TB Modelling and Analysis Consortium

Country-level TB Modelling

benchmarks, reporting & review

Motivation

1. Mathematical modelling increasingly used to understand the implications of TB policy and funding decisions

   → Supported by funders and technical orgs to facilitate objective decision-making

   → Utilized by countries to suggest priority interventions, allocate budgets, and support funding applications

   → Increasing professionalization of country-support modelling

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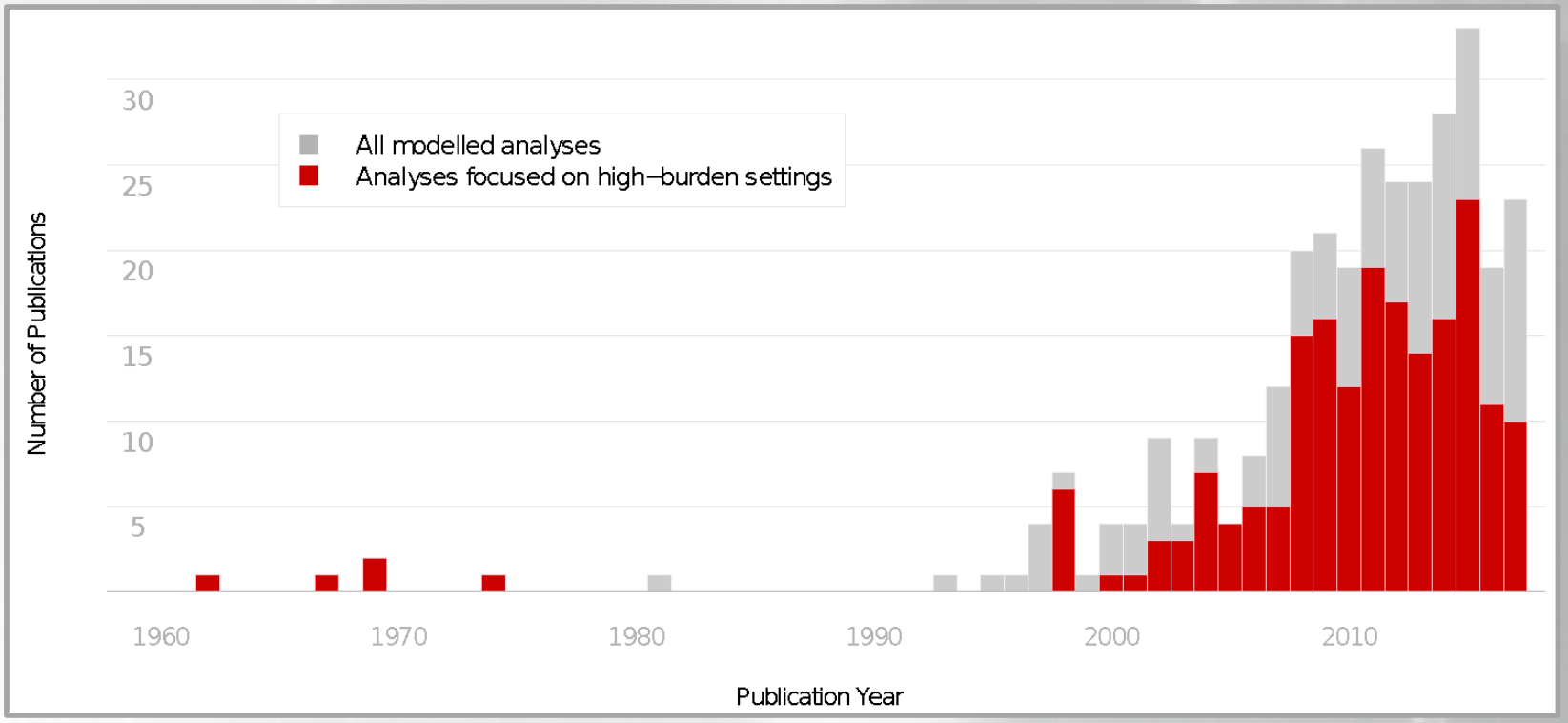
TB modelling in the scientific literature



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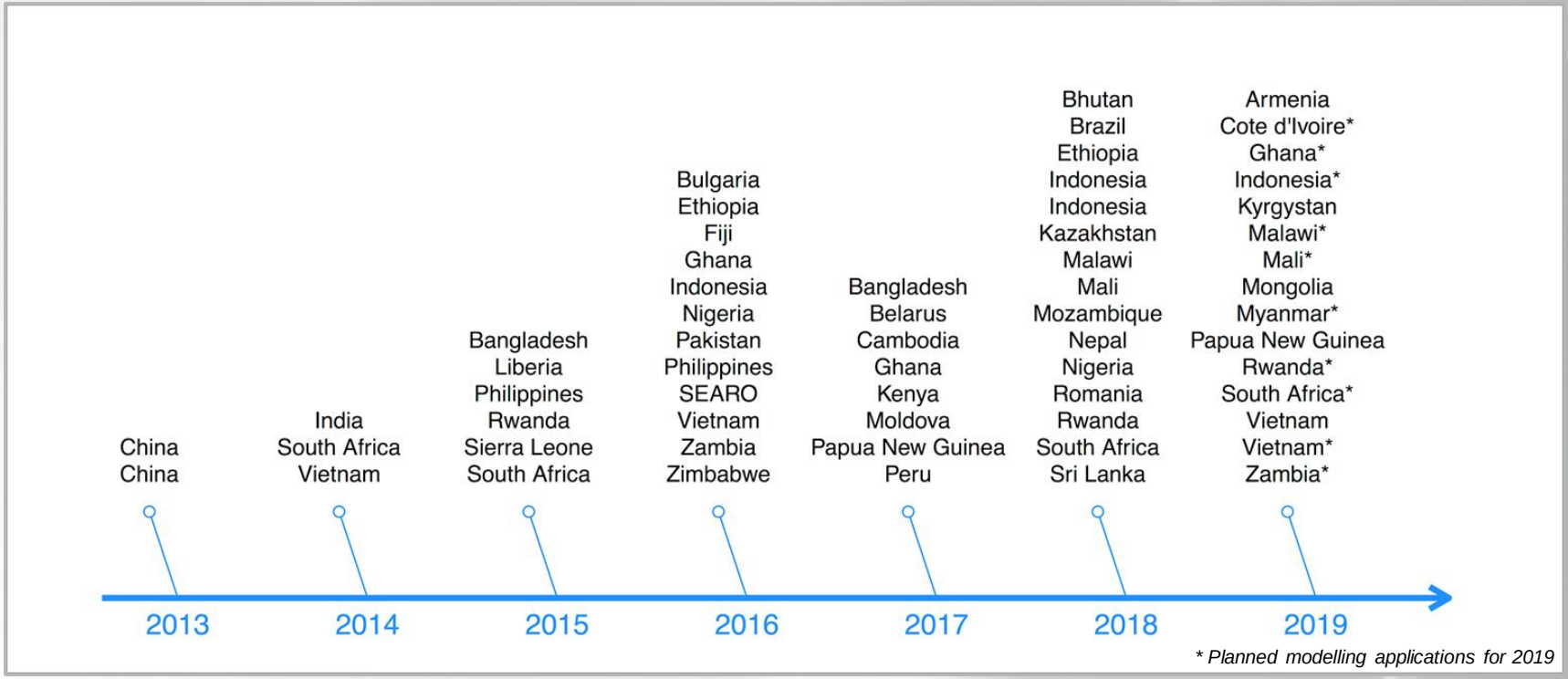
Menzies et al Lancet ID 2018

TB modelling for country decision-making



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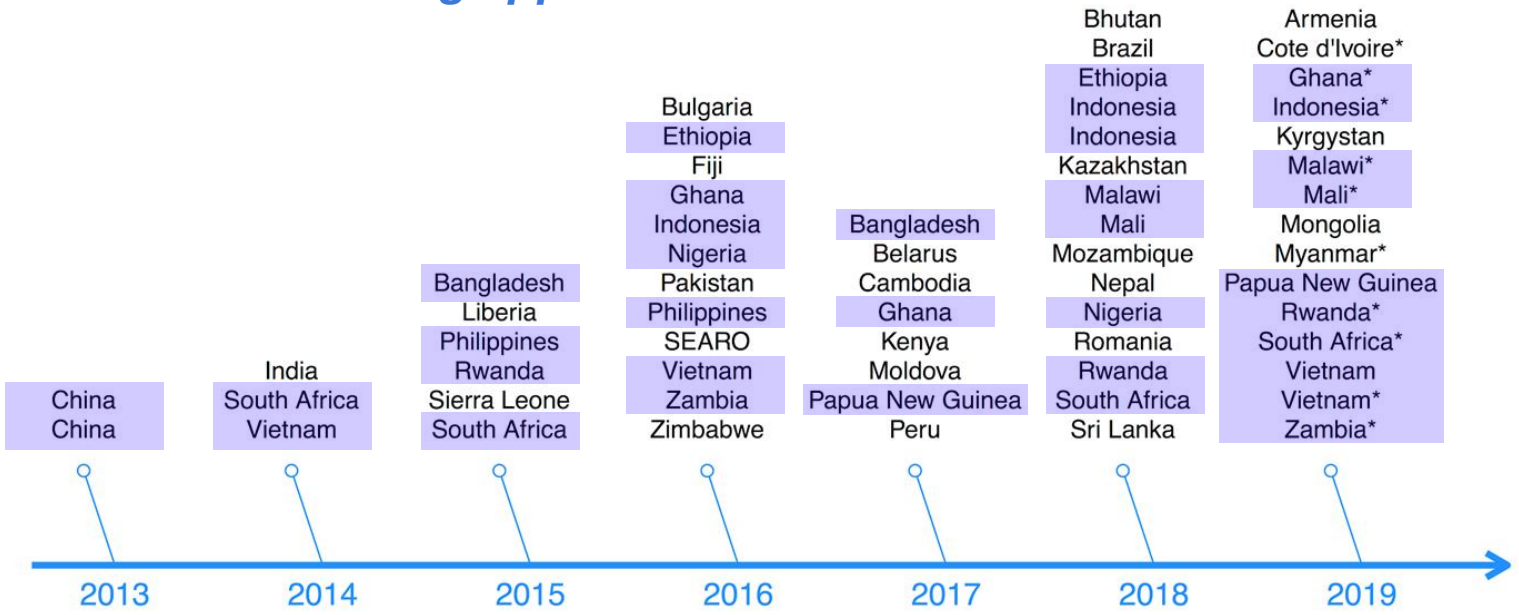
TB MAC Technical Assistance Database, 2019

TB modelling for country decision-making

More than 1 modelling application:



** Planned modelling applications for 2019*

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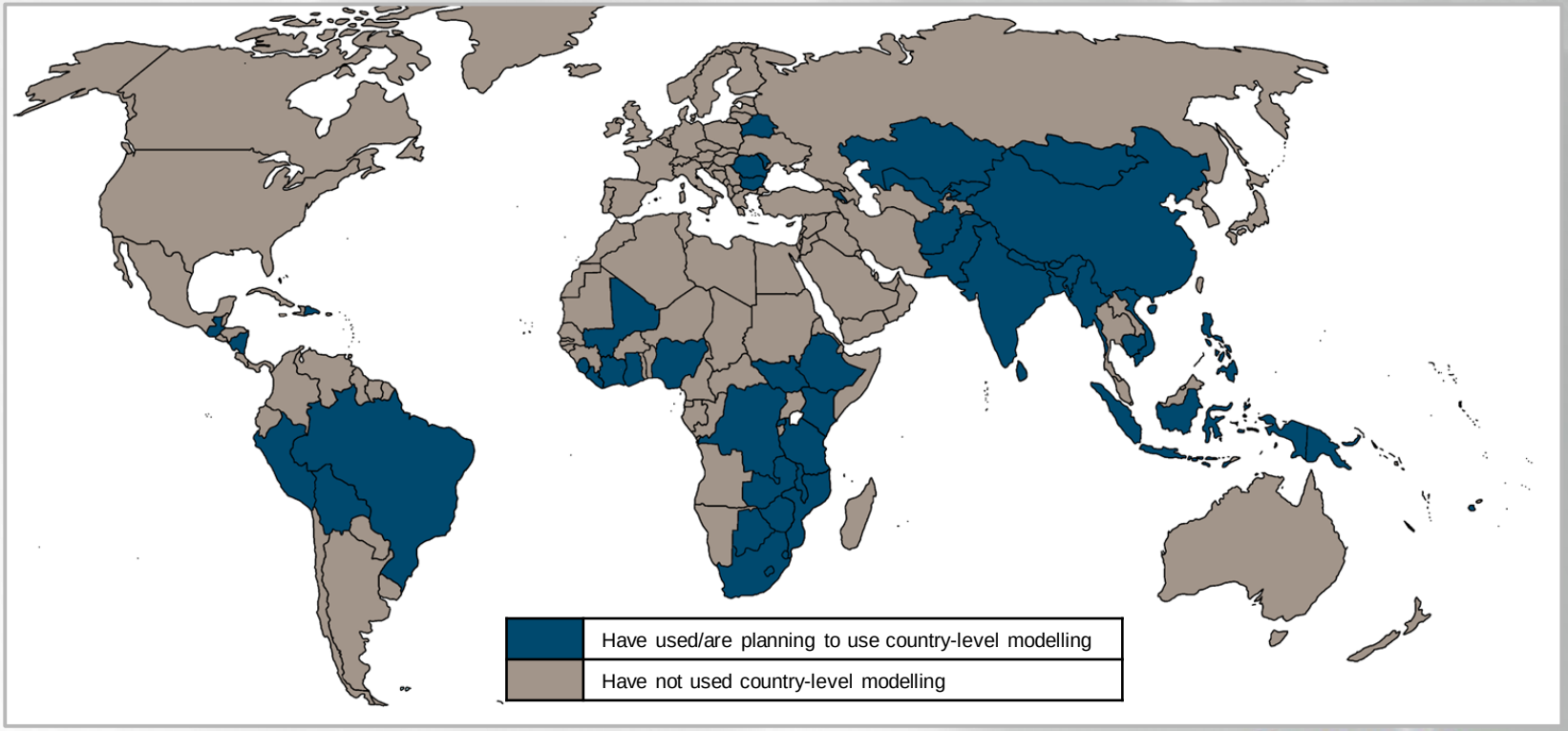
TB MAC Technical Assistance Database, 2019

TB modelling for country decision-making



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TB MAC Technical Assistance Database, 2019

Country-level TB modelling applications

Who is funding this work?	
Mainly	GFATM, USAID, World Bank, BMGF
Sometimes	European Union, WHO-SEARO, UK MRC, Philippine Govt, Canadian Govt, Aus Govt, Global Good Fund

Who is doing this work?	
Non-academic	Avenir, Optima, Institute for Disease Modelling, PHFI
Academic	LSHTM, Imperial College, UCL, Burnet Institute, James Cook University, Monash University, University of Melbourne, Yale University, Liverpool School of Trop Med

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Modelling decision-support workforce

- Multiple modelling teams involved
- Investment in developing detailed models & codebases
  - Models universally more complicated
  - Models more durable, same model adapted to new settings
- Separation of functions:
  - Model development and country support by different individuals
  - Separation from traditional academic research
- Accumulating experience about what works or doesn't work

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Motivation

1. Mathematical modelling increasingly used for understand the implications of TB policy and funding decisions
2. Recent experience raises questions about the accuracy and reproducibility of model-based policy evaluation

   → When empirical evidence available to verify model projections, results don't always line up

   → When tuned to the same setting and policy question, different models giving different answers

   → Not difficult to find large policy impacts predicted from modelling, much harder to find real-world examples

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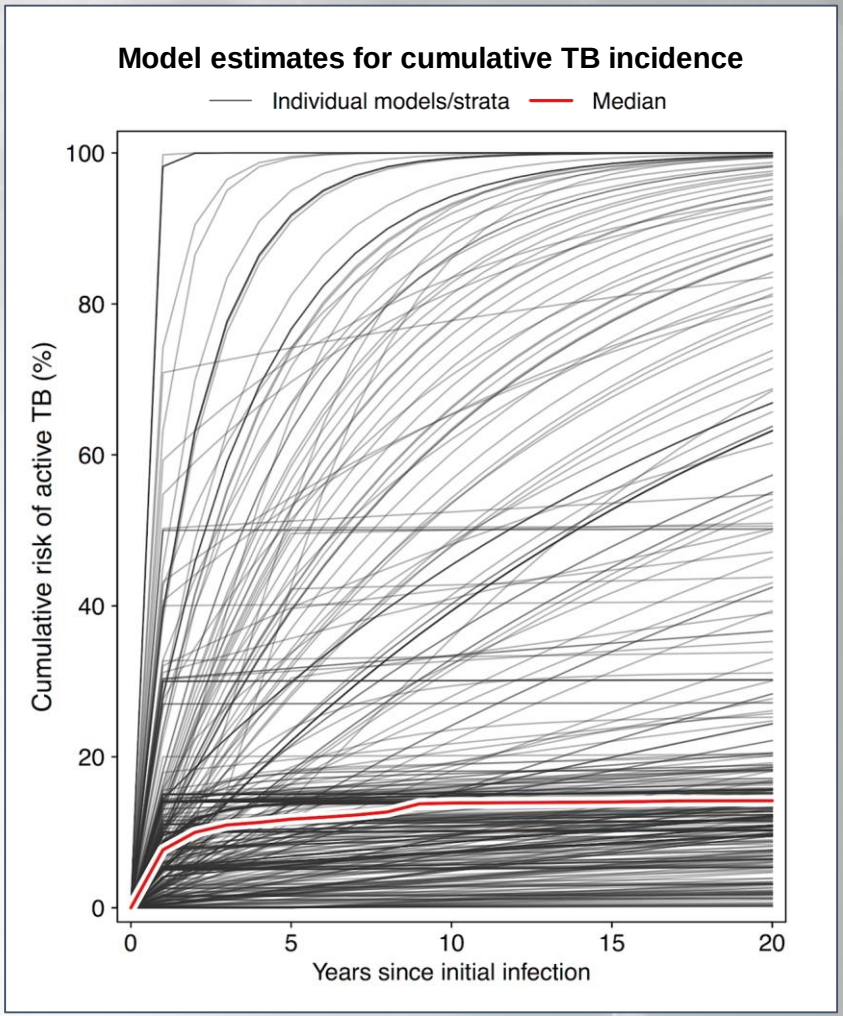
Variation in natural history assumptions

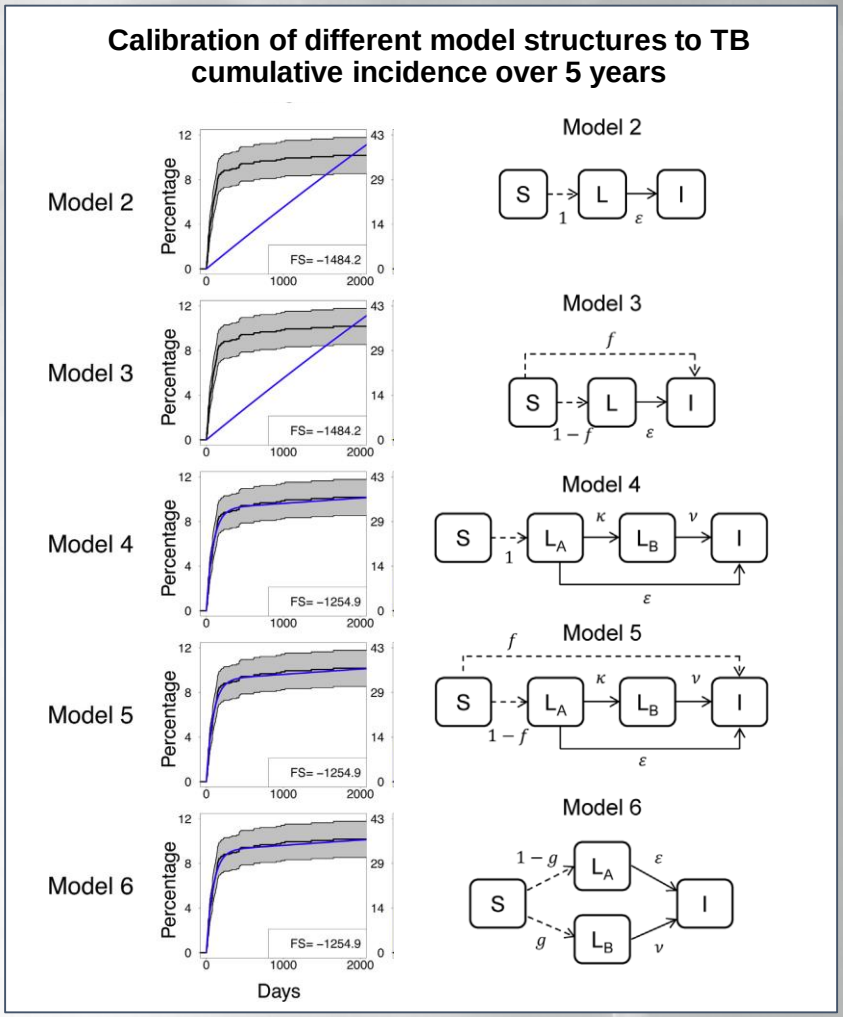
- Systematic review of published TB models (to 2017)
- Compared assumptions for cumulative TB incidence following *Mtb* infection, for adults with no risk factors
- Some models with <1% lifetime risk
- Some models with >50% lifetime risk
- Many models inconsistent with available empirical data



Menzies et al Lancet ID 2018

Variation in natural history assumptions

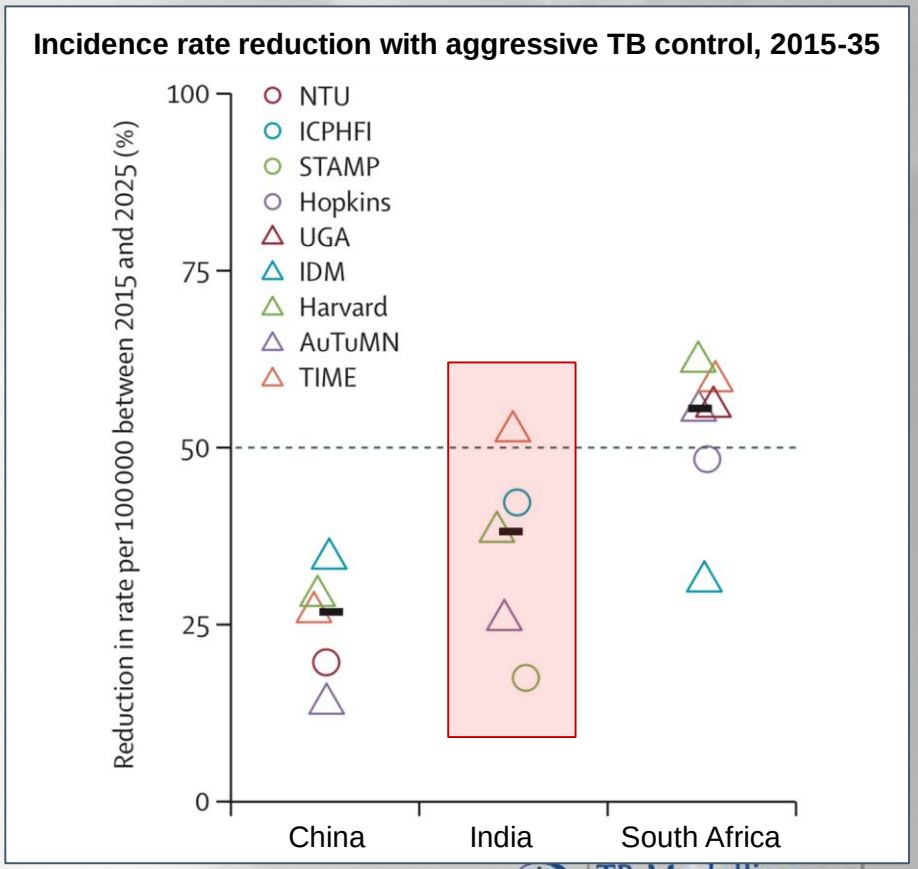
- Ragonnet 2017 – compared model structures to cumulative incidence curves over 5 years post-infection
- Some earlier approaches to modelling latency show poor fit to empirical data
- Implication: either get the reactivation rate right in the short-term, or the long-term, not both



Ragonnet et al Epidemics 2017

Variation in modelled policy projections

- Multi-model collaboration to test potential to reach End TB Strategy Goals, cost-effectiveness of efforts to do so
- Multiple models projecting standardized policy scenarios in India, China, South Africa
- Despite standardization of setting, outcome, and policy definition, variation in **impact estimates** produced by models



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Houben et al Lancet GH 2016

Variation in modelled policy projections

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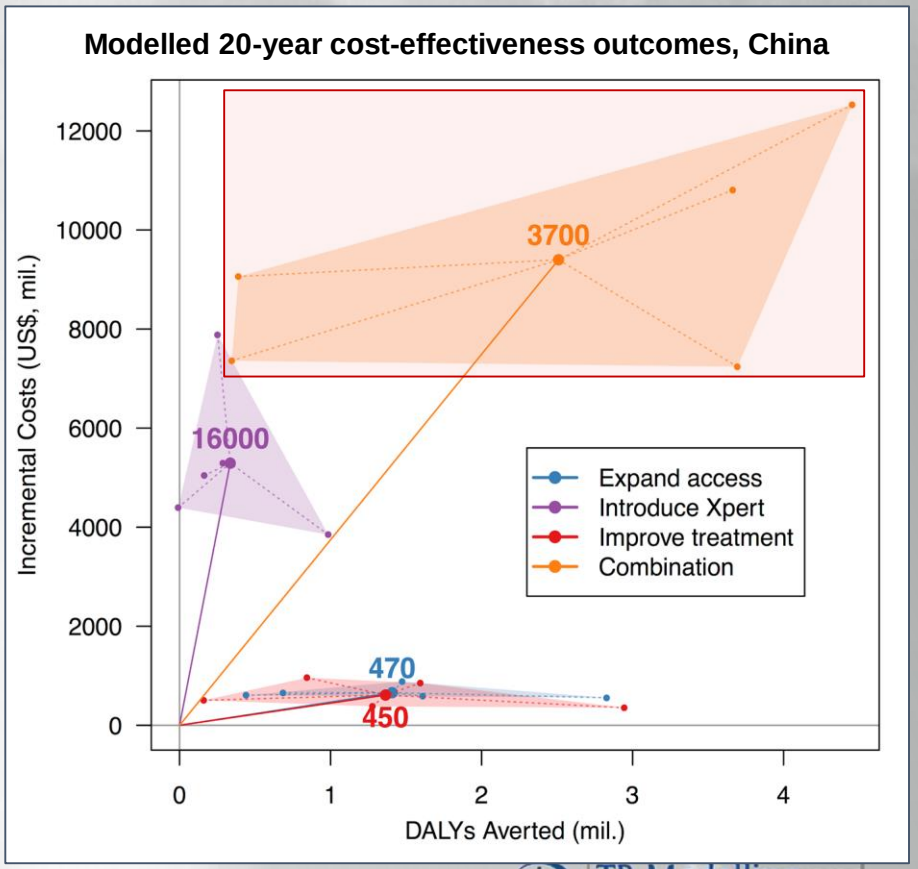

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Menzies et al Lancet GH 2016

Motivation

1. Mathematical modelling increasingly used for understand the implications of TB policy and funding decisions
2. Recent experience raises questions about the accuracy and reproducibility of model-based policy evaluation

→ *Demand for activities to improve the quality and reproducibility of modelling, confirm when models adequate for purpose*

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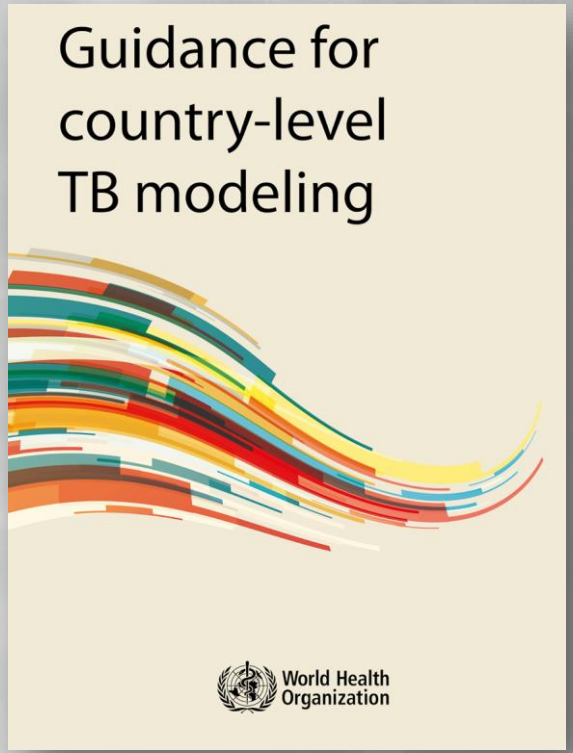
Country-level TB Modelling Guidance

- Collaboration of TB MAC, WHO TB Dept, funders, modellers, other stakeholders, published in 2018
- Describes 10 principles for country decision support modelling
- Examples and good practices for implementing principles
- Concerned with the use of models, rather than just the models themselves



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Remaining gaps?

- Modelling guidance provides broad direction
- Does not provide mechanism to confirm that models are fit for purpose
- Funders looking for confirmation that models are valid for use

BRR Initiative

- BRR = Benchmarking, reporting, external review
- Led by TB MAC under direction of TB Roadmap Steering Committee and international funders

GOALS	
	Reveal where a modelling application is inconsistent with existing evidence or modelling best-practice
	Provide standard reporting template for describing modelling approaches and model performance
	Create a system for independent evaluation of modeling approach and results

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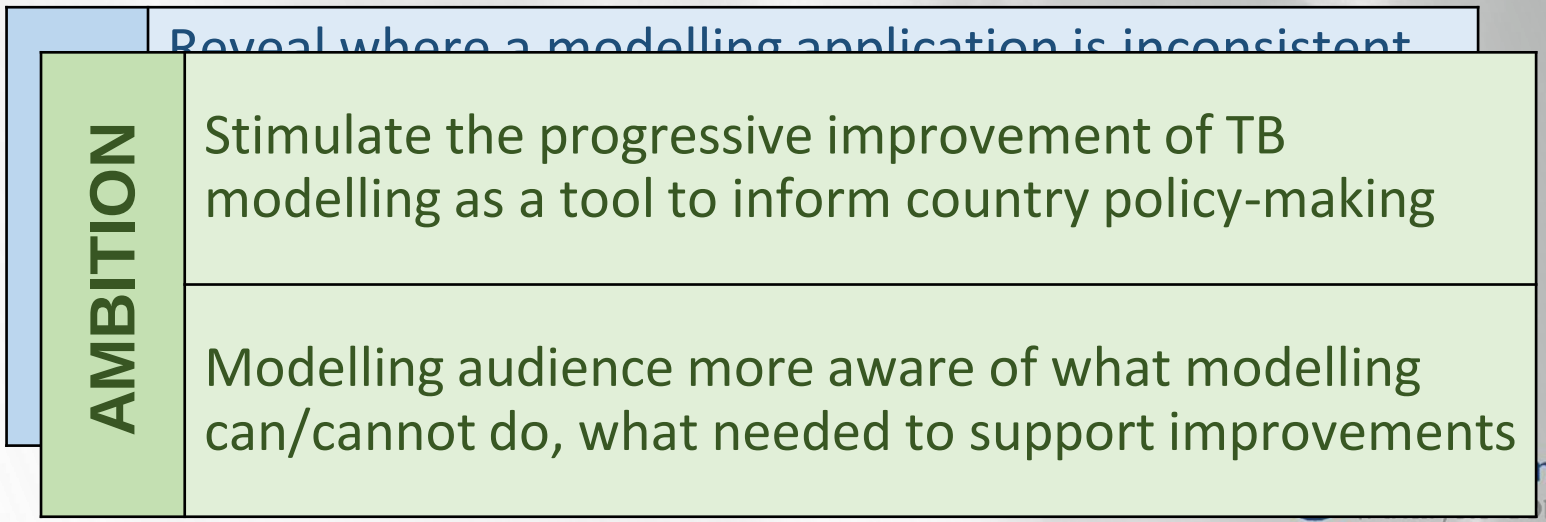

1. Benchmarks for country-level TB modelling applications

- Quantitative benchmarks describing features of TB natural history, epidemiology, health services, and costs
- Modelling assumptions & results compared to benchmarks to assess appropriateness for given policy question and context
- Not enforced dogmatically: modelling applications requested to compare assumptions and results to benchmarks, justify/discuss major deviations

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2. Standard reporting approach, template, and checklist

- Standard format for reporting modelling questions, approaches, and results, + checklist to assess completeness
- Include quantitative indicators (benchmarks) and process indicators of modelling good practice
- Final format to be adopted by the agencies that commission and fund modelling work
- General trends can inform evidence gaps, future activities

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3. External review of modelling applications

- Mechanism to allow expert assessment of modelling approach, for a particular application
- TB MAC role: develop the system to link reviewing supply and demand, and approaches for how this should occur
- Expert reviewers represent themselves, not TB MAC
- When review needed: a decision for funder / country / modelling group

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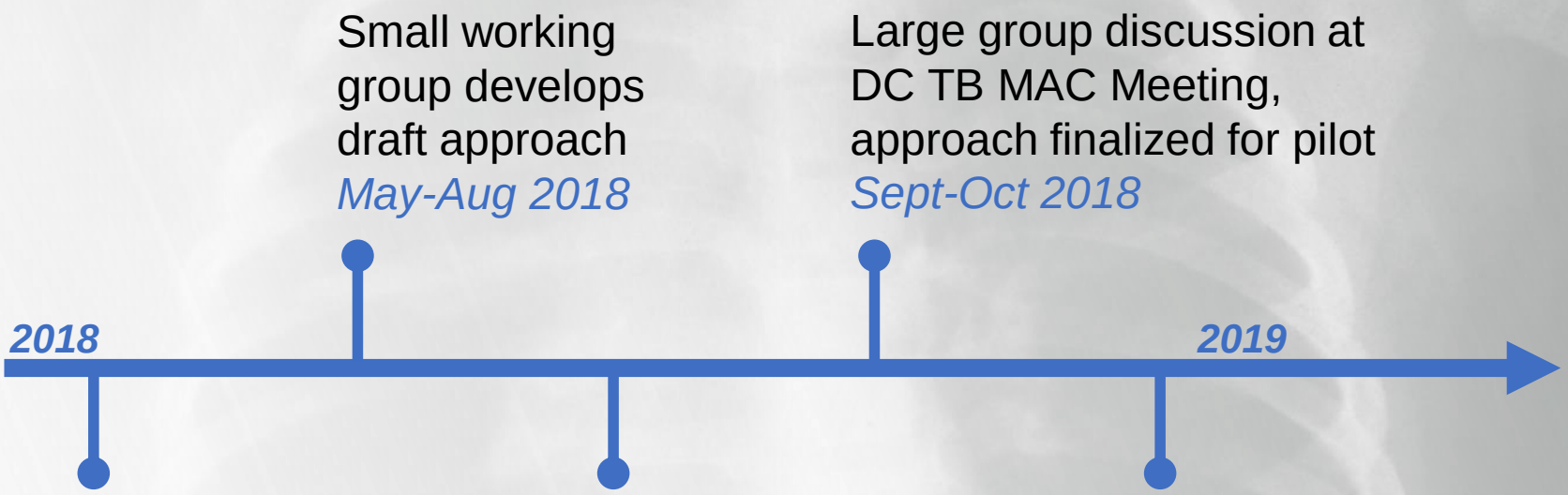
Current status



Project started after completion of CL TB Modelling Guidance
Early 2018

Small working group develops draft approach
May-Aug 2018

Review by external experts and modelling teams,
Aug-Sept 2018

Large group discussion at DC TB MAC Meeting, approach finalized for pilot
Sept-Oct 2018

Piloting of approach with five real modelling applications
Nov 2018-present

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BRR Pilot – evaluation questions

1. Does the current approach achieve its immediate goals? (*describe consistency of modeling with existing evidence/norms, provide useful feedback to modelling teams, assess whether modelling evidence adequate for given application)*

2. If applied routinely, is the current approach likely to achieve the long-term goals of this initiative? (*strengthen incentives for high-quality modelling, stimulate the progressive improvement of TB modelling for country-level decision-making*)

3. Does the current approach place undue burden on modelers or other participants in a modelling application, or harm the ability of modelers to provide modelling technical assistance that is timely, relevant, and rigorous?

4. Are there ways in which the BRR approach should be modified to improve its efficiency and feasibility?

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BRR Pilot – implementation

- Plan: pilot BRR with ~5 ‘real’ country-level modelling applications
- Review teams: three individuals covering three domains (epi modelling / economics / programmatic)
- Process: TB MAC forms review teams, oversees process, but interaction primarily between reviewers and modelling team
- Funding: Global Fund
- Evaluation: interviews with modelers and reviewers after each application completed

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BRR Pilot – progress

Country	Modelling team	Reviewers	Status
Kenya*	Nim Pathy, Juan Vesga	Nick Menzies Finn McQuaid	Completed
Bhutan	Emma McBryde, AuTuMN team	Rachel Sanders Matt Hamilton Nguyen Tuan Anh	Underway
Mongolia	Romain Ragonnet, AuTuMN team	Rachel Sanders Matt Hamilton Nguyen Tuan Anh	Underway
Indonesia	Jamie Rudman, LSHTM-TIME team	[self-review]	Completed
Myanmar	LSHTM-TIME team	TBD	Not yet started

* Expedited process given modelling almost completed

Goals for today

- Receive and discuss interim feedback from piloting
- Consider any near-term modifications to BRR content or process based on this
- Consider linkages between BRR and other initiatives to support country TB decision-making
- Consider other actions to improve the quality of country-level modelling

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