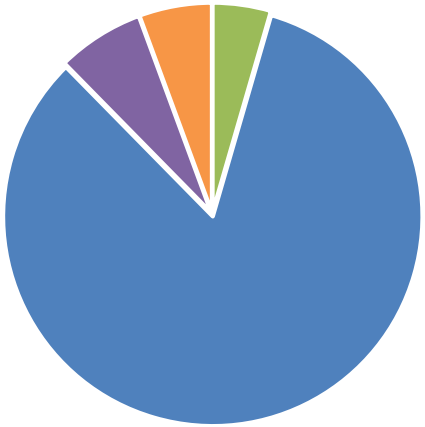
What types of issues are addressed by current guidance?

Does any analysis underlie guidance?

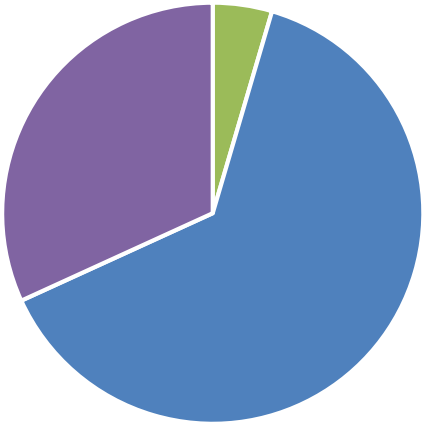
Overview guides to costing



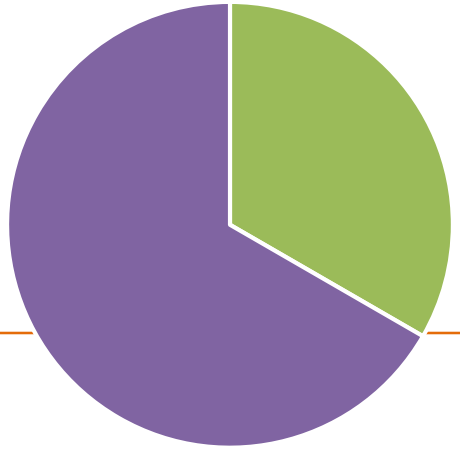
Measuring quantities of resources / visits



Top-down vs. bottom-up costing



Reporting

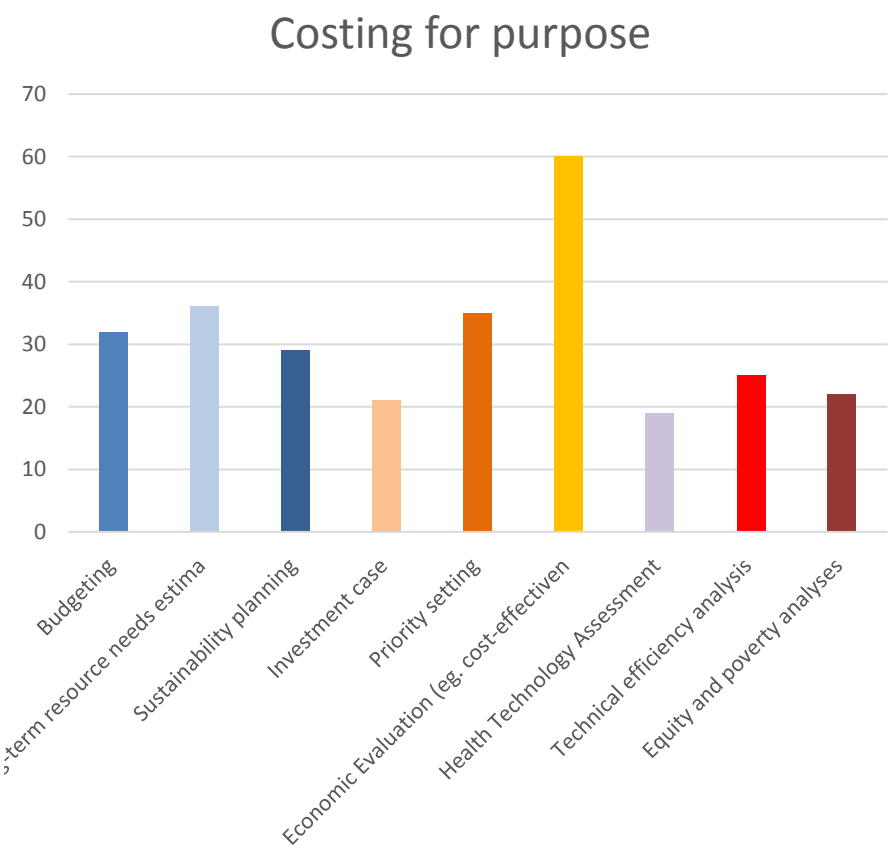


Valuation

- Empirical comparison / validation
- Case study / worked example
- Other analysis
- No analysis

Challenge 1 – ‘Principles for purpose’

- Guidance specific for four purposes
  - Economic evaluation and priority setting
  - Medium term planning
  - Budgeting
  - Efficiency analyses
- *Economic vs financial cost*
- *Tolerance for uncertainty may differ*



Challenge 2 – Costs or cost functions?

Why cost functions?

- Cost vary economies of scale and other determinants
- Are unit costs for single services jointly produced possible to estimate?
- Cost functions pivotal in priority setting models

Why not?

- Most studies under limited budget small number of sites

Compromise

- Cost data collection still required to estimate cost functions
- Section explaining cost functions and inference
- Later guidance and review on both mechanistic and empirical approaches

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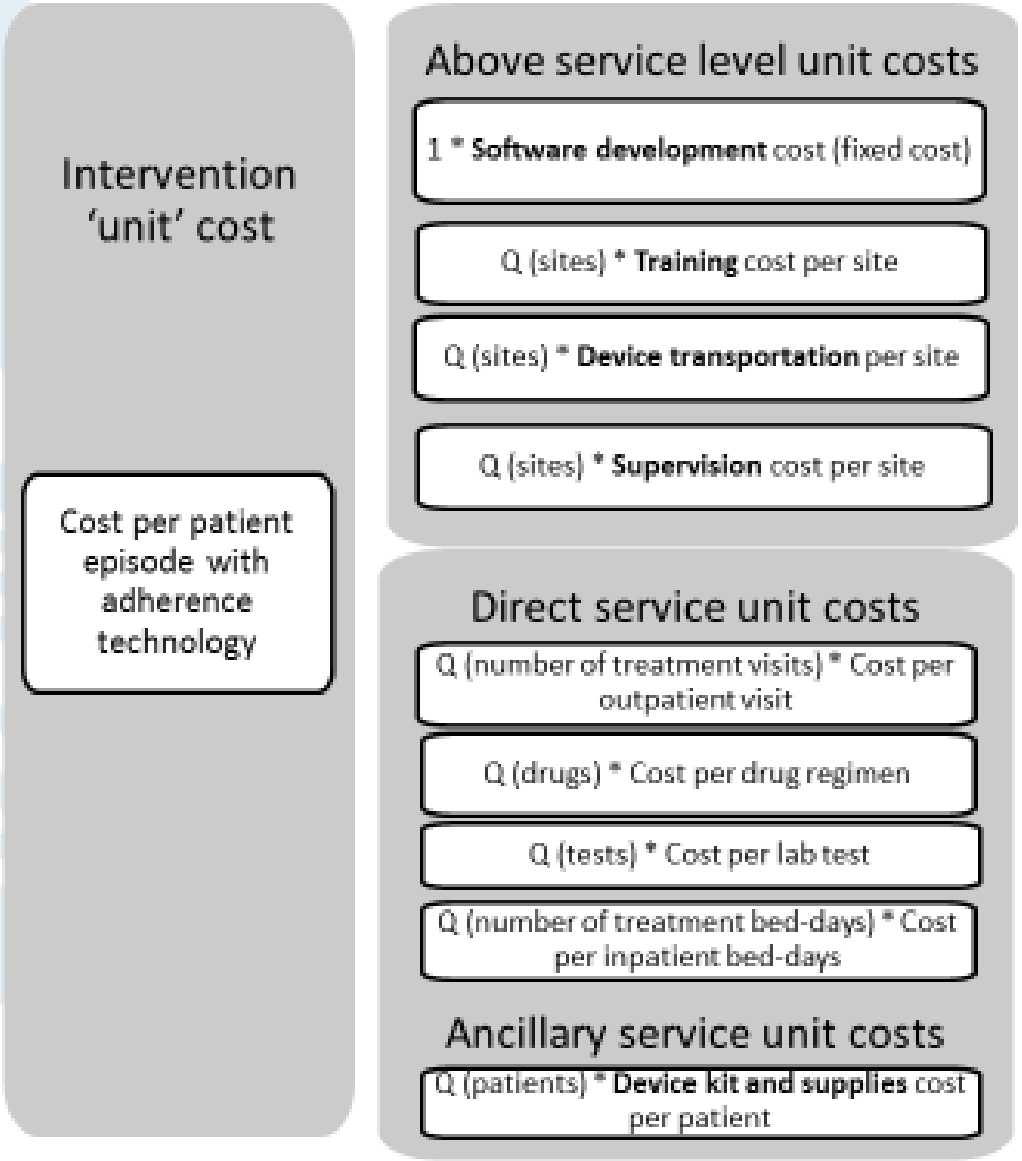
Challenge 3 – Standardising What is a 'unit cost'?



LONDON SCHOOL of HYGIENE &TROPICAL MEDICINE

Other areas we addressed (methods spec)

Encourage improvement in…

- Definitions – geographical, conceptual, categories
- Above service level costs
- Sampling for costing
- Real world vs per protocol/ guidance
- Research costs/ timing
- Dis-aggregated reporting
- **TB specific costing tools**

Study Design

1	The **purpose**, the **population**, and the **intervention and service/output** of the cost estimation should be defined.
2	The **perspective** of the cost estimation should be defined.
3	The type of unit cost estimated should be defined in terms of **economic** versus **financial**, **real world** versus **normative best practice** and **full** versus **incremental** cost, and whether the cost is **net of future cost savings**. The type of cost should be justified relevant to purpose.
4	The **'units'** in the unit costs for strategies, services, and interventions, should be defined, relevant for the costing purpose, and generalizable.
5	The **time horizon** should be clearly stated and of sufficient length to capture all costs relevant to intervention and purpose, and consideration should be given to disaggregating costs into **separate time periods** where they vary over time.

Resource use measurement

6	The **scope of the inputs** to include in the cost estimation should be defined and justified relevant to purpose. Where inputs are excluded for pragmatic reasons these should be reported.
7	The methods for estimating the **quantities of inputs** should be described, including methods, data sources and criteria for allocating shared costs, and the **exclusion of research costs**
8	The **sampling frame, method and size** should be determined by the precision demanded by the costing purpose and designed to minimize bias.
9	The selection of the **data source and methods for estimating 'units'** for unit costs should be described, with potential biases reported in the study limitations.
10	Consideration should be given to the **timing of data collection** to minimize recall bias and, where relevant the impact of seasonality and other differences over time.

Valuation and pricing

11	The **sources for price data** should reflect the price relevant to purpose and be described for each input in a way that allows for adjustment across settings.
12	**Capital** costs should be appropriately amortized or depreciated to reflect the expected life of capital inputs
13	Where relevant an appropriate **discount rate, inflation, and currency conversion rates** should be used and clearly stated.
14	The use and source of shadow prices, for goods where **no market price** exists, and for the **opportunity cost of time** should be reported.

Reporting and analysing results

15	**Variation** in the cost of the intervention by site size/organization, sub-populations, or by other drivers of **heterogeneity** should be explored and reported.
16	The **uncertainty** associated with cost estimates should be appropriately characterized.
17	Cost estimates should be communicated clearly and **transparently** to enable decision-maker(s) to interpret and use the results.

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Reporting Checklist

Principle 1 - The purpose of the study, the population, and the intervention and/or service/output being costed should be clearly defined.	
Purpose type:	Economic evaluation, Financial planning, Budget impact analysis, Efficiency Analysis, Other
Relevance for health practice and/or policy decisions:	Free text
Aim of the cost analysis:	Free text
Intended user(s) of the cost estimate:	Free text
Main activities/technologies involved:	Free text
Target population:	As relevant: age, gender, geographical location, clinical indication
Coverage level:	Percentage of target population or sites
Delivery mechanism (e.g. health system level, facility type, ownership, etc.):	As relevant: level of health service, facility type
Epidemiological context (i.e. incidence/prevalence of disease)	As relevant: incidence and/or prevalence
Intervention	Describe production process (e.g. list main activities and key technologies involved in delivering the intervention)

With thanks….

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Ulla Griffiths
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Hojoon Sohn
Fabrizio Tedosi

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Patient-incurred cost and catastrophic expenditures

Sedona Sweeney, Mariana Siapka, Anna Vassall, Gabriela B Gomez, on behalf of GHCC team

GHCC work on patient costs

1. Cost repository of data
2. Supporting WHO methods development through data analysis
    1. Focus on specific useful elements for methods (GHCC)
    2. *Development of guidelines (WHO)*
3. Extrapolating across & within countries
    1. Pooling study data into a country estimate (South Africa)
    2. *Producing final estimates with countries (WHO)*

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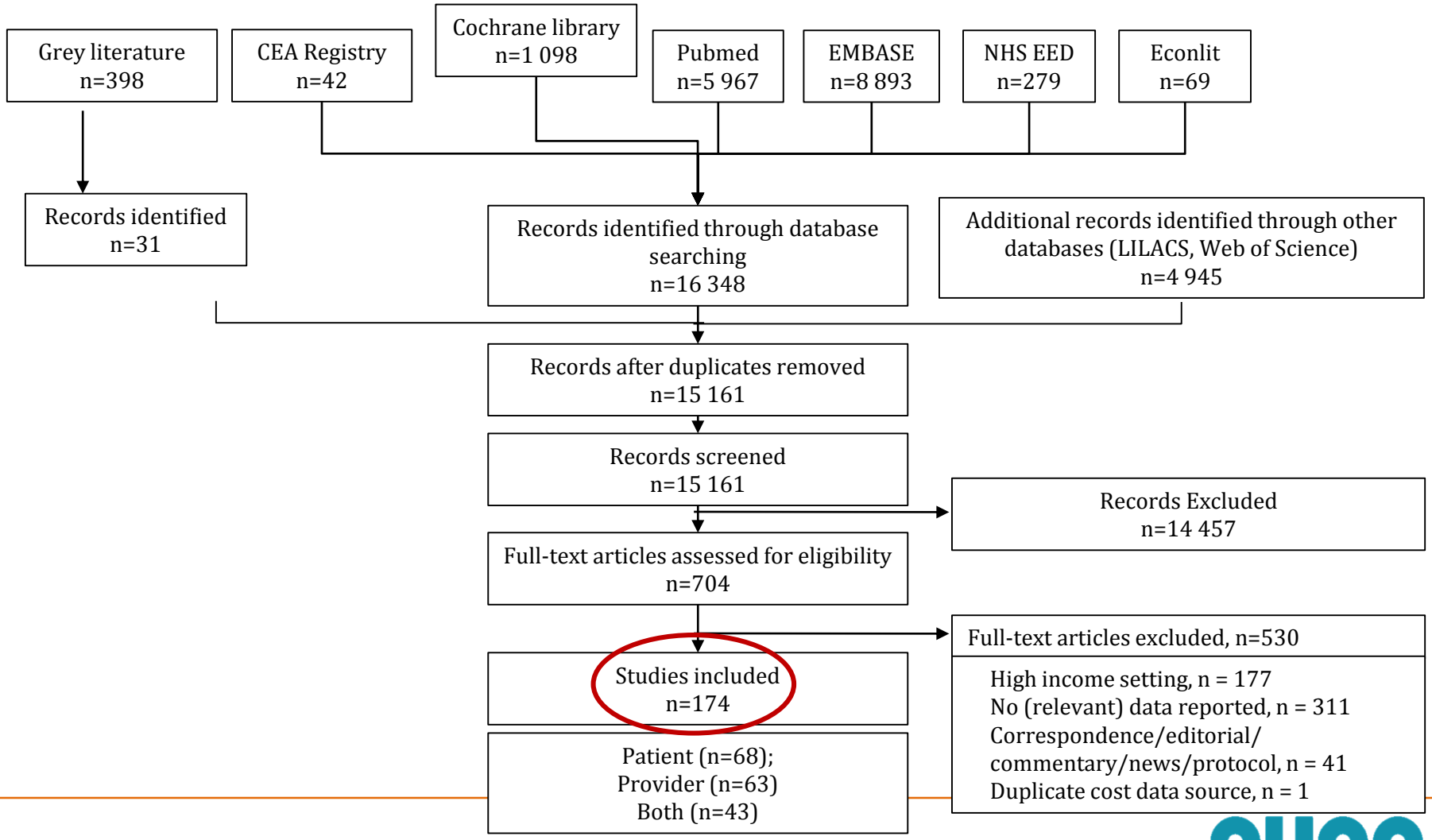
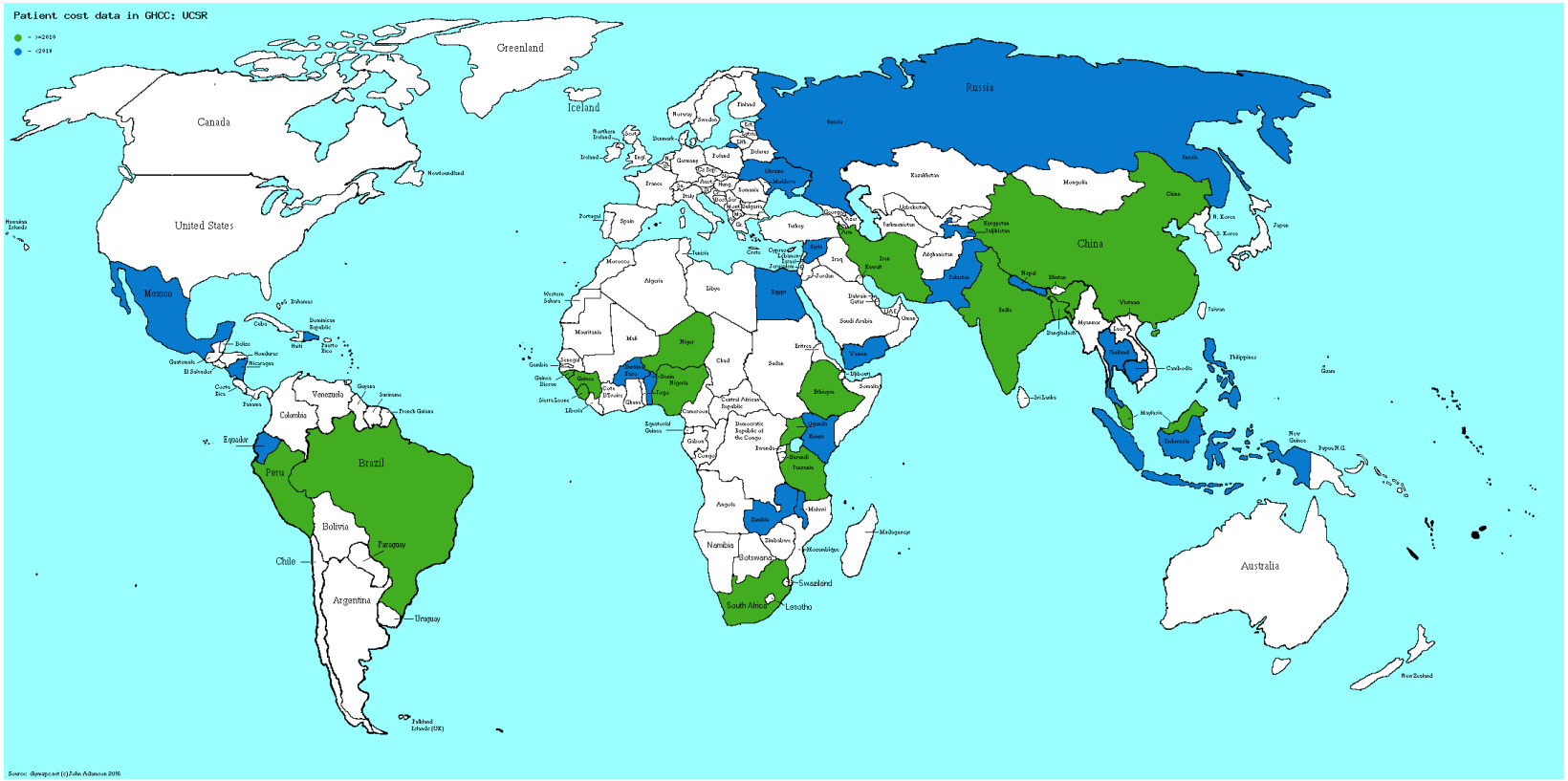
TB cost data


Grey literature
n=398
CEA Registry
n=42
Cochrane library
n=1 098
Pubmed
n=5 967
EMBASE
n=8 893
NHS EED
n=279
Econlit
n=69
Records identified
n=31
Records identified through database searching
n=16 348
Additional records identified through other databases (LILACS, Web of Science)
n=4 945
Records after duplicates removed
n=15 161
Records screened
n=15 161
Records Excluded
n=14 457
Full-text articles assessed for eligibility
n=704
Full-text articles excluded, n=530
High income setting, n = 177
No (relevant) data reported, n = 311
Correspondence/editorial/ commentary/news/protocol, n = 41
Duplicate cost data source, n = 1
Studies included
n=174
Patient (n=68);
Provider (n=63)
Both (n=43)

3. Extrapolating across countries

- Only 25% of unit costs are >=2010 (green)



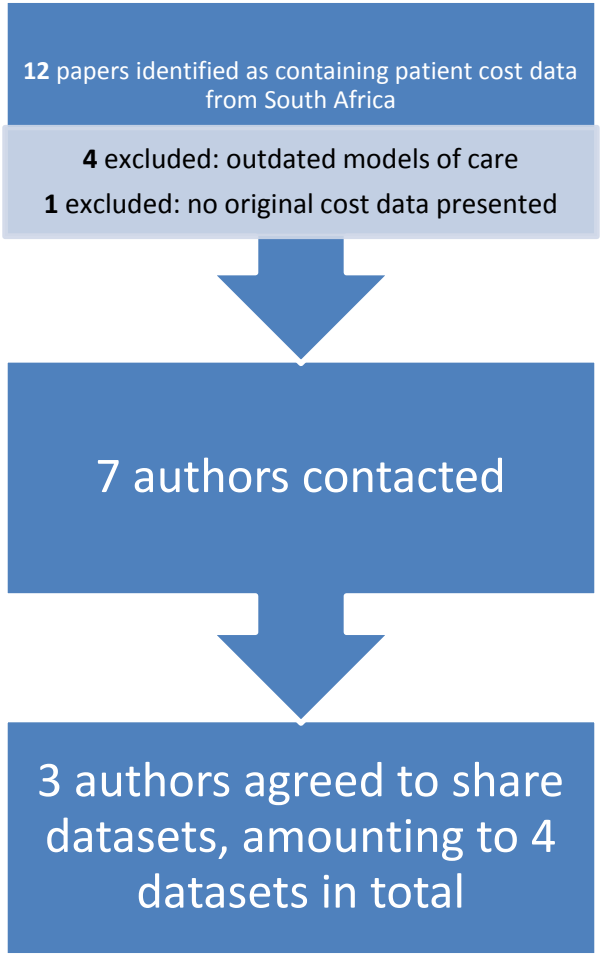
3. Extrapolating across countries

- PCF 20% of data, different technologies and algorithms
- Treatment >75% of data
  - First line treatment accounts for 75% of treatment data
- Regression based methods for extrapolation of FLT only:
  - Country variables
  - Study variables
- Timeline: Q1 2019

Extrapolating within countries: Pooled analysis – catastrophic TB costs

- In some countries, existing data from smaller-scale projects and trials
- Is it possible to get a ‘reasonable’ estimate of national prevalence of catastrophic cost using few, small and convenient sample studies?
- Example using patient cost data from South Africa

Searches and data access



Author (Date)	Study Name	Provinces	Number MDR-TB patients	Number DS TB patients
Fairall (2010)		Free State	0	1,999
Van Rie (2013)		Johannesburg	0	199
Du Toit (2015)		Cape Town	153	0
Ramma (2015)		Cape Town	134	0
Chimbindi (2005)	**REACH**	**KwaZulu-Natal, Gauteng, Mpumalanga**	**0**	**1,229**
Foster (2015)	**XTEND**	**Gauteng, Free State, Eastern Cape, Mpumalanga**	**0**	**175 (cases); 35 (suspects)**
Mudzengi (2016)	**MERGE**	**Gauteng**	**0**	**156**

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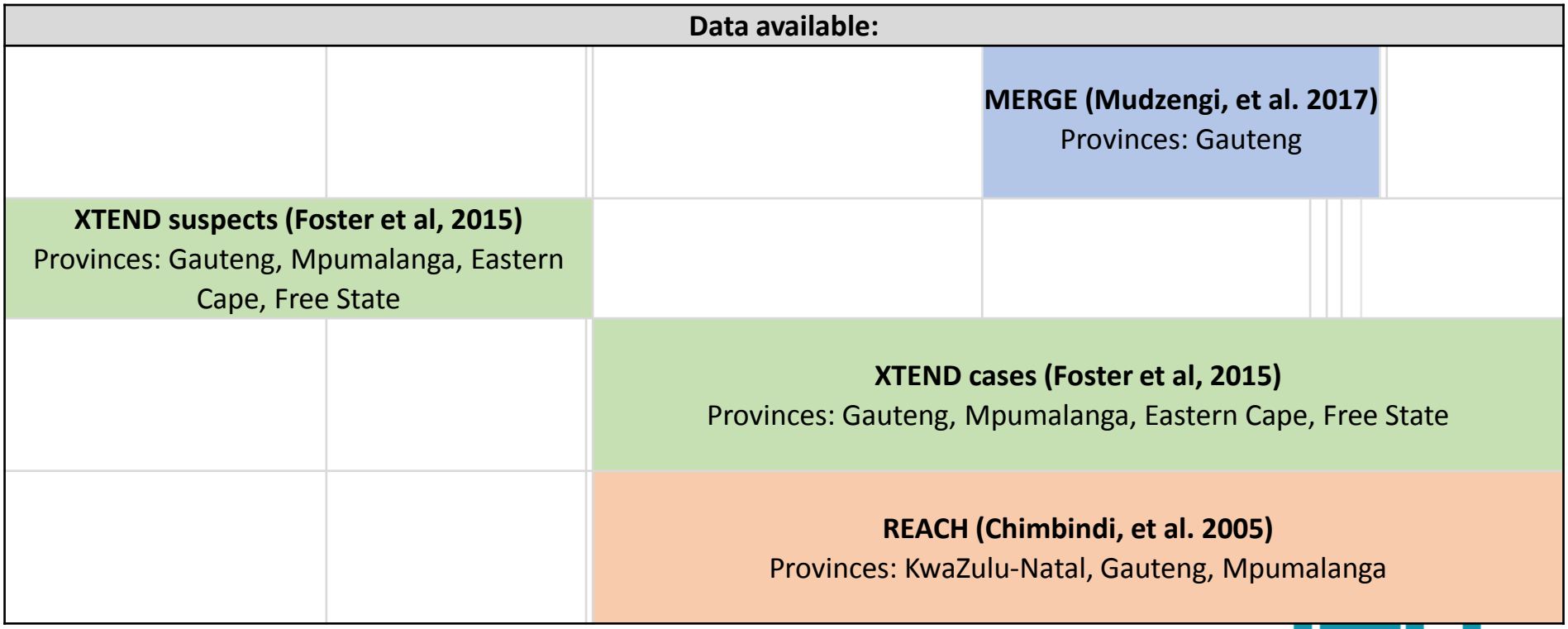
Constructing the dataset: Demographics

As expected, demographics varied across studies. Demographics in the pooled analysis were also not nationally representative

	REACH n = 1219	MERGE n = 148	XTEND n = 171	Pooled Dataset n = 1573	Difference (chi2)
Female n (%)	638 (52%)	76 (51%)	77 (45%)	802 (51%)	8.68*
Urban n (%)	628 (52%)	148 (100%)	109 (64%)	908 (58%)	131.09***
Mean age (Std Dev)	37 (12)	35 (10)	40 (13)	37 (12)	7.74
Black/African n (%)	1162 (95%)	145 (98%)	167 (98%)	1508 (96%)	4.10
Grade 8 and above n (%)	756 (62%)	125 (84%)	124 (73%)	1025 (65%)	34.65***
Married / Cohabitating n (%)	315 (26%)	48 (32%)	55 (32%)	430 (27%)	6.16
Employed at interview n (%)	195 (16%)	75 (51%)	64 (37%)	351 (22%)	133.19***
Income quintile distribution (quantile regression approach) n (%)	Quintile 1: 52 (4%) Quintile 2: 641 (53%) Quintile 3: 432 (35%) Quintile 4: 94 (8%) Quintile 5: 0 (0%)	Quintile 1: 0 (0%) Quintile 2: 39 (26%) Quintile 3: 78 (53%) Quintile 4: 31 (21%) Quintile 5: 0 (0%)	Quintile 1: 11 (6%) Quintile 2: 72 (42%) Quintile 3: 62 (36%) Quintile 4: 27 (16%) Quintile 5: 0 (0%)	Quintile 1: 66 (4%) Quintile 2: 765 (49%) Quintile 3: 581 (37%) Quintile 4: 162 (10%) Quintile 5: 0 (0%)	83.81***

Constructing the dataset: Reconciling timeframes

Period definitions:								
Period 1		**Period 2**	**Period 3**		**Period 4**			
Symptom onset	Seeking Care	Diagnosis received	Treatment: Intensive phase		Treatment: Continuation phase			
			Month 1	Month 2	Month 3	Month 4	Month 5	Month 6



Constructing the dataset: Reconciling income measures

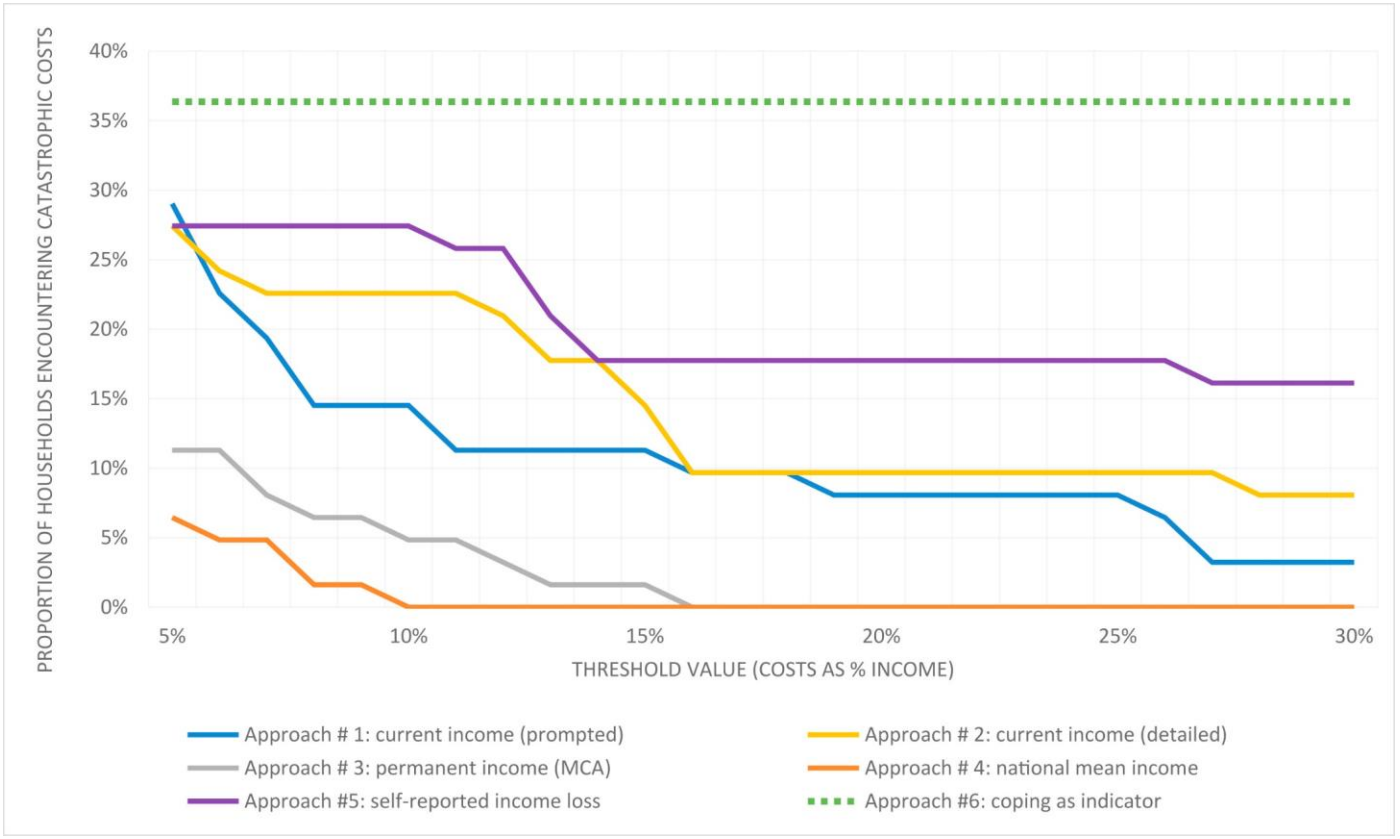
Period definitions:								
Period 1		**Period 2**	**Period 3**		**Period 4**			
Symptom onset	Seeking Care	Diagnosis received	Treatment: Intensive phase		Treatment: Continuation phase			
			Month 1	Month 2	Month 3	Month 4	Month 5	Month 6

Data available:
MERGE (Mudzengi, et al. 2017) Income estimation: self-reported individual income
XTEND suspects (Foster et al, 2015) Income estimation: self-reported individual income (brackets)
XTEND cases (Foster et al, 2015) Income estimation: self-reported individual income (brackets)
REACH (Chimbindi, et al. 2005) Income estimation: self-reported household expenditures (brackets)

Measuring income for catastrophic cost estimates: Limitations and policy implications of current approaches

Sedona Sweeney*, Rachel Mukora, Sophie Candfield, Lorna Guinness, Alison D. Grant, Anna Vassall

https://doi.org/10.1016/j.socscimed.2018.08.041



Constructing the dataset: Provider types

	Period 3 MERGE n = 1	REACH n = 102	XTEND n = 172	One-way ANOVA (F statistic)	Period 4 MERGE n = 146	REACH n = 1021	XTEND n = 172	One-way ANOVA (F statistic)
Visits per month								
This clinic	2.0	8.3	6.3	1.99	4.3	8.9	0.8	74.39***
Pharmacy	0.0	0.2	0.0	4.03*	0.0	0.4	0.0	9.11***
General Practitioner	0.0	0.1	0.1	0.04	0.0	0.1	0.0	4.36*
Outpatient Hospital	0.0	0.0	0.1	0.60	0.0	0.0	0.0	0.48
Inpatient Hospital	0.0	0.1	0.1	0.01	0.0	0.1	0.0	1.52
Traditional Healer	0.0	0.0	0.0	1.17	0.0	0.1	0.0	2.92
Direct medical cost per visit								
This clinic	$0.00	$0.00	$0.00		$0.00	$0.00	$0.00	
Pharmacy		$2.42	$54.13	2.50	$0.22	$1.84	$7.13	5.02**
General Practitioner		$23.23	$110.46	0.62	$23.78	$17.38	$55.18	27.58***
Outpatient Hospital		$7.28	$40.05	0.11	$4.12	$2.87	$4.63	0.45
Inpatient Hospital		$0.00	$104.72	0.15	$18.69	$1.14	$13.46	4.00*
Traditional Healer			$90.37		$439.05	$20.58	$109.76	139.02***
Direct non-medical cost per visit								
This clinic	$0.00	$1.65	$0.66	8.27***	$1.00	$2.06	$1.14	1.39
Pharmacy			$3.42		$0.00		$3.29	
General Practitioner			$6.88		$26.56		$4.28	1.91
Outpatient Hospital			$12.66		$9.88		$5.39	0.76
Inpatient Hospital			$24.39		$17.57		$5.43	0.60
Traditional Healer			$14.63		$21.95		$0.00	0.06

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Analytic approaches

- Logistic regression with multiple imputation
- Meta-analysis and decision model

Analytic approach #1: Logistic regression with multiple imputation

- Estimate income through quantile regression analysis linked to National Income Dynamics Study (NIDS) dataset
- Multiple imputation of missing cost observations (treating as MAR)
- Logistic regression to identify determinants of catastrophic
- Results used to estimate national catastrophic prevalence based on national population characteristics & TB prevalence

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Regression results

	Odds Radio (Std Err)
Employed	5.47*** (2.23)
Rural	0.34* (0.18)
Female	0.76 (0.30)
Educated ≥ grade 8	0.33* (0.16)
Married/Cohabitating	0.63 (0.30)
HIV positive	3.51* (1.71)
Income Quintile (reference: Quintile 1)	
Quintile 2	1.03 (0.76)
Quintile 3	0.59 (0.53)
Quintile 4	0.47 (0.60)
Quintile 5	(omitted)
Age (reference: 15-29)	
30-44	1.81 (1.03)
45 and over	0.43 (0.38)
Use of alternative providers	
Traditional healer	3.83* (2.28)
Pharmacy	2.46* (1.01)
GP	4.65** (2.04)
Inpatient hospital	4.72** (2.37)
Outpatient hospital	2.59 (1.52)
Coping strategies	
Sold assets	0.73 (0.80)
Took loans	1.31 (0.59)
Constant	0.02*** (0.02)
F statistic	3.45***

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Analytic approach #2: Meta-analysis and decision model

- Decision model creates hypothetical cohort of 5000 South Africans
- Income assigned using mean national income and Gini coefficient
- Estimate adjusted mean cost per period through meta-analysis, by income quintile and HIV status
- Income generated to reflect national income distribution
- TB infection, TB type, HIV status, treatment cascade, costs all determined by income quintile

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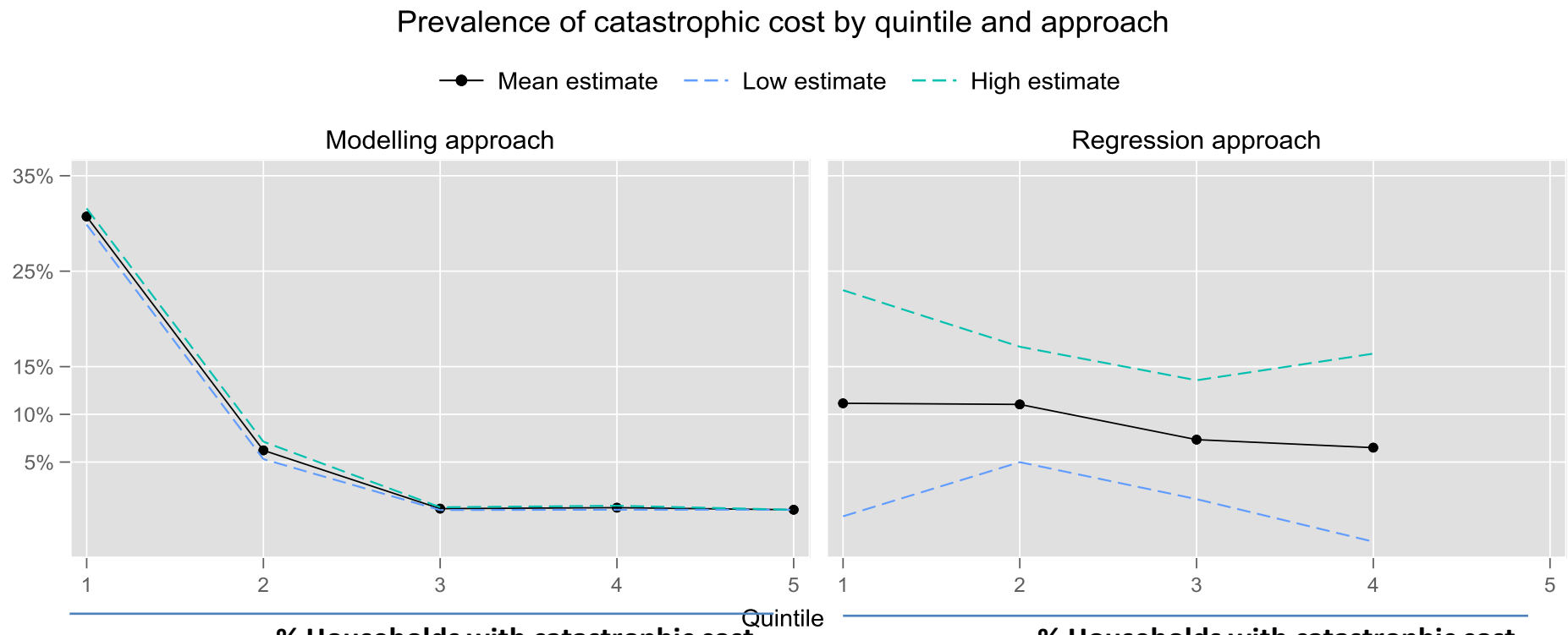
Model results

	Direct non-medical costs		Special foods cost		Direct medical costs		Total travel and consultation time		Total Indirect Costs	
	Mean	+/-	Mean	+/-	Mean	+/-	Mean	+/-	Mean	+/-
Quintile 1	$30.44	$0.37	$68.60	$0.11	$21.78	$0.18	82.3	$2.33	$4.52	$0.19
Quintile 2	$16.54	$0.15	$136.81	$0.92	$59.64	$2.09	40.7	$0.28	$8.16	$0.12
Quintile 3	$18.17	$0.22	$117.34	$0.44	$14.44	$0.10	35.3	$0.20	$14.50	$0.17
Quintile 4	$25.23	$0.49	$126.62	$1.29	$28.25	$0.63	48.4	$0.35	$39.17	$0.52
Quintile 5	$18.01	$0.85	$112.77	$5.12	$41.29	$1.79	47.7	$1.45	$217.30	$16.24
Overall	$24.73	$0.07	$98.75	$0.14	$28.49	$0.22	60.8	$0.83	$16.02	$0.12

Comparing results



	% Households with catastrophic cost Mean (95% CI)
Quintile 1	30.7% (29.9% - 31.6%)
Quintile 2	6.2% (5.3% - 7.1%)
Quintile 3	0.1% (0.0% - 0.3%)
Quintile 4	0.2% (0.0% - 0.4%)
Quintile 5	0.0% (0.0% - 0.0%)
Overall	15.8% (15.3% - 16.4%)

	% Households with catastrophic cost Mean (95% CI)
Quintile 1	11.2% (-0.7% - 23.0%)
Quintile 2	11.0% (5.0% - 17.1%)
Quintile 3	7.3% (1.1% - 13.6%)
Quintile 4	6.5% (-3.3% - 16.4%)
Quintile 5	-
Overall	9.2% (0.4% - 18.1%)

Reflections

- Great deal of uncertainty in both the numerator (costs) and the denominator (income) of the catastrophic costs equation

- Better data is needed:
  - On costs of care across the TB pathway, but especially before receipt of diagnosis
  - On individual and household income for people with TB

Reflections

- Likely not currently appropriate to use existing data from past studies to predict national prevalence of catastrophic cost

- But these methods could be used for follow-up / monitoring in future

GHCC

With thanks....

REACH study team: Natsayi Chimbindi, Jacob Bor, Marie-Louise Newell, Frank Tanser, Rob Baltusen, Jan Hontelez, Sake de Vlas, Mark Lurie, Deenan Pillay, Till Bärnighausen

XTEND study team: Nicola Foster, Anna Vassall, Susan Cleary, Lucy Cunnama, Gavin Churchyard, Edina Sinanovic

MERGE study team: Don Mudzengi, Sedona Sweeney, Piotr Hippner, Tendesayi Kufa, Katherine Fielding, Alison D Grant, Gavin Churchyard, Anna Vassall

GHCC

GHCC Global Health Cost Consortium

How does the Unit Cost Study Repository (UCSR) work?

Willyanne DeCormier Plosky and Lori Bollinger

11 September 2018

TB-MAC annual meeting

Washington DC

University of Washington Department of Global Health
Avenir Health
UCSF University of California San Francisco advancing health worldwide
London School of Hygiene & Tropical Medicine
Instituto Nacional de Salud Pública

UCSR Overview

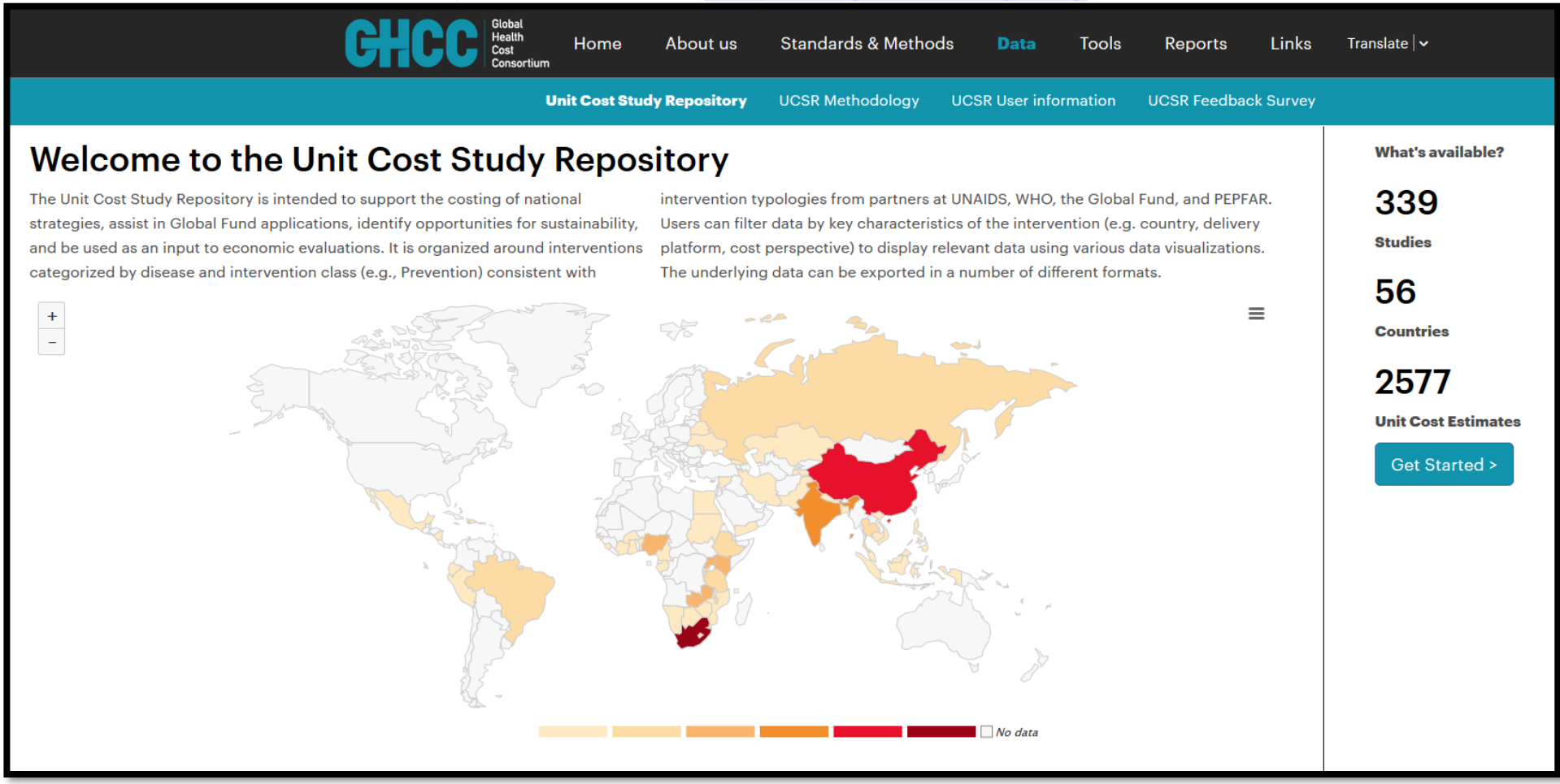
History:

- Need for ACCESS to centralized cost data source; also information to assess the QUALITY of cost estimates, without overwhelming the user with data.
- Need for ability to sort data by key characteristics: region, country, type of intervention, platform, etc.
- Builds upon previous [Avenir Health] version which was for HIV only and for studies up to 2013.
- The new and improved version includes studies until mid-year 2016 for HIV and TB, with more details. It currently includes 339 studies in HIV and TB across 56 countries, and 2,577 unique unit cost estimates.
- The TB classification system follow the typology agreed upon by TB-MAC: Prevention; Case Detection, Testing and Diagnosis; Treatment and Care; Enablers and Support; Health System; and Infection control.
- Note that a full patient cost search was done for TB, and these results are also available.

GHCC

UCSR overview: Welcome screen

Available for you to test at: https://ghcosting.org (under data)



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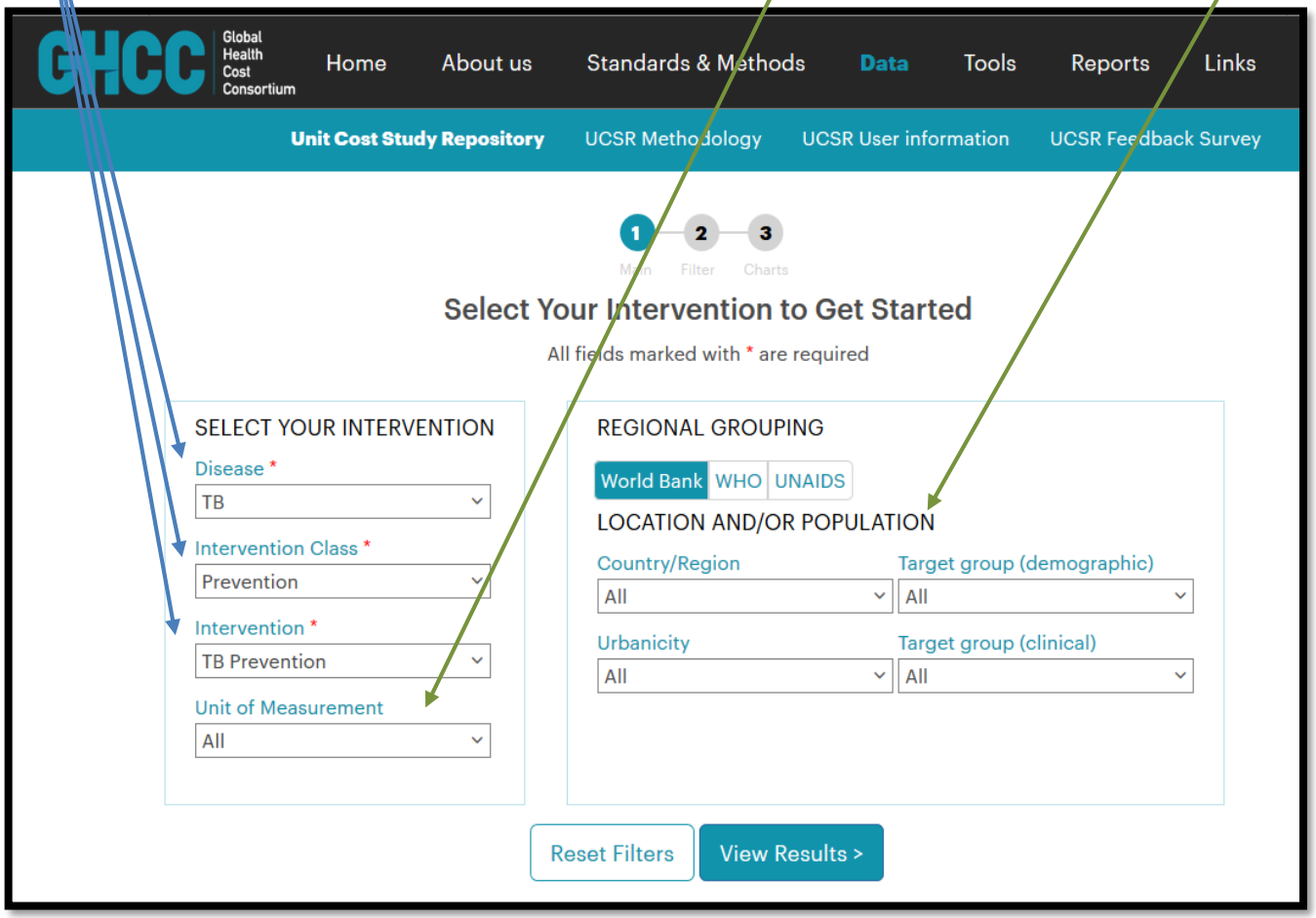
UCSR: Step #1 – Main

First, **Select** Disease, Intervention Class, and Intervention. You may narrow your search further by **Selecting** unit of measurement, or location and/or population. Then click **View Results**.



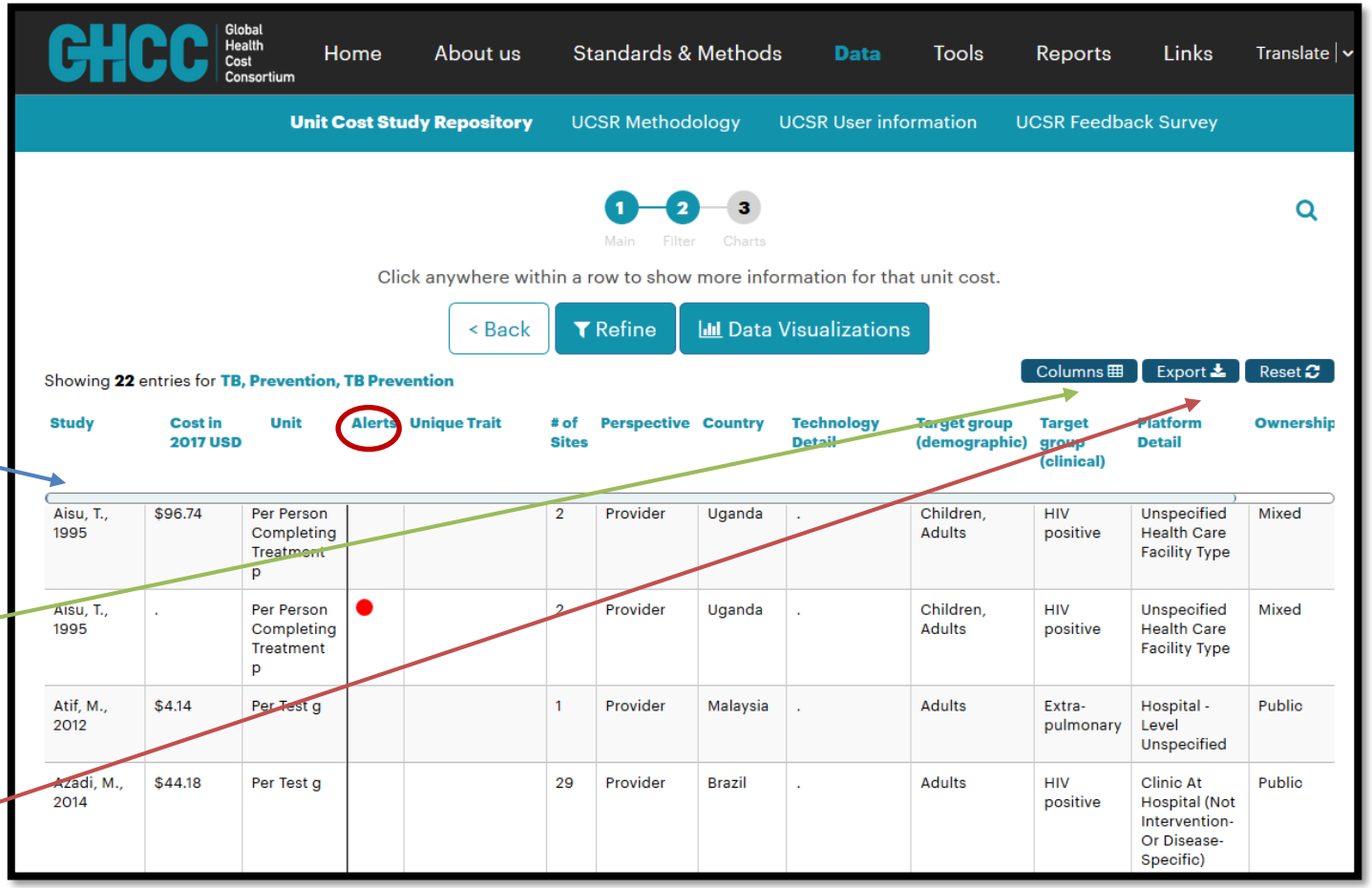
UCSR: Step #2 – Refine

Your results will appear in table form.

Use the scroll bar to see columns to the right.

Reduce columns by choosing from the **Column** list.

You can export the table by clicking **Export.**

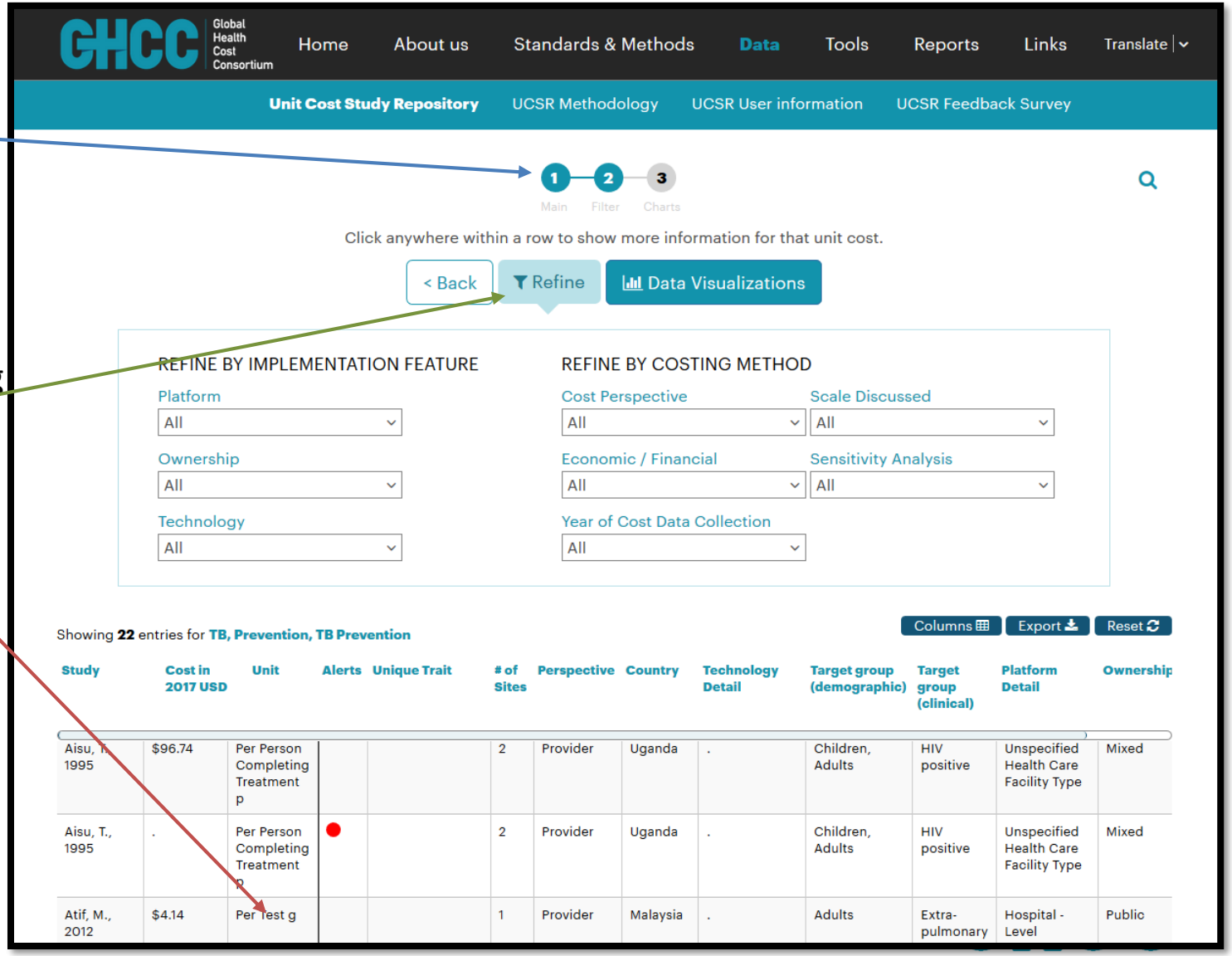


UCSR: Step #2 – Refine (con't)

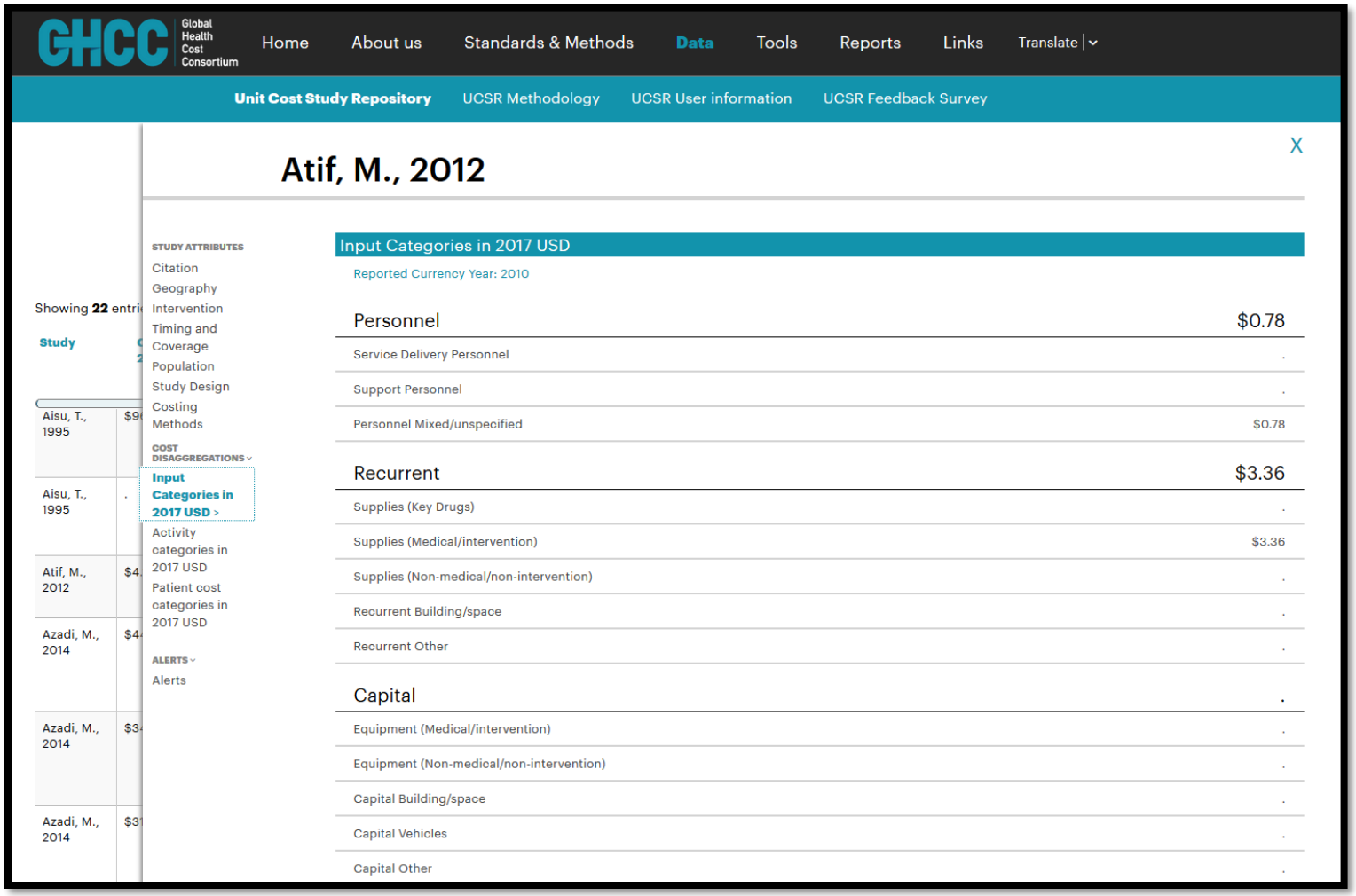
You may return to the first screen by clicking on **1**.

Click on **Refine** to filter by implementation feature or by costing method.

Mouse over an individual row to highlight in yellow; click on it, and a second level of further information appears.



UCSR: Step #2- More information



The second level contains details on study attributes, disaggregated costs, and alerts.

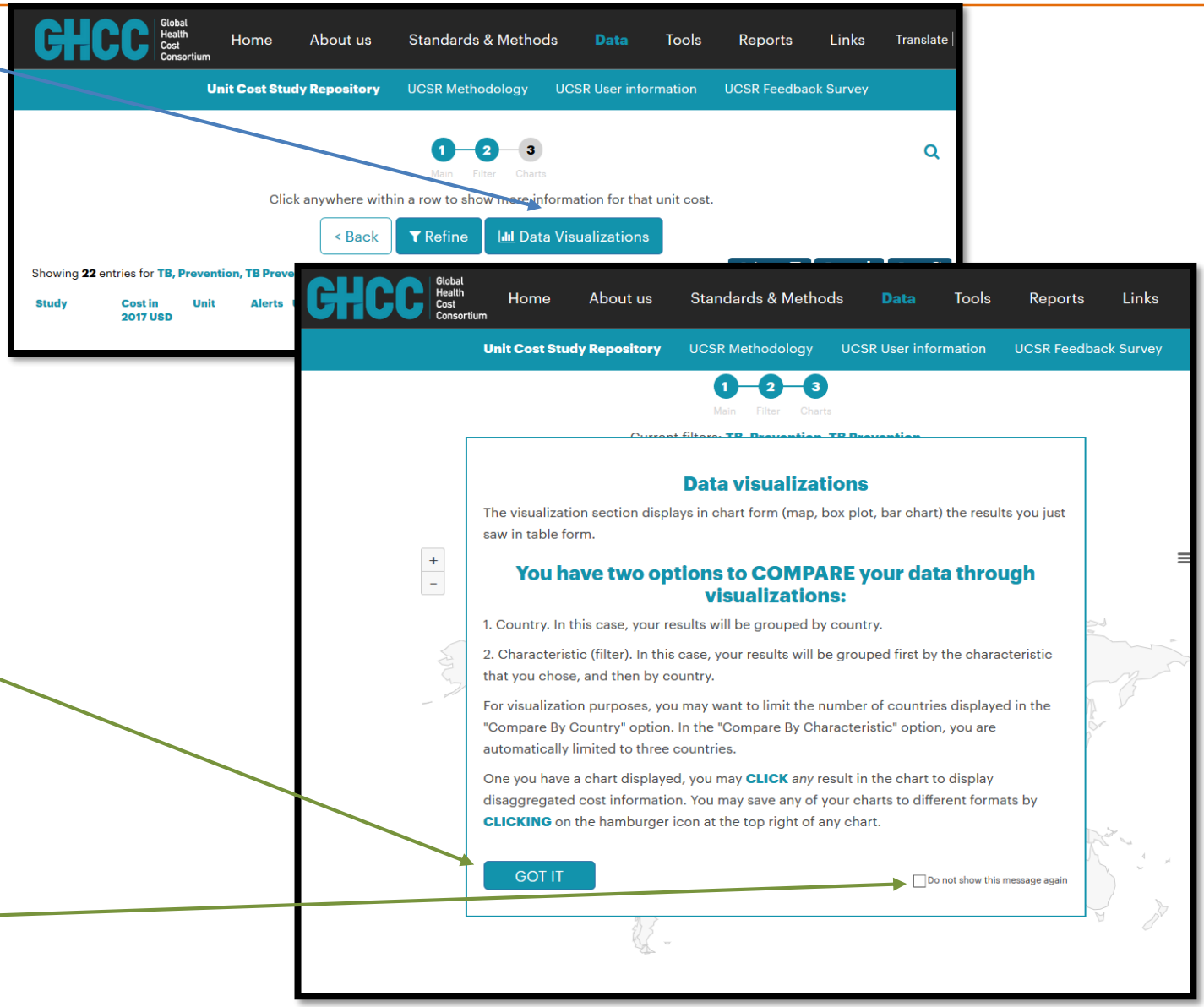
To be added: costs in the original currency

UCSR: Step #3 – Data visualizations

Click on **Data Visualizations** to display your data in chart form.

A pop-up box will appear describing the two different options available to compare your data visually – by country or by characteristic. Click **Got it**.

Check the box if you do not want the pop-up message to be shown again.



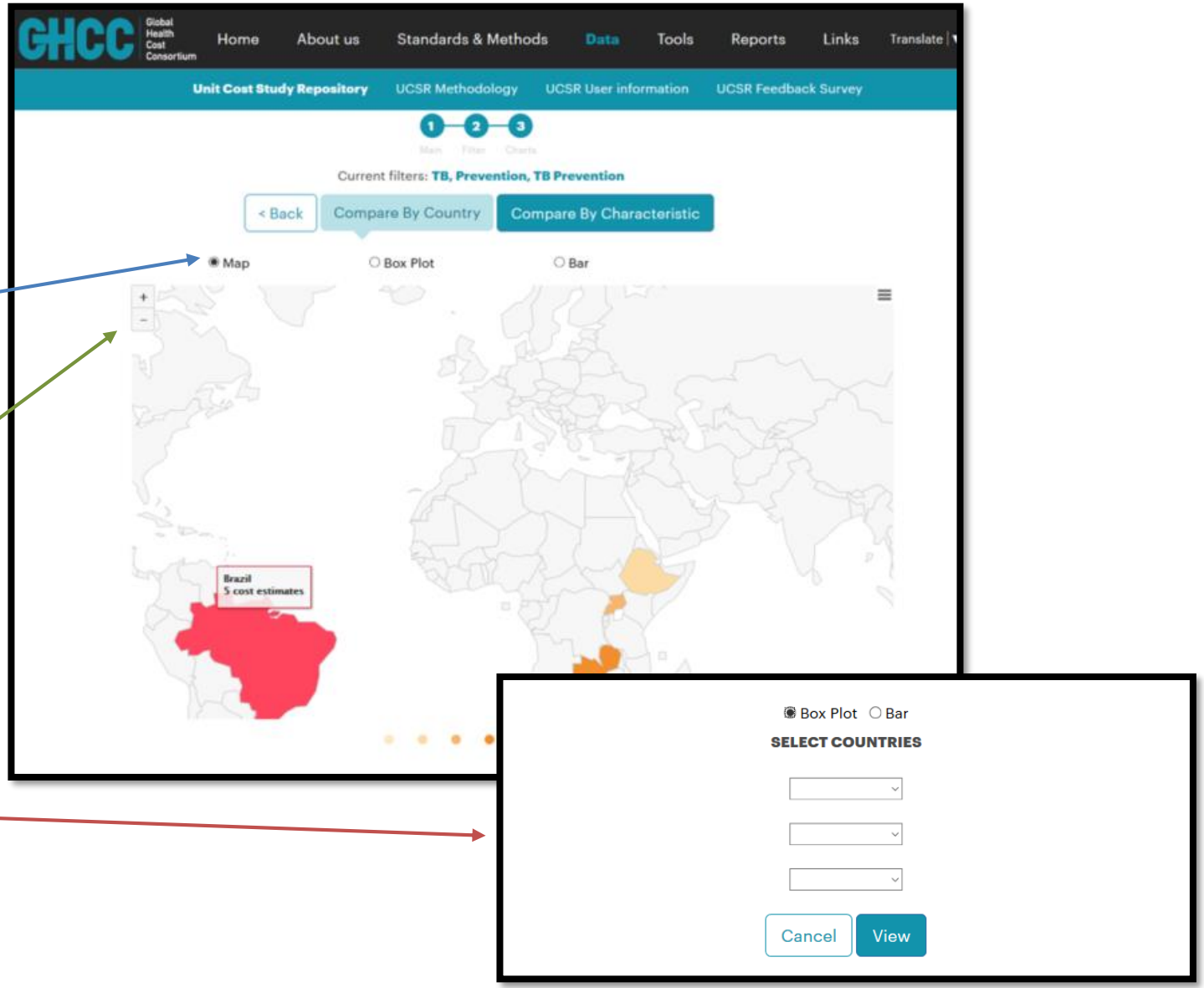
UCSR: Step #3 – Data viz (cont'd)

There are different types of main charts.

The map shows the number of cost estimates by country.

Click + or – to zoom in or out on the map.

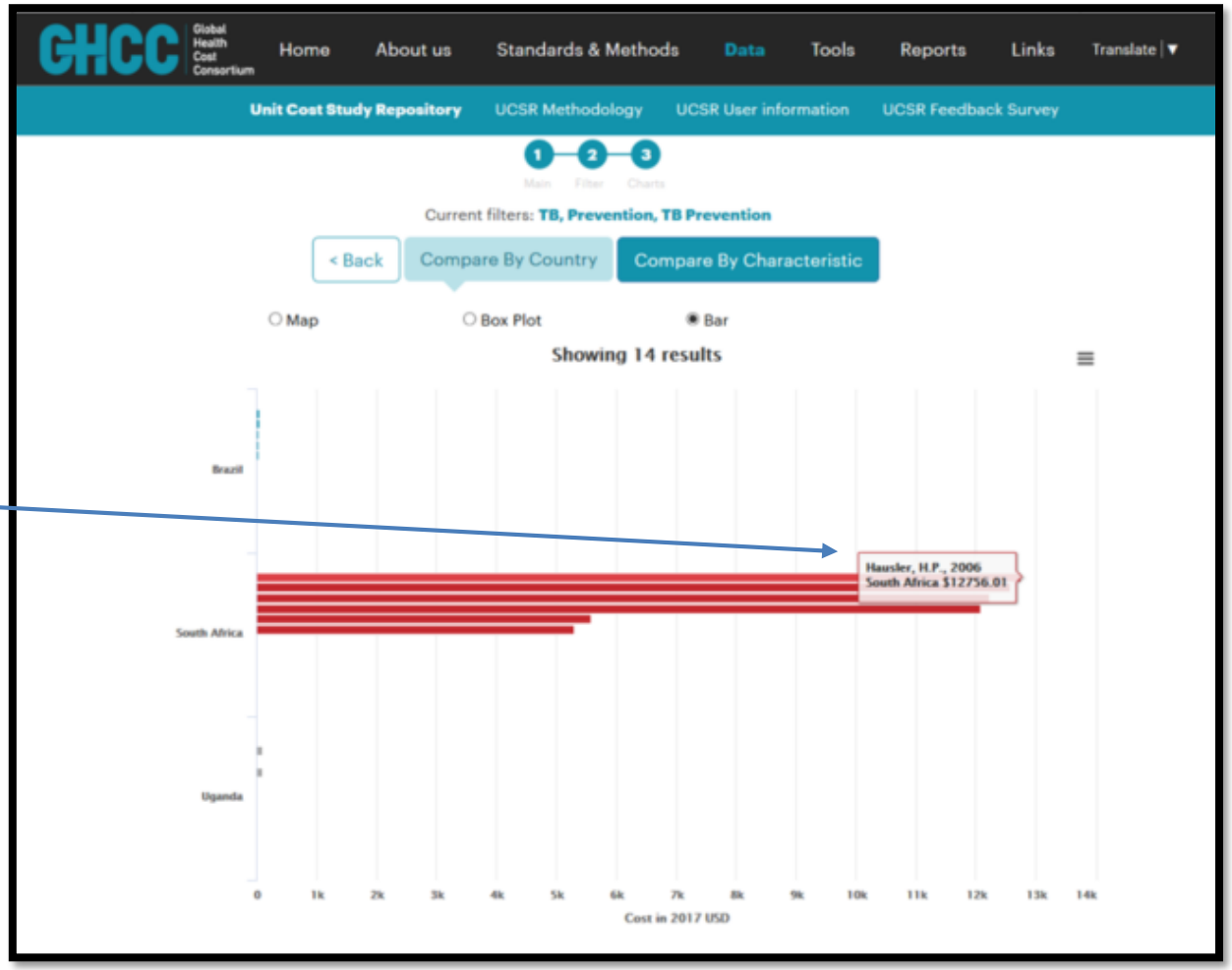
If you choose box plot or bar chart, a box will pop up asking you to narrow your country selection for display purposes.



UCSR: Step #3 – Data viz (cont'd)

Countries are color coded in the box plot and bar chart.

When you hover over a data point (one unit cost estimate), the value and source appear.

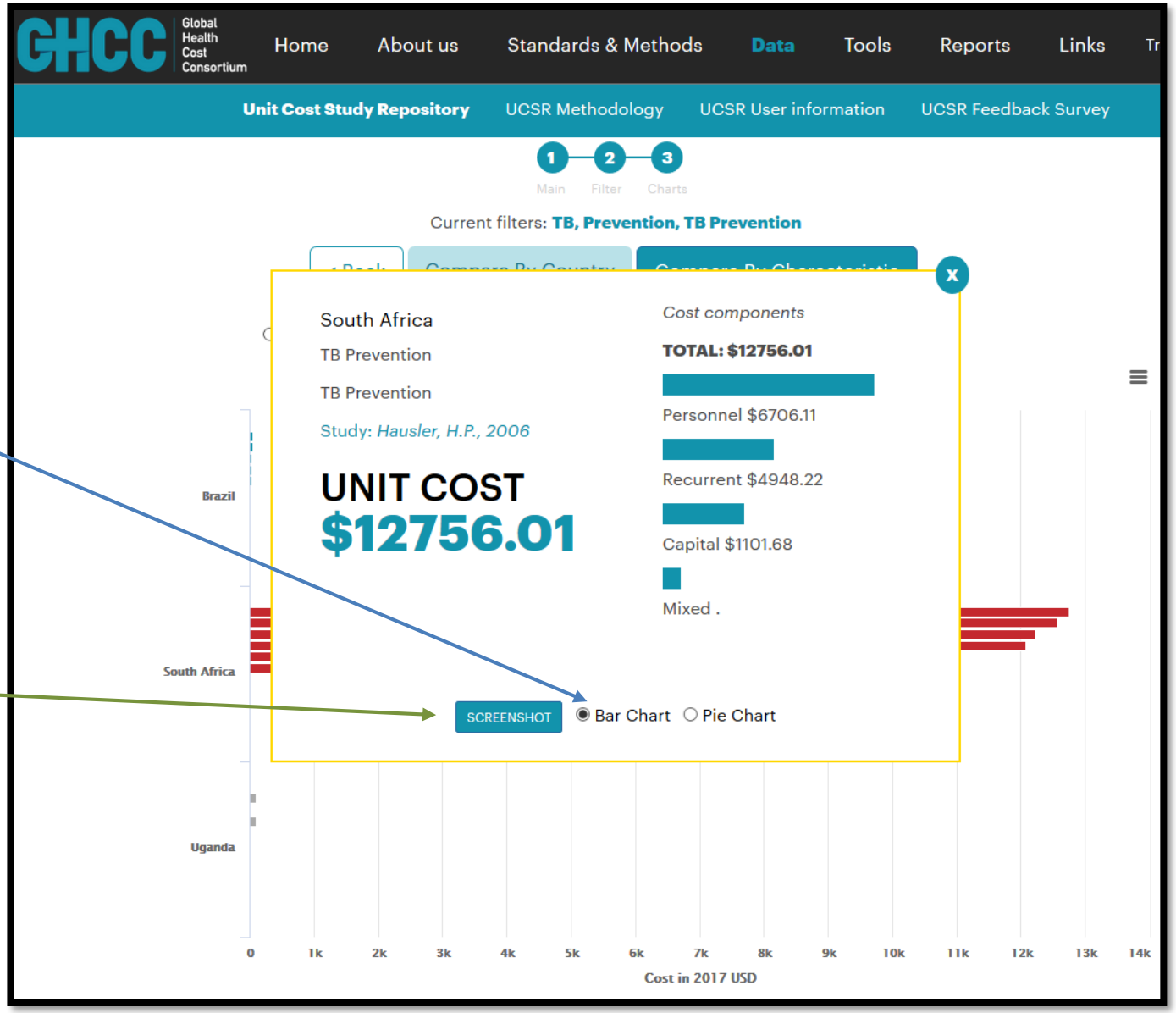


UCSR: Step #3 – Data viz (cont'd)

If you **click** on a data point, a secondary chart will appear with either bar or pie charts (click the radio buttons at the bottom).

You may also take a screenshot of your chart

(N.B.: For the main charts click on the hamburger icon)



Thank you!

Your feedback is welcome! Please go to “UCSR Feedback survey” on the web site to fill out a brief survey!

GHCC Global Health Cost Consortium

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Instituto Nacional de Salud Pública

WHO Global TB Programme finance/economic data sources

- Patient cost surveys
- National reports of budgets and expenditures
  - In some cases, detailed costed national strategic plans (country permitting)
- Provider cost surveys (Value TB)

Patient cost surveys - Basic design

- Facility-based patient survey
  - National sample of patients on treatment
- Sample size: 500-1200 patients (min. 20 clusters)
- Cost ranges: $30,000 - $150,000
- Survey frequency: once every 5 years
- Cross sectional study with retrospective data collection and projections
- Estimated survey implementation time: 6 months
- Questionnaire (approximately 90 questions ; 40-60 mins long)
- All data owned by country and not publicly available

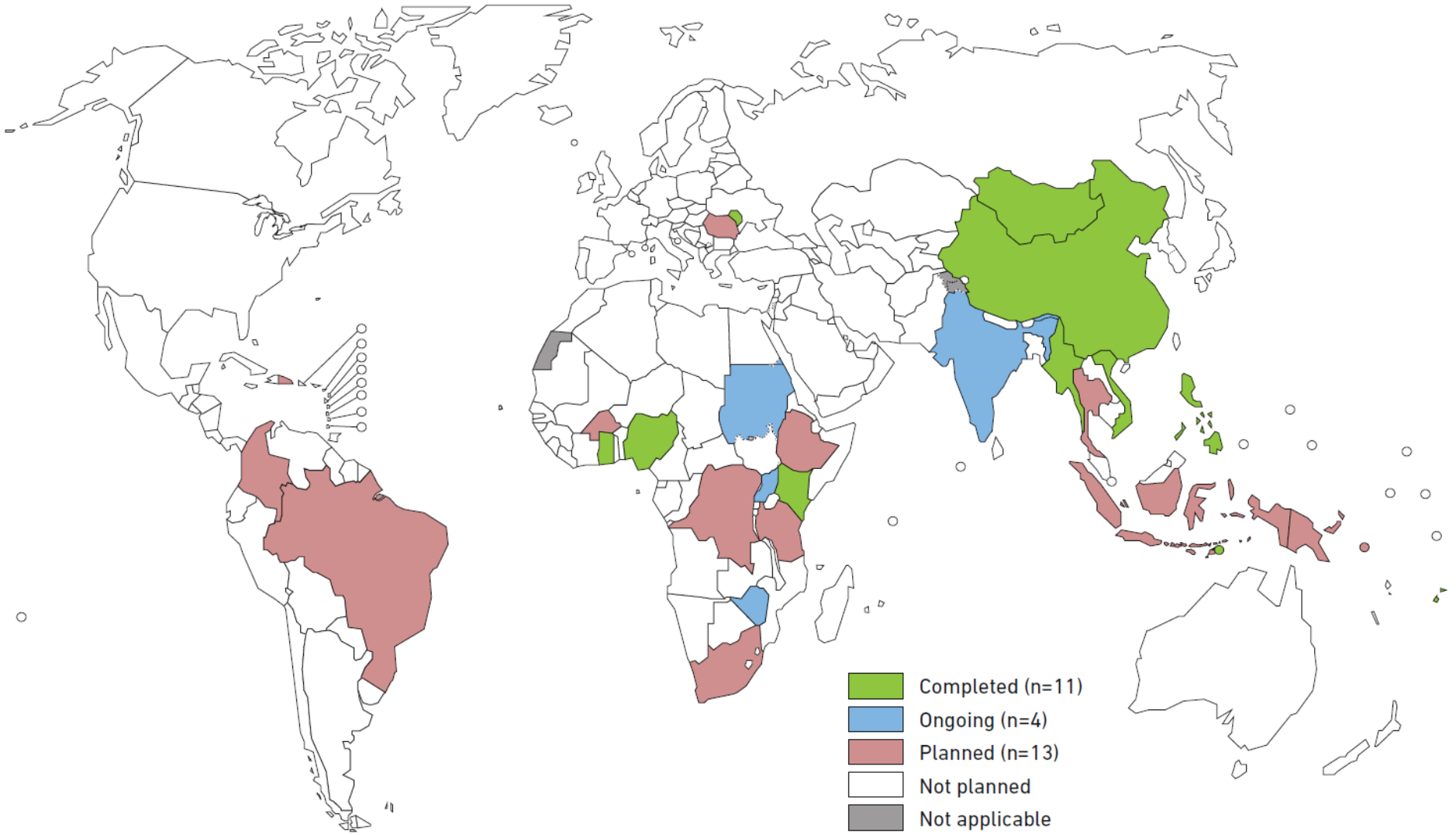
Nationwide TB patient cost survey in South Africa

Part I. Patient information to be obtained from TB treatment card before interview

PATIENT REGISTRATION NUMBER IN FACILITY TB REGISTER	DATE OF INTERVIEW yyyy-mm-dd
PROVINCE none selected	NAME OF DISTRICT none selected
PLACE OF INTERVIEW (FACILITY NAME)	INTERVIEWER NAME
CATEGORY OF TREATING FACILITY none selected	
NAME OF PATIENT	

SEX Male Female	AGE (IN YEARS)	DATE OF DIAGNOSIS yyyy-mm-dd

Patient cost surveys - Global progress

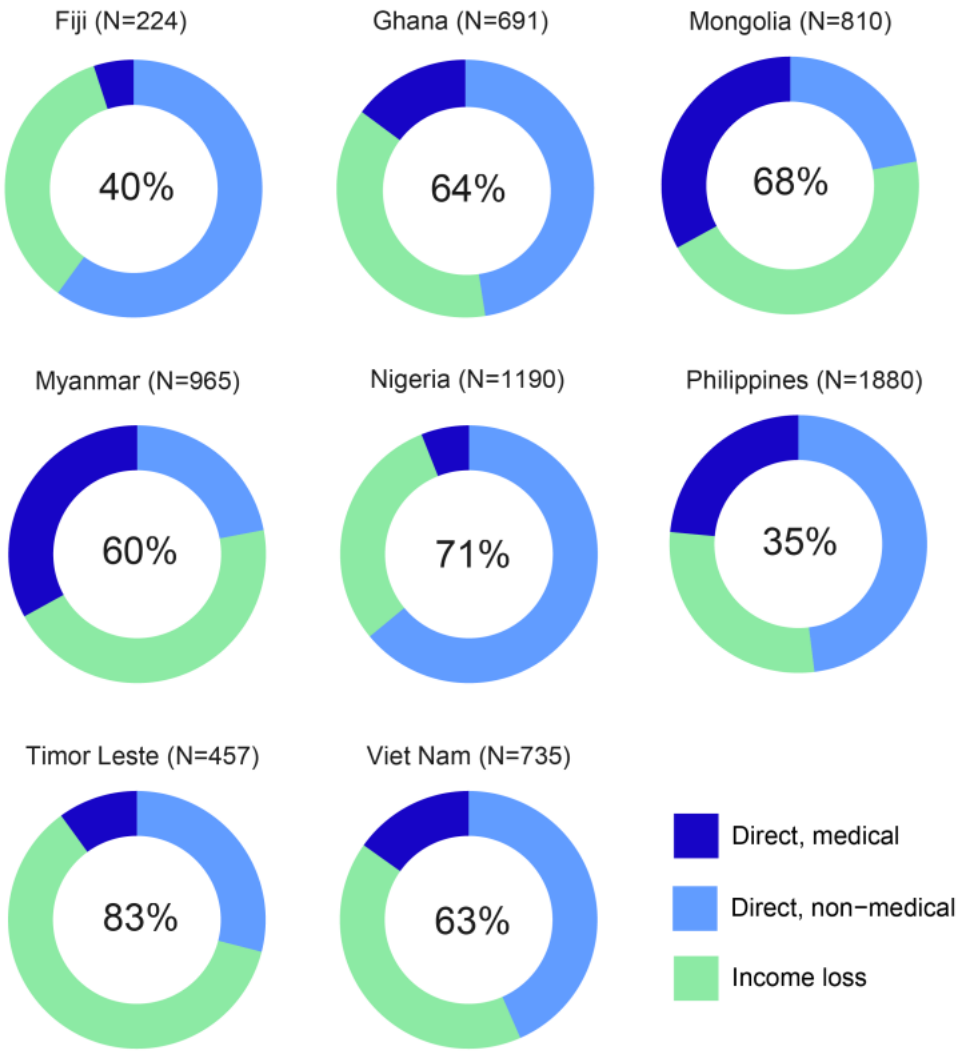


Results of selected national patient cost surveys (preliminary)

% households facing catastrophic cost:
35% to **83%**

Cost drivers vary yielding different policy implications

- Food/Nutritional support
- Medical
- Transportation
- Income loss



Additional findings and analyses

- DR-TB incur much higher cost in general
  - Primarily due to longer treatment regimen
- Risk factors for experiencing catastrophic costs
  - Often comorbidities, lower household income, primary earner
- Impact / intensity of current social support interventions
  - How much? How often?
- Impoverishment measures
  - Proportion that started below national/international poverty line
  - Proportion that fall below national/international poverty line
  - Depth of poverty

PCS: Data available for modellers

World Health Organization

Costs from patient perspective

Pre-diagnosis costs

Medical costs (X-ray, lab tests, medicines, etc.)

Non-medical costs (transportation, accommodation, food and nutritional supplements)

Time lost / income lost

Patient pathway

Diagnostic delay

Frequency of DOT visits

Frequency of drug pickups

Frequency of follow-up visits

Travel time to facilities

Household characteristics

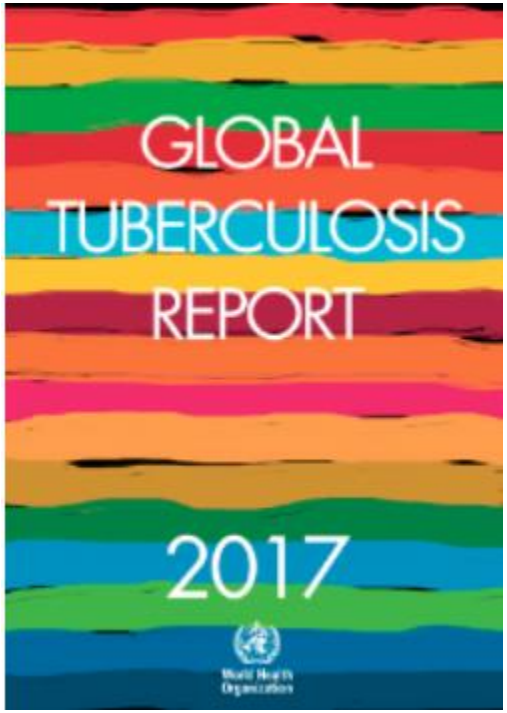
Household size

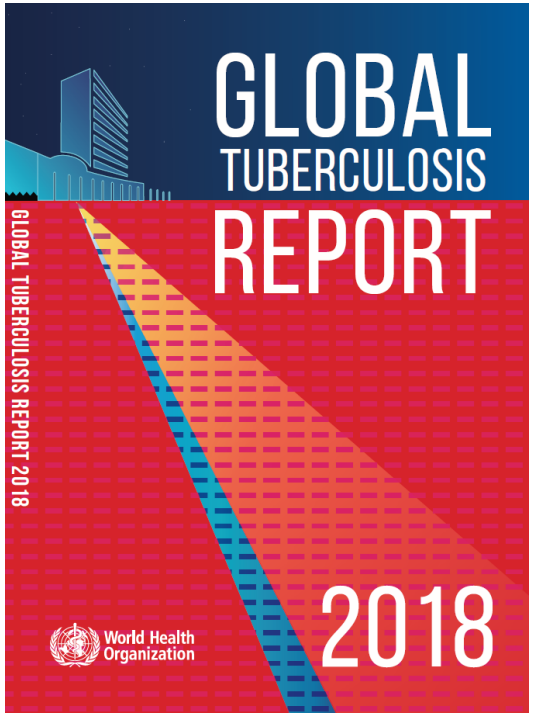
Household socioeconomic status

Social protection uptake

World Health Organization

GTB Finance database





GTB Finance database

High quality annual data reported by National TB Programs from 2006 onwards

- Collected via online data collection platform

Reviewed by GTB to ensure data quality

- Extra emphasis on 30 high-burden countries

Used to estimate the health services component of the cost of providing TB care in each country

Will be publicly available on website starting this fall (www.who.int/tb/data)

GTB Finance database: Data available for modellers

Budgets (prospective year) and expenditures (previous year)

- Split into 10 broad categories

Sources of funding (Domestic, Global Fund, USAID, other)

Projected number of patients to be treated (prospective year)

Average cost of drug regimen

Average number of facility visits

Proportion of patients hospitalized and average length of stay

- Split by DS-TB and MDR-TB

Sample expenditure table

		Actual expenditure [a]	Received funding [b]
4.27	Laboratory infrastructure, equipment and supplies	2 463 321	2 463 321
4.28	National TB Programme staff (central unit staff and subnational TB staff)	625 971	625 971
4.29	Drug-susceptible TB: drugs	3 073 211	3 073 211
4.30	Drug-susceptible TB: programme costs	2 764 809	2 764 809
4.31	Drug-resistant TB: drugs	417 694	417 694
4.32	Drug-resistant TB: programme costs	43 918	43 918
4.33	Collaborative TB/HIV activities	0	0
4.34	Patient support	38 000	38 000
4.35	Operational research and surveys	839 482	839 482
4.36	All other budget lines for TB	1 805 071	1 805 071
4.37	**Total**	**12 071 477**	**12 071 477**

World Health Organization

Utilization of health services, 2017

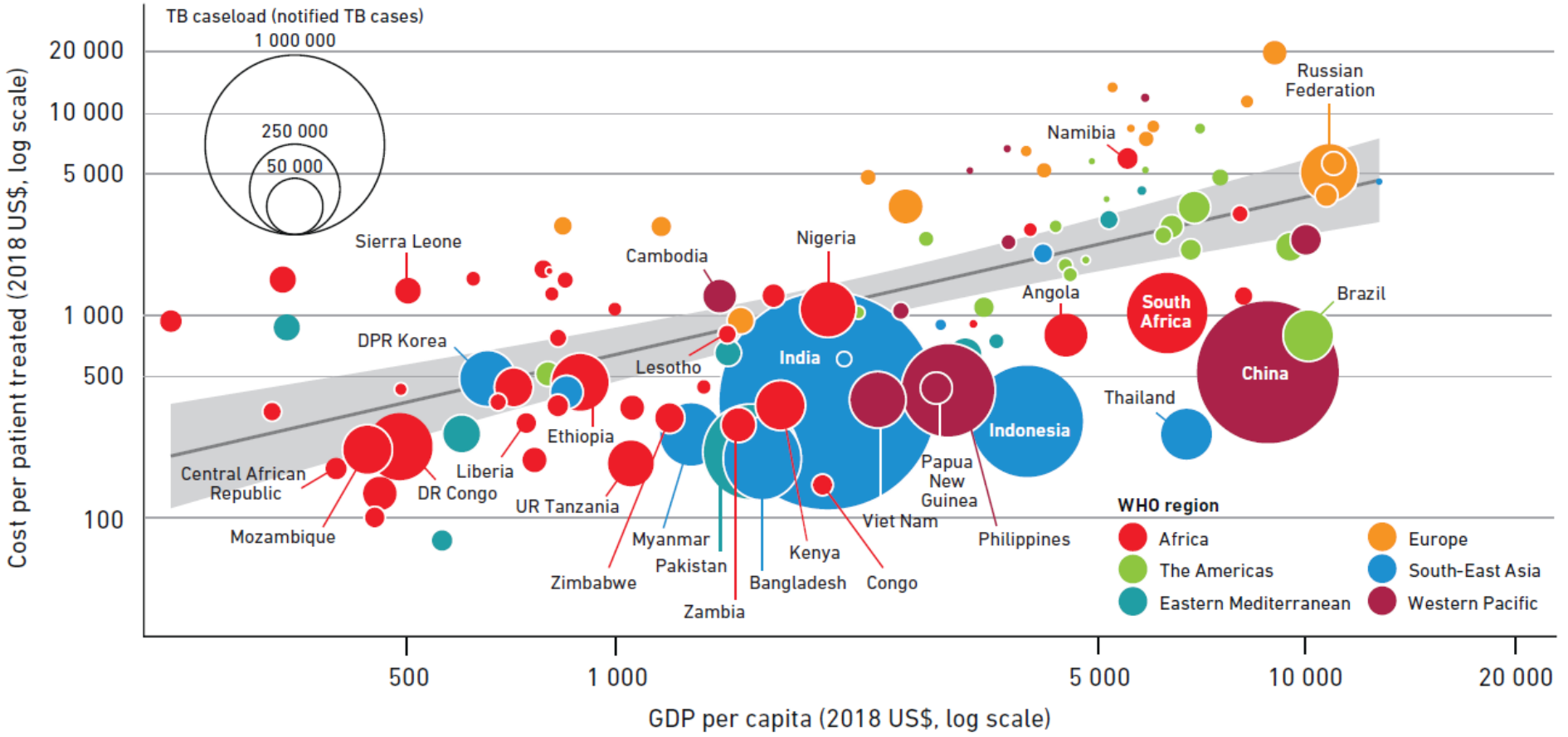
		Patients starting first-line TB treatment	Patients starting MDR-TB / XDR-TB treatment
4.20	Typical number of visits to a health facility after diagnosis *The average number of visits per patient to any health facility during TB treatment, for example for observed treatment (DOT), collection of drugs, smear monitoring, etc. after the patient has been diagnosed with TB, in view of your treatment guidelines. For example, if a TB patient on first-line treatment receives directly observed treatment daily in the intensive phase at clinics and, in the continuation phase 4 visits are required (one per month for collection of drugs), the total would be 60+4=64.*	12	256
4.21	Estimated percentage of cases that are hospitalized (%) *If the actual percentage of hospitalisations is available from the basic management unit register, please report. If not, please report the approximate percentage of patients hospitalized for TB treatment (for any duration of stay), in view of your treatment guidelines. For example, if your policy or general practice is to admit all TB patients for 2 months, the figure will be 100%.*	2	100
4.22	Estimated average duration of stay if hospitalized (days) *If the actual duration of stay is available from the basic management unit register, please report. If not, please estimate the number of days a patient would spend in hospital "on average".*	15	240

4.23 If MDR-TB patients are hospitalized, in which type of facility are they most often treated?

- [ ] Primary-level hospital
- [ ] Secondary-level hospital
- [X] Tertiary-level hospital
- [ ] Not applicable

World Health Organization

Estimated cost per patient treated for drug-susceptible TB in 113 countries, 2017[a]



TB Modelling and Analysis Consortium

Equity considerations in model-based economic evaluations

Workshop

London, 26-27 March 2018

Co-convened by TB MAC and CMMID

Participant	Affiliation
Alec Morton	University of Strathclyde
Alessandro Grosso	University of York
Andrew Mirelman	University of York
Anna Vassall	LSHTM
David Dowdy (online)	John Hopkins Bloomberg School of Public Health
Déirdre Hollingsworth	University of Oxford
Fabrizio Tediosi	Swiss Tropical and Public Health Institute
Fiammetta Bozzani	LSHTM
Finn McQuaid	LSHTM
Francis J Ruiz	iDSI
Francisco Pozo-Martin	LSHTM
Gabriela Gomez	LSHTM
Graham Medley	LSHTM
Hassan Haghparast-Bidgoli	University College London
Henk Broekhuizen-Versteeg	Radboud University
Jolene Skordis-Worrall	University College London
Kara Hanson	LSHTM
Katherine Hauck	Imperial College London
Lori Bollinger	Avenir Health
Matthew Quaife	LSHTM
Maria Merritt	John Hopkins Berman Institute of Bioethics and Bloomberg School of Public Health
Mariana Siapka	LSHTM
Miqdad Asaria (online)	University of York
Nick Menzies	Harvard T.H. Chan School of Public Health
Oliver Brady	LSHTM
Patrick Walker	Imperial College London
Pete Winskill	Imperial College London
Pieter van Baal	Erasmus University Rotterdam
Richard Cookson	University of York
Richard White	LSHTM
Rob Baltussen	Radboud University
Shufang Zhang	GFATM
Stephane Verguet	Harvard T.H. Chan School of Public Health
Susan Griffin	University of York
Tom Drake	LSHTM
Y-Ling Chi	iDSI

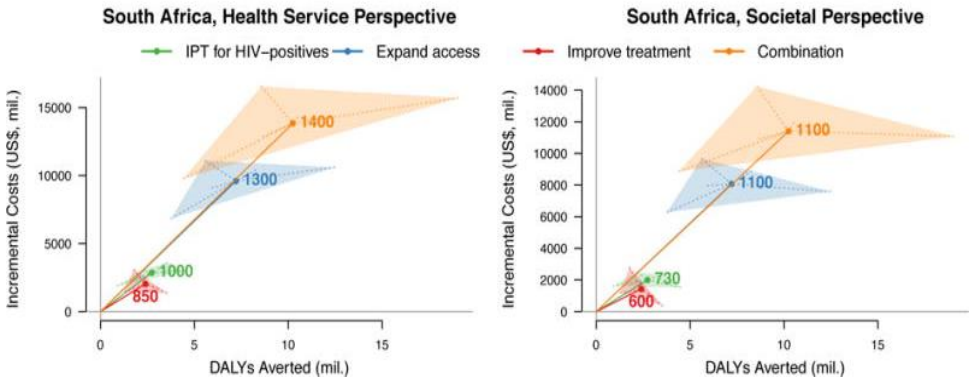
- Create space for modellers and economists to connect and learn from each other's approaches to equity analysis and the inclusion of heterogeneity in modelling, economic evaluation, and priority setting;
- Generate discussion around the technical opportunities and challenges of evaluating equity in economic evaluations using mathematical modelling of infectious diseases;
- Inform recommendations on applying the equity principle of the reference case when using transmission model based economic evaluations
  - identifying the gaps (data and methods),
  - transparency in reporting

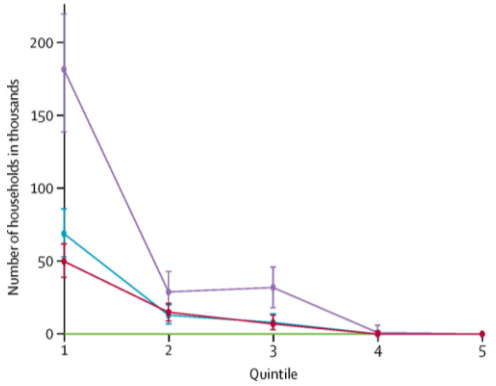
Day 1 – exploratory

Day 2 – decision/policy-driven

Transmission models are being used (increasingly) for priority setting to address equity issues

- TB MAC
  - inclusion of equity during last GFATM replenishment round;
  - Impact, cost and cost-effectiveness of aggressive TB control – including equity considerations (ECEA)





TB Modelling and Analysis Consortium

Reference case for economic evaluations

iDSI Reference Case to economic evaluations is a principle-based approach for analysts to guide the planning, conduct and reporting of economic evaluations.

Related initiatives

- Harvard T.H. Chan School of Public Health are developing guidelines to encourage the conduct of high quality benefit-cost analyses.
- Global Health Cost Consortium developed a reference case for costing in global health

TB Modelling and Analysis Consortium

Reference case for economic evaluations

Aim: Identify key challenges and solutions in applying the iDSI Reference Case to economic evaluations using transmission models with a particular focus on principles 8 and 11

- Principle 8 (Heterogeneity) – the cost and effects of the intervention on sub-populations within the decision making problem should be explored and the implications appropriately characterised
- Principle 11 (Equity) – an economic evaluation should explore the equity implications of implementing the intervention

Table 1 – The iDSI Reference Case principles.

1	An economic evaluation should be communicated clearly and transparently to enable the decision maker(s) to interpret the methods and results.
2	The comparator(s) against which costs and effects are measured should accurately reflect the decision problem.
3	An economic evaluation should consider all available evidence relevant to the decision problem.
4	The measure of health outcome should be appropriate to the decision problem, should capture positive and negative effects on length of life and quality of life, and should be generalizable across disease states.
5	All differences between the intervention and the comparator in expected resource use and costs of delivery to the target population(s) should be incorporated into the evaluation.
6	The time horizon used in an economic evaluation should be of sufficient length to capture all costs and effects relevant to the decision problem; an appropriate discount rate should be used to discount cost and effects to present values.
7	Nonhealth effects and costs associated with gaining or providing access to health interventions that do not accrue to the health budget should be identified when relevant to the decision problem. All costs and effects should be disaggregated, either by sector of the economy or to whom they accrue.
8	The cost and effects of the intervention on subpopulations within the decision problem should be explored and the implications appropriately characterized.
9	The uncertainty associated with an economic evaluation should be appropriately characterized.
10	The impact of implementing the intervention on the health budget and on other constraints should be identified clearly and separately.
11	An economic evaluation should explore the equity implications of implementing the intervention.

TB Modelling and Analysis Consortium

Preparatory work informing the workshop

1. • Review of equity concepts (for a broad audience)
2. • Review of methods for including equity considerations in economic evaluations (for a broad audience)
3. • Review of current practices for inclusion of heterogeneity in transmission models (for a broad audience)
4. • Workshop: reflection on key methodological issues

LONDON SCHOOL of HYGIENE &TROPICAL MEDICINE

TB Modelling and Analysis Consortium

Equity frameworks

Equity often defined in terms of differences that are *avoidable* and *unjust or unfair*

It implies a *value judgement* invoking ethical frameworks and theories of social justice

There is no universal consensus as to what can be considered fair in systematic differences (a normative question); variations across countries (and analysts) related to differences in political attitudes and values

Equity of what? Health economists have considered differences in health (outcomes), healthcare utilization (outputs) or healthcare financing (contributions)

Several frameworks to differentiate fair inequalities from unfair inequalities (inequities) have been proposed.

Equity concepts

Guiding principle
Egality
Distribution according to entitlement
The ‘decent minimum’
Utilitarianism
Rawlsian maximin
Envy-free allocations
Equity as choice
Equality in capabilities

Principles for allocating resources

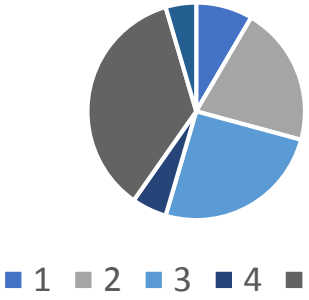
In resource allocation, the choice of principle for decision making will guide funding decisions.

Example: Global Malaria Programme, allocation of USD 100 million:

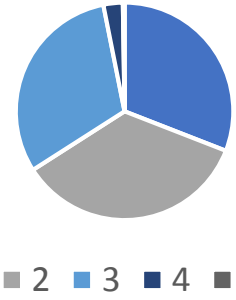
1. Equal amount of resources per person at risk – while following a principle of equality, does not take into account 'need'
2. Allocating funds in proportion to disease burden e.g. number of deaths – follows an utilitarian principle in that it will maximize benefits
3. Allocating fund to provide equal access to interventions – will provide equity as a access to choice
4. Allocating funds to the least well off (then successively according to need) (Rawlsian maximin)

Richard Cibulskis. MPAC meeting March, 2013. Financing Malaria Control – allocating limited resources.
http://www.who.int/malaria/mpac/resource_allocation_mpac_presentation_march_2013.pdf

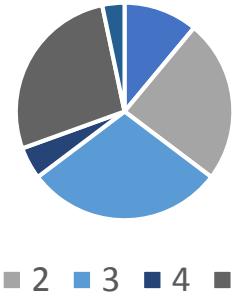
Equal amount per person



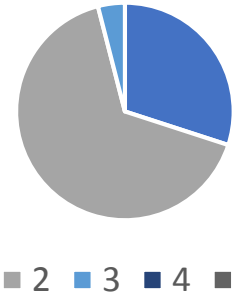
In proportion to deaths



In proportion to resource need

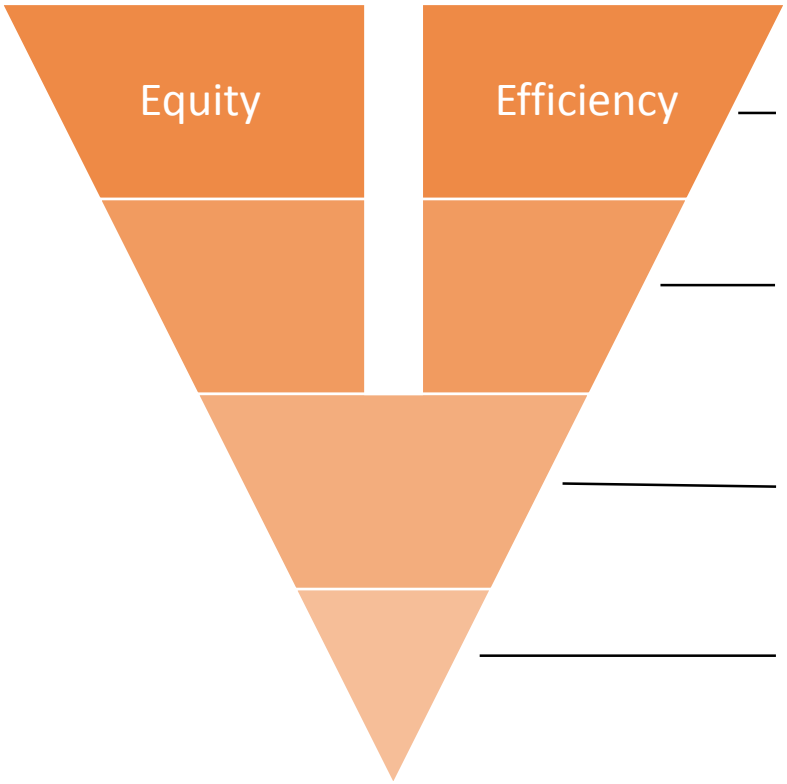


Until resource need fulfilled



Richard Cibulskis. MPAC meeting March, 2013. Financing Malaria Control – allocating limited resources.
http://www.who.int/malaria/mpac/resource_allocation_mpac_presentation_march_2013.pdf

Different levels of integration of equity and efficiency concepts



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Transmission modelling – heterogeneity in baselines (HIV, Imperial College)

- Sophisticated modelling of heterogeneities in risk
- In general, aim is to maximize population health

- Limited work integrating equity considerations in economic evaluations

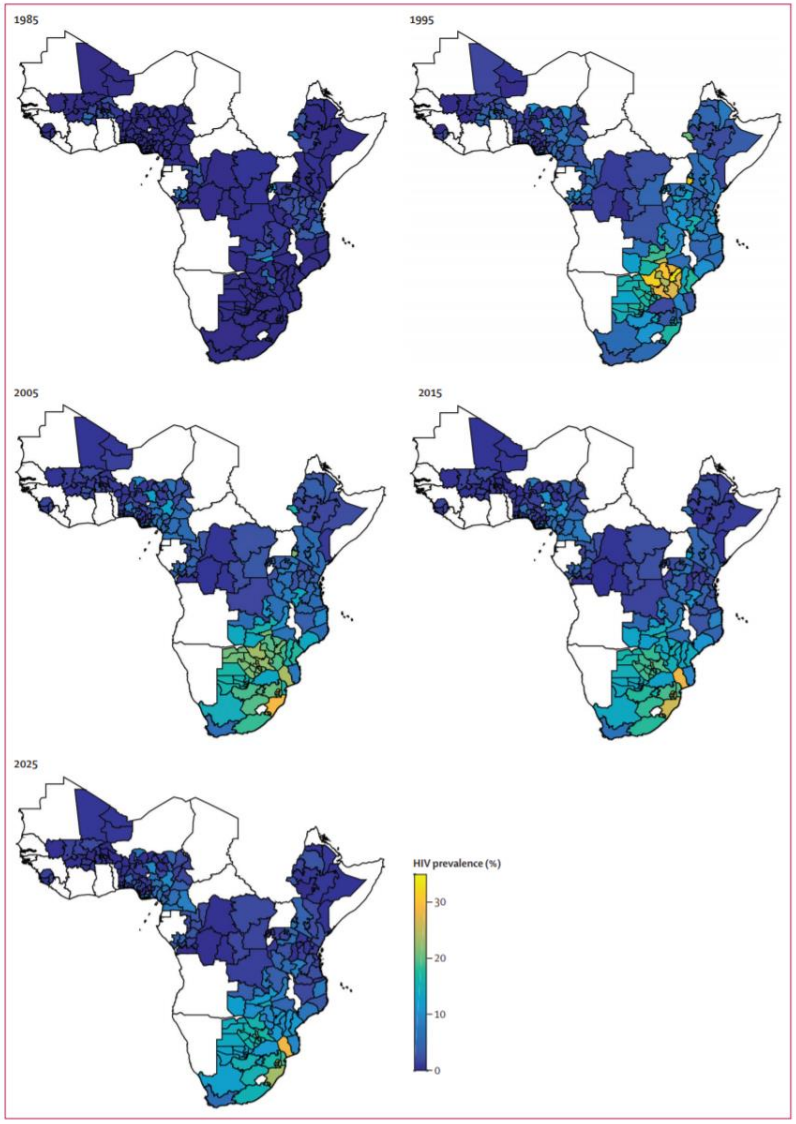
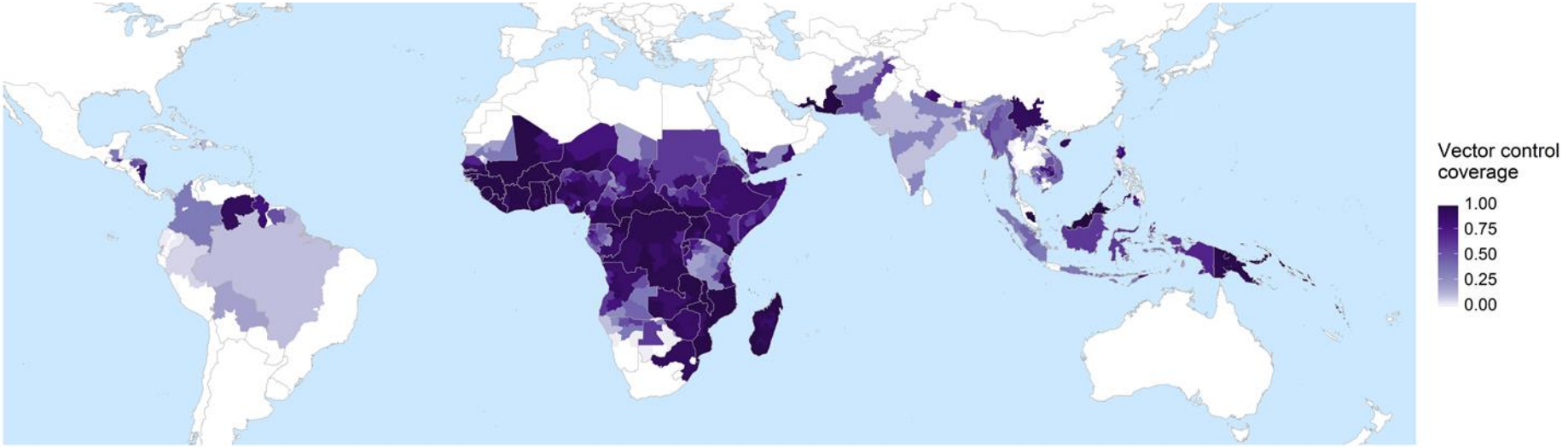


Figure 1: **Modelled spatiotemporal dynamics of HIV**
One possible trajectory, in 10 year increments from 1985 to 2025, produced by the model for subnational HIV prevalence among adults (ages 15–49) across sub-Saharan Africa, consistent with present estimates and past trends. Modelled countries are listed in the appendix (p 2); countries in white are not modelled. The average HIV prevalence across all modelled countries is 5·8% for 2015.

Targeted coverage – heterogeneity in access to maximise uptake (malaria, Imperial College)

Target coverage needs to be very high in high burden countries but can be lower overall but targeted in lower transmission countries where malaria is more heterogeneous.



How these methods interact with transmission models?

Approach	Application to transmission models
Qualitative comparison	These approaches do not attempt an integration with economic evaluation and can be applied in the same way to any models.
Quantitative comparison **(additional criteria)**	Use of model outputs for post-simulation accounting of health effects, costs and financial protection. It would be possible to link healthcare seeking decisions to ability-to-pay, therefore assessing impact of financial protection on indirect health effects.

How these methods interact with transmission models?

Approach	Application to transmission models
Trade off equity efficiency	Algorithmic resource allocation using equity-constrained optimisation – as is currently done with budget constraints (OPTIMA) DCEA emphasizes the simultaneous assessment of multiple dimensions of equity – has not been applied to transmission models, needs additional dimensions
Equity weights	The application of differential weights to transmission model outcomes is straight forward and analogous to the weighting of outcomes from other health economic models.

Conclusions: Principle 11, specifications

- Focus scope
  - Global/country (different objectives between groups and within group of policy makers)
  - Equity relevant question – evaluation or planning
  - General modelling v ID modelling
  - Transparency, not prescription but reporting standards: uncertainty, assumptions (both conceptual and structural)

- Highlight process with stakeholder engagement: Focus on making results that are useful to policymakers by using their definitions and framework choices
- Incorporate political constraints where able to
- Identify data needs: importance, availability and limitations of data and linkage (epidemiological, demographic, economic)
- Methods development needs

Conclusions: further work

What do we do next as a community: further research, case studies?

- Country/global applications
- Exploratory modelling – what are the dimensions that matter, what are the most efficient ways to include equity (characterisation of equity v number of dimensions)

Outputs

- Meeting report – circulated (to all)
- Statement – paper (draft, October)
- Chapter in Equity Handbook

Reach out to people we missed

Engagement with other communities – work with consortia (modelling and cost), iDSI (HTA process), and global funders to engage other groups and LMIC researchers

Prioritizing global health resources using cost-effectiveness analysis

TB MAC / WHO Annual meeting
September 11, 2018

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    Increasing use of health economic information for global health

Key points

- **Why is resource priority setting important**
- **What are some new tools available to help resource prioritization?**
- **How can these tools be used?**

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Universal Health Coverage (UHC)

*"I regard **universal health coverage as the single most powerful concept** that public health has to offer".*

- Dr. Chan, WHO Director-General

Challenges in achieving UHC

- No way to cover everything for all people
- Understanding trade-offs between benefits and resources
- Cost-effectiveness analysis (CEA) can be a useful tool

Motivation

Aggregate, curate, and improve the world's cost-effectiveness information to help resource allocation decisions in global health

Global Health CEA Registry

Tufts Medical Center

- Published cost-per-DALY analyses
- Continually-updated
- Open access and available for download

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Global Health CEA Registry

Tufts Medical Center

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www.ghcearegistry.org

~5,000
Cost-per-DALY ratios
(through 2017)

620
English-language Cost-per-DALY analyses

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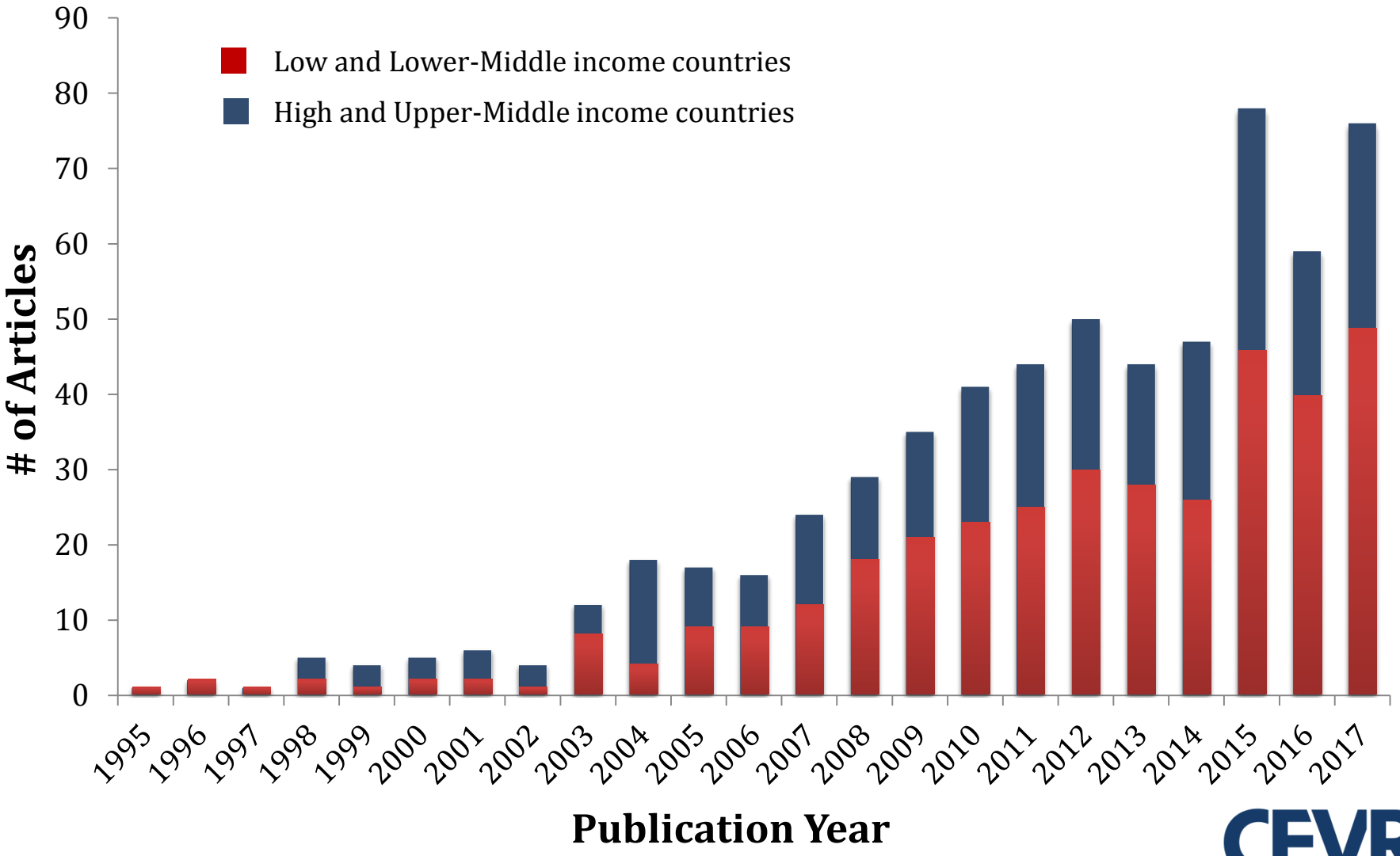
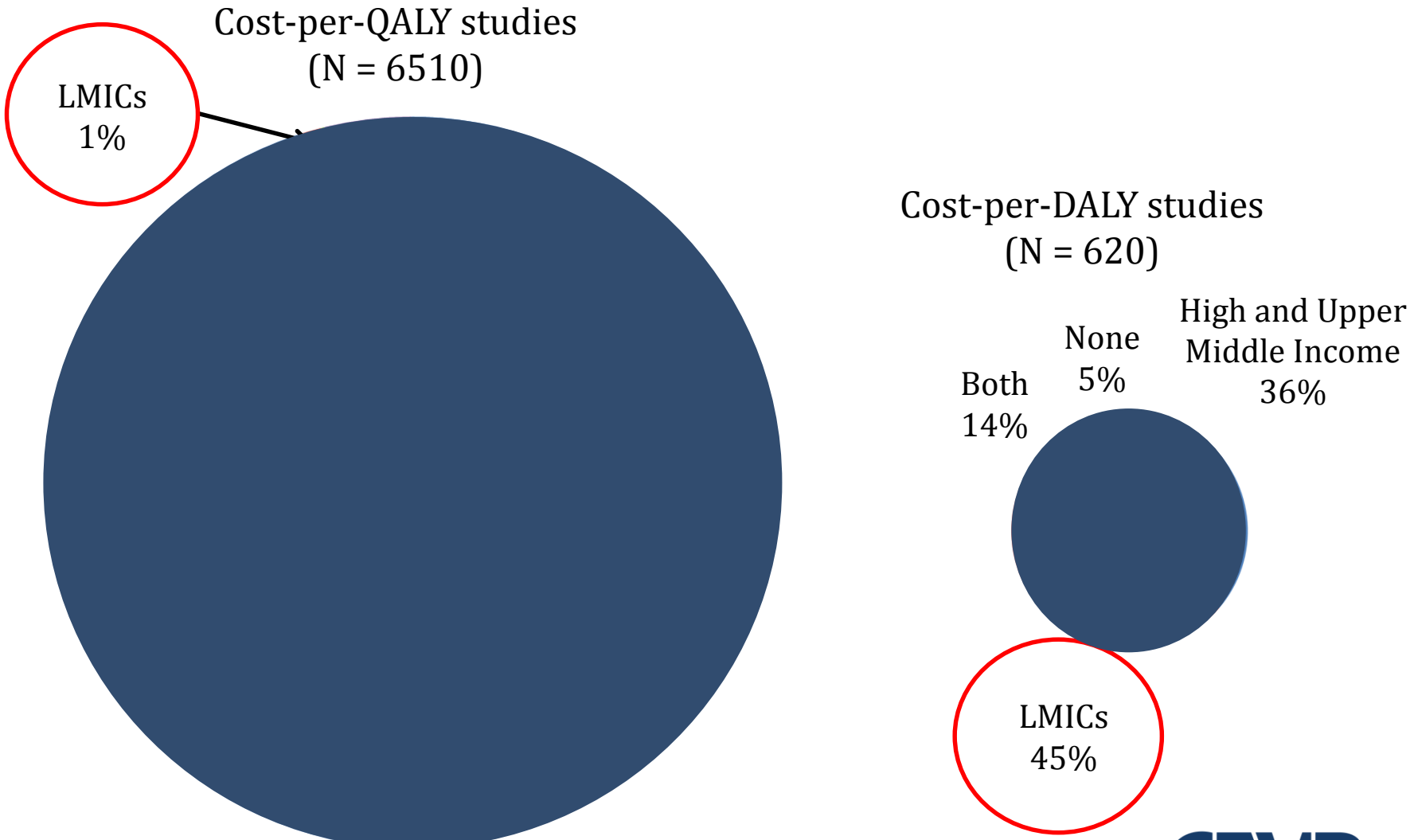
Growth of the cost/DALY literature



Cost/QALY vs Cost/DALY studies



Source: Neumann et al., Gates Open Research (2018)

Registry contents

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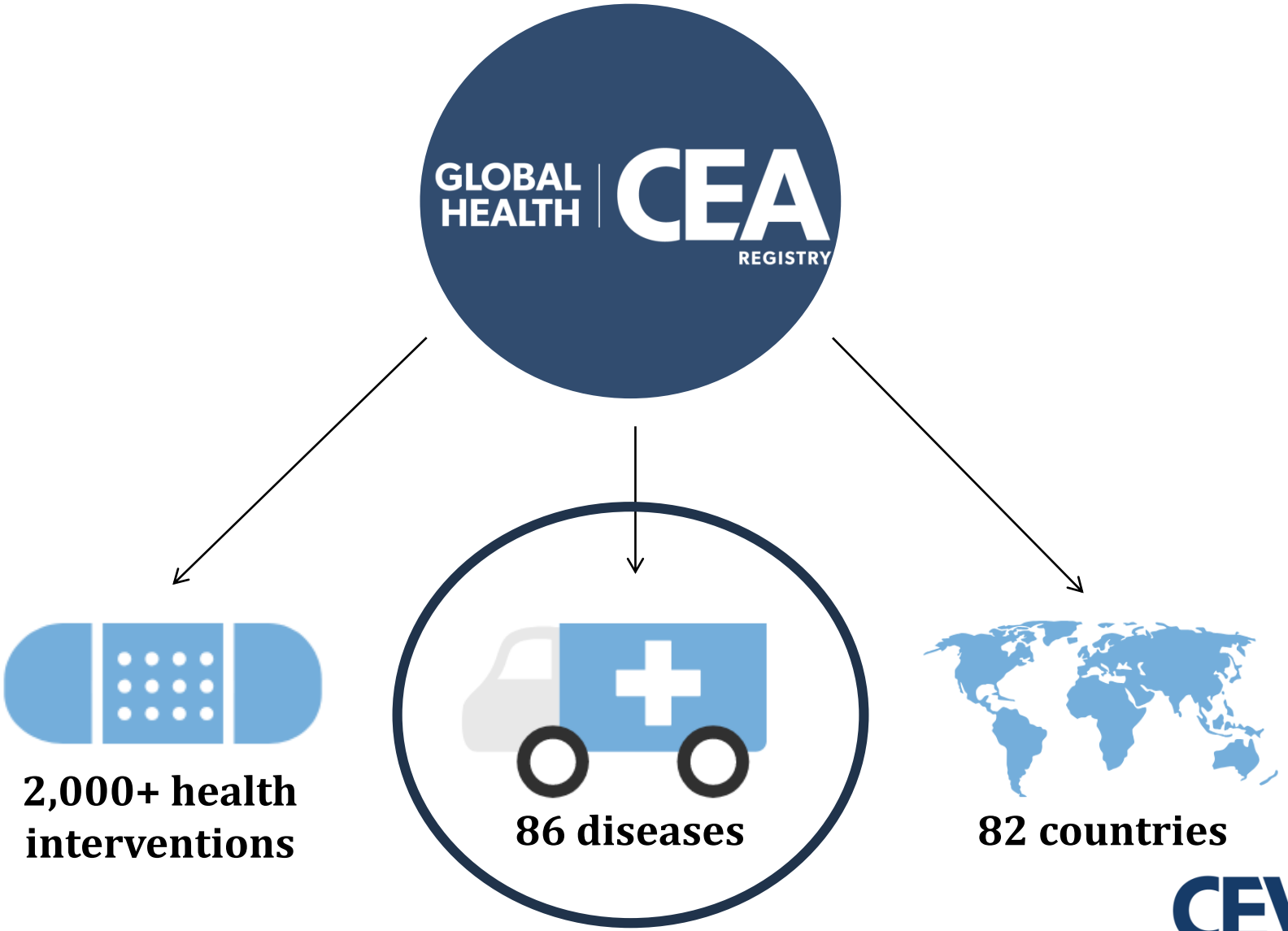

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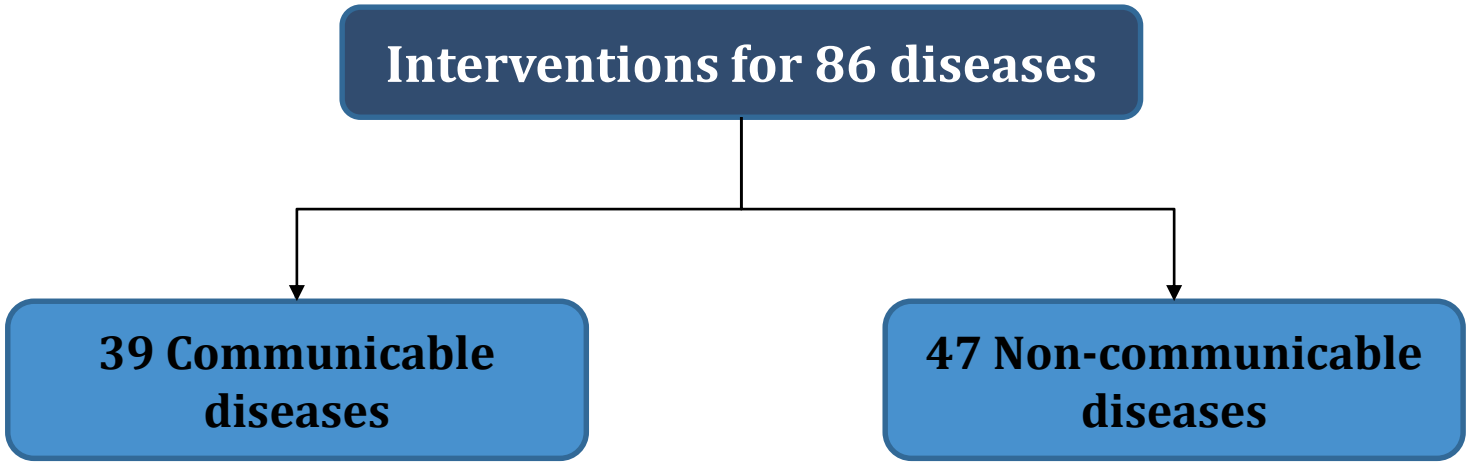
Registry contents



- HIV/AIDS & TB
- Diarrhea & common infectious diseases
- Neglected tropical diseases
- …

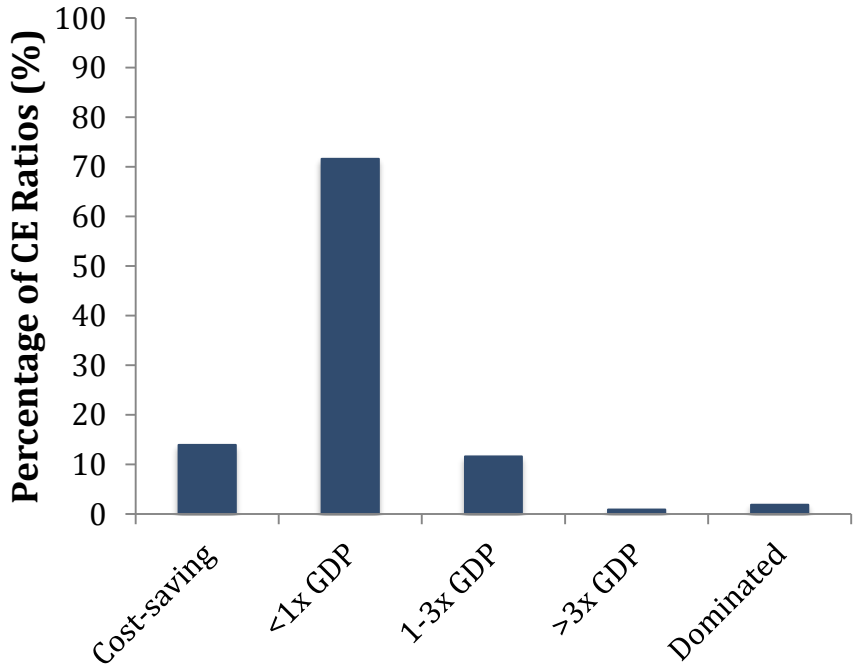
- Neoplasms
- Cardiovascular diseases
- Chronic respiratory disease
- …

TB studies in GH CEA Registry

Tufts Medical Center

616
Cost-per-DALY ratios
(through 2017)

44
Cost-per-DALY analyses



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Cost-effectiveness of selected TB interventions

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Cost-saving	<$200/DALY averted	$200-1000/DALY averted	>$1000/DALY averted

Drug susceptibility testing (DST) for MDR-TB patients in Peru

MDR treatment as per WHO guidelines in Russian patients
$770/DALY averted

Xpert rapid TB test in South Africa
$30/DALY averted

Expanded access to TB treatment in China

BCG vaccination for low-TB prevalence groups in the Netherlands
$7000/DALY averted

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Cost-per-DALY averted studies

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Online DALY Calculator

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- **Help users to calculate disease burdens in DALYs**

- **Help users to convert non-DALY metrics to DALYs**

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Case study

Tufts Medical Center

Cost-effectiveness of HIV prevention for high-risk groups at scale: an economic evaluation of the Avahan programme in south India

Anna Vassall, Michael Pickles, Sudhashree Chandrashekar, Marie-Claude Boily, Govindraj Shetty, Lorna Guinness, Catherine M Lowndes, Janet Bradley, Stephen Moses, Michel Alary, Charme India Group, Peter Vickerman*

Vassall et al., (2014) Lancet Global health

HIV cases averted:
61,744

DALYs averted:
1,061,255

DALYs per HIV case:
17.18

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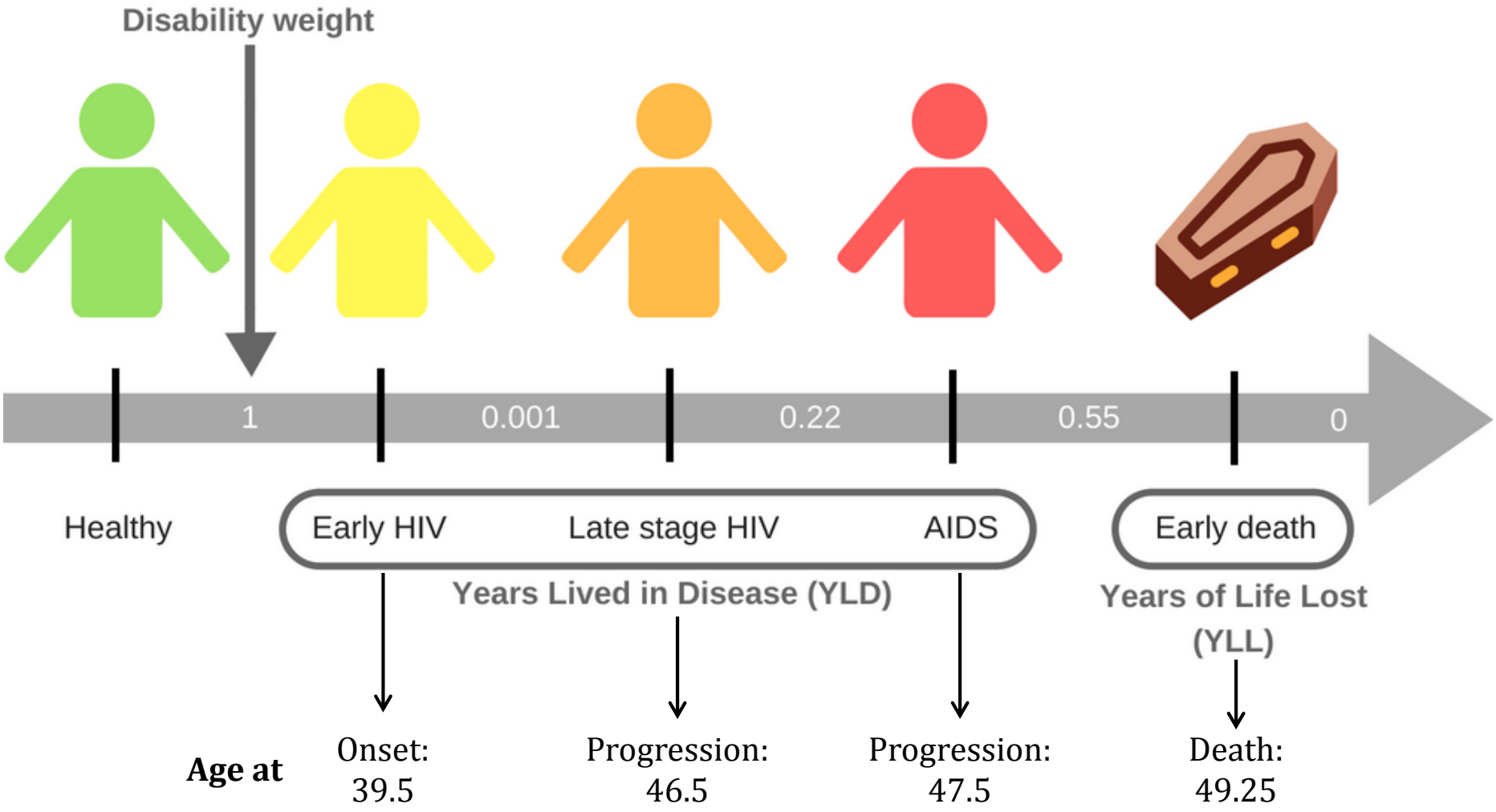
Case study


Disability weight
1
0.001
0.22
0.55
0
Healthy
Early HIV
Late stage HIV
AIDS
Early death
Years Lived in Disease (YLD)
Years of Life Lost (YLL)
Age at
Onset: 39.5
Progression: 46.5
Progression: 47.5
Death: 49.25

Case study

Tufts Medical Center

DALY Calculator | Calculate DALYs for an individual | Calculate DALYs for a population | References | Code

Inputs:

Disease:

AIDS without antiretroviral treatment

Age of onset of disease (years):

39.5

Age of premature death due to disease (years):

49.25

☑ Discount rate?

Discount rate:

0.03

☐ Include age weighting?

Calculate!

Outputs:

Disability weight = 0.55

Years lived with disease = 10

Life expectancy at age of premature death = 26.5

Years of Life Lost (YLLs), Years Lived in Disability (YLDs), and total Disability Adjusted Life Years (DALYs):

Contribution of YLLs	18.28
Contribution of YLDs	0.92
Total DALYs	19.2

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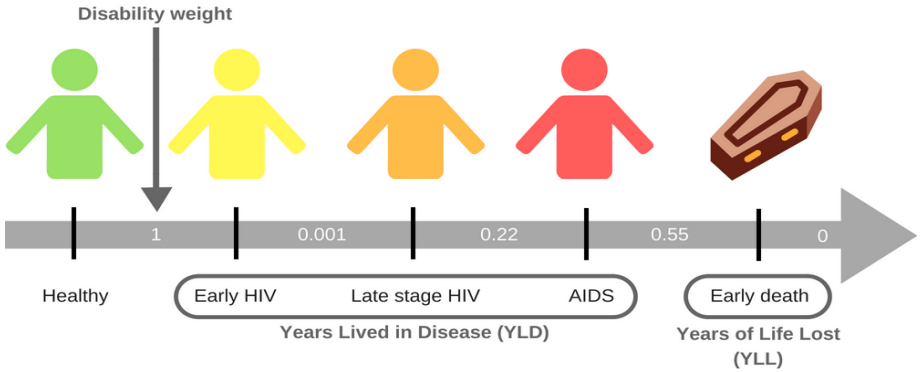
Case study



Years Lived in Disease (YLD)		
	Early HIV	0.1
	Late stage HIV	0.22
	AIDS	0.92
+	**Years of Life Lost (YLL)**	18.28
	Total DALYs	**19.52**

Reported DALYs per HIV case: **17.18**

Motivation

Aggregate, curate, and improve the world's cost-effectiveness information to help resource allocation decisions in global health

Future directions

- [x] Update the cost/DALY studies
- [x] Add other data sources
- [x] Model clearinghouse

Thank you!

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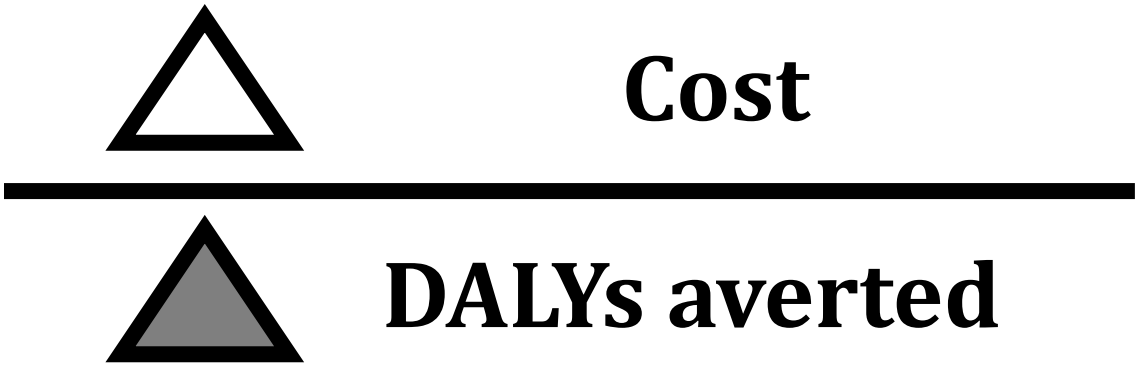
EXTRA SLIDES

Cost-per-DALY ratios



DALYs: Years of Life Lost + Years living with disability

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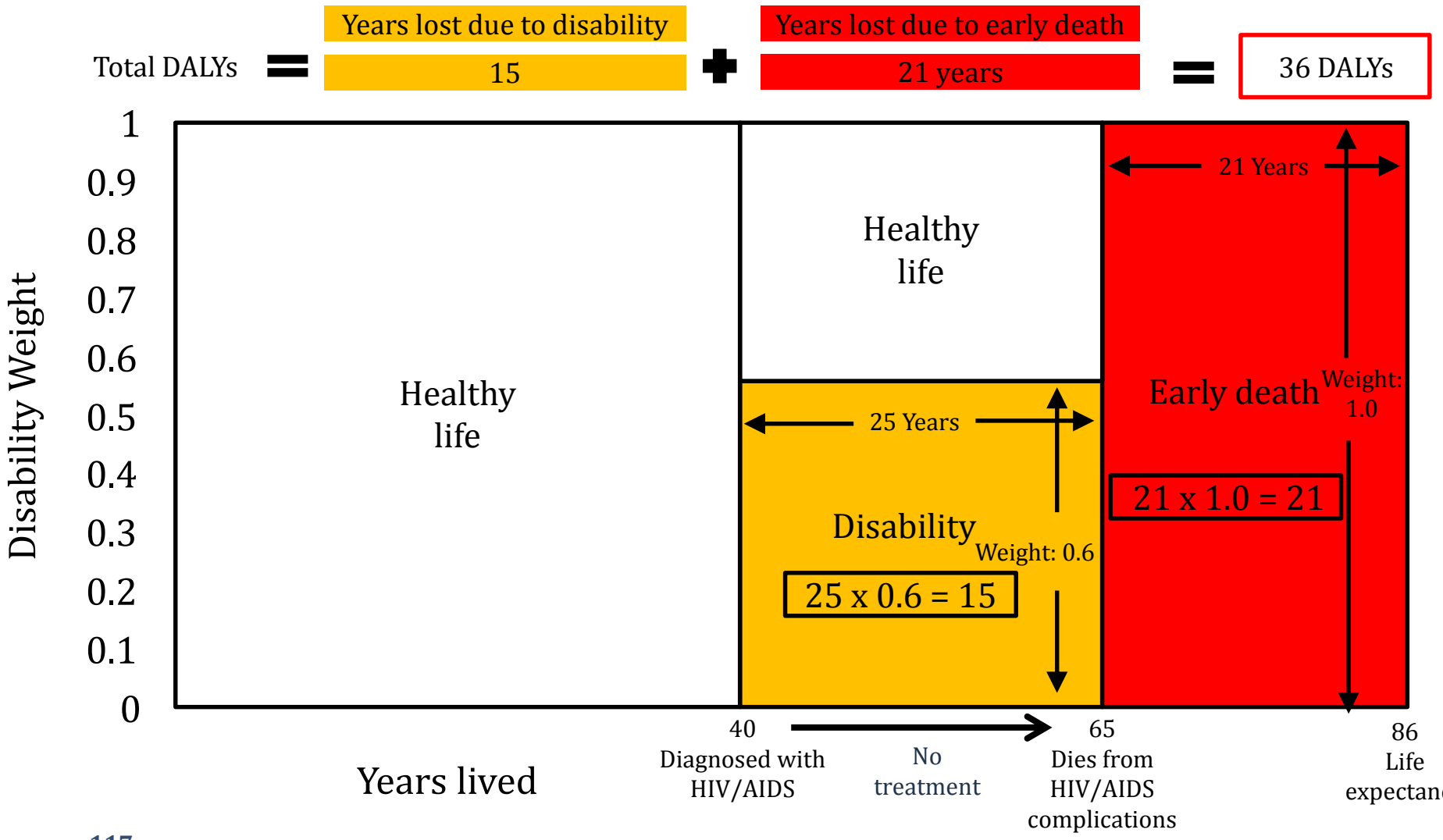

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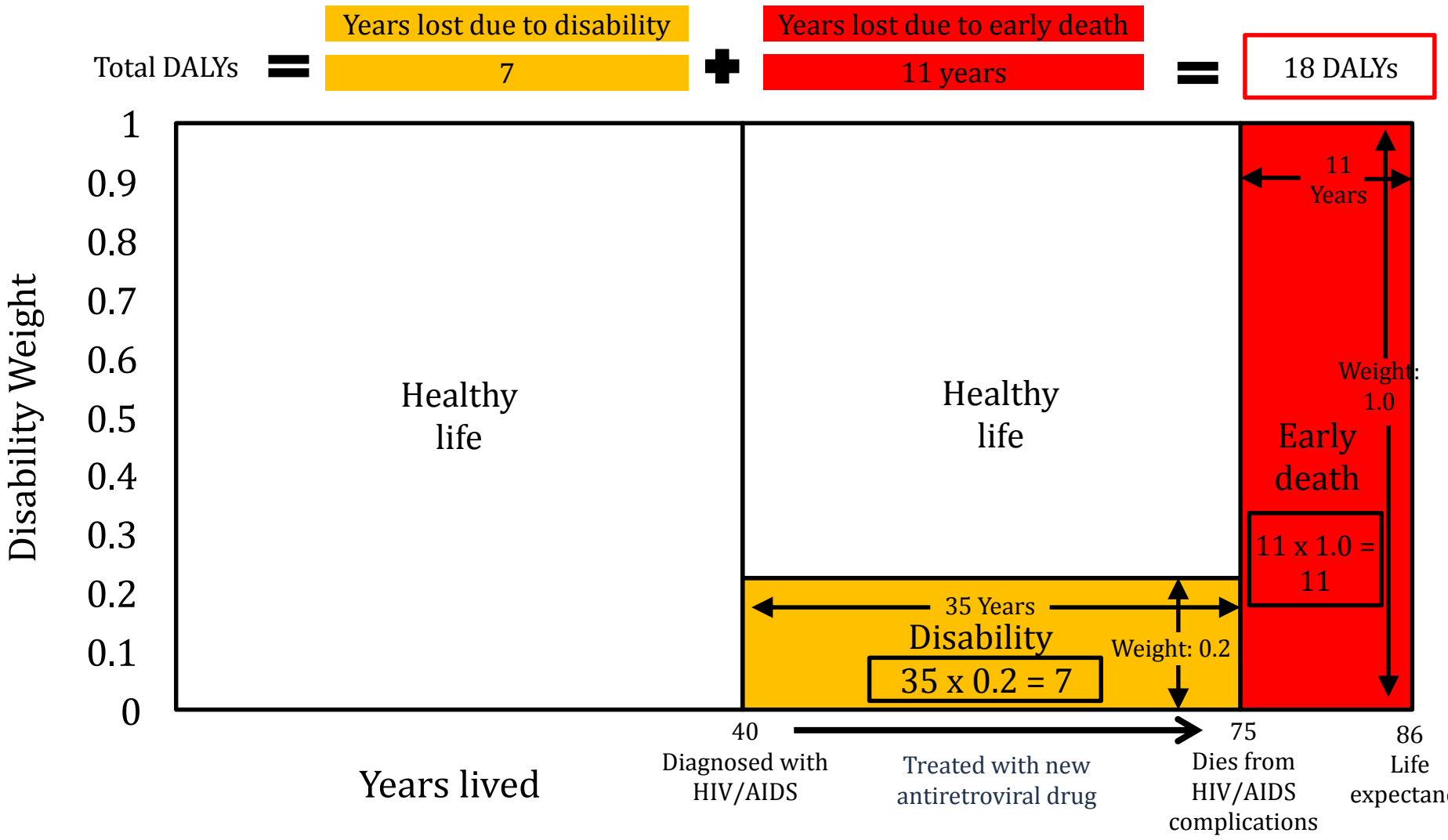
Therapy that delays death by 10 years & reduces disability prior to death



DALYs averted

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DALYs incurred without treatment		DALYs incurred with treatment		
36	−	18	=	18 DALYs averted

Lifetime treatment cost = $36,000

$$\frac{\text{Cost}}{\text{DALYs averted}} = \frac{\$36{,}000}{18} = \$2{,}000 \text{ per DALY averted}$$

Activities for next year

- Health system constraints
- Further links with GHCC

TB Modelling and Analysis Consortium