Modelling the cost of TB interventions at scale

applied cost functions

Gabriela B. Gomez, Fiammetta Bozzani, Don Mudzengi, Nicola Foster, Ines Garcia Baena, Andrew Siroka, Nick Menzies, Anna Vassall

Background

- Mathematical and economic modelling to inform priority setting
- Low quality and quantity of data informing cost estimates of current TB services and new interventions
- Also scarce information describing how those costs change over time and with scale.
- Assumption: unit costs do not change with scale and that there is a linear relationship between cost and coverage

Background (cont.)

- Default assumption of non-linearity might be better.
- Empirically deriving and parameterising cost functions: comprehensive cost data unavailable through routine systems.
- Theoretically derived cost curves: incorporate the economic theory, challenges when fitting due to data scarcity.

- We present a framework to estimate cost functions using secondary data and routine reporting systems
  - Apply it to the expansion of ICF in South Africa.

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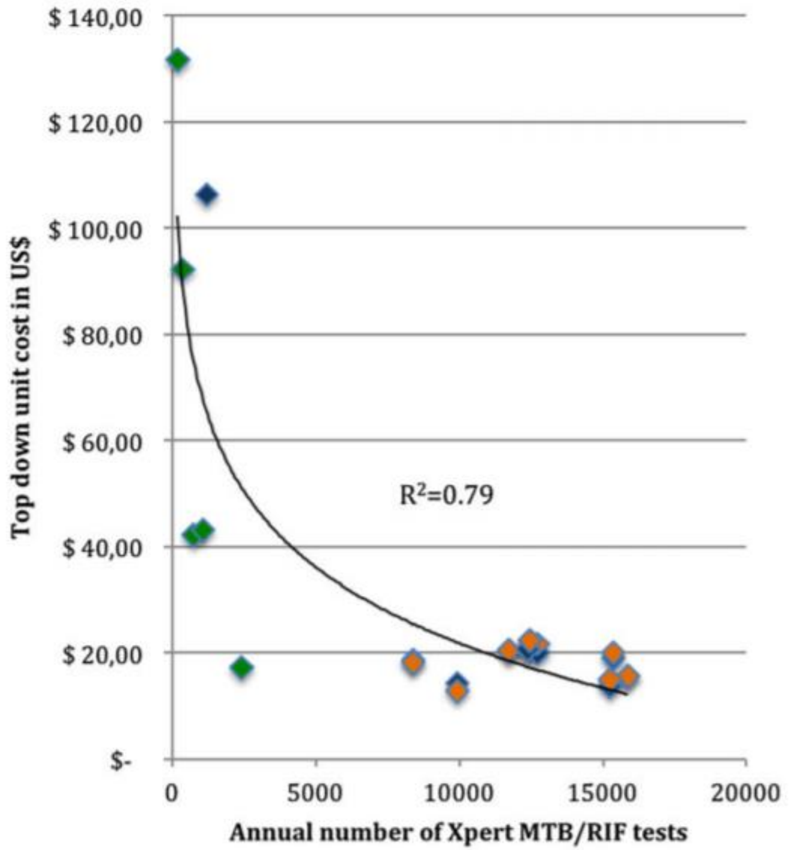
Unit v functions

- 'Unit' costs: total cost of producing a service divided by the number of units produced.
- Static and relative to a given level of production
- Cost functions reflect underlying production functions: how inputs can be combined to produce services and interventions.



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Short v long run

- Short run: the period where some of the factors of production are fixed
- Long run: all factors of production are variable

Example

- In the short run, it may not be possible to change the number of health facilities
- A scale-up in coverage would need to happen by increasing variable factors such as the number of TB staff or drugs for a specific strategy across an already existing network of health facilities

Coverage v scale

- Cost functions can be defined at the national level as coverage expands or at the facility level, as the level of output expands
- We postulate that a cost function should be derived by considering both
  - Density of provision
  - Capacity utilization

- **Density of provision:** relationship between programme coverage and the number of facilities included during scale-up (how coverage of facilities expands)
- **Capacity utilization:** expansion of number of people serviced at each facility (the point at which the current health system is able to reach people)

Joint production function

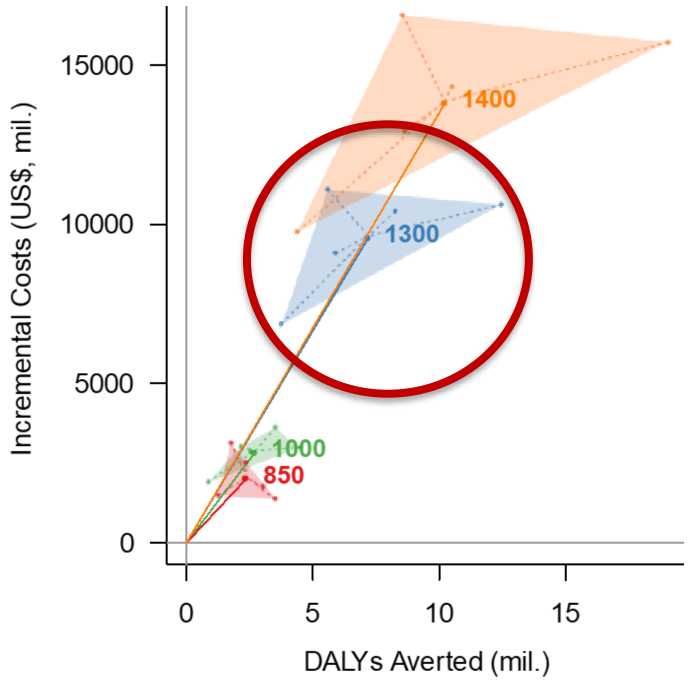
We propose a short run function that includes:

- Fixed program costs: fixed at the national level (eg investment to manage a new intervention or the continuous service delivery)
- Variable program & fixed facility costs: variable at the national level and fixed at facility level, that is variable by numbers of facilities (eg building costs or facility-based training).
  - Economies of scale.
  - Economies of scope - where providers deliver services cheaper where multiple services are delivered jointly.
- Variable facility costs: those costs that change as output levels change, (e.g. consumables or staff).

Intensified case finding in South Africa

- Previous work: feasibility of achieving the goals of the WHO 'End TB strategy 2016-2035' in three countries: China, India, and South Africa

- In South Africa
  – no single intervention scenario was sufficient to reach the targets by 2025; all cost-effective; considerable budget increases



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Research question

- Increased access: TB symptom screening for all patients attending primary care clinics, followed by current diagnosis algorithm for those symptomatic.
- Linear unit cost assumption

- What would be the economic implications of changing this assumption
  - If we account for economies of capacity (economies of scale at facility level)
  - If we account for economies of capacity AND density (economies of scale at national level)

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Unit costs (constant)

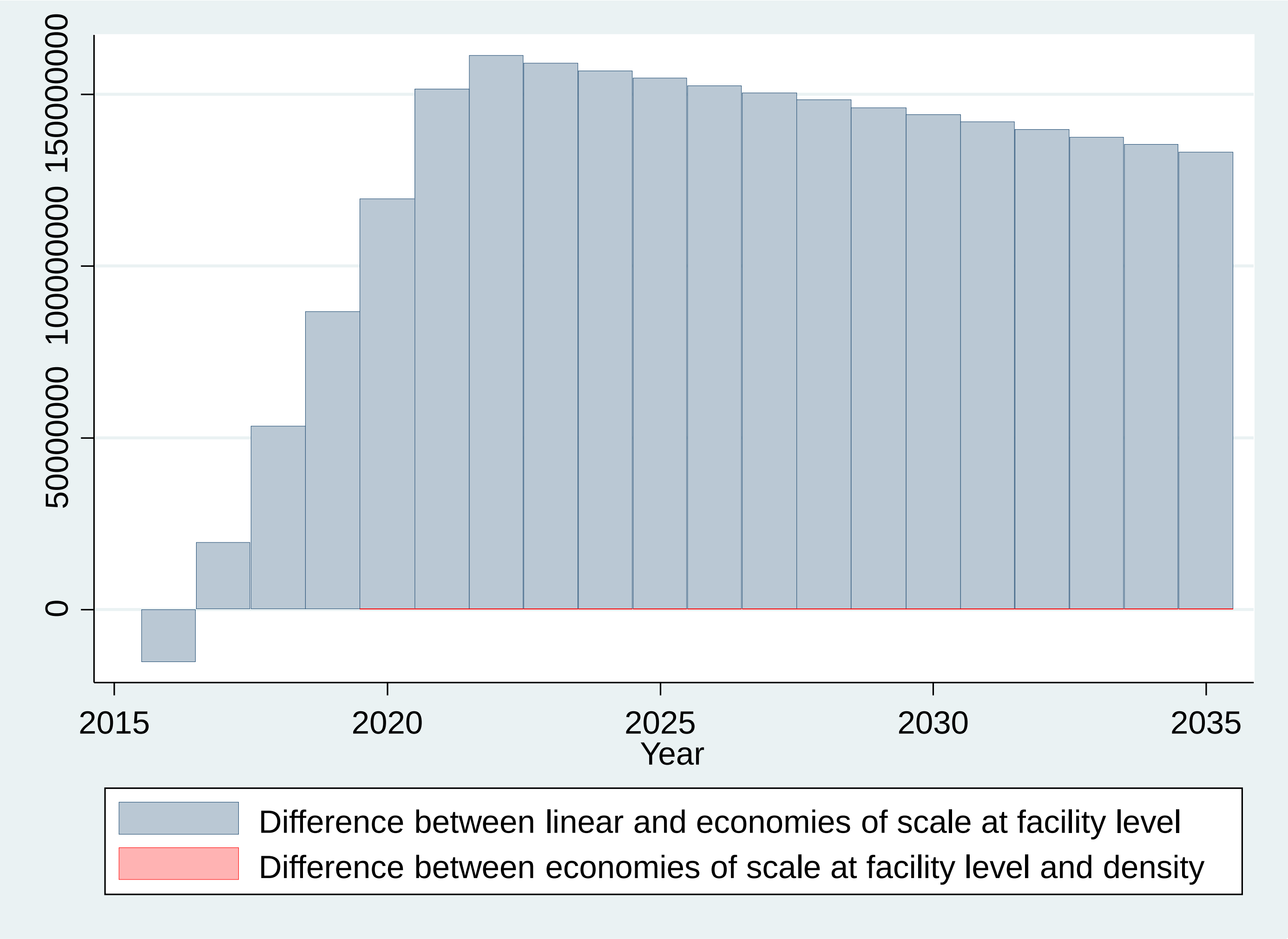
Service/intervention	Average unit costs (constant)	USD 2016
TB diagnosis	per person to be evaluated for TB	54,4
DS treatment (first line)	per person-month (DS)	18,5
MDR treatment	per person-month (MDR)	357,0
TB screening in ART	per ART patient screened	4,1
IPT treatment	per person-month (IPT)	7,8
TB symptom screening	cost per PHC attendee screened	1,4

Unit costs (disaggregated)

Service/intervention	Type of input	unit	USD 2016
Labs	Variable program (genexpert)	per laboratory-year	13 327,0
	Fixed laboratory (genexpert)	per average laboratory-year	57 769,6
TB diagnosis	Variable laboratory (genexpert)	per person to be evaluated for TB	19,0
	Fixed facility	per average facility-year	305,6
	Variable facility	per person to be evaluated for TB	17,2
DS treatment (first line)	Fixed facility	per average facility-year	1 833,6
	Variable facility	per person-month (DS treatment)	15,4
MDR treatment	Fixed facility	per average facility-year	2 890,5
	Variable facility	per person-month (MDR treatment)	345,1
TB screening in ART	Fixed facility	per average facility-year (ART)	574,5
	Variable facility	per ART patient screened	3,3
IPT treatment	Variable laboratory (genexpert)	per person-month (IPT)	1,6
	Fixed facility	per average facility-year (ART)	287,2
	Variable facility	per person-month (IPT)	4,6
TB symptom screening	Fixed facility	per average facility-year (PHC)	3 992,8
	Variable facility	per PHC attendee screened	1,2

Results

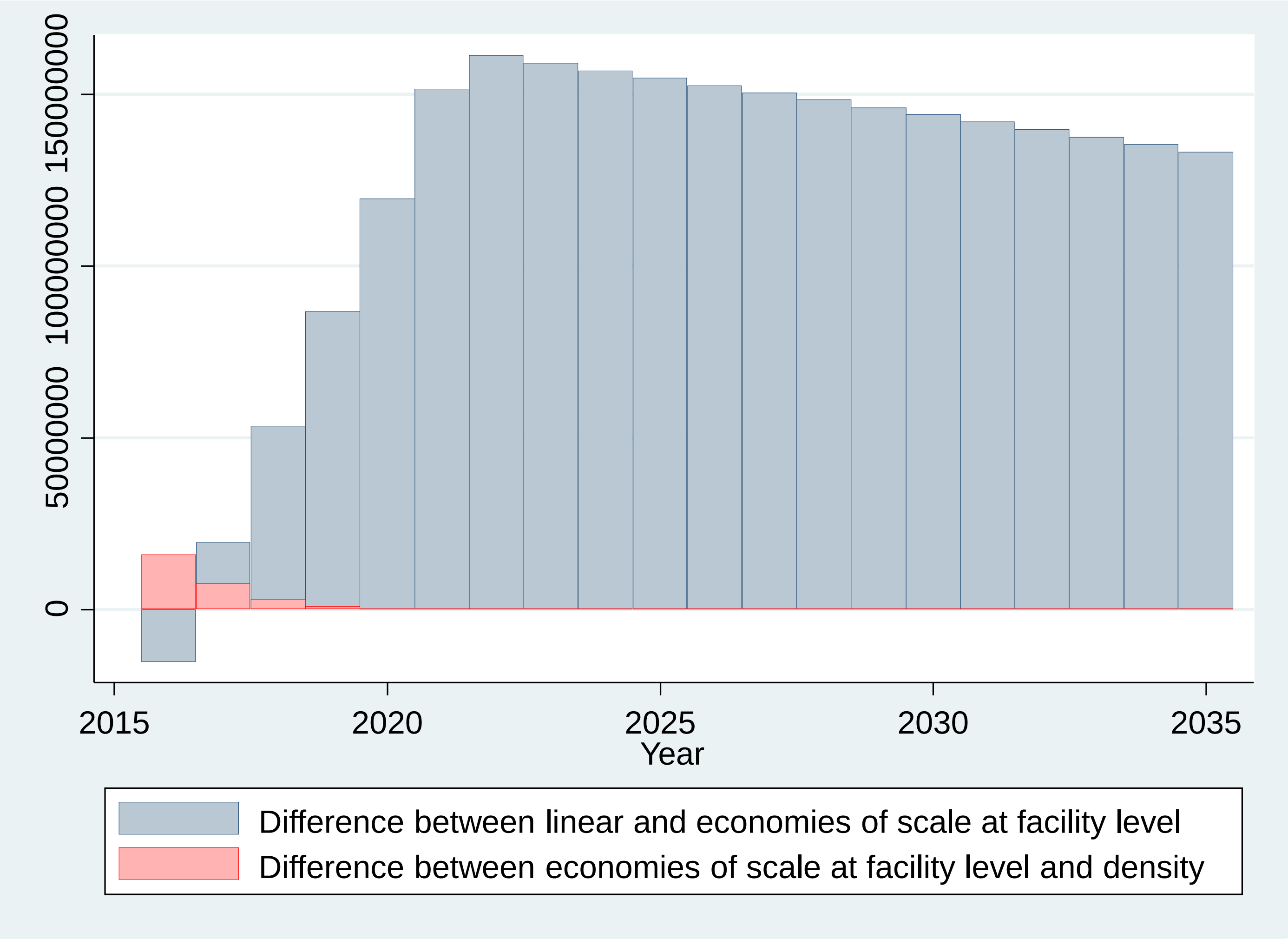
Capacity



Results

Capacity

Density



Conclusion

- The assumption of a linear relationship between costs and scale should be improved.
- Economies of capacity (or scale at facility level) and scope can change substantially the cost estimates over time.
- Assumptions on how the program expand within the network of facilities (economies of density) do not seem to have a major impact on cost estimates over time.

Next steps

- Ongoing work on improvement of data standards and reporting going forward: GHCC
- As well as discussion on best way to inform cost models within countries
- Country engagement in definition of intervention activities AND program implementation assumptions is essential when evaluating new interventions at scale

Acknowledgements

TB Modelling and Analysis Consortium funded this work through a grant from the Bill and Melinda Gates Foundation, OPP1084276

Thank you