

Current availability and use of cost data for mathematical modelling

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Cost information needs

- Priority setting exercises need quality, up-to-date, disaggregated cost information
- Current services and new interventions across a range of settings
- Cost information includes
 - unit cost estimates (disaggregated by inputs or activities)
 - Other information to describe changes in these unit cost estimates as program expansion is being modelled – scale, but also modifiers such as levels of integration, managerial capacity, etc
- Few considerations...

Unit costs v cost functions

- **‘Unit’, or average, costs** represent the total cost of producing a service divided by the number of units of intervention, output or service produced.
- Static and relative to a given level of production
- As intervention, service or output levels increase or decrease average unit costs will change.

Coverage v scale

- **Cost functions** reflect underlying production functions that describe how the factors of production, or ‘inputs’, can be combined to produce services and interventions.
- Cost functions can be defined at the national level as coverage expands
- Or at the facility level, as the level of output expands
- The relationship between the cost functions at national and facility levels is determined by
 - the decision on how to expand coverage
 - the point at which the current health system is able to reach people

Short v long run

- The amount of some inputs used stay constant, or **'fixed'**, as the level of service provision increases.
- The determination of which costs are fixed is highly contextual: 'fixity' of a cost reflects the characteristics of inputs, preferences and constraints faced by managers.
- In general, at low levels of production, fixed costs may be spread across a low number of services/outputs: average cost is relatively high.
- As production increases, fixed costs are spread across more persons and average costs decrease.

Short v long run

- The long-run is defined as the point where no inputs are fixed, so complete managerial flexibility to change the level of all resources (buildings etc included)
- Relatively large volumes of service provision may enable improved service organization and 'learning by doing' within providers, resulting in a more efficient input mix.
- However, at very high levels of service provision, the production process may become challenging.

Economies of scope

- A last critical issue that determines ‘average costs’ of a particular service is the other services it is delivered with.
- **‘Economies of scope’** exist where providers deliver services cheaper where multiple services are delivered jointly.
- OHT – separates health system component (infrastructure, HR, supply chain...) and economies of scope are applied here

Empirical cost function analysis

Finally, there will be modifiers to this underlying structure of fixed and variable costs :

- coverage decisions
- integration
- managerial capacity

Empirical cost function analysis tends to focus on determining the relationship between those modifiers and costs.

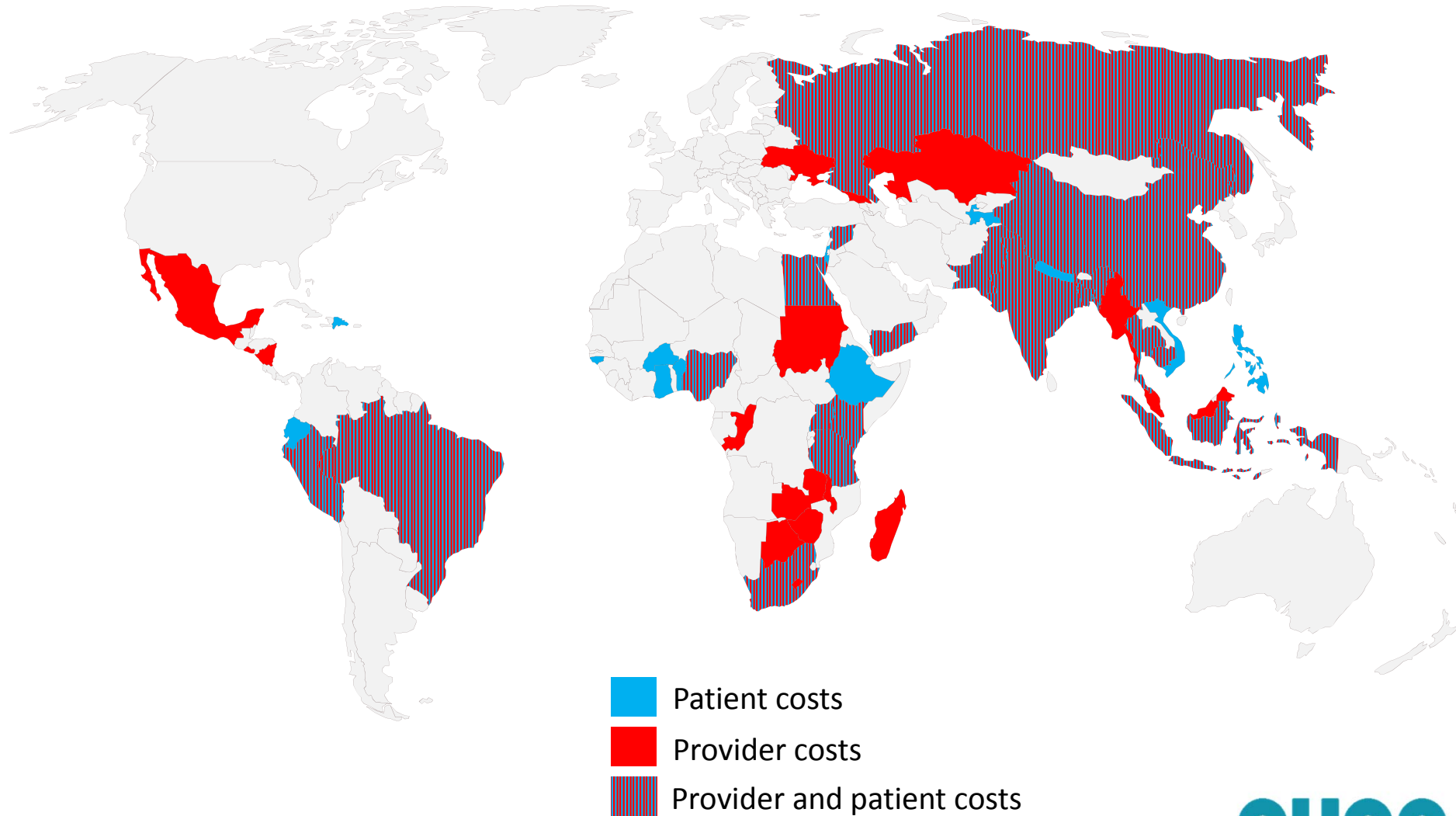
Current use of cost data

- Currently, modelling groups can apply empirical or more mechanistic approaches:
 - an assumption of linearity of costs (single constant unit cost per unit of output),
 - fitting theoretically-defined cost functions to observed data (one or two data points at times) - reflecting underlying assumptions about the production function
 - build mechanistic cost functions by varying marginal costs at different levels of service delivery
 - Relies on understanding and explicitly modelling the underlying production function, describing how different inputs, fixed and variable, are used and combining this with detailed cost data

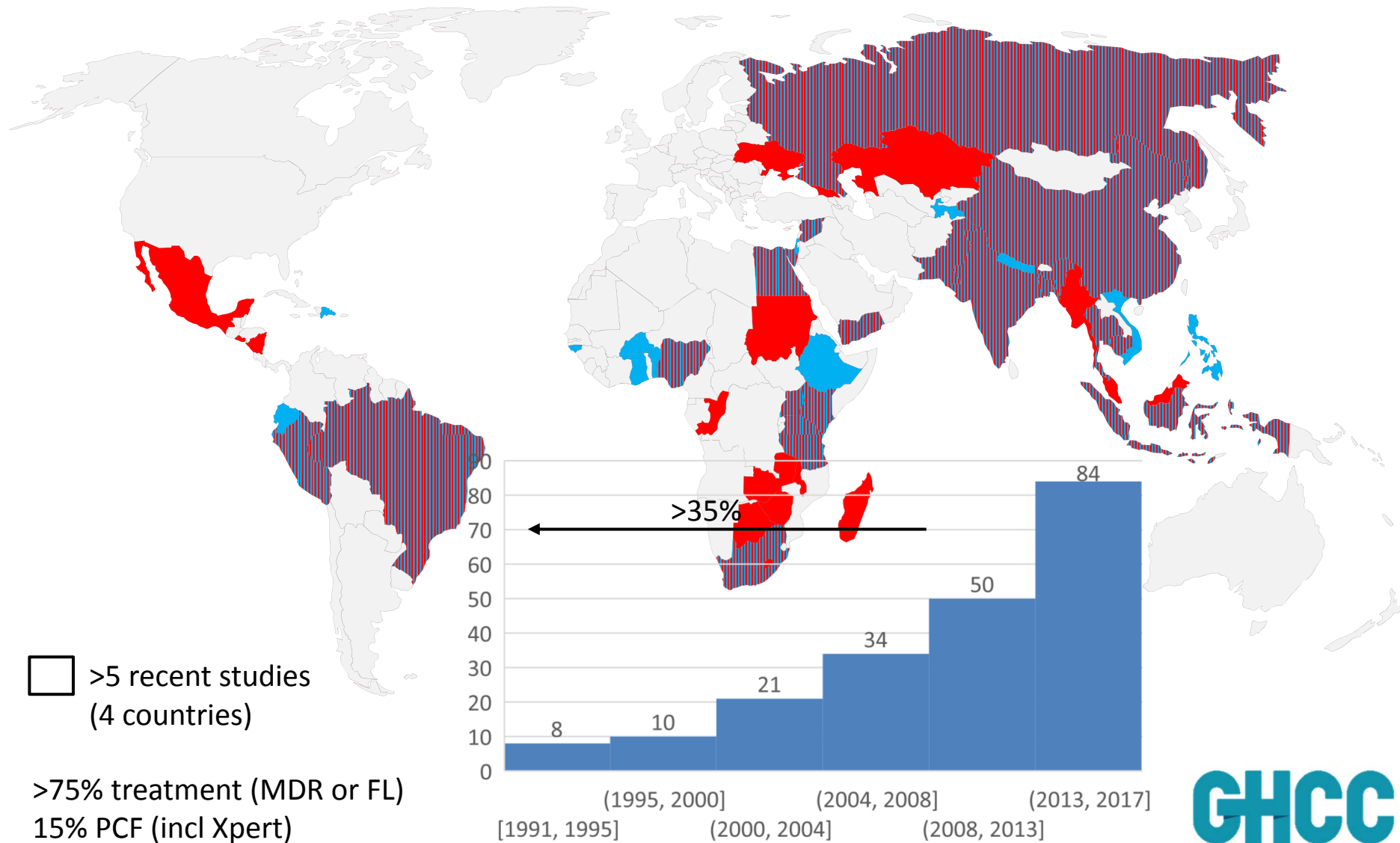
Data availability (unit costs)

- In TB, recent systematic reviews (published by different groups and ongoing as part of the Global Health Cost Consortium work) have highlighted that unit cost estimates are
 - outdated,
 - not available for most high burden countries,
 - not representative of delivery modalities rapidly evolving or new technologies emerging

Data availability (unit costs)



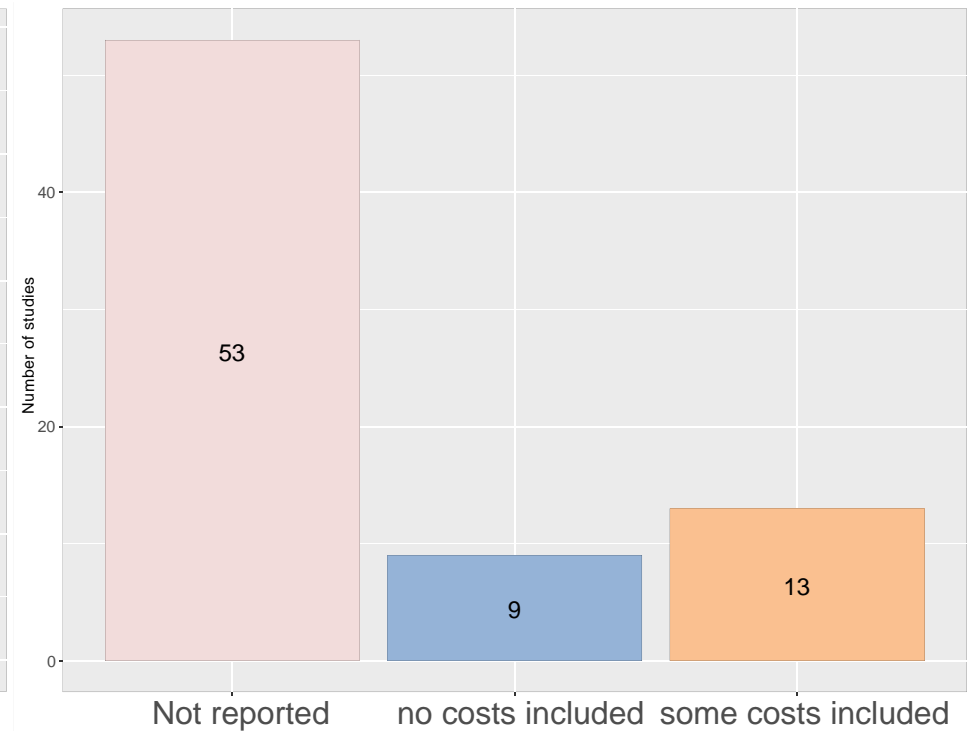
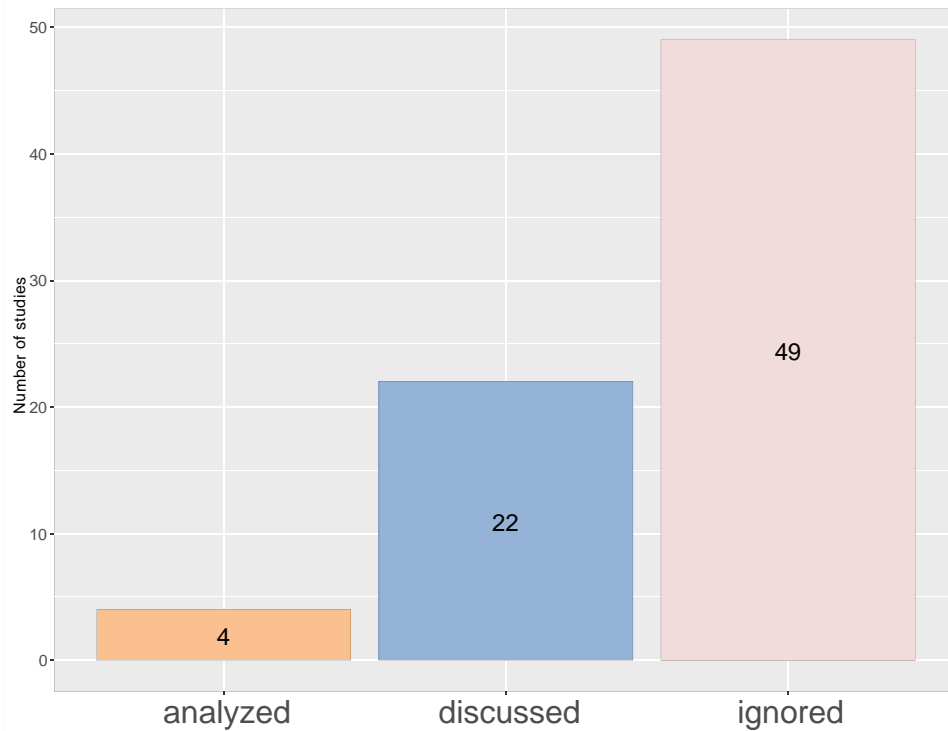
Data availability (unit costs)



Data availability (cost functions)

- There have been very few (multi or single-country) multi-site studies conducted to derive empirically cost functions
- There is very limited information to inform issues such as economies of scale or levels at which costs are being incurred

Economies of scale and program costs



Major initiatives currently funded

- GHCC (Global Health Costing Consortium) aims to improve future TB (and HIV) cost data quality by providing **a reference case and tools** for costing studies. It also aims to improve availability of cost data from past studies through an open access **unit cost repository** and dynamic tool (Carol and Lori)
- VALUE-TB: aims to provide comprehensive cost (health service) data across 5 countries
- WHO-TB catastrophic costs aim to provide comprehensive (patient) cost data across 20 countries

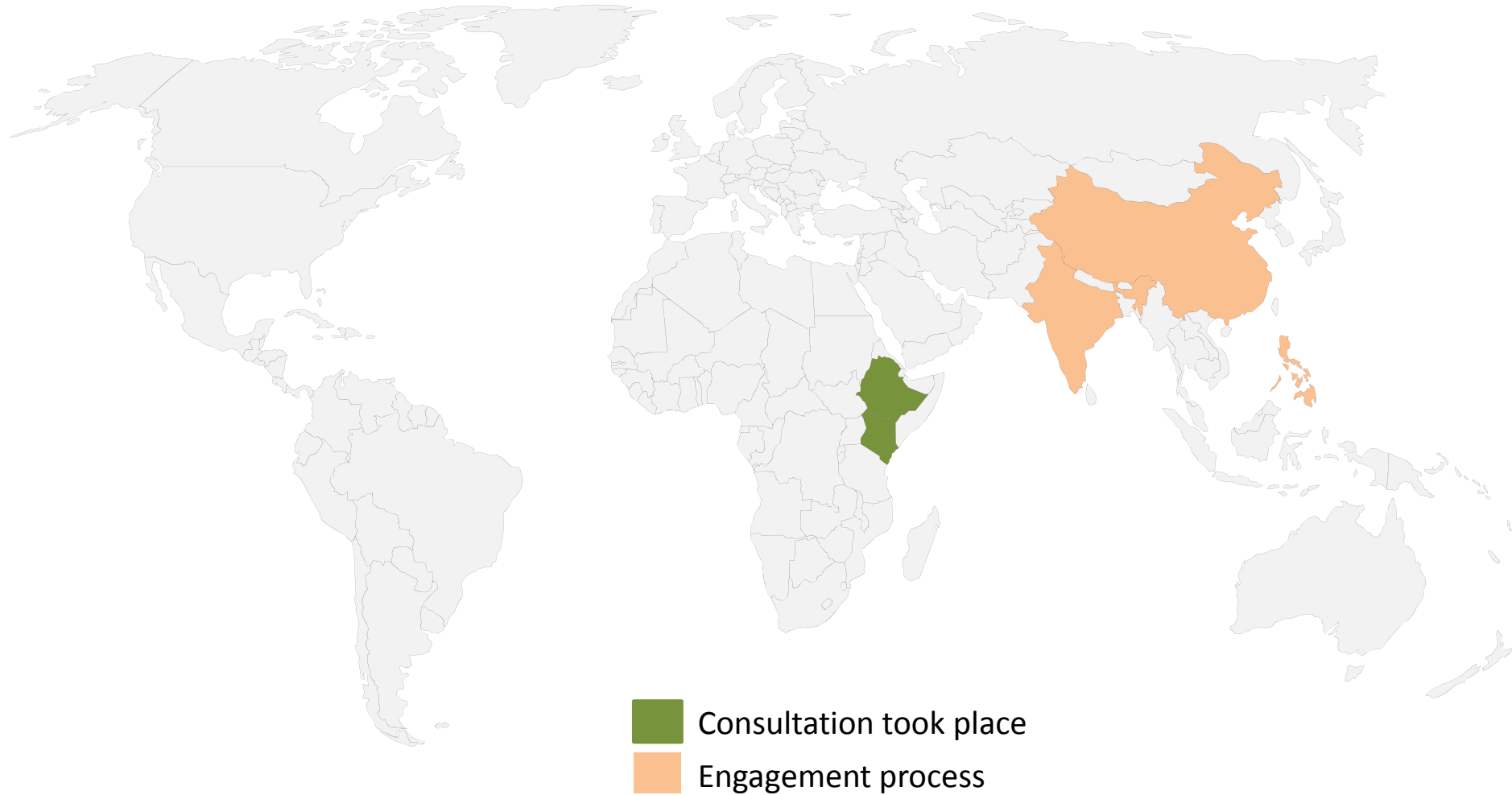
VALUE TB

1. To provide a **comprehensive set of unit costs** for TB services five countries (to be available on the GHCC data repository)
2. To develop a **sustainable framework** (in terms of tools and processes) for TB cost data collection at the country level
3. To support the **use of cost data by policy-makers and TB planners**, in collaboration with the GHCC and TB Modelling Consortium (TB-MAC)
 - People's Republic of China,
 - Ethiopia,
 - India,
 - Kenya,
 - Philippines

VALUE TB

- 2017-2019
- Streamlined process
- Strong centralized guidance but working through the National TB Programmes (country leadership in future regular (2 yearly cycles) costing efforts)
- Reporting on financial and economic, fixed/ variable costs for all available TB interventions
- 20-40 facilities per country
- Costs: \$70,000 - \$150,000/country

Progress as of Aug 2017



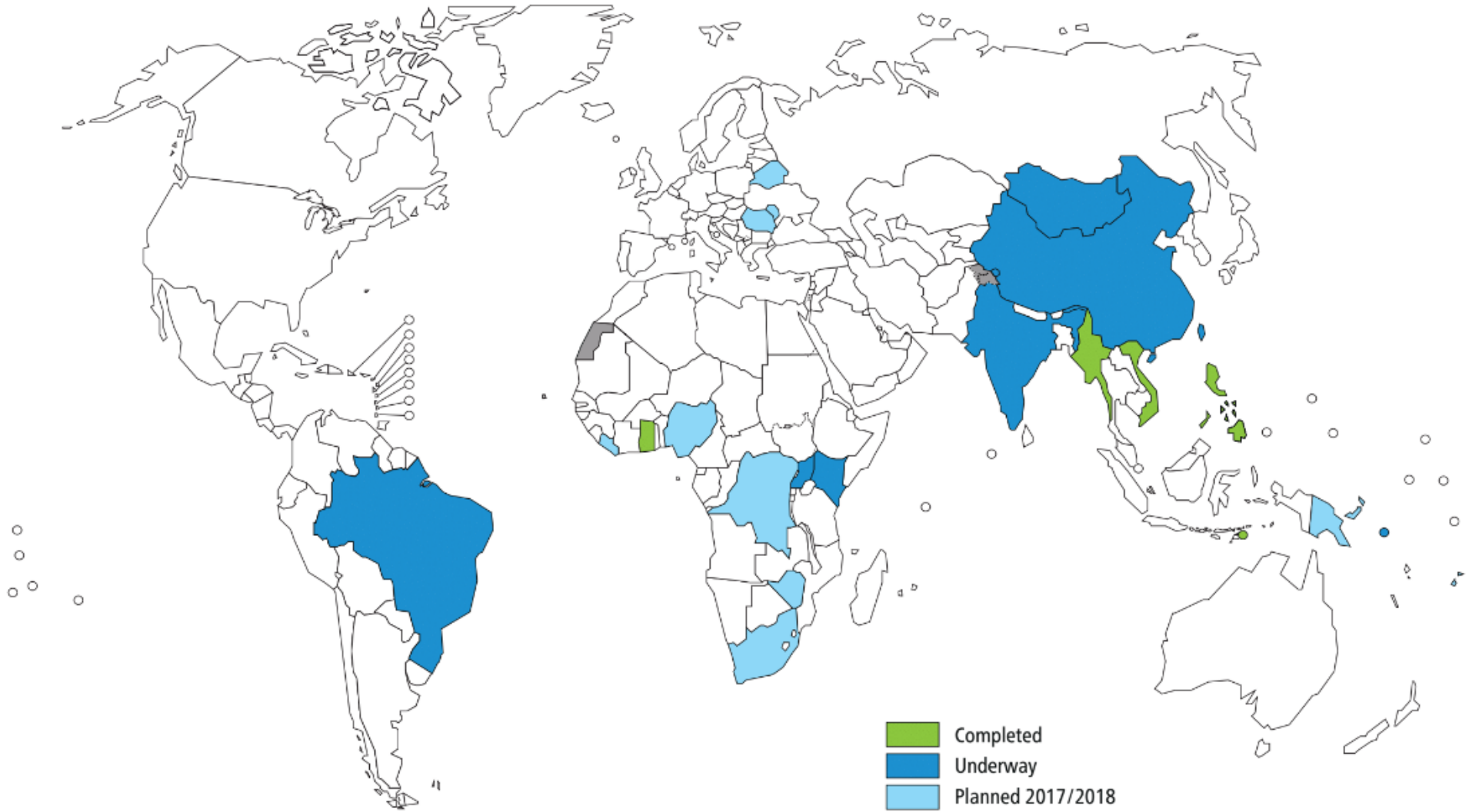
WHO's surveys of catastrophic costs

- WHO-TB leads the development of standard indicators and measurement approaches for the monitoring of progress against the post-2015 TB target of “no TB-affected family facing catastrophic costs due to TB” by 2020.
- WHO-TB is collaborating with local NTPs to undertake nationally representative patient costs surveys.

Surveys of cost faced by TB patients and their households

- Facility-based patient survey
 - National sample (random cluster sampling) of patients on treatment
 - Cross sectional survey with retrospective data collection and projections
 - 40-60 minute questionnaire per patient
- Usually 500-1000 patients (min. 20 clusters)
 - Sampling of persons in intensive and continuation phase
- Estimated survey implementation time:
 - data collection: 2-3 months
 - entire survey: 6-9 months
- Survey frequency goal: once every 5 years
- Costs: \$40,000 - \$100,000

Surveys progress as of Aug 2017



Acknowledgements

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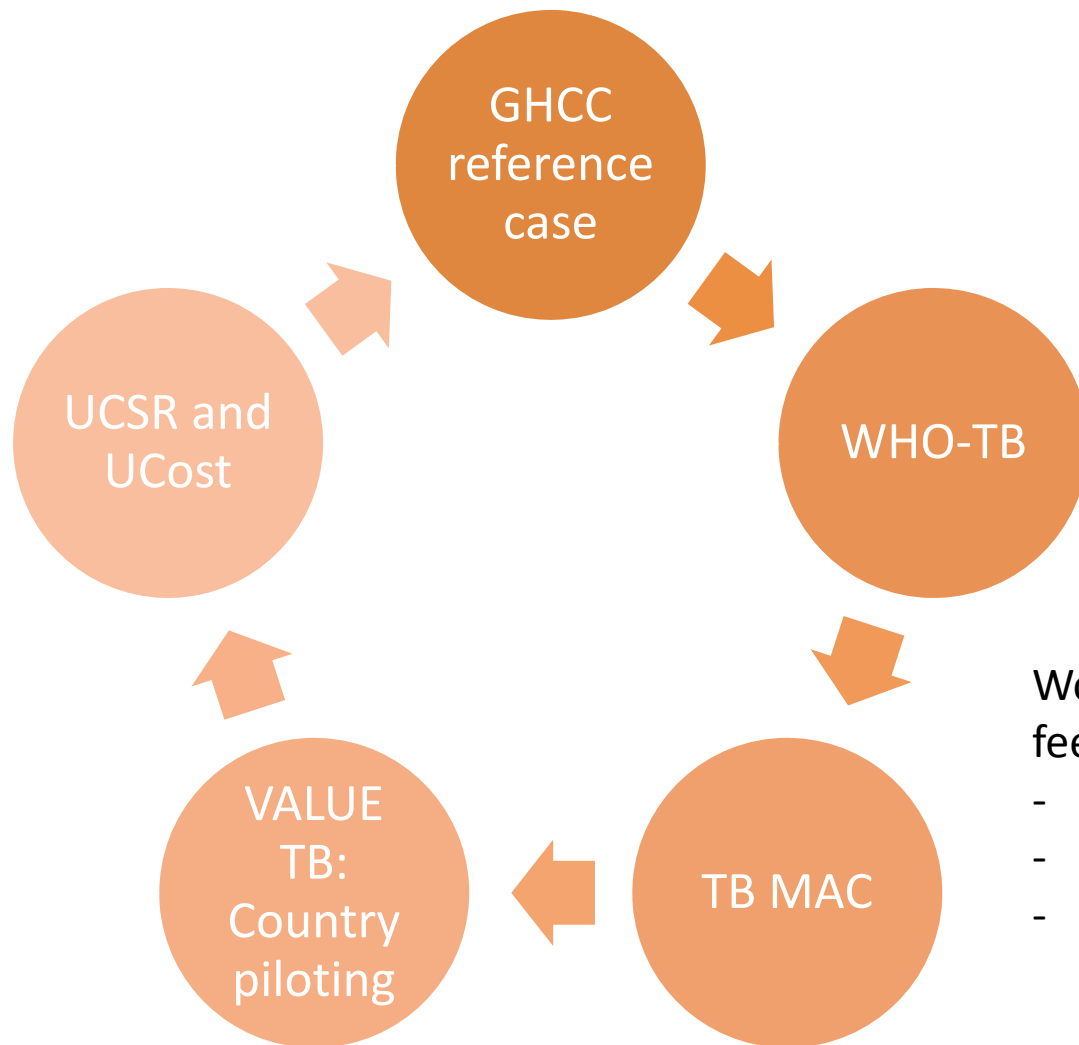
Standardisation of interventions, units, and inputs

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Consultation process and piloting



Work in progress - we are looking for feedback on:

- Interventions – comprehensive list?
- Outputs – do these link to your model?
- Inputs – is this the right dis aggregation?

Defining the interventions

Intervention: new service, existing services or change to existing services

- **Technologies:** diagnostic techniques, medical devices, drugs, procedures, health promotion or patient support activities
- **Platforms:** where the intervention takes place, e.g. public facility, private facility, household, general hospital
- **Population (demographic and clinical):** population that should be receiving the intervention

Proposed standardised TB interventions

- Case detection and diagnosis
 - Passive case finding (PCF)
 - Active case finding (ACF)
 - Intensified case finding (ICF)
- Treatment: intensive and continuation phases
 - First line
 - DS-TB
 - Second line: long, short and individual regimen; ambulatory and in-patient care
 - DR-TB: RR/MDR-TB; Pre XDR-TB; XDR-TB
- Prevention
- Infection control
 - Health facilities
 - Laboratories
- TB Policy, planning, coordination and management

Example

Intervention class	Intervention Type	Intervention Details	Technology	Platform Ownership	Platform Type	Population Demographic	Population Clinical
TB case detection and diagnosis	Passive Case Finding (PCF)	Screening and diagnosing active and latent TB in those who report to TB services with symptoms	Symptom screen	Public	Health Post	Children Adults	(HIV+, HIV-) (pulmonary/ extra-pulmonary) (DS, MDR, pre-XDR, XDR)
			Xpert MTB/RIF	Private for profit	Health Center		
			Sputum induction	Private non for profit	Hospital - Primary		
			Microscopy (LED)	Public/ private mix	Hospital - Secondary		
			Microscopy (ZN)		Hospital - Tertiary		
			Culture (solid media)	Hospital - Level Unspecified			
			Culture (liquid media)	Laboratory			
			X-ray				
			Digital X-ray				
			Rapid HIV Test				
			LPA - FLD				
			LPA - SLD				
			DST (solid media)				
			DST - FLD (liquid media)				
			DST - SLD (liquid media)				
			LAMP				
			LF-LAM				
IGRA*							
Mantoux							
Fine needle biopsy							
Bronchial lavage							
Gastric lavage							
Aspirates (EPTB)							

Unit costs: definitions

Intervention 'unit' cost

Average cost of an intervention (or strategy) (e.g., unit cost per person or episode of expanding TB treatment, or costs of peer education per person reached)

Direct service / output 'unit' cost

Average cost per health service output/service delivered. This can be per person or per specific output/service (e.g., outpatient visit, diagnostic test, inpatient bed-day). In some cases, this may be the same as the intervention cost, but in other cases multiple services may combine to produce an intervention

Ancillary service / output 'unit' cost

Average costs of supporting or ancillary services and outputs. This can be per output or per specific service (e.g., critical enablers) that support the delivery of health services (e.g., cost of information and education per person reached)

Activity cost

Cost for each action required to provide services (e.g., per health worker trained)

Standardized TB unit costs by intervention

Intervention class	Intervention	Standard unit cost	List of outputs	Standard unit costs (service direct)	Standard unit costs (service ancillary)
TB case detection and diagnosis	Passive Case Finding (PCF)	Cost per person diagnosed DS-TB Cost per person diagnosed DR-TB Cost per TB case diagnosed	Outpatient visit Inpatient bed-day Diagnostic test Patient support provision (session)	Cost per outpatient visit Cost per inpatient visit* Cost per test Cost per sample/ slide	Cost per person patient support
	Intensified case finding (ICF)	Cost per person screened Cost per person diagnosed Cost per TB case diagnosed	Patient screen Outpatient visit Inpatient bed-day Triage test Diagnostic test	Cost per screen (different platforms and approaches) Cost per outpatient visit Cost per inpatient visit Cost per triage test Cost per diagnostic test Cost per sample/slide	Cost per patient support (per visit, screen or diagnosis)
	Active Case Finding (ACF)	Cost per person screened Cost per person diagnosed Cost per TB case diagnosed	Patient screen Outpatient visit Inpatient bed-day Triage test Diagnostic test Patient support provision Community event	Cost per screen (different platforms and algorithms) Cost per outpatient visit Cost per inpatient visit Cost per mobile clinic visit Cost per household visit Cost per other visit Cost per triage test Cost per diagnostic test Cost per sample/slide	Cost per patient support (per visit, screen or diagnosis) Cost per community event

*e.g. for children needing fine-needle biopsy

Standardized TB unit costs by intervention

Intervention class	Intervention	Standard unit cost	List of outputs	Standard unit costs (service direct)	Standard unit costs (service ancillary)
TB treatment	TB Treatment	Cost per treatment month (DS-TB, MR-TB, PDR-TB, MDR-TB, pre-XDR-TB, XDR-TB) Cost per person treated Cost per person completing treatment Cost per treatment monitoring	Outpatient visit Inpatient bed-day DOT visit community platform Monitoring visit	Cost per outpatient visit Cost per inpatient bed-day Cost per DOT visit community Cost per microscopy Cost per other test Cost per DS-TB regimen Cost per short DR-TB regimen Cost per long DR-TB regimen	Cost per person month patient support Cost per person patient support Cost per patient support visit
TB prevention	TB Prevention	Cost per treatment month LTBI Cost per person treated LTBI Cost per person completing treatment LTBI	Outpatient visit Person screened Diagnostic test	Cost per outpatient visit Cost per screen Cost per test Cost per regimen	Cost per person month patient support Cost per person patient support Cost per patient support visit Cost per community event

Standardized TB unit costs by intervention

Intervention class	Intervention	Standard unit cost	List of outputs	Standard unit costs (service direct)	Standard unit costs (service ancillary)
TB Infection control	TB Infection control	Cost per facility Cost per laboratory			
TB policy, planning, coordination and management	TB policy, planning, coordination and management		PPM Support Training sessions Information systems development Events Workshops Supervisory visit		Costs per training Costs per software development Cost per event Cost per workshop Cost per supervisory visit Cost per item transported

Input and activities breakdowns

Activity breakdown

Service provision

Management / operational

Input breakdown

Direct Service Personnel

Support Personnel

Drugs - TB

Drugs - other

Medical supplies

Non - medical supplies

Laboratory equipment

Medical/Intervention Equipment

Vehicles

Non-medical/non-intervention Equipment
(excl. vehicles)

Equipment - other

Equipment - maintenance

Vehicle - maintenance

Buildings

Buildings - maintenance

Utilities

Food



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- Carol Levin
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- Ines Garcia Baena
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Discussion

- What are you currently doing? Are you:
 - a) using unit costs or cost functions
 - b) if using unit costs, disaggregating data in which way
 - c) if extrapolating costs from other services, are you splitting by tradable / non-tradable
 - d) if using cost functions, are they at the coverage level, and are you considering facility functions (and expansion patterns)
 - e) Economies of scale and scope
- What would you ideally like to do? And how does this affect your data needs?