TB incidence estimates for SDG and End TB Strategy 2025 milestone and 2030 targets assessment

Existing & new options for methods that could be used

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TB Monitoring, Evaluation and Strategic Information

Global Tuberculosis Programme

Overarching questions

1. How can the absolute level of TB incidence in 2025 and 2030 and changes compared with 2015 be robustly assessed, in the 29 countries for which estimates for 2015–2023 currently rely on data from national TB prevalence surveys?

2. Is there a better alternative to using case notifications and expert opinion about case detection gaps, for the 39 countries (11% of incident cases globally) where this is still relied upon?

3. Can the method of making a standard adjustment to case notification data, currently used for 137 countries, be improved upon?

Two main themes

Existing and new prevalence-based estimates

Existing and new notification-based estimates

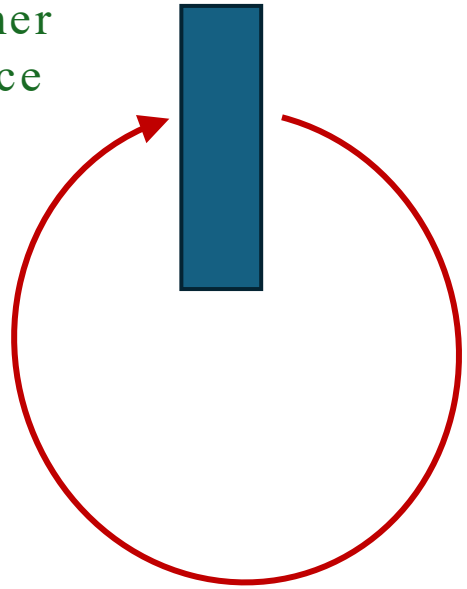
Prevalence-based TB burden estimation

Used for 29 countries having a prevalence survey, accounting for ~2/3 of global TB incidence

1. Primary data collection, community TB burden

Prevalence surveys

Mass ACF rather than prevalence surveys?



2. Conversion to estimates of annual incidence

Models using natural history of TB

Equilibrium-based estimation

Incorporating new literature for role of subclinical TB?

3. TRENDS: how TB burden is evolving between rounds of primary data collection

Notification trends

Expert opinion

ACF data?

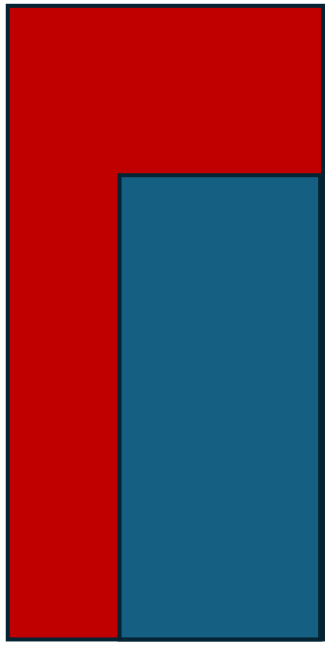
Wider use of programmatic data?

Incorporating impact of interventions?

Notification-based TB burden estimation

(A) High- and medium-burden LMICs with no other sources of evidence (e.g. prevalence)

(B) High-income/Low-burden countries



Notification : incidence ratio (case detection rate, CDR):

- Expert opinion in absence of other evidence

- Standard adjustment for low-burden countries

- Estimate CDR based on metrics for Universal Health Coverage?

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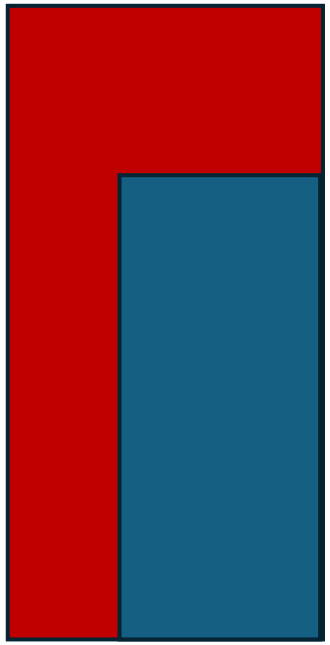


Notification : incidence ratio (case detection rate, CDR):

- Expert opinion in absence of other evidence

- Standard adjustment for low-burden countries

- Estimate CDR based on metrics for Universal Health Coverage?

Potential application and relevance

Country group A: Countries for which incidence estimates currently rely on notification data combined with expert opinion about underreporting, underdiagnosis and overdiagnosis

Country group B: Countries for which incidence estimates currently rely on notification data combined with a standard upward adjustment

SDG Universal Health Coverage

- UHC means that everyone can obtain the health services they need without suffering financial hardship
- Two indicators are used to monitor progress:
  - UHC service coverage index (SCI) (Indicator 3.8.1), and
  - The percentage of the population experiencing household expenditures on health care that are "large" in relation to household expenditures or income (Indicator 3.8.2).
  - WHO is responsible for producing these indicator values every two years

Definition of the UHC SCI

- It is calculated as the geometric mean of 14 "tracer" indicators for the coverage of health care.
- The UHC SCI can take values from 0 (worst) to 100 (best).

Reproductive, maternal, newborn and child health (RMNCH)
1. Family planning (FP)
2. Antenatal care, 4+ visits (ANC)
3. DTP3 immunization (DTP3)
4. Care seeking for suspected ARI (ARI)

→ $RMNCH = (FP*ANC*DTP3*ARI)^{1/4}$

Infectious diseases (ID)
5. TB treatment (TB)
6. HIV therapy (ART)
7. Insecticide-treated nets (ITN)
8. Basic sanitation (WASH)

→ $ID = (TB*ART*ITN*WASH)^{1/4}$ *if high malaria risk*
$ID = (TB*ART*WASH)^{1/3}$ *if low malaria risk*

Noncommunicable diseases (NCD)
9. Hypertension treatment (HP)
10. Diabetes prevalence (Diab)
11. Tobacco non-use (Tobacco)

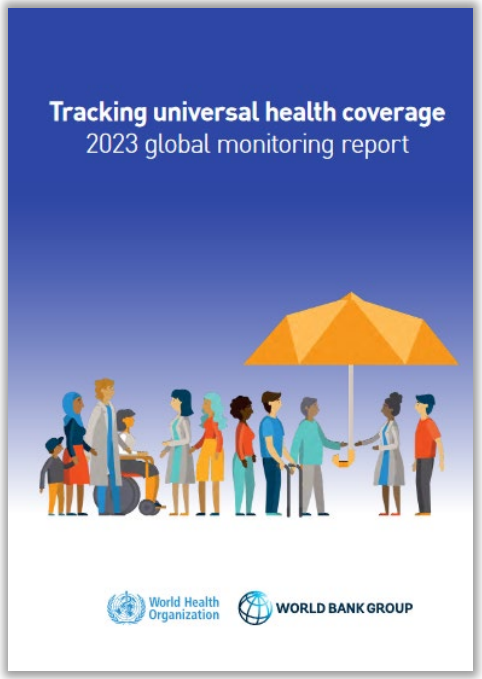
→ $NCD = (HP*Diab*Tobacco)^{1/3}$

Service capacity and access (Capacity)
12. Hospital bed density (Hospital)
13. Health worker density (HWF)
14. IHR core capacity index (IHR)

→ $Capacity = (Hospital*HWF*IHR)^{1/3}$

$UHC\ Service\ Coverage\ Index = (RMNCH*ID*NCD*Capacity)^{1/4}$

Note: DTP3, three doses of the combined diphtheria, tetanus toxoid and pertussis vaccine; ARI, acute respiratory infection; HIV, human immunodeficiency virus; TB, tuberculosis; IHR, International Health Regulations.



See: background document 1, p.24, for more details

Potential application (country group A)

- TB incidence could be estimated using TB case notification data that are upward adjusted using the UHC SCI (replacing an upward adjustment based on expert opinion).
- This approach would be in two steps:
  - Step 1: Fit the statistical model based on countries with prevalence survey data
    - Result: treatment coverage predicted from UHC SCI and covariates
  - Step 2: Estimate TB incidence using TB case notification data that are upward adjusted according to the predicted TB treatment coverage at Step 1

Potential application (country group A): Step 1

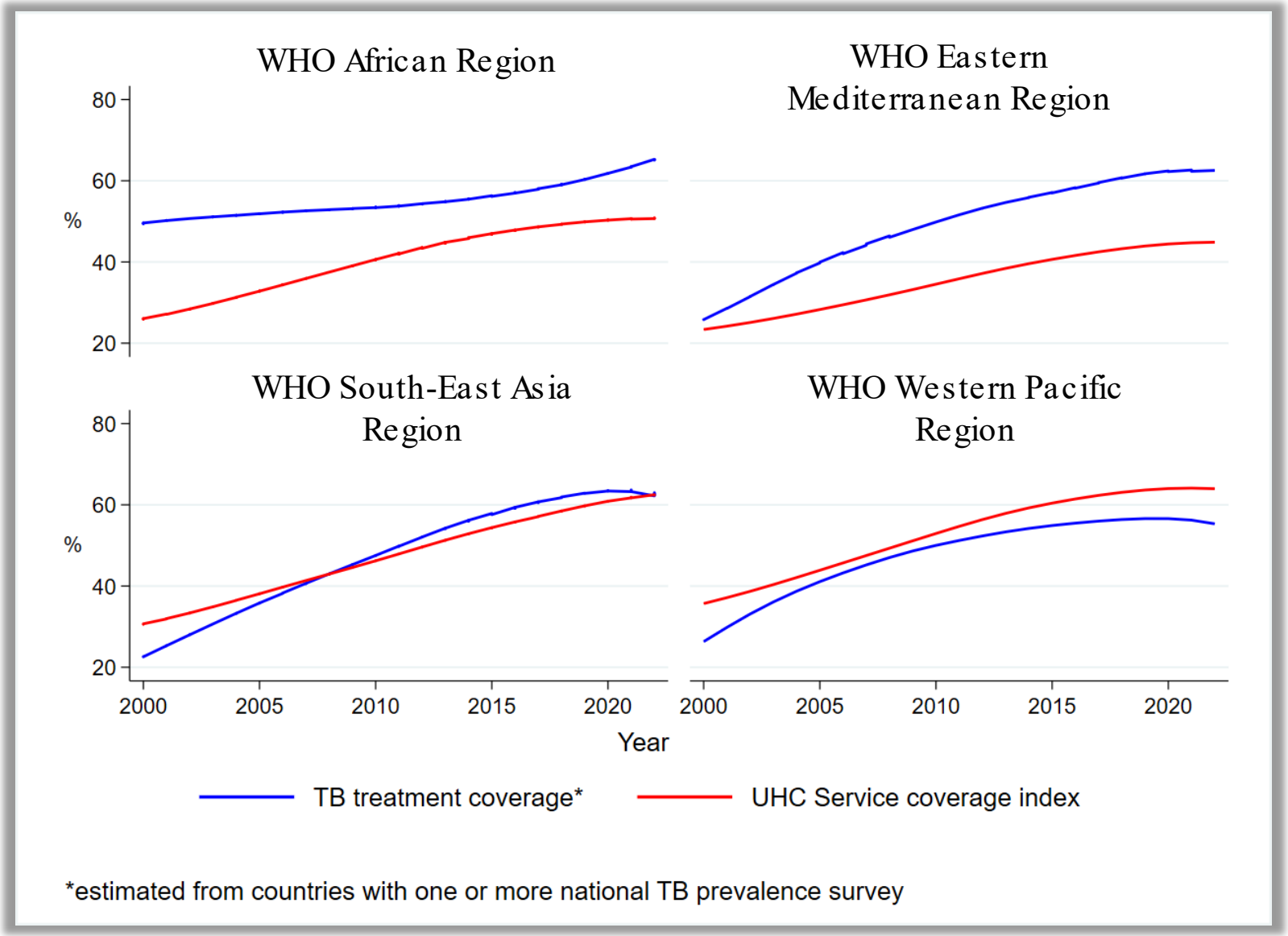
$$y_{i,j} = \beta_0 + \beta_1 t_{i,j} + \beta_2 t_{i,j}^2 + \beta_3 UHCSCI_{i,j} + \beta_4 UHCSCI_{i,j} * t_{i,j} + \beta_5 UHCSCI_{i,j} * t_{i,j}^2 + \beta_6 Region_{i,j} + \beta_7 Region_{i,j} * t_{i,j} + \beta_8 Region_{i,j} * t_{i,j}^2 + \alpha_i + \varepsilon_{i,j}$$

Where,

- $y_{i,j}$ is the treatment coverage of country i in year j
- $t_{i,j}$ and $t_{i,j}^2$ a 2-degree polynomial of time (year 2000–2022)
- $UHCSCI_{i,j}$ the Universal Health Coverage service coverage index for country i at year j
- $Region_{i,j}$ the WHO region for country i
- α_i the random intercept for country i
- $\varepsilon_{i,j}$ the residuals, normally distributed

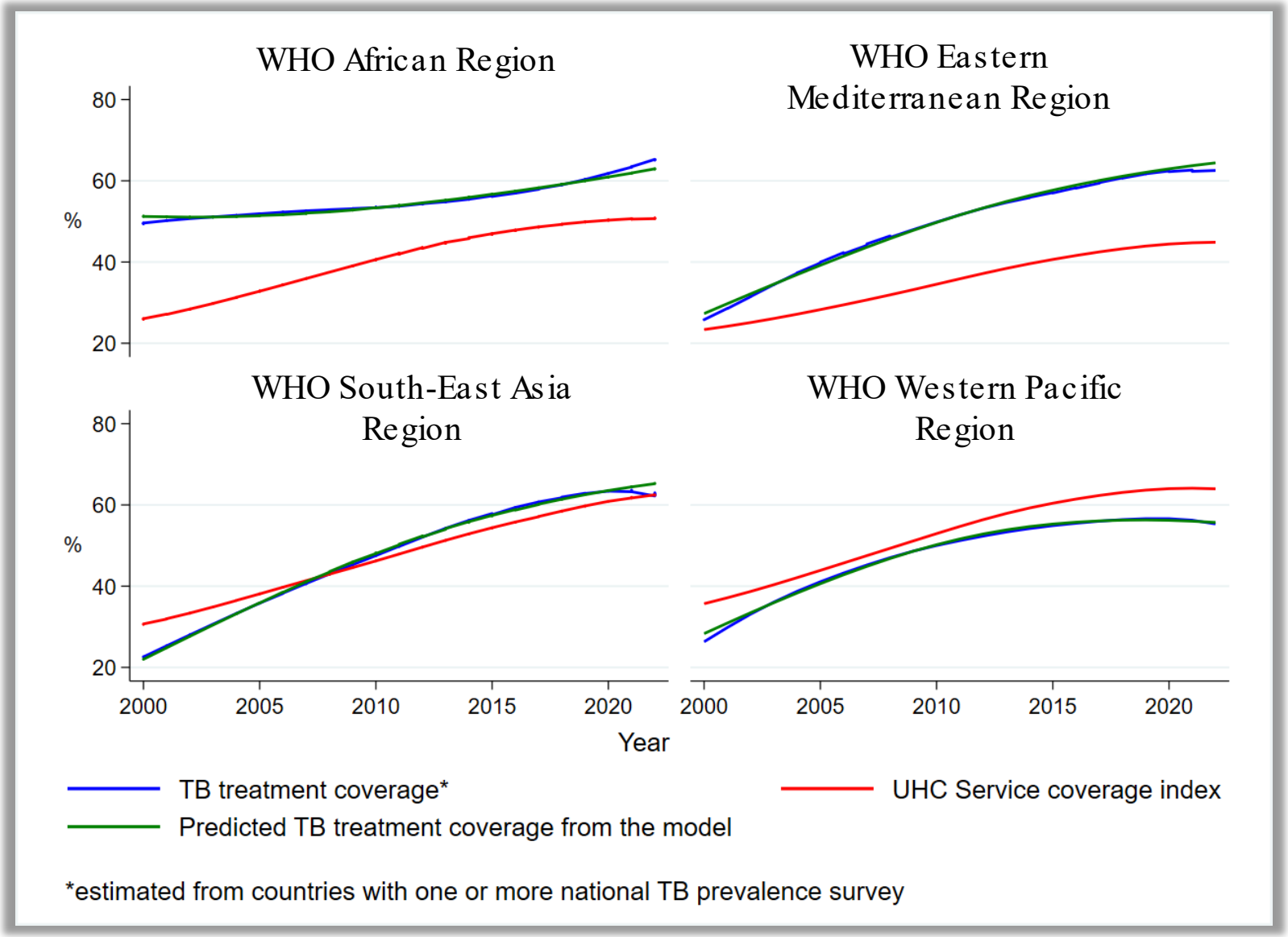
Step 1, Fit of the model

Data available to fit the model: estimates of treatment coverage and UHC SCI in 31 countries with one or more national TB prevalence surveys



Step 1, Goodness of fit

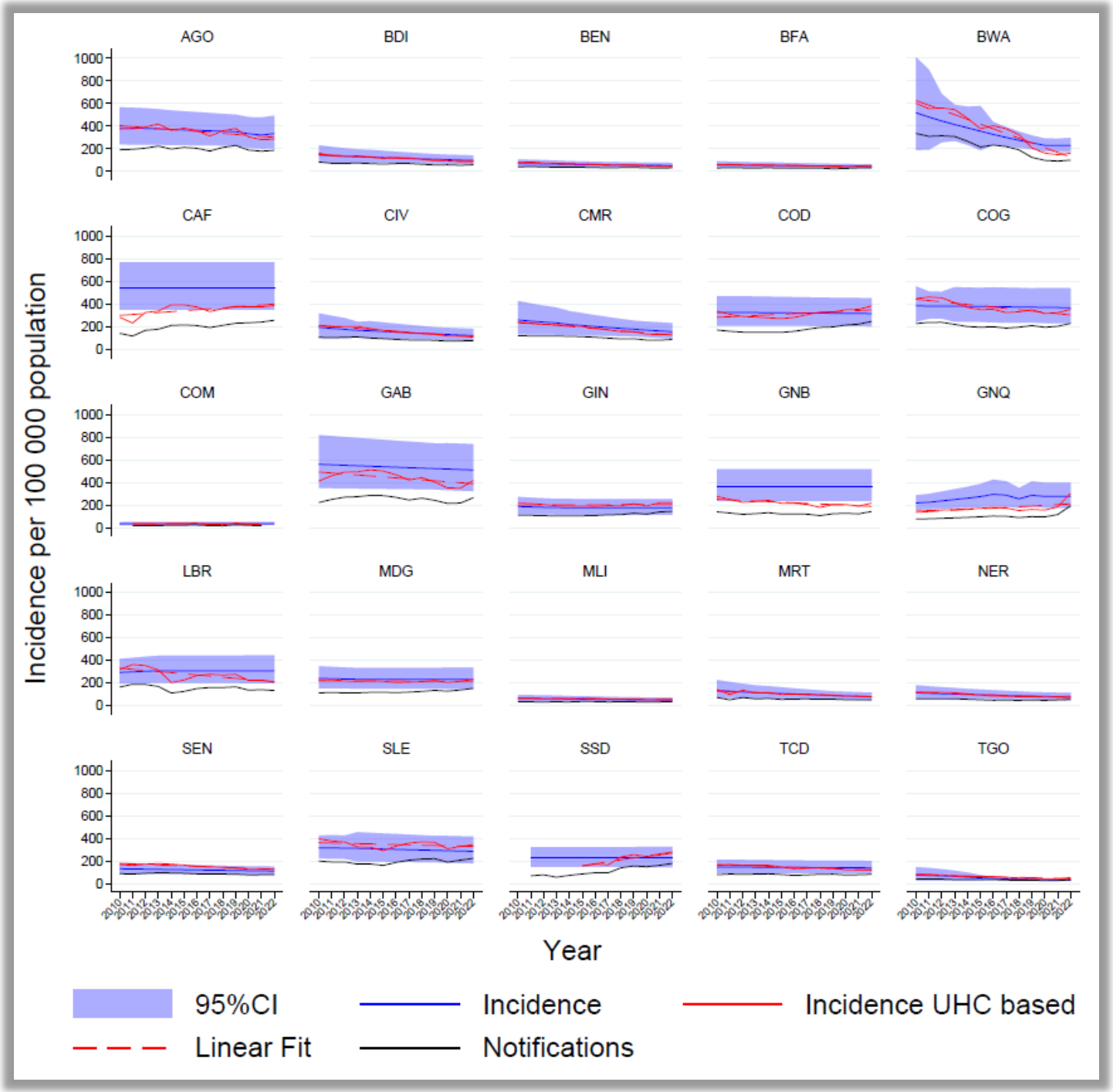
Comparison of the blue and green lines



Step 2, Estimate TB incidence

Applied to 25 countries* in the WHO African Region, 2010–2022

Broad consistency with previous estimates, and more robust approach (using more objective, standard measures than expert opinion)



*Country group A: case notifications plus expert opinion

Potential application (country group B)

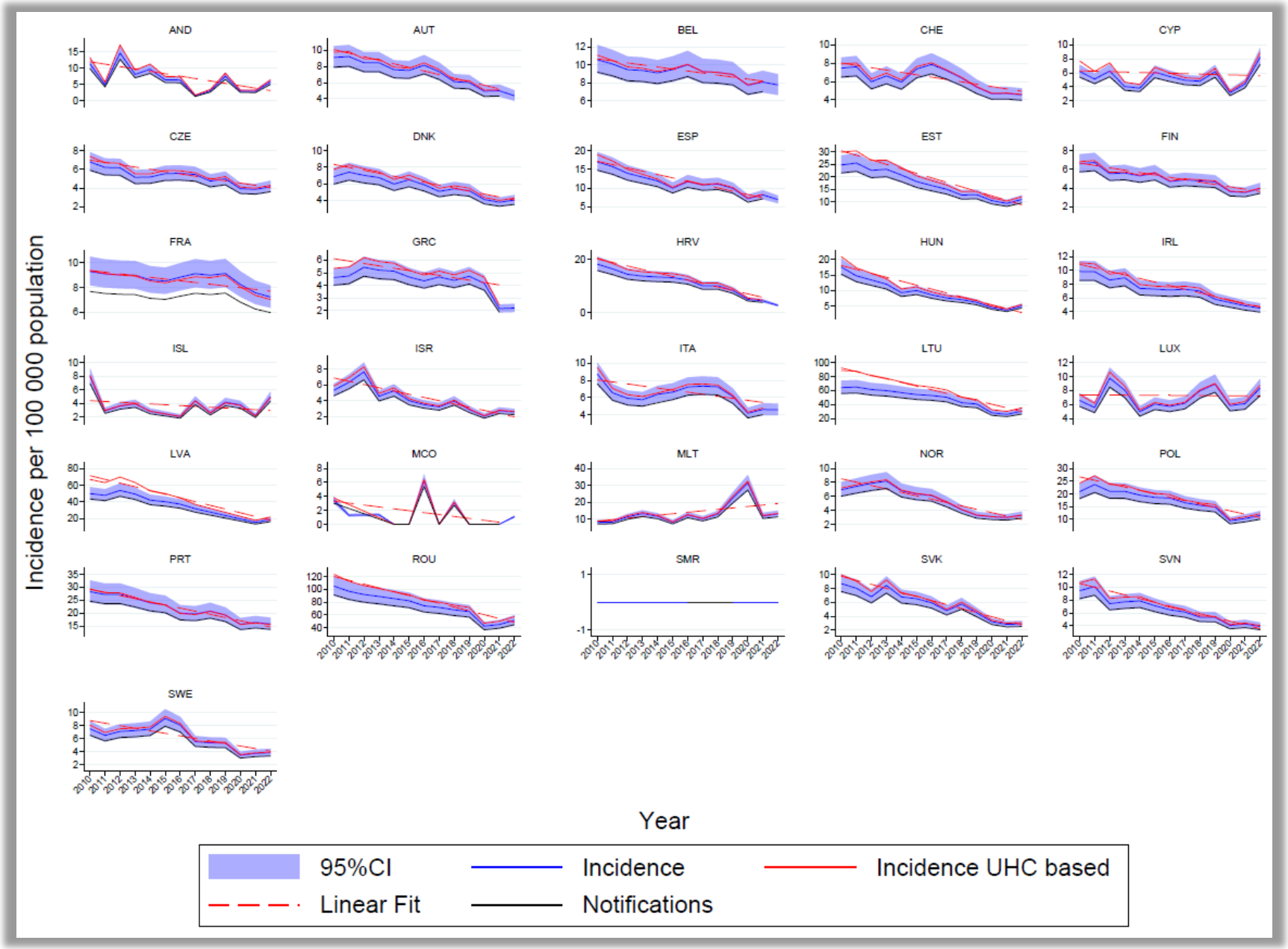
- TB incidence could be estimated using TB case notification data that are upward adjusted using the UHC SCI (replacing a standardized upward adjustment) as a proxy for TB treatment coverage
- TB incidence *I* is then estimated as:

$$I = \frac{n}{UHC}$$

n : case notification data
UHC is expressed as a proportion

Applied to 31 countries* in the WHO European Region, 2010–2022

Broad consistency with previous estimates, and approach allowing more country specificity



*Country group B: case notifications plus standard adjustment

Main strengths and limitations

Strengths

- Does not rely on expert opinion but rather uses a range of indicators that provide information about health service coverage
- Allows for both standardization and reproducibility, while allowing more country-specific customization
- Transparent and easy to explain
- Relies only on routinely available estimates, which are available for almost all countries and areas
- Using an indicator already discussed and agreed with countries

Limitations

- Arise in TB case notifications will imply a rise in TB incidence
  - E.g: DR Congo, Equatorial Guinea, South Sudan, Central African Republic
  - Special cases: country discussion needed
- TB treatment coverage in the 31 countries where a prevalence survey was implemented may also rely on non-data driven assumptions about trends in TB incidence after the prevalence survey, including a flat trend
- The UHC SCI is calculated using a geometric mean of sub-indexes of health coverage, including TB treatment coverage (using estimates provided by GTB)
- No estimate of SE

Summary of comments (verbatim)

Strong support for the proposed method as an improvement on the previous approach (31 of 34 reviewers)

	Comments
General feedback	• A new approach could have limitations but still be preferable • An improvement over less transparent approaches based on expert opinion around CDR • Useful alternative to standardize the various options that are currently used to adjust case notifications (e.g., expert opinion, standard adjustment) • Better than the currently used method of expert opinion or standard adjustment
Considerations	• Arise in case notifications in [some] countries [may reflect] better diagnosis and treatment rather than a rise in incidence

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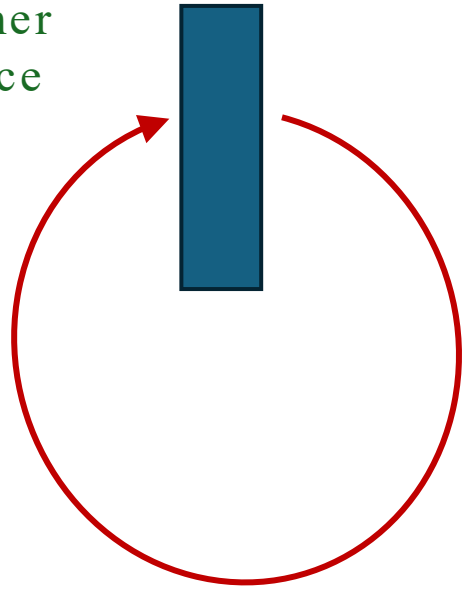

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Potential uses of routine programmatic data

- Number-needed-to-test (NNT): ratio of notifications to the number of presumptives examined for TB
- All else being equal, an increase in NNT over a time interval suggests a decrease in TB burden in this same period
  - And vice versa

- However, important to separate NNTs for routine TB surveillance, and any active case-finding
  - To avoid artificially inflating NNTs when a country sees increasing levels of ACF

- Advantage: Routine surveillance data can be used to inform estimates for trends over time
- Challenge: Need further work to quantify what a given increase in NNT means, for incidence declines
  - E.g. can we assume that relative burden changes at the population level are proportional to those observed at the facility level?
  - If not, what is their relationship?

Summary of comments

Message	Comments
Interesting, but needs development	…possibly suitable for use, but requires further work because a specific quantitative formula has not been proposed. I am strongly in favour of anything that can improve estimates beyond just a flat trend, for those countries relying on prevalence surveys. I am particularly enthusiastic about the idea of collection of additional data about routine laboratory testing data as a source for improving assumptions about trends… Using NNT, laboratory testing data alongside case notification data is appealing because of feasibility and availability of programmatic data from most countries. Does GTB have any examples of this approach, using retrospective data to demonstrate as a case study? This approach seems promising, but probably needs much more empirical testing first. In particular, is it feasible to have these data reported?

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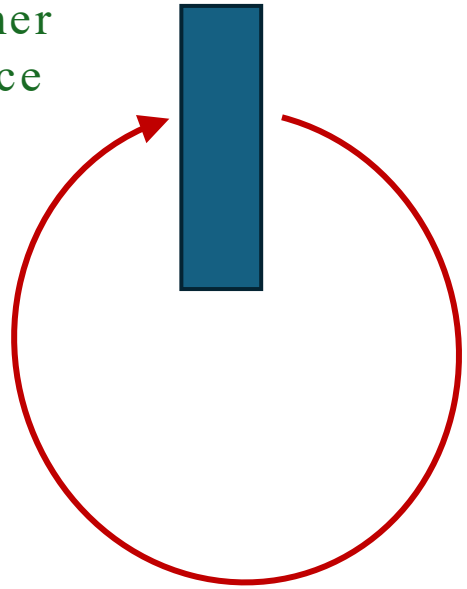

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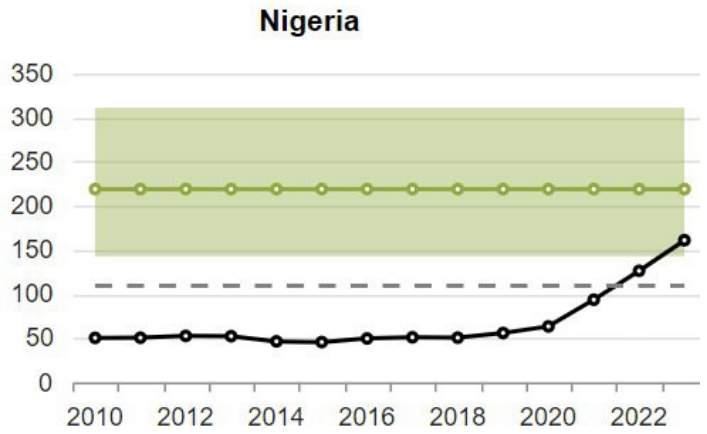
Taking account of intervention impact

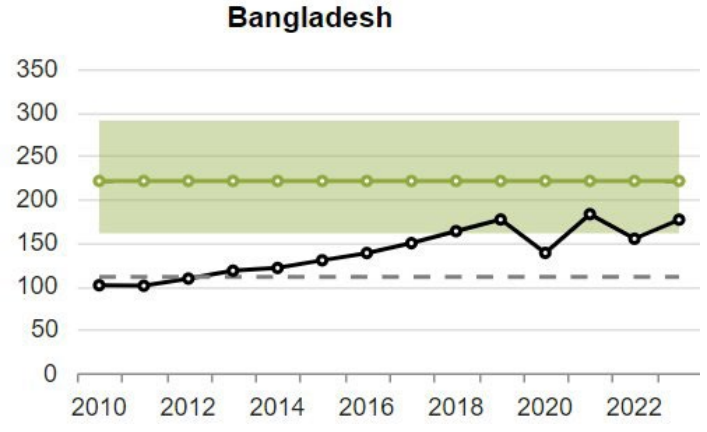
- The challenge: current approaches for incidence estimation do not take account of programmatic improvements, including large-scale interventions

- Two prominent examples: Bangladesh, and Nigeria
- Incidence estimates remain flat, despite widespread case-finding efforts in Bangladesh, and rapidly increasing notifications in Nigeria

- One approach: modelling to estimate incidence impact of these interventions
- Challenge: modelling ACF is subject to a range of uncertainties: would need validation against available data, e.g. ACT-3 study

- Other than modelling, alternative approaches…?
- Fall back on other options presented, e.g. looking for changes in NNT?
- Or need for direct evidence on burden, e.g. through repeat prevalence survey?





Summary of comments

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Reservations about modelling impact	…TPT and ACF would all need to be incorporated via models in ways that aren't currently clear…still not clear to me how these would be incorporated and how much weight they would have. And what limits this to TPT and ACF, as opposed to other potential issues such as socioeconomic determinants, or treatment outcomes? I would generally disfavour the approach of using programmatic data on ACF and TPT through a model to estimate TB incidence – feels too indirect to me. The strategy as currently written is too vague about how TPT and ACF data might be used. It is also unclear how the limitations of ACF data (representativeness, consistency over space and time, assumptions about infectiousness) would be addressed. I am…more dubious about using ACF and TPT data to inform these trends given anticipated variation in the manner in which these programmes might operate…

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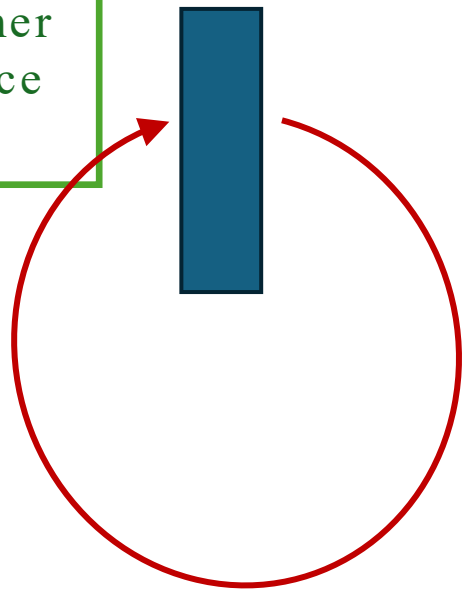

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What future for prevalence surveys?

- For most high-burden countries, prevalence surveys have offered the most direct evidence for TB burden
  - Invaluable source of evidence for informing incidence estimates, and other insights

- Despite their contribution to burden estimates, concern has been raised about their cost
- In a time of constrained global resources, which countries should be prioritised for prevalence surveys? For discussion

- At the same time, some countries are expanding ACF efforts to national scale, e.g. CAST-TB in Uganda
- Could such mass ACF initiatives offer a reasonable alternative to prevalence surveys?

Differences between ACF and surveys

Prevalence surveys

- Aim to be representative of the national population
- Use X-ray as well as symptom screening (to find subclinical TB)
- Combine different methods for TB confirmation: molecular diagnostics, culture

Active case-finding

- Usually targeted in high-prevalence populations or areas
- Often dependent on symptom screening alone
- May or may not include additional confirmation

Differences between ACF and surveys

How we might adjust

- Account for the relative risk of TB in screened population (with assumptions)
- Account for the proportion of TB that is symptomatic (with assumptions)
- Adjust for the specificity of the confirmatory algorithm

Active case-finding

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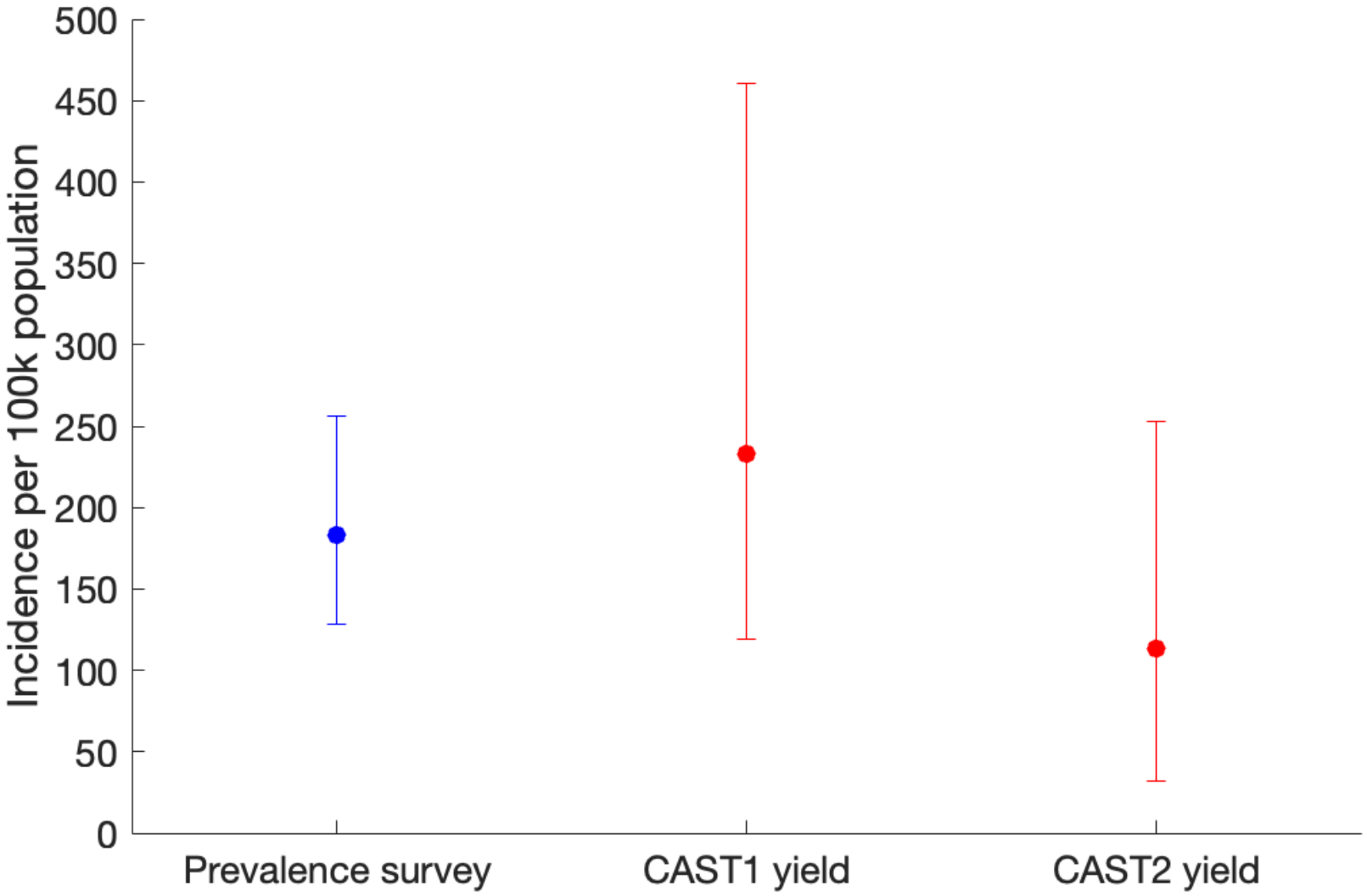
ACF in Uganda: a test case for burden estimation from ACF

- Community Awareness, Screening, Testing, Prevention and Treatment to End TB and Leprosy (CAST-TB)
- Began in 2022, involving >70,000 healthcare workers
  - Round 1 in March 2022: 1.29 million screened
  - Round 2 in Sept 2022: 5.13 million screened

- In collaboration with Uganda NTP and Makerere University
  - What are the implications of data from CAST-TB, for incidence estimation?
  - How do these estimates compare with those from Uganda's prevalence survey in 2015?

Illustrative results

- Incidence estimates have substantially wider uncertainty than those based on national TB prevalence survey data
- Central estimates vary considerably from those derived from national TB prevalence survey data
- Value in a nested TBPS within CAST-TB if it could be re-designed:
  - More representative of the general population
  - Screening to include CXR
  - Subnational estimates?
  - Trend analysis?
- Is it cost effective?



Potential value of ACF

- ACF alone is unlikely to be a good replacement for prevalence surveys
  - Uncertainties 'add up', in projecting from ACF yield to national incidence

- However, ACF could be a useful complement to prevalence surveys
  - If ACF is sustained consistently over several years, it could offer helpful evidence for trends in TB burden over time (Kendall et al. Thorax 2024)
  - CAST-TB is large in scale! Potential for 'nested' design, where selected locations pursue more focused collection of data that can be useful for burden estimation - E.g. X-ray screening for better estimates of proportion of TB that is symptomatic

- To be discussed in group work

Summary of comments

Message	Comments
Issues of representativeness, and lack of standardization of ACF	May be suitable for use, although I have some reservation. These campaigns are often…targeting special parts of the population. My main concern here is the representativeness of the population receiving ACF…ACF is implemented without strict sampling methodology used in prevalence surveys, so ACF findings cannot be extrapolated in the way prevalence surveys are. Would a RR be calculated for all participants, including those who may cross risk groups?
…but potentially useful for trends	…I think it would be better used as an indicator of trends (where a time trend can be established from ACF data) rather than absolute level…it is also possible that the success of ACF in targeted groups will mean ACF-derived measures of trend will show faster reductions than is truly the case at the population level.

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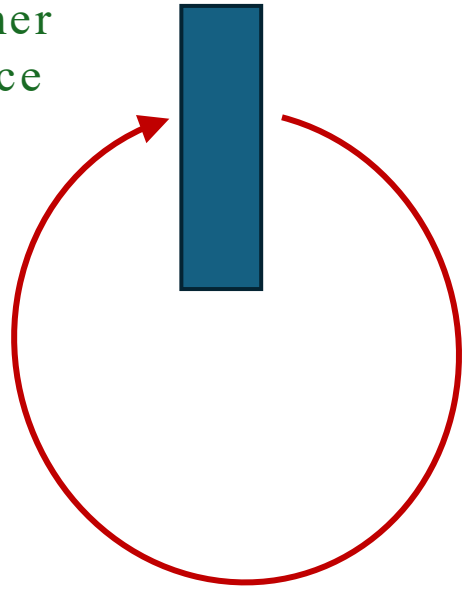

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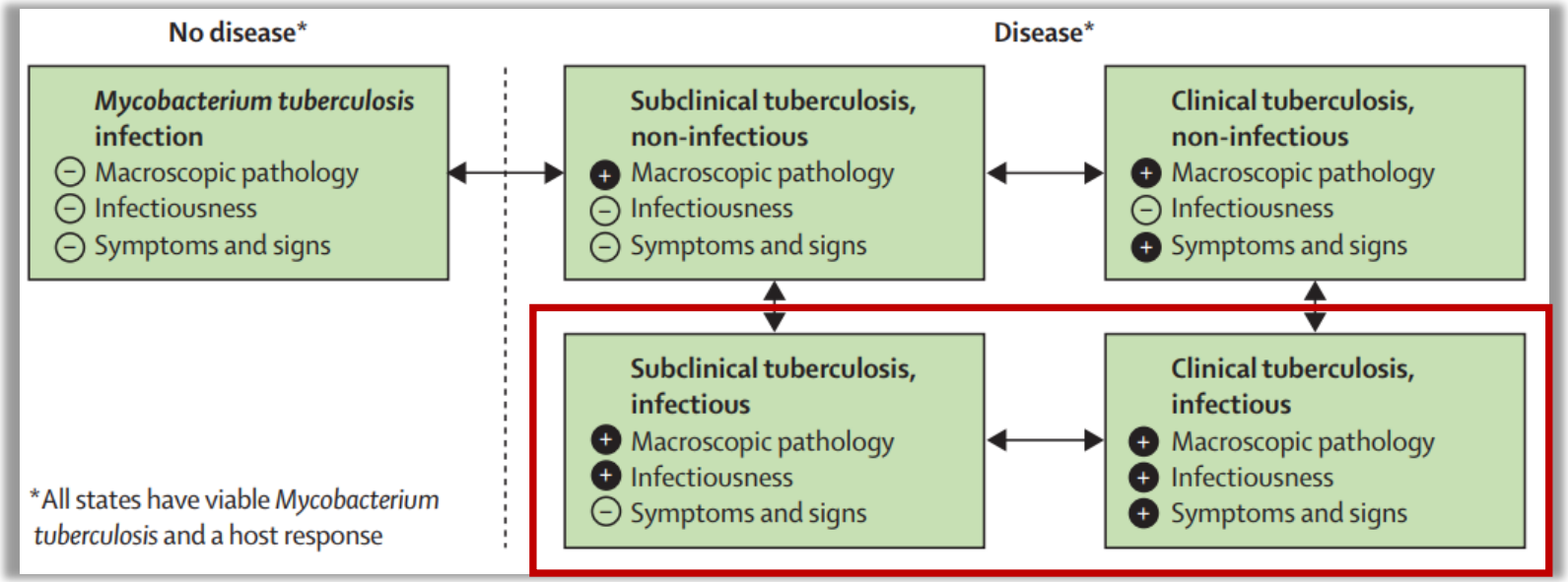
Some definitions



Coussens et al, Lancet Respiratory Medicine (2024)

Infectious TB disease

- Sputum bacteriologically positive

Of which…

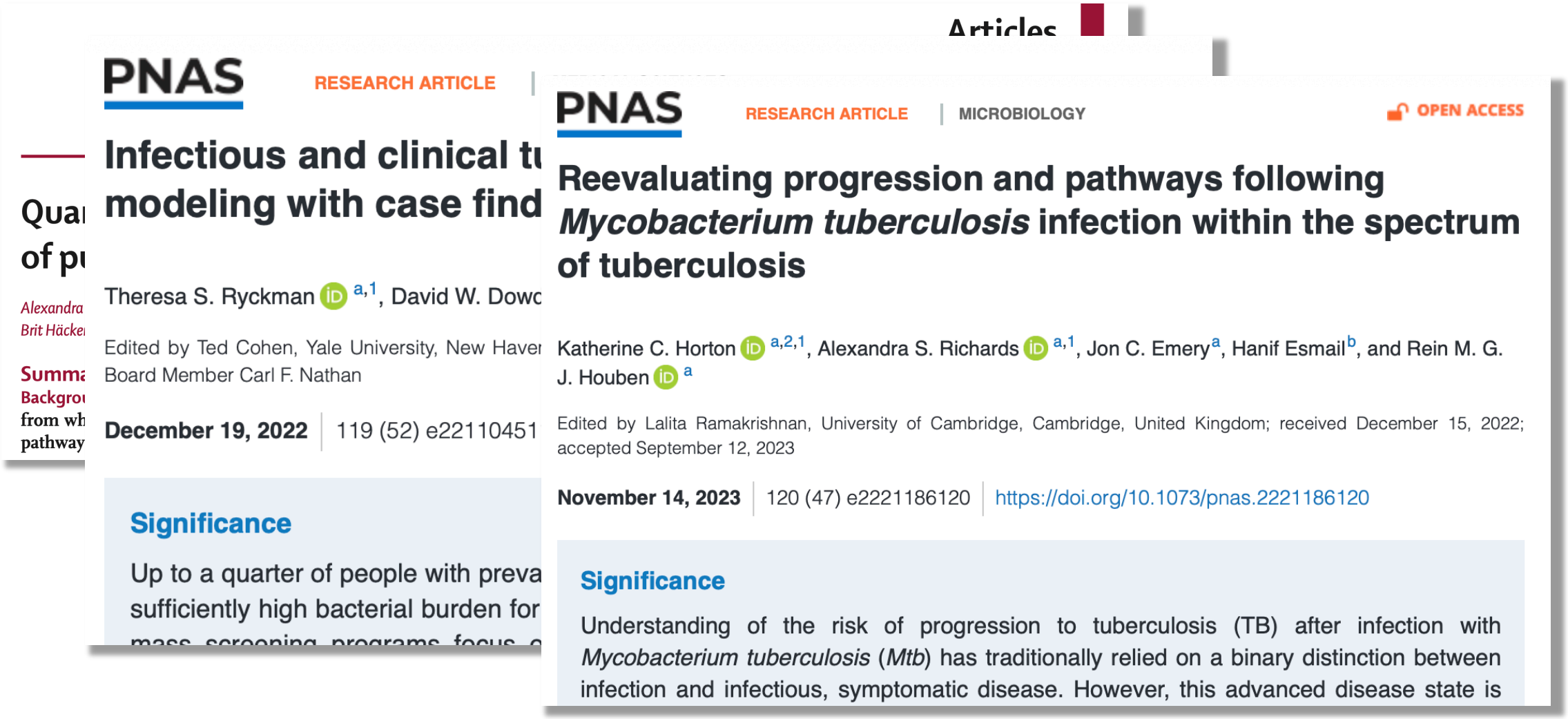
Subclinical TB

- Not reporting symptoms

Clinical/Symptomatic

- Reporting symptoms

Recent literature on complex natural history of TB



Articles

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PNAS RESEARCH ARTICLE

Infectious and clinical tu
modeling with case find

Theresa S. Ryckman [a,1], David W. Dowc

Edited by Ted Cohen, Yale University, New Haver
Board Member Carl F. Nathan

December 19, 2022 | 119 (52) e22110451

Significance

Up to a quarter of people with preva
sufficiently high bacterial burden for
mass screening programs focus

PNAS RESEARCH ARTICLE | MICROBIOLOGY OPEN ACCESS

Reevaluating progression and pathways following *Mycobacterium tuberculosis* infection within the spectrum of tuberculosis

Katherine C. Horton [a,2,1], Alexandra S. Richards [a,1], Jon C. Emery[a], Hanif Esmail[b], and Rein M. G. J. Houben [a]

Edited by Lalita Ramakrishnan, University of Cambridge, Cambridge, United Kingdom; received December 15, 2022; accepted September 12, 2023

November 14, 2023 | 120 (47) e2221186120 | https://doi.org/10.1073/pnas.2221186120

Significance

Understanding of the risk of progression to tuberculosis (TB) after infection with *Mycobacterium tuberculosis* (*Mtb*) has traditionally relied on a binary distinction between infection and infectious, symptomatic disease. However, this advanced disease state is

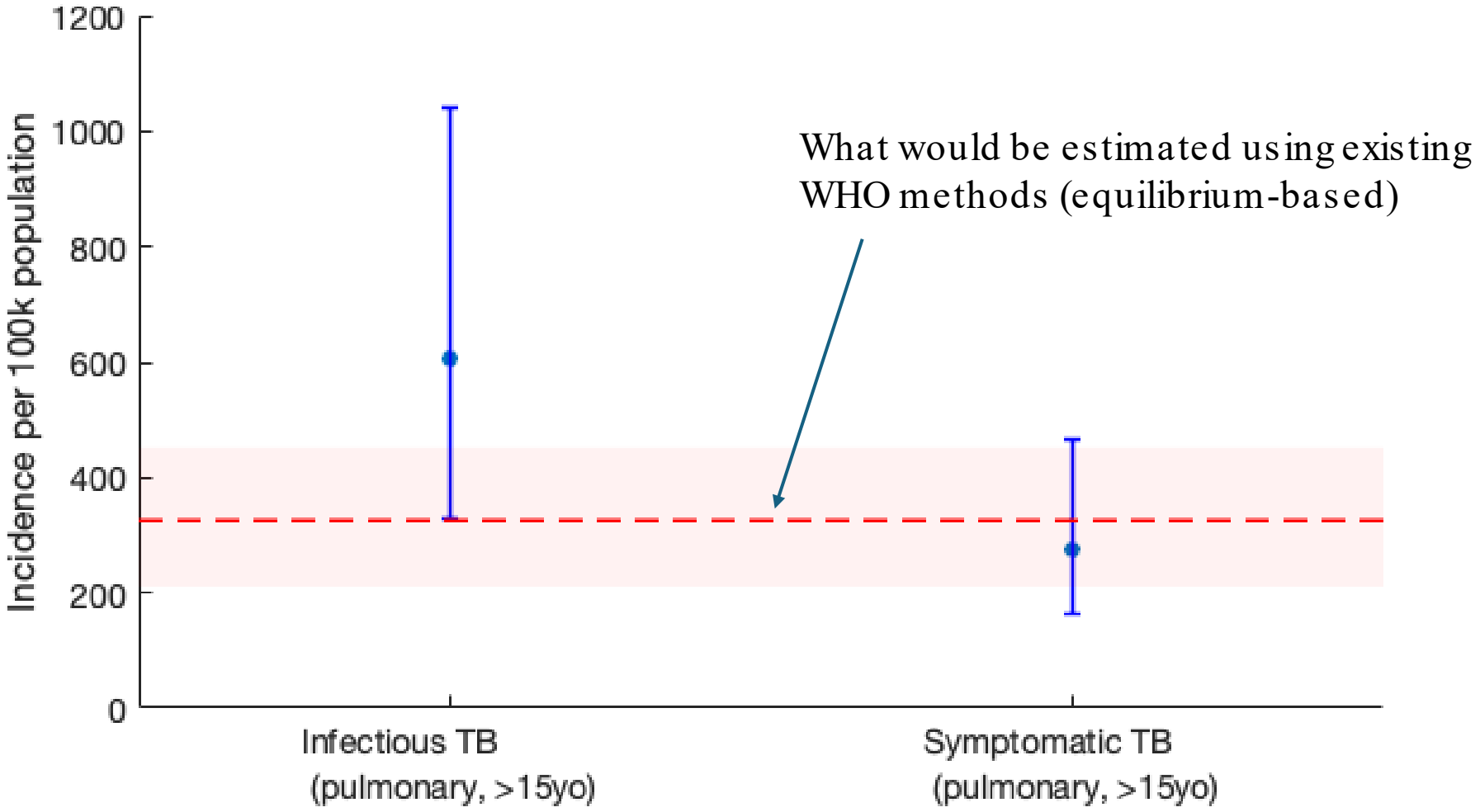
Implications for TB burden estimation

Relevant study findings	Questions arising

• Undulation is a common feature of TB natural history
  • Subclinical <-> Symptomatic TB
  • Infection <-> Bac +ve disease
	• Should we count episodes or unique individuals with incident TB?

• Roughly half of people with subclinical TB will ever develop symptoms	• Should we estimate incidence of infectious or only symptomatic TB? • Former could be twice as much

Illustrative example: recent prevalence survey



Summary of comments

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Concerns about uncertainty…	…Valuable, but also comes with substantial uncertainty…any new approach for TB incidence…will be very sensitive to assumptions about the parameters defining the natural history transitions. I think this is a major question to consider – as inclusion of subclinical TB in incidence estimates could double (or more!) the estimated incidence of TB. While I agree that evolving understanding of the importance of subclinical disease is very important – I think it is premature to include these in the main estimates of incidence…and would be confusing for programs and difficult to square with the history of incidence estimates that WHO has provided.
…with support for its importance	…But I would include [estimates related to] subclinical TB – as this is clearly relevant to transmission…

A proposed 'middle way'

Principal estimates
Country-level incidence: consistent with that of symptomatic incidence

To be discussed in group work
(See table 4 in background document 1)

Complementary estimates

- Global estimates for the prevalence of infectious TB
- Country estimates for the disaggregated prevalence of infectious TB (subclinical vs symptomatic) for countries with recent prevalence surveys
- Where countries request their own national estimates for incidence of infectious TB, provide support for this purpose
  - Only where appropriate data exists, e.g. from recent prevalence survey

But…questions to be addressed first

- Published estimates are largely informed by literature from pre-chemotherapy era
- How generalizable are the findings to high-burden countries today?
  - E.g. potentially different populations by undernutrition, etc

- Particular focus: half of subclinical TB developing symptoms
  - Which data informs this ratio?
  - Is contemporary data available, for more updated estimates?

- Ongoing work with Katherine Horton, Rein Houben et al
  - Watch space for opportunities for collaboration…

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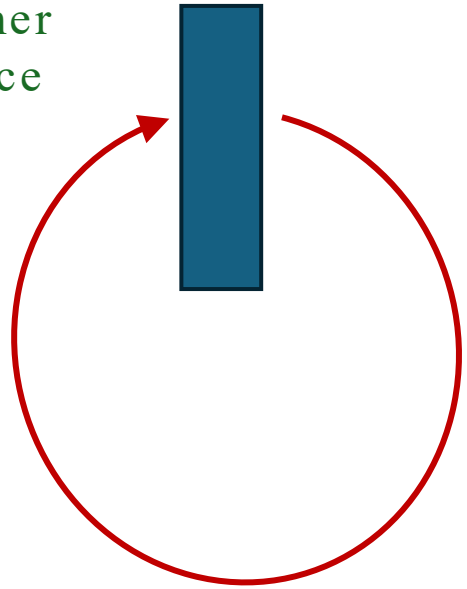

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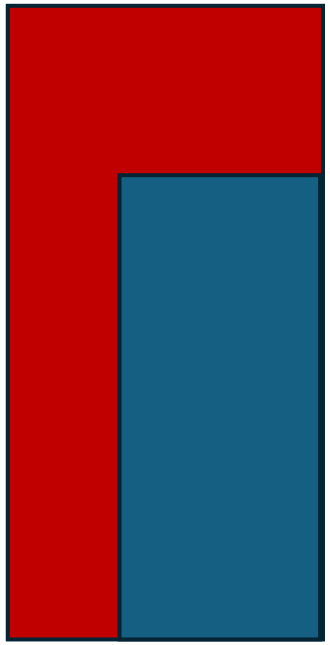
Incorporating impact of interventions?

Summary

High-burden countries with no other sources of evidence (e.g. prevalence)

Low-burden countries



Notification:incidence ratio (case detection rate, CDR):

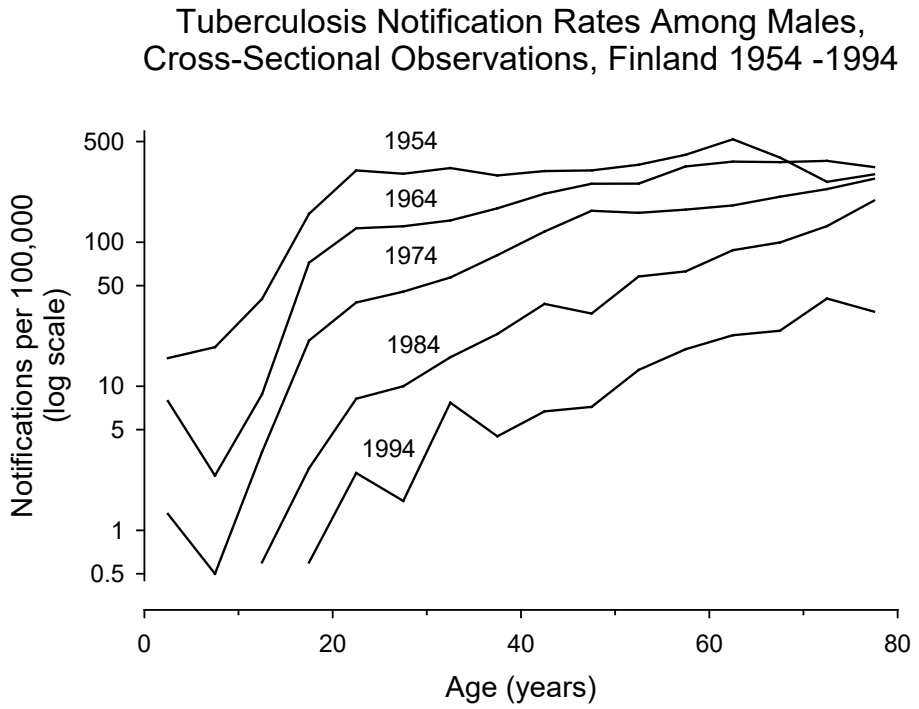
- Expert opinion in absence of other evidence

- Standard adjustment for low-burden countries

- Estimate CDR based on metrics for coverage of Universal Health Care?

Some additional prospects…

- Improving basic surveillance: signal from 'ageing' of the TB epidemic?
- Triangulating between different approaches, e.g. programmatic data together with prevalence-derived estimates
- More systematic use of sentinel surveillance, to monitor trends?
- 'Bringing back' infection surveys?
  - Not necessarily directly to measure incidence, but to monitor trends over time



Härö AS. Tuberc Respir Dis Yearbook 1998;24:1-151

Summary: Overarching questions

1. How can the absolute level of TB incidence in 2025 and 2030 and changes compared with 2015 be robustly assessed, in the 29 countries for which estimates for 2015-2023 currently rely on data from national TB prevalence surveys?

2. Is there a better alternative to using case notifications and expert opinion about case detection gaps, for the 39 countries (11% of incident cases globally) where this is still relied upon?

3. Can the method of making a standard adjustment to case notification data, currently used for 137 countries, be improved upon?

TB mortality estimates for the End TB Strategy 2025 milestone and 2030 targets assessment: data sources, analytical methods and process

Mathieu Bastard

- Draft in a separate pptx on the sharepoint

Extra slides: prevalence surveys

Questions to inform review & discussion

Are national TB prevalence surveys in the period 2025–2030 still relevant to inform estimates of TB disease burden?

Questions to inform review & discussion

If Yes:

- In which of the following two categories of country do you think they are most relevant in terms of assessment of whether (or to what extent) the 2025 milestone and 2030 target for incidence are met?

a) Countries that have already completed at least one survey and that meet both epidemiological and feasibility criteria

b) Countries that have not previously implemented a survey but meet both epidemiological and feasibility criteria

- For your selected category, what criteria could be used to identify countries that are particularly high priorities for implementing a survey between 2025 and 2030, from a global perspective?

Questions to inform review & discussion

If No:

- For the 29 countries for which the main source of data currently used to inform WHO estimates of TB incidence is a national TB prevalence survey, what alternative(s) to a repeat survey would you propose for assessment of trends in the period between the last survey and 2030?

a) National TB inventory study in the period 2025–2030

b) Case notification data combined with expert opinion about case detection gaps, for selected years

c) Use of data from active case finding activities covering the general population

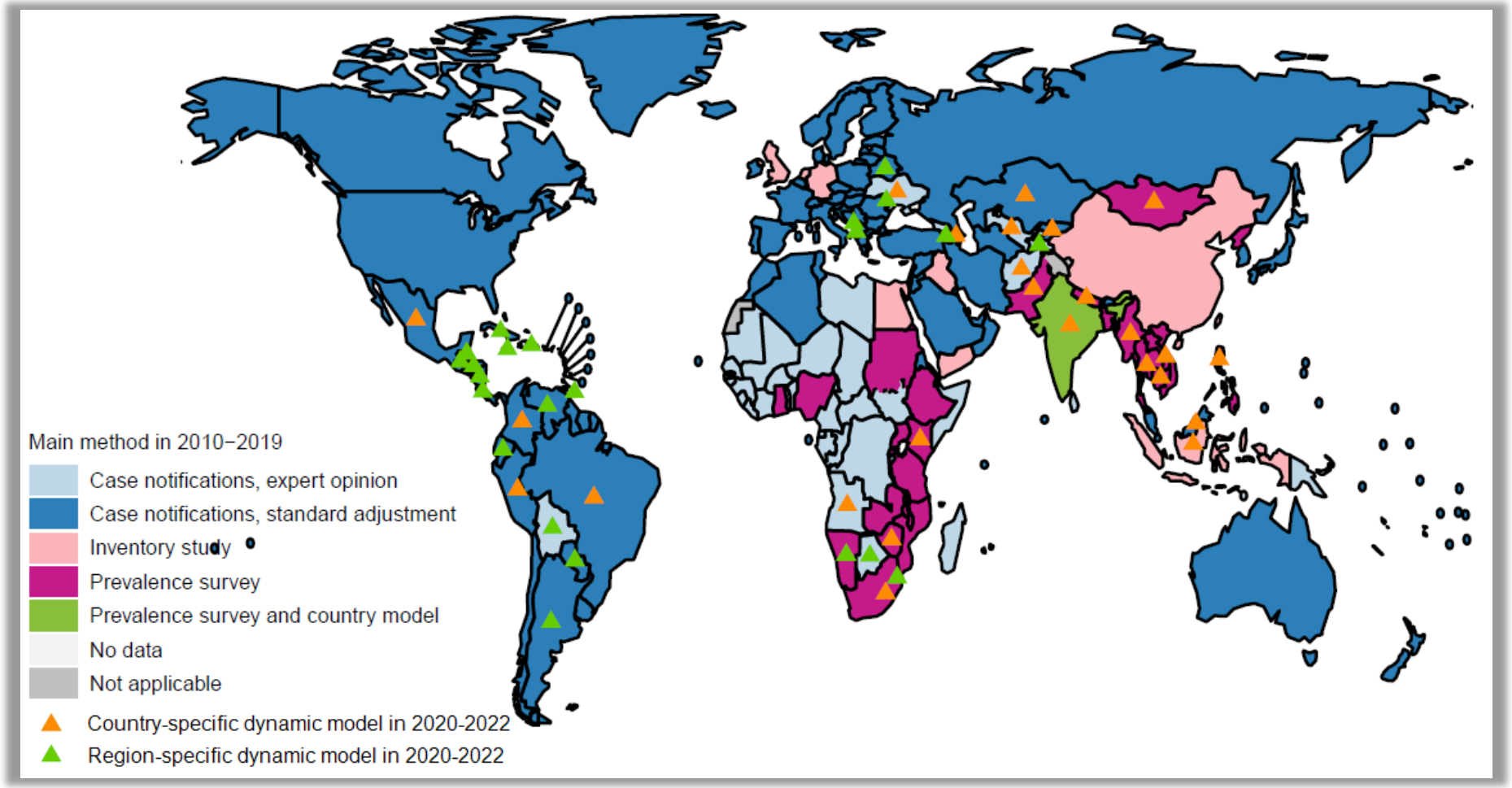
d) Use of data from active case finding activities focused on target populations

e) Use of case notification data combined with an upward adjustment based on the UHC service coverage index

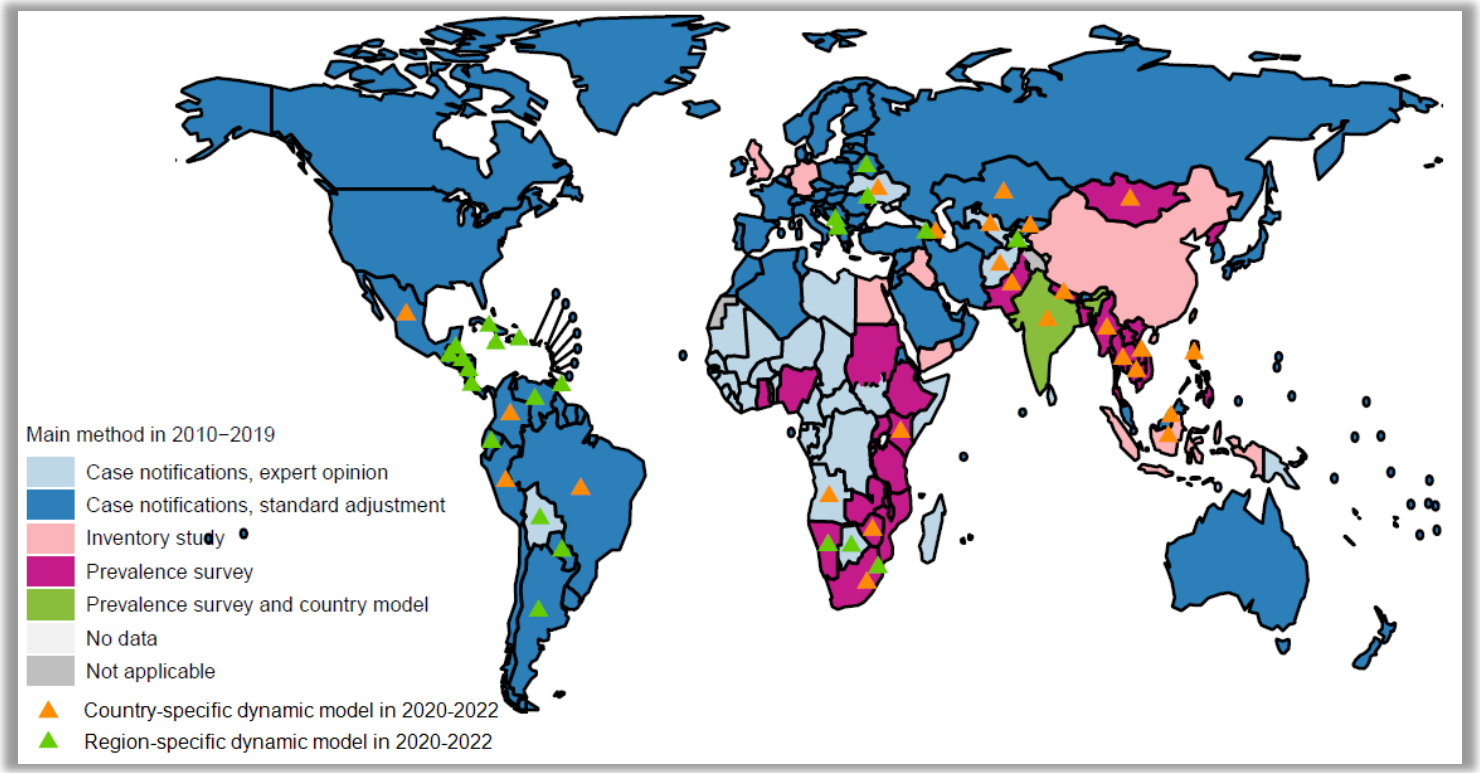
f) Estimation of trends using routinely available programmatic data (please specify what these data would be)

g) Other (if selected, please define what this would be)

Main data sources and analytical methods used to produce the estimates of TB incidence that were published in the Global TB report 2023, which covered the period 2010–2022



Survey data were the main data source used for 29 countries that collectively accounted for 66% of the world's estimated number of incident cases in 2022.



Africa
Eswatini
Ethiopia
Ghana
Gambia
Kenya
Lesotho
Malawi
Mozambique
Namibia
Nigeria
Rwanda
Sudan
Tanzania
Uganda
South Africa
Zambia
Zimbabwe

Asia
Bangladesh
Cambodia
India
Lao PDR
Myanmar
Mongolia
Nepal
Pakistan
Philippines
DPR Korea
Thailand
Viet Nam

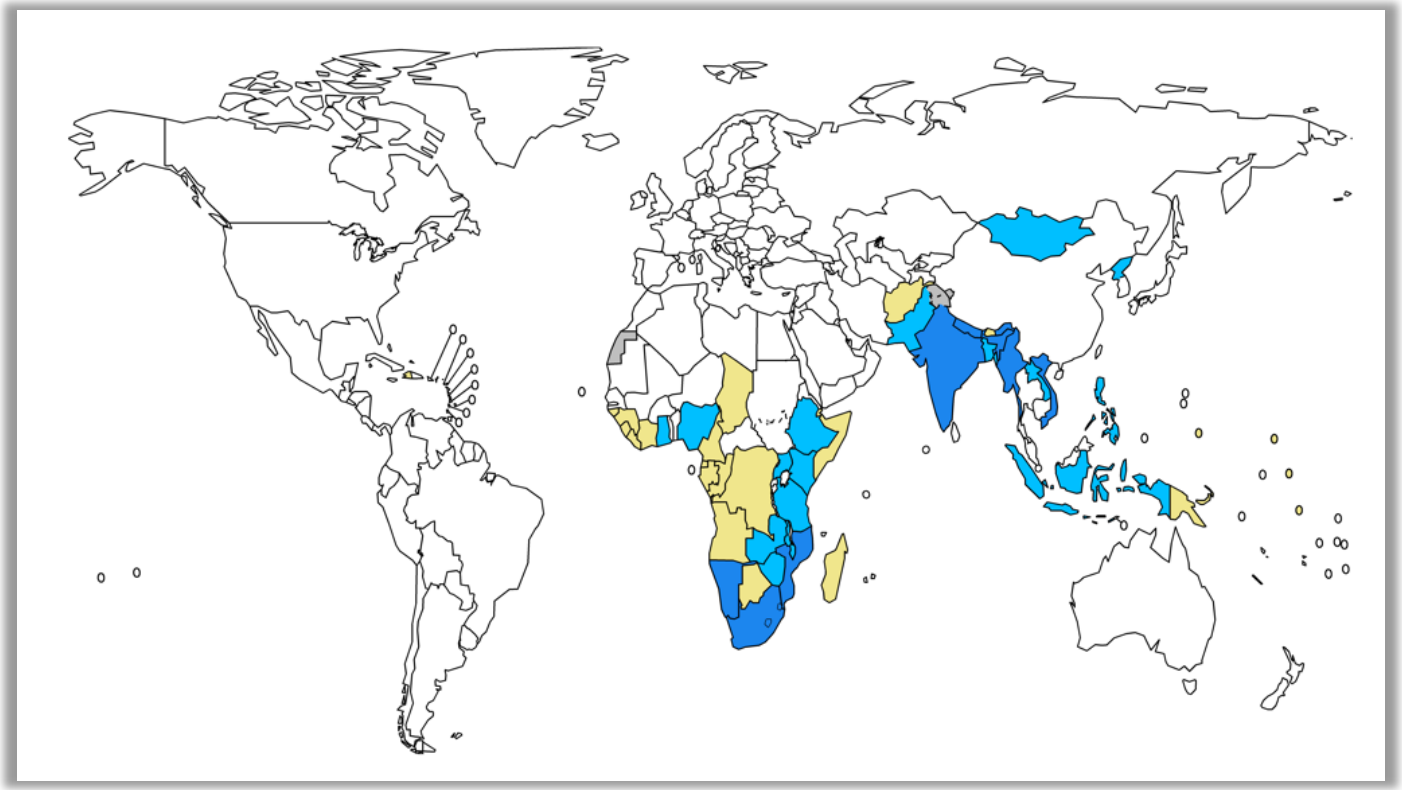
Epidemiological criteria that can be used to assess whether a country that implemented a survey between 2007 and 2023 should consider implementing a repeat survey in the years leading up to 2030, and countries that meet these criteria

Criteria	Explanation of criteria	Countries that meet both criteria (n=25)
1. Estimated prevalence of bacteriologically confirmed TB ≥250 per 100 000 population aged ≥15 years during the previous survey and	Sample size small enough (<70 000 individuals) to make surveys feasible in terms of cost and logistics	Meet criteria in period 2024–2026: Bangladesh, Democratic People's Republic of Korea, Ethiopia, Ghana, Indonesia, Kenya, Lao People's Democratic Republic, Malawi, Mongolia, Nigeria, Pakistan, the Philippines, Uganda, United Republic of Tanzania, Zambia, Zimbabwe (n=16)
2. About 10 years since the last survey	Time between surveys is sufficient to allow a statistically meaningful comparison of prevalence	Meet criteria in period 2027–2030: Eswatini, India, Lesotho, Mozambique, Myanmar, Namibia, Nepal, South Africa, Viet Nam (n=9)

Epidemiological criteria that can be used to assess whether a country should consider implementing a national TB prevalence survey, for countries that have not previously implemented a survey

Criteria	Explanation of criteria	Countries that currently meet criteria (n=25)
1. Estimated TB incidence ≥150 per 100 000 population per year (all forms, all ages) and	Sample size small enough (<70 000 individuals) to make survey feasible in terms of cost and logistics	Afghanistan, Angola, Bhutan, Botswana, Cameroon, the Central African Republic, Chad, the Congo, Côte d'Ivoire, the Democratic Republic of the Congo, Djibouti, Equatorial Guinea, Gabon, Guinea, Guinea-Bissau, Haiti, Kiribati, Liberia, Madagascar, Marshall Islands, Micronesia, Papua New Guinea, Sierra Leone, Somalia and Tuvalu.
2. No national or sample VR system of high coverage and quality that includes coding of causes of deaths according to international standards and	No reliable direct measurement of TB disease burden	
3. UHC service coverage index score is <80 (SDG Indicator 3.8.1)	This is an indirect indicator of insufficient access to quality health services, as defined in the WHO TB surveillance checklist of standards and benchmarks (second edition)	

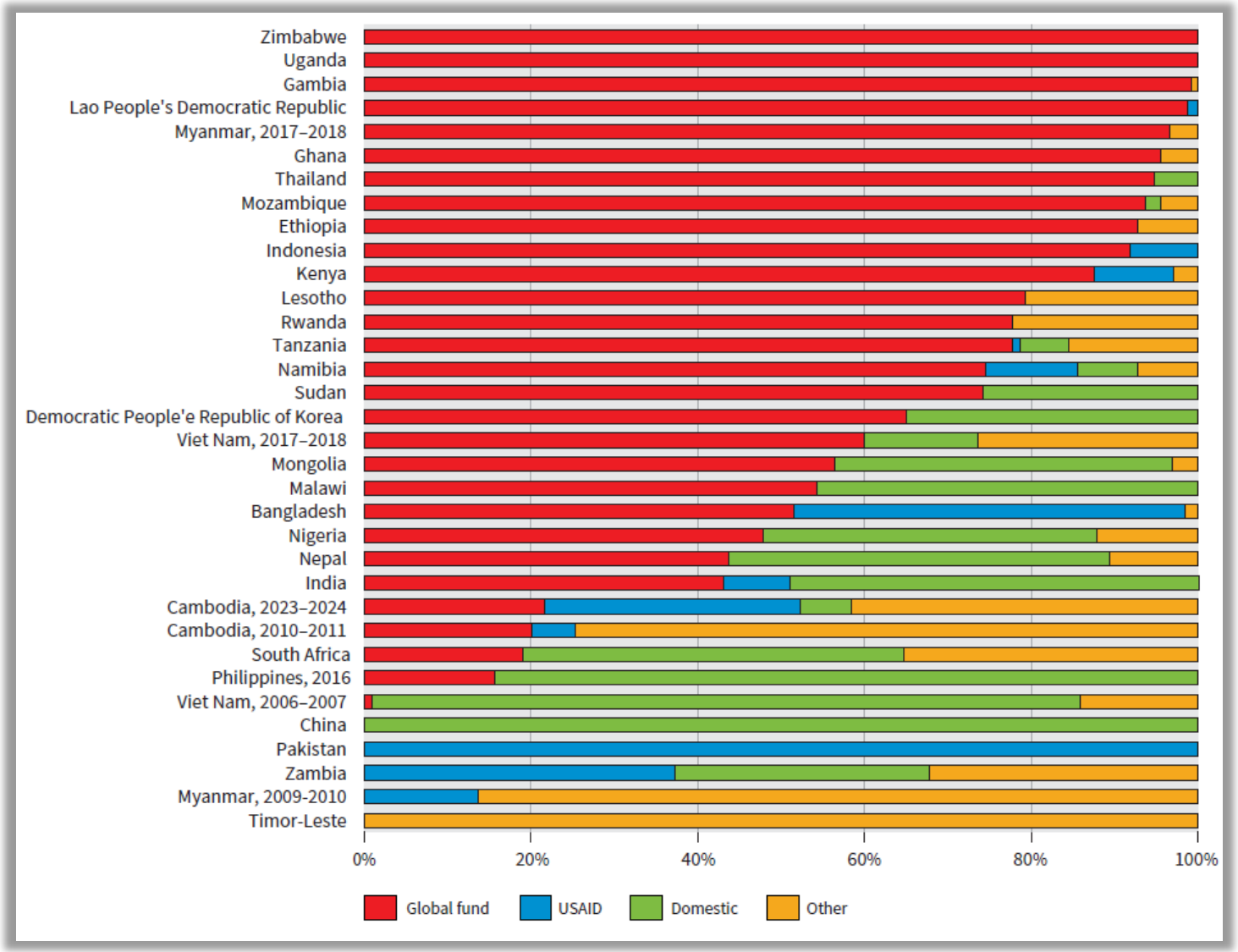
Countries that meet epidemiological criteria for considering a repeat or first national TB prevalence survey in the years leading up to 2030



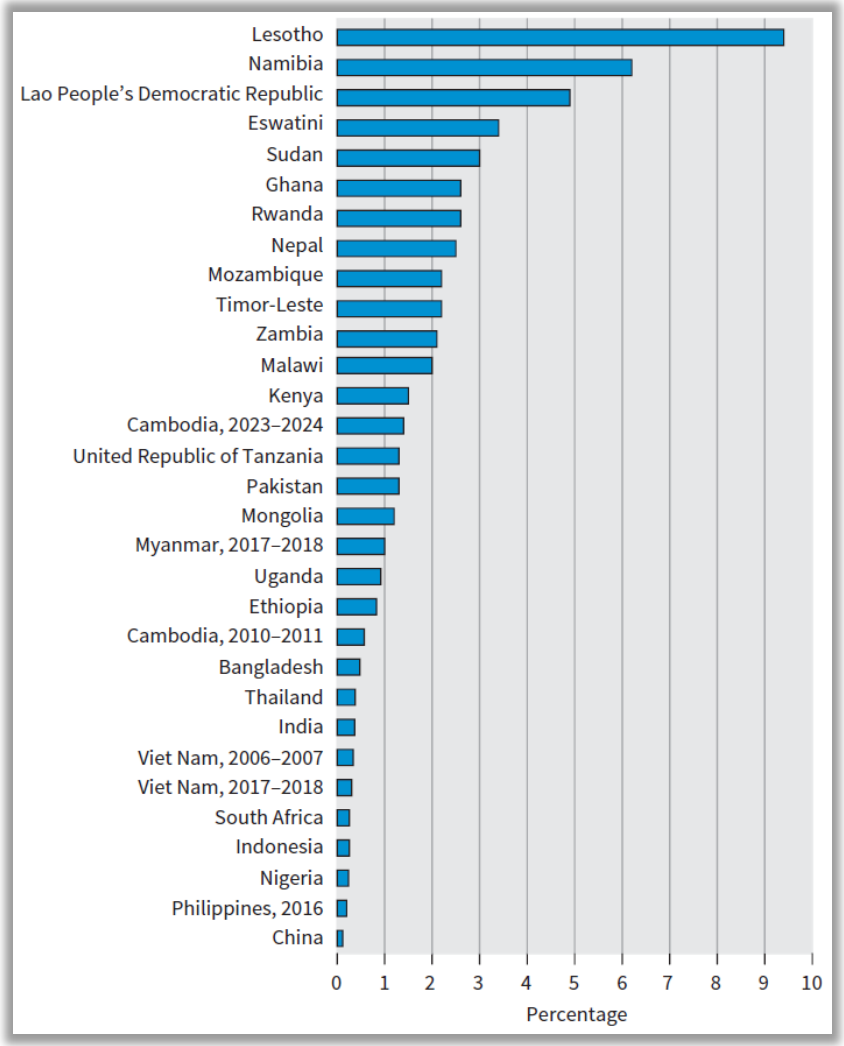
Non-epidemiological requirements that must be satisfied before a national TB prevalence survey can be embarked upon

1. Strong commitment and leadership from the NTP and the MOH
2. Availability of a suitable organization to lead and manage the survey
3. National security
4. Funding
5. High participation rate
6. Laboratory capacity
7. CXR capacity
8. Good clinical practice and good data management practices
9. Reliable and timely procurement of equipment
10. Survey protocols have undergone expert review and clearance
11. Availability of external support and technical assistance

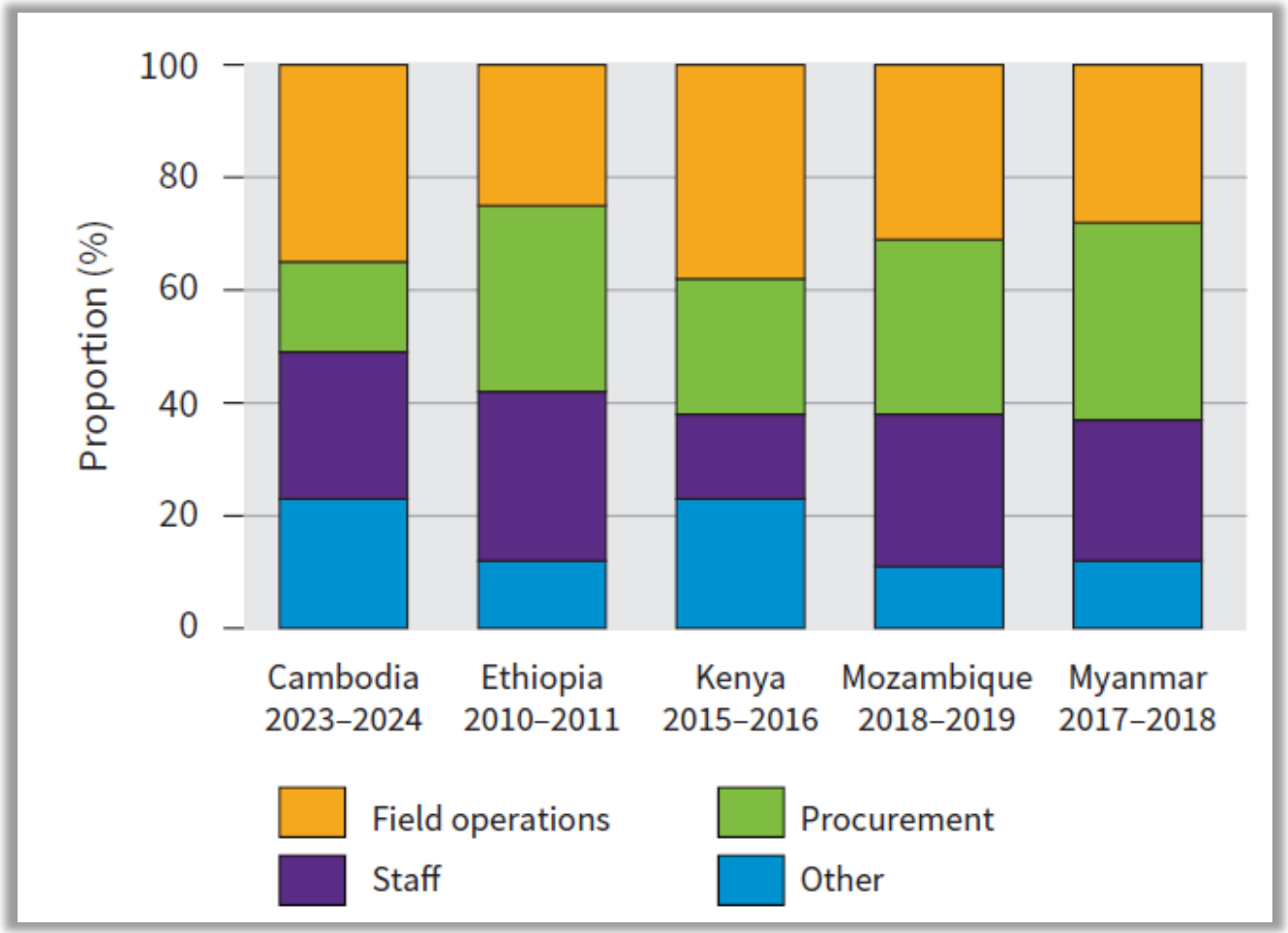
Sources of funding for national TB prevalence surveys (expressed as a share of the total reported budget), 2007–2024



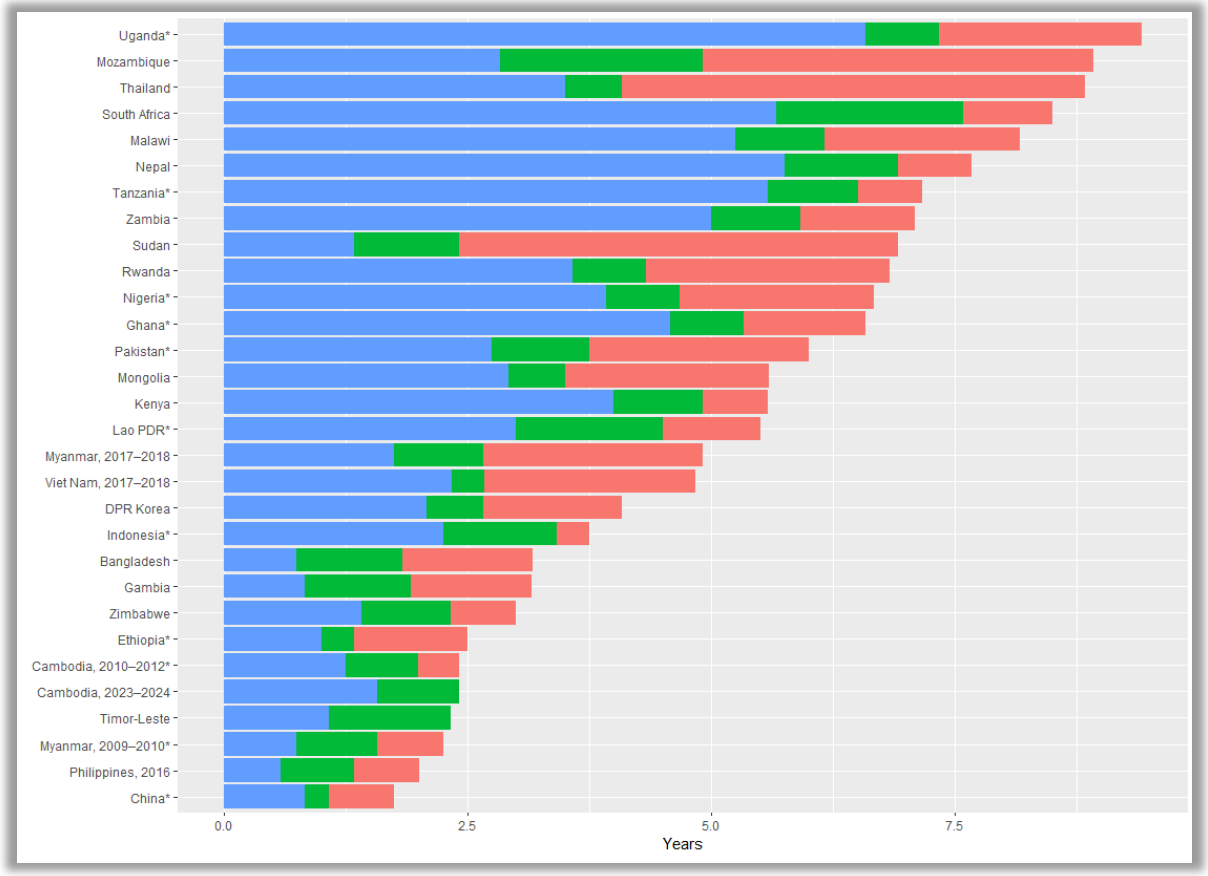
Annualized survey budget (in constant US$ values for 2022) as a percentage of the total amount of funding available for the TB response at country level in 2022, 31 national TB prevalence surveys implemented between 2007 and 2024. The annualized budget assumes that the expected lifetime of a survey is 10 years and a discount rate of 3%.



Distribution of survey budgets by major cost category – illustrative examples



Approximate time taken (in years) for 30 countries to complete a national TB prevalence: from survey preparation and field operations to official dissemination or first publication

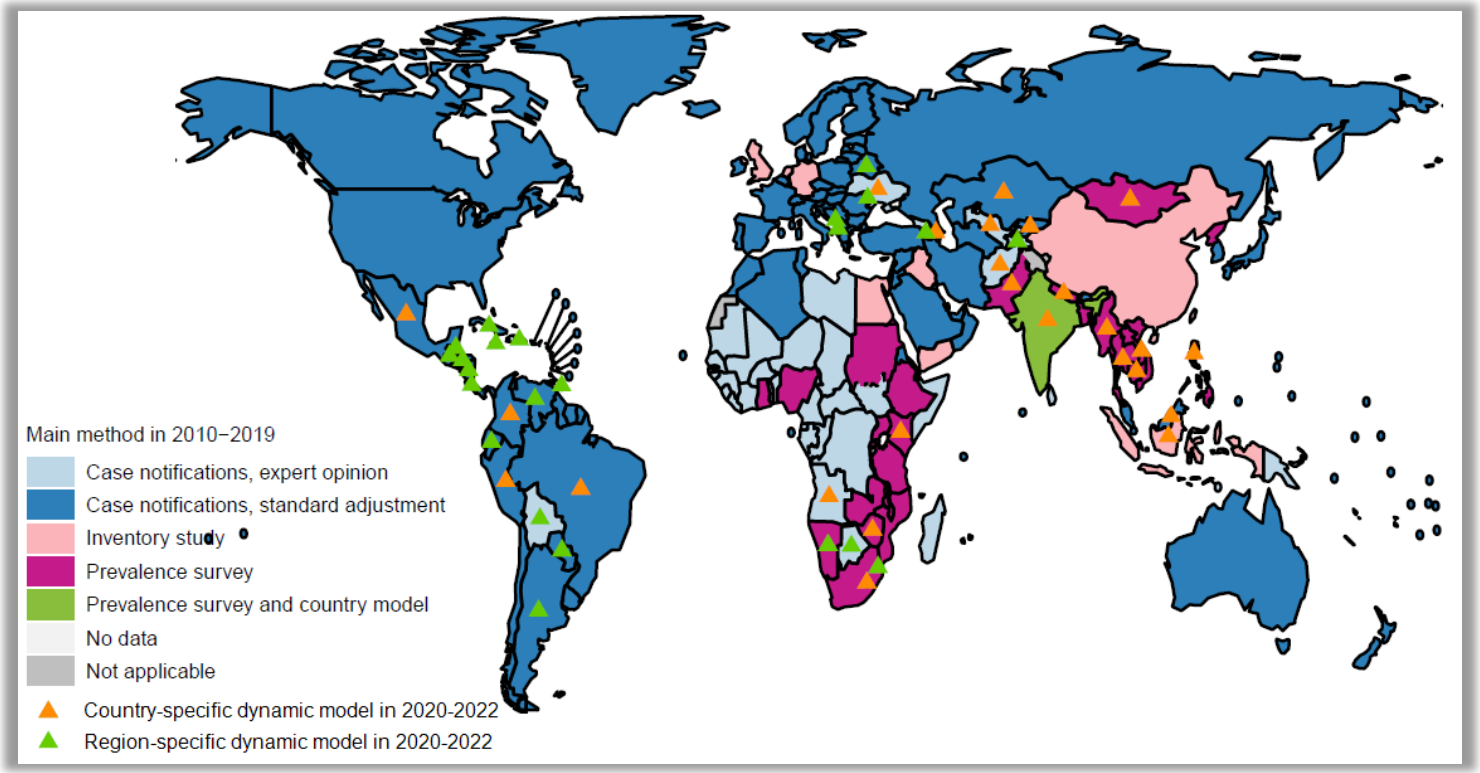


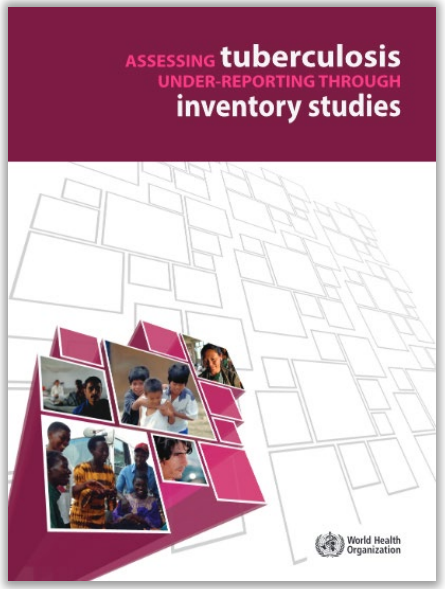
Preparation time (e.g. first official meeting, ethics review submission)
Duration of field operations
Duration to official dissemination (*) or first publication (report or peer-reviewed paper)

What are the alternatives to national TB prevalence surveys to produce estimates of TB incidence?

1. National TB inventory studies
2. Case notification data with a standard adjustment
3. Case notification data combined with expert opinion about case detection gaps (in selected years)
4. Active case finding

National TB inventory studies





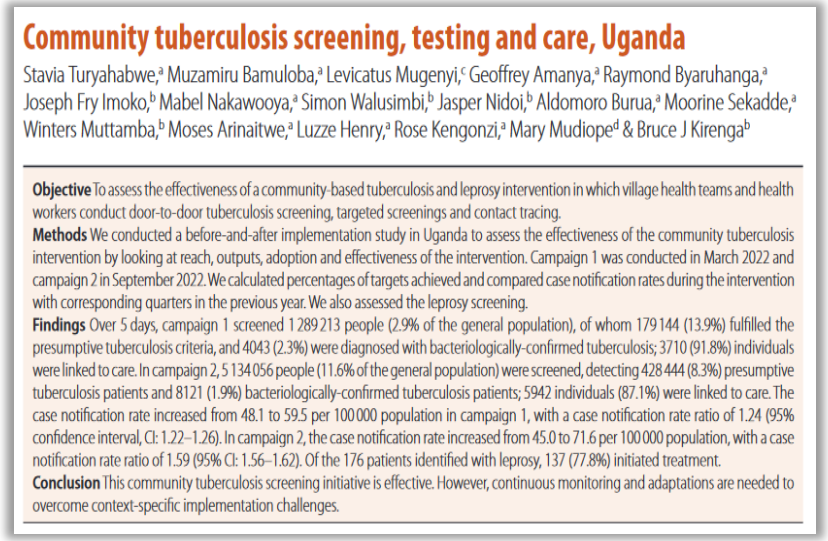
10 countries that collectively account for about 17% of the annual global number of incident cases

China and Indonesia are by far the two most significant in terms of this share (combined, 16.5% of global TB incidence).

Large scale active case finding in Uganda, 2022:

Community Awareness, Screening, Testing, Prevention and Treatment to End TB and Leprosy (CAST-TB)

- Community TB case finding and raising community awareness of TB
- 70 000+ community healthcare workers
- 2 rounds x 5 days of screening: March and September 2022
- Global Fund and USAID support
- Round 1 :
  - 1.2+ million screened (2.9% of population)
  - 179 144 screened positive (14%)
  - 117 975 were tested
  - 4043 were positive for TB (3.4%)
- Round 2 (more door-to-door screening):
  - 5.1+ million screened (11.6% of population)
  - 428 444 screened positive (8.3%)
  - 225 813 were tested
  - 8121 were positive for TB (3.6%)



Community tuberculosis screening, testing and care, Uganda

Stavia Turyahabwe,[a] Muzamiru Bamuloba,[a] Levicatus Mugenyi,[c] Geoffrey Amanya,[a] Raymond Byaruhanga,[a] Joseph Fry Imoko,[b] Mabel Nakawooya,[a] Simon Walusimbi,[b] Jasper Nidoi,[b] Aldomoro Burua,[a] Moorine Sekadde,[a] Winters Muttamba,[b] Moses Arinaitwe,[a] Luzze Henry,[a] Rose Kengonzi,[a] Mary Mudiope[d] & Bruce J Kirenga[b]

Objective To assess the effectiveness of a community-based tuberculosis and leprosy intervention in which village health teams and health workers conduct door-to-door tuberculosis screening, targeted screenings and contact tracing.

Methods We conducted a before-and-after implementation study in Uganda to assess the effectiveness of the community tuberculosis intervention by looking at reach, outputs, adoption and effectiveness of the intervention. Campaign 1 was conducted in March 2022 and campaign 2 in September 2022. We calculated percentages of targets achieved and compared case notification rates during the intervention with corresponding quarters in the previous year. We also assessed the leprosy screening.

Findings Over 5 days, campaign 1 screened 1 289 213 people (2.9% of the general population), of whom 179 144 (13.9%) fulfilled the presumptive tuberculosis criteria, and 4043 (2.3%) were diagnosed with bacteriologically-confirmed tuberculosis; 3710 (91.8%) individuals were linked to care. In campaign 2, 5 134 056 people (11.6% of the general population) were screened, detecting 428 444 (8.3%) presumptive tuberculosis patients and 8121 (1.9%) bacteriologically-confirmed tuberculosis patients; 5942 individuals (87.1%) were linked to care. The case notification rate increased from 48.1 to 59.5 per 100 000 population in campaign 1, with a case notification rate ratio of 1.24 (95% confidence interval, CI: 1.22–1.26). In campaign 2, the case notification rate increased from 45.0 to 71.6 per 100 000 population, with a case notification rate ratio of 1.59 (95% CI: 1.56–1.62). Of the 176 patients identified with leprosy, 137 (77.8%) initiated treatment.

Conclusion This community tuberculosis screening initiative is effective. However, continuous monitoring and adaptations are needed to overcome context-specific implementation challenges.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC11132162/

Extra slides: incidence estimates from mortality data

Potential application and relevance

- Countries with national or sample VR data of sufficient quality and coverage
- Countries that have implemented a TB mortality survey

Informing incidence using TB mortality data, for countries with good VR systems

- In countries with strong vital registration systems, data for TB mortality could offer valuable evidence for informing estimates of TB incidence
- Recent modelling work in Brazil brought together different sources of data for TB burden to estimate incidence, with mortality data playing a critical role

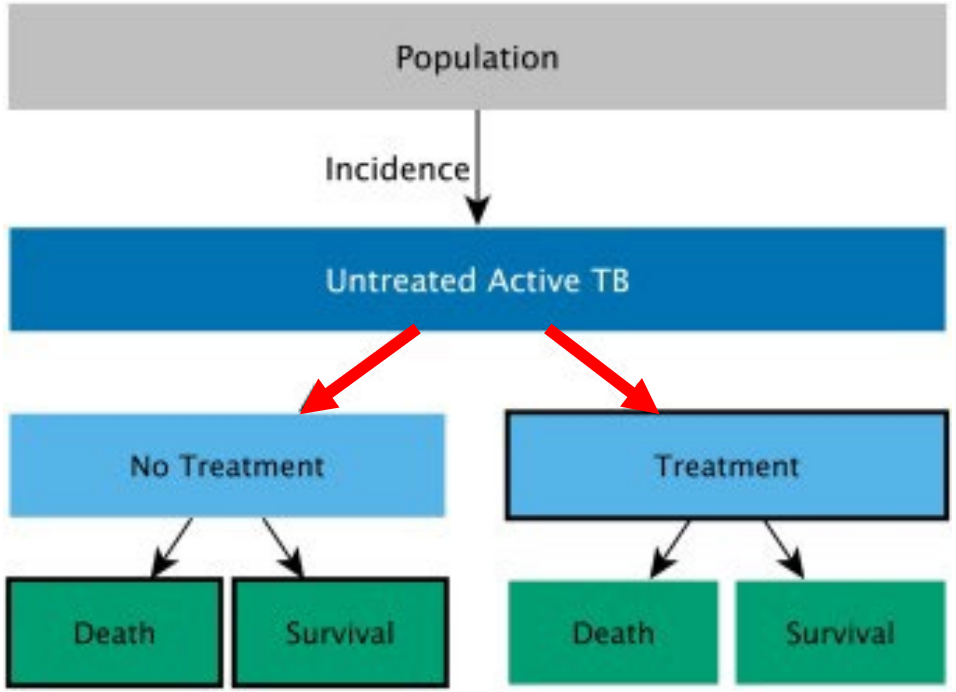
Bayesian evidence synthesis to estimate subnational TB incidence: An application in Brazil

Melanie H. Chitwood [a,*], Daniele M. Pelissari [b], Gabriela Drummond Marques da Silva [b], Patricia Bartholomay [b], Marli Souza Rocha [b], Mauro Sanchez [c], Denise Arakaki-Sanchez [b], Philippe Glaziou [d], Ted Cohen [a], Marcia C. Castro [e], Nicolas A. Menzies [e]

Epidemics, Volume 35, 2021

Estimation strategy

- Approximate TB incidence as the number of individuals exiting untreated active disease, which can be estimated in settings where TB treatment initiation and TB deaths are well documented



Data from TB mortality studies to inform estimates of underdiagnosis

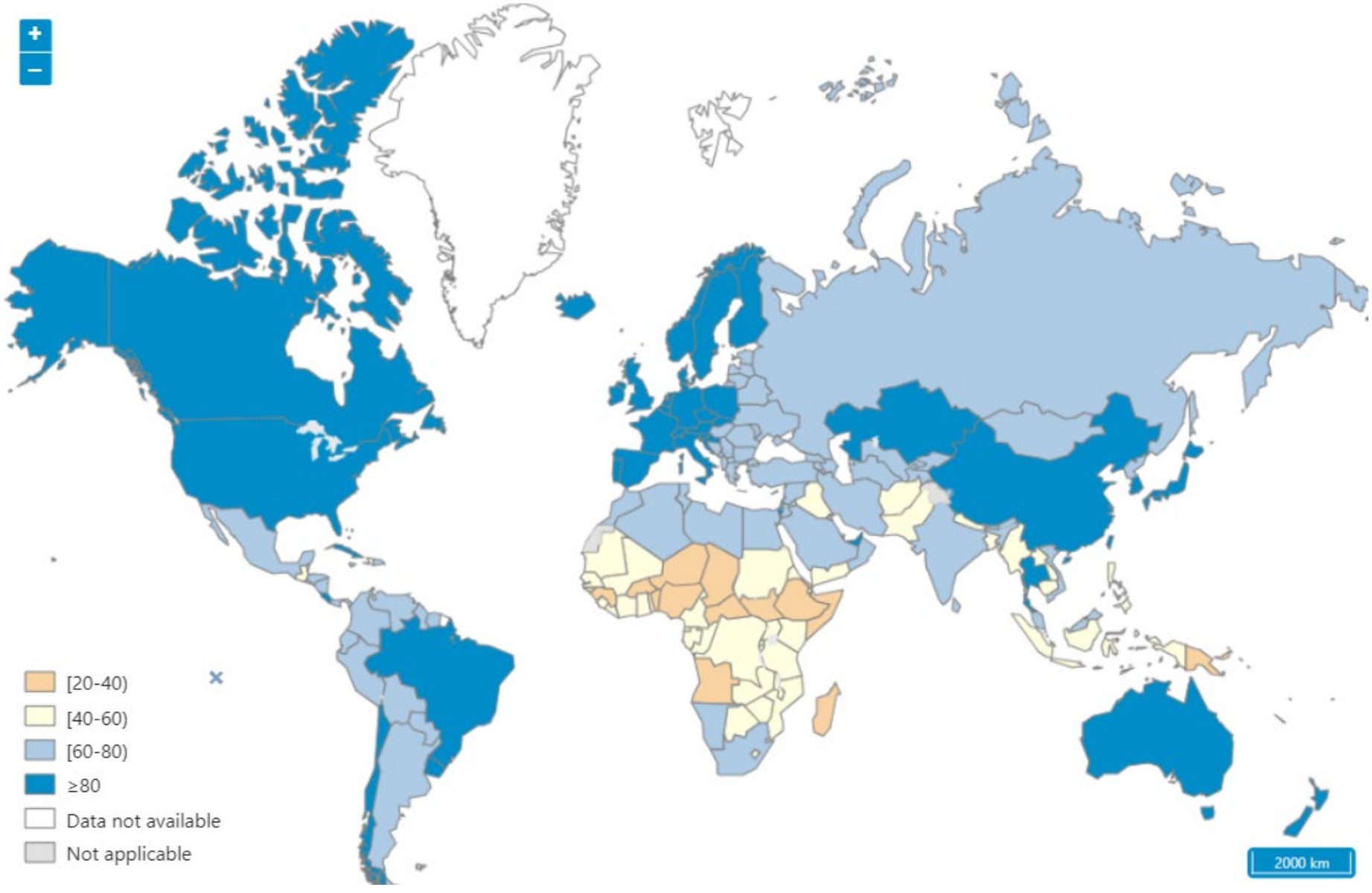
- Mortality surveys can provide evidence about the extent to which there is underdiagnosis of people with TB
- Recent example of a TB mortality survey conducted by the Public Health Foundation of India
  - A substantial proportion of TB that had gone undiagnosed (including by the private sector), and played an important role in validating model-based estimates
- Should such surveys be encouraged in other settings?
  - Standard approach

Feedback quotes

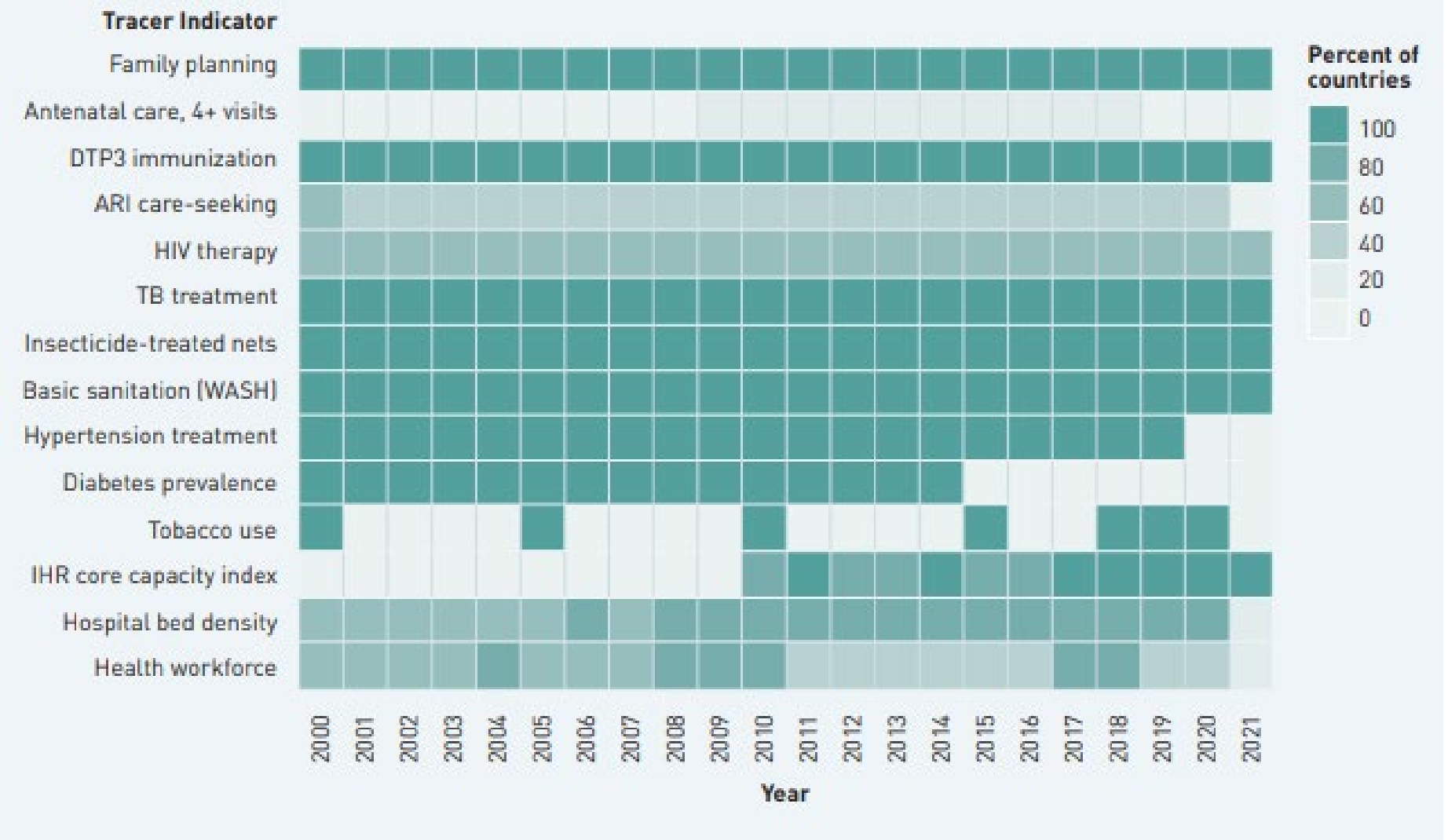
- “Where the mortality data are good enough, this represents a high-value strategy.”
- “promising approach - but requires further work. Not sure that there is a specific quantitative method proposed yet, that would be comparable across countries.”
- “The description of this approach is more limited than descriptions of other approaches, so it’s more difficult to evaluate.”
- “Not clear how it would be used as described in the write up.”

Extra slides: UHC SCI

UHC SCI in 2021 by country



Global coverage of tracer indicators



Trends in UHC SCI by sub-component, 2000–2021

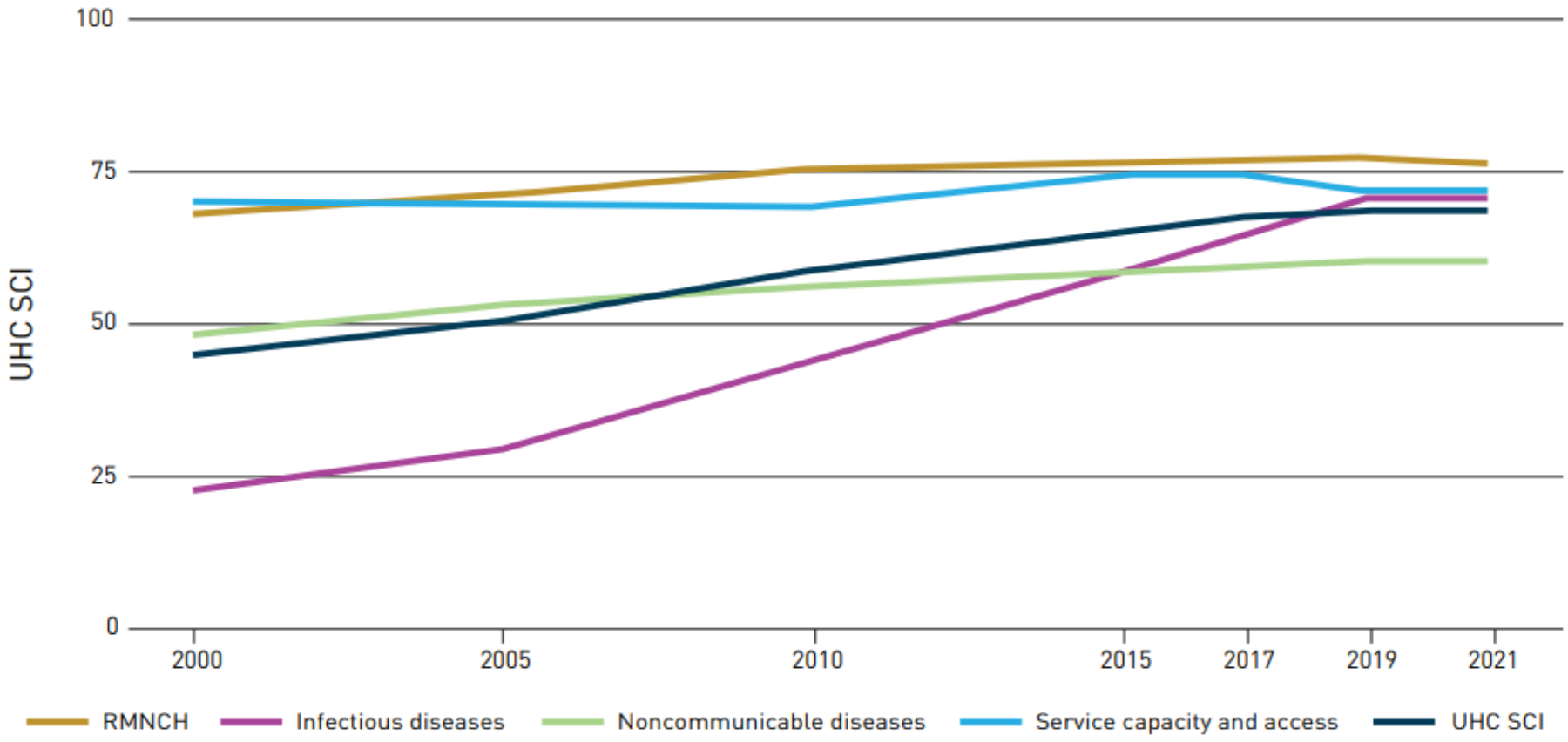


Table 1.1. Breakdown of SCI by indicator contribution, 2000–2021

Sub-index	Indicator	Contribution (%) to UHC SCI (SDG 3.8.1), 2000–2021
RMNCH	Family planning	2.4
	Antenatal care, 4+ visits	2.9
	DTP3 immunization	0.5
	ARI care-seeking	0.7
Infectious diseases	HIV ART	61.2
	TB treatment	4.4
	Insecticide-treated nets	3.5
	Basic sanitation (WASH)	7.4
Noncommunicable diseases (NCDs)	Hypertension treatment	11.4
	Diabetes prevalence	-3
	Tobacco non-use	6.4
Service capacity and access	IHR core capacity index	1.7
	Hospital bed density	-0.5
	Health workforce	1.2

Fig. 1.10. Gini coefficient of SCI by WHO region, 2000–2021