Modelling to explore the cost-effectiveness and resource implications of reaching the post-2015 targets

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Motivation I

- Post-2015 End TB strategy formalized goals for aggressive TB control:

  → TB incidence reduced by 50%, TB mortality reduced by 75% by 2025

- If goals to be achieved at global level, need major gains in high-burden countries

- TB-MAC convened a collaboration of TB modelling groups: can intensified TB control meet the global TB targets in China, India and South Africa?

Motivation II

- Countries need to understand cost-effectiveness and affordability of expanded TB control before committing to efforts
- In planning expanded TB control, what to do?

  → Multiple approaches which could be adopted, useful to compare relative costs and health impact of each
- TB places major economic burden on households, how will expanded TB control affect these costs?

The questions:

1. What is the cost-effectiveness of competing approaches for expanded TB control?
2. What are the resource requirements of expanded TB control?
3. How would expanded TB control impact the costs borne by patients and families?

Analytic approach I

- Collaboration of multiple TB modelling groups

Model	Model type	Age structure	Population strata	Countries
AuTuMN	DC	<15 and 15+	MDR/non-MDR-TB, care access. For South Africa: HIV/ART/CD4 status	CH, IN, SA
Harvard	DC	15+	HIV/ART/CD4 status, drug resistance, tx history, TB care access	CH, IN, SA
Hopkins	DC	15+	HIV/ART/CD4 status, MDR/non-MDR-TB	SA
ICPHFI	DC	15+	MDR/non-MDR-TB, tx history	IN
IDM	SM	Explicit age	MDR/non-MDR-TB, provider and tx history	CH
NTU	DC	15+	MDR/non-MDR-TB, health care system, tx history	CH
STAMP	SM	Monthly groups	Sex, tx history and type, time since infection and activation	IN
TIME	DC	<15 and 15+	HIV/ART/CD4 status, MDR/non-MDR-TB, tx history	CH, IN, SA
UGA	DC	<15 and 15+	HIV/ART status, MDR	SA

Analytic approach II

- Sought input from program experts in each country to define scenarios for expanded TB control

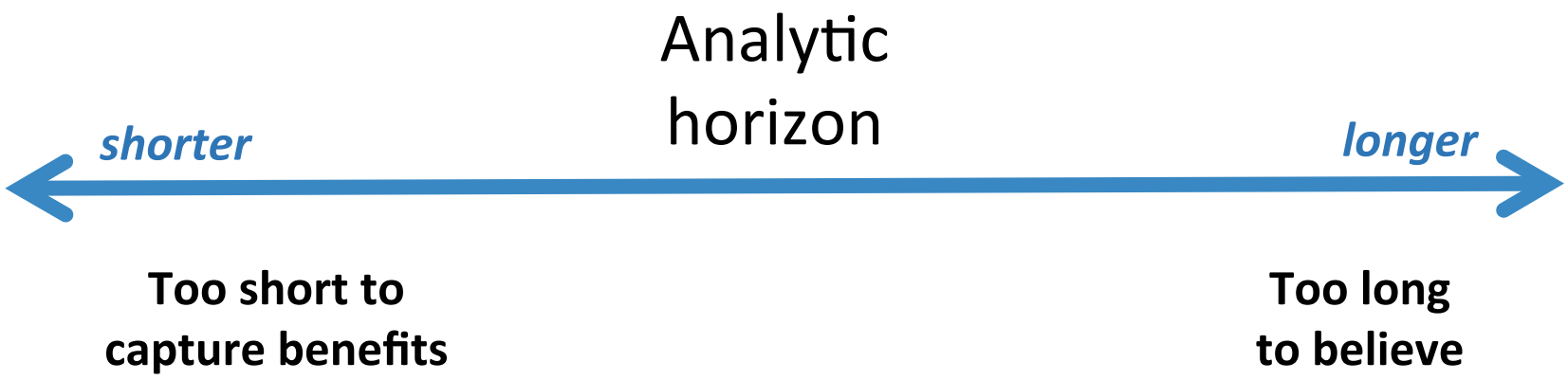
  e.g. Reduce default between diagnosis and treatment from 10% to 5%

- Worked with country experts to define activities required to achieve scenario goals

  e.g. Compensation for patient expenses assoc with diagnosis and treatment, follow-up of defaulters in community

Analytic approach III

- Each intervention scenario: scale-up of some intervention(s) over 10 years, then maintained at final level for following 10 years



Scenarios: China

Intervention scenario	Activities	Timing and program effects
Expanding access to care	Reimbursement of patient expenses, encourage TB care in designated hospitals, from CDCs	Population without TB care access from 5% to 3.75% by 2025. Population accessing high-quality care from 80% to 95% by 2025
Xpert MTB/RIF for TB diagnosis	Xpert replaces smear in routine diagnostic algorithm	Xpert MTB-RIF coverage from 0% to 100% by 2022
Improved treatment quality	Better referral systems and sample transport, reimbursement of patient expenses, Mhealth, case mgmt and adherence support. Better mgmt for MDR-TB treatment side-effects	Initial default from 3% to 1.5% by 2025 for DS-TB, and from 50% to 15% by 2025 for DR-TB. Treatment success from 82% to 90% by 2025 for DS-TB, and from 35% to 65% by 2025 for DR-TB
Combination	All above	All above

Scenarios: India

Intervention scenario	Activities	Timing and program effects
Expanding access to care	Subsidies for TB care in private sector, increased microscopy access in public sector	Pop without TB care access from 9.5% to 4.75% by 2022. Pop accessing high-quality care from 50% to 90% by 2022
Active case finding in the general pop	Mobile screening units with symptom screen/x-ray/Xpert	Population coverage of 1.6% for annual screening from 2015 to 2020
Xpert MTB/RIF for TB diagnosis	Xpert into routine diagnostic algorithm in public sector	Xpert MTB-RIF coverage from 0% to 30% by 2019
Improved treatment quality	Improve private sector quality: provider training, supervision & regulation, subsidies. Patient retention incentives, nutritional support, links to social welfare programs	Initial default from 10% to 5% by 2015 for DS-TB, and from 11% to 5% by 2020 for DR-TB. Treatment success from 75% to 85% by 2022 for DS-TB, and from 48% to 67% by 2022 for DR-TB
Combination	All above	All above

Scenarios: South Africa

Intervention scenario	Activities	Timing and program effects
Screening and IPT for individuals receiving ART	Screening of current and new ART patients, continuous IPT for all without active TB	Population without TB care access reaches from 5% to 0% by 2022
Expanding access to care	Outreach clinics to underserved areas, symptom screening in primary care	ART population on IPT from 5% to 80% by 2021
Improved treatment quality	Mhealth + patient follow up in community, adherence counseling, improved MDR-TB staffing	Initial default from 17% to 5% by 2021 for DS-TB, and 30% to 15% by 2021 for DR-TB. Treatment success from 76% to 85% by 2021 for DS-TB, and from 52% to 67% by 2025 for DR-TB
Combination	All above	All above

Analytic approach IV

- DALYs used as summary measure of health burden

  → Combine mortality and non-mortality benefits of TB control

- Costs assessed from multiple perspectives

  → **TB health services** (relevant for affordability)

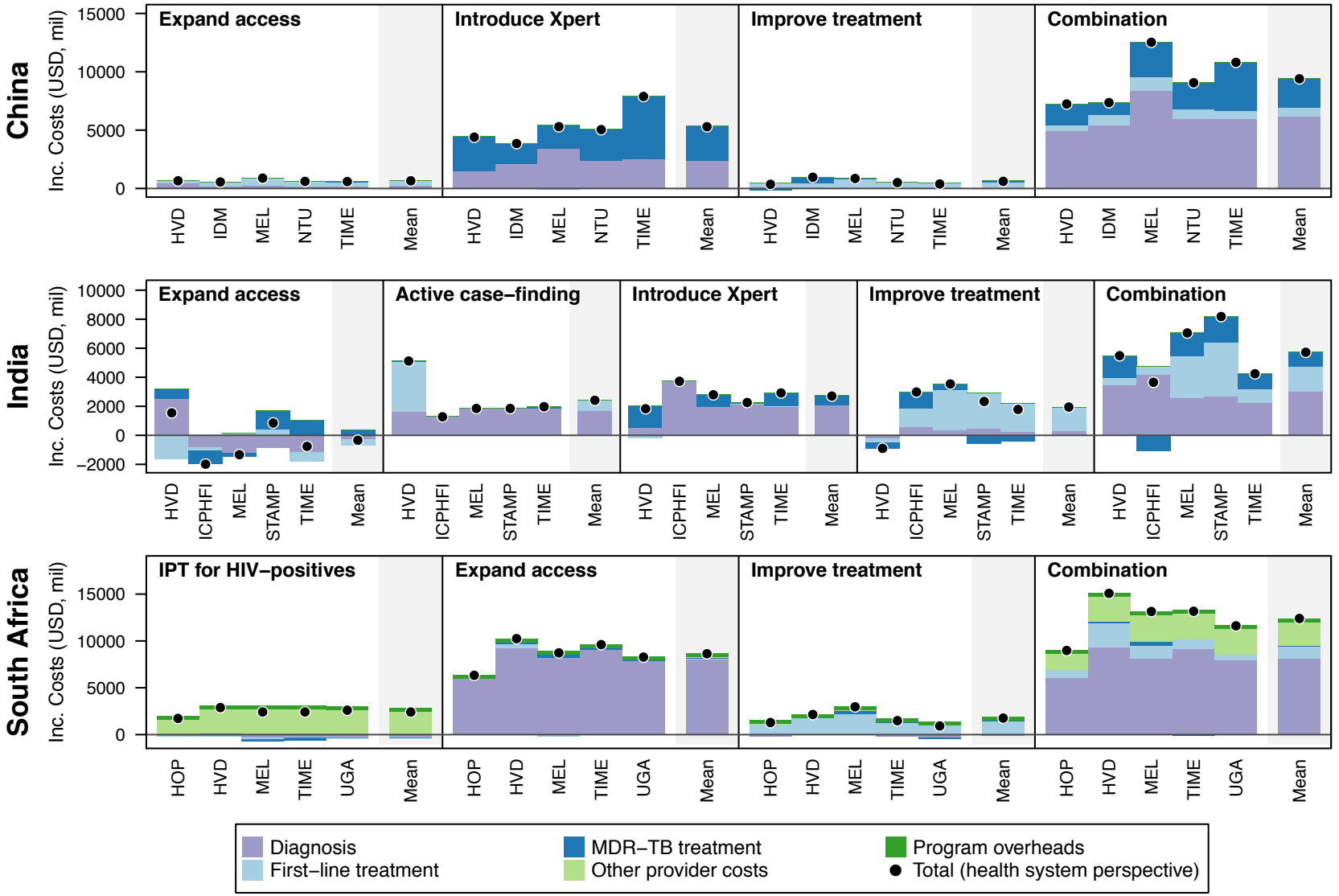
  = Diagnosis, 1st line tx, 2nd line tx, other costs, program overheads

  → **Patients and families** (relevant for economic burden)

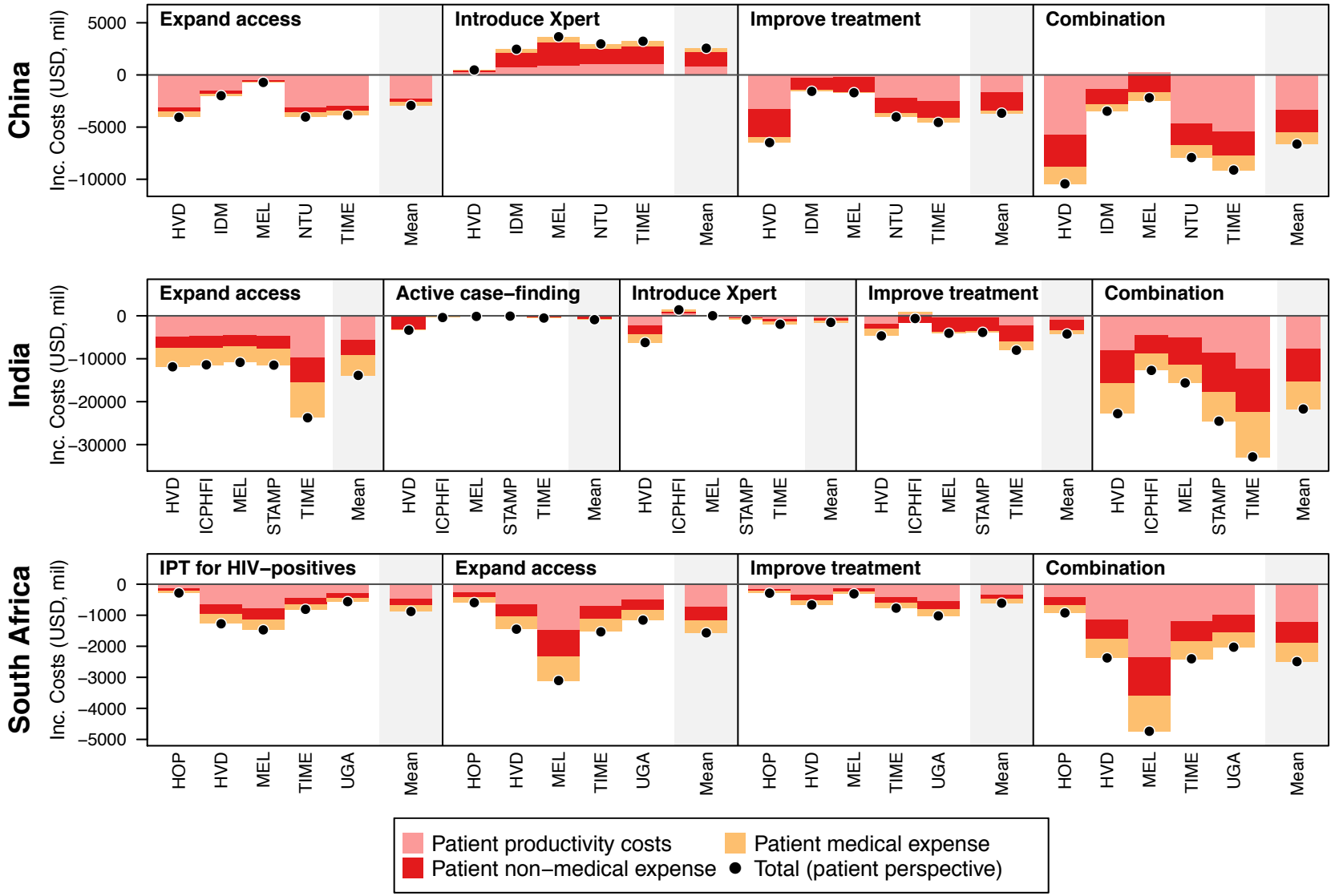
  = Productivity costs, patient medical + non-medical costs

  → **Societal** (sum of above)

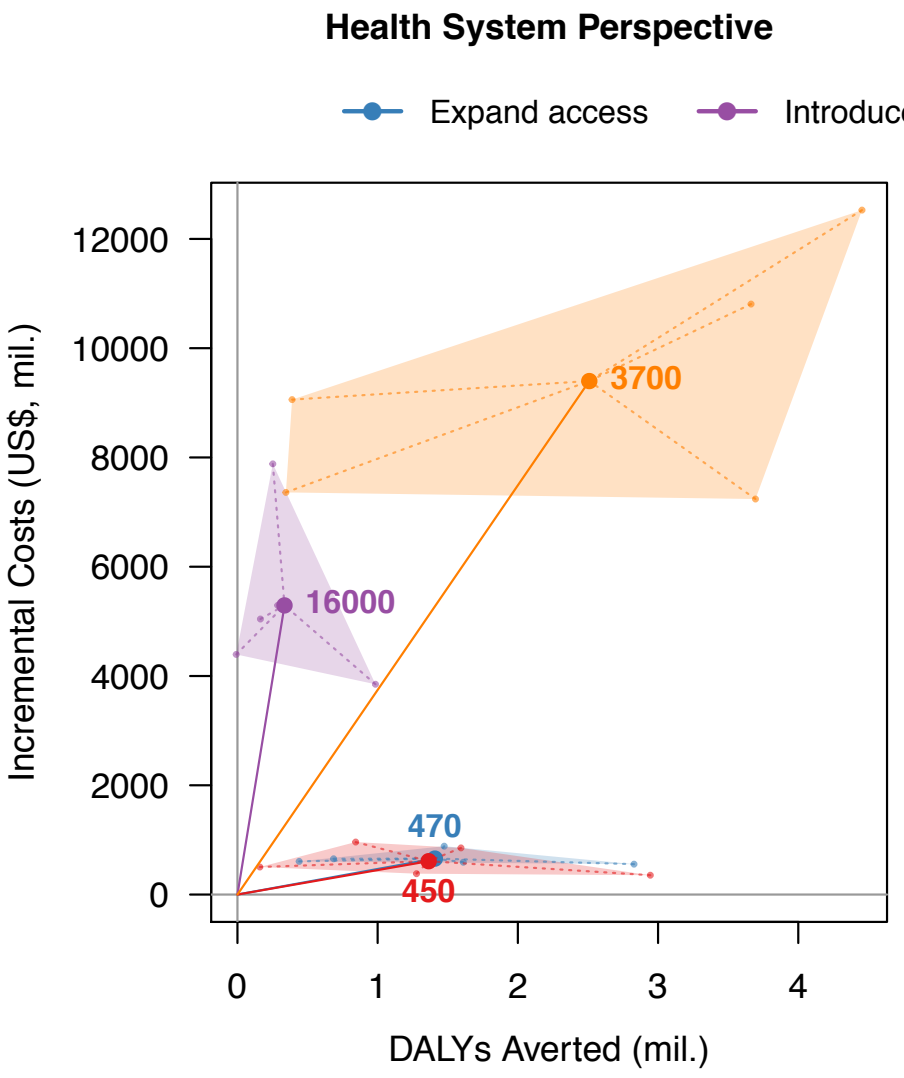
Health service costs

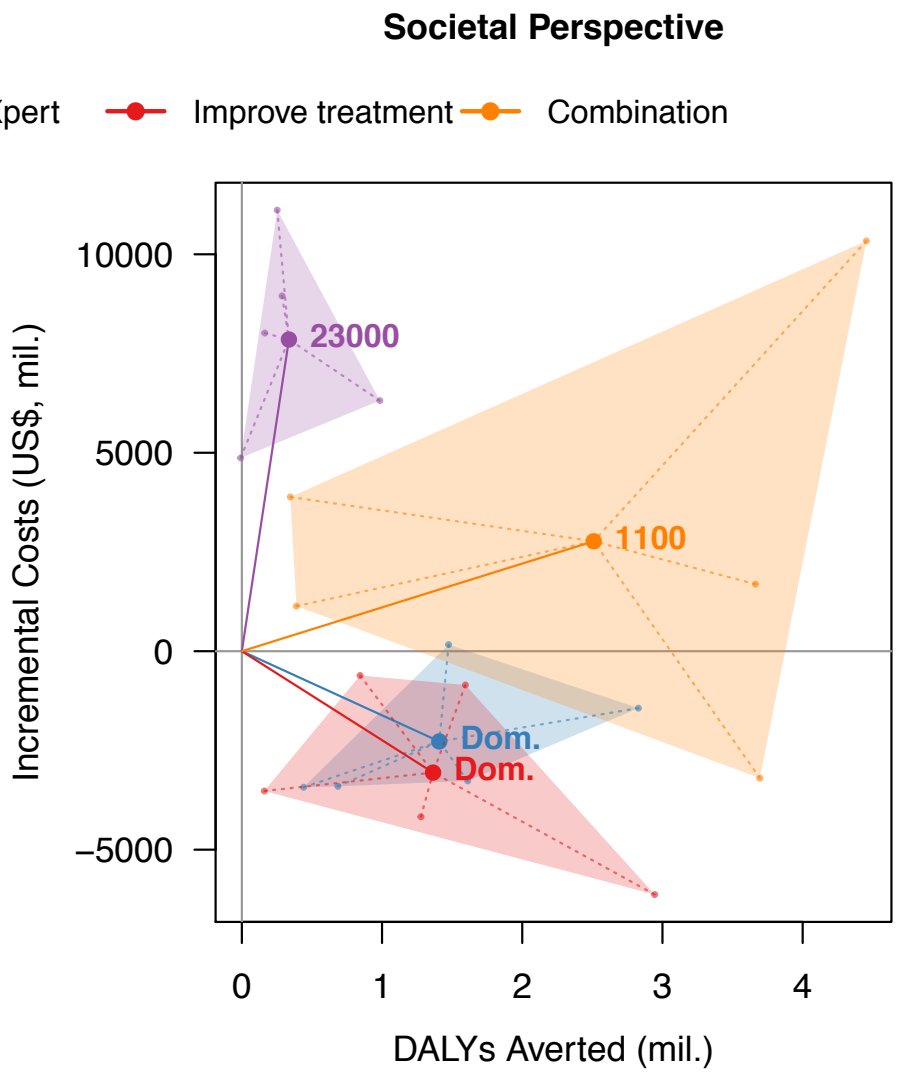


Patient costs

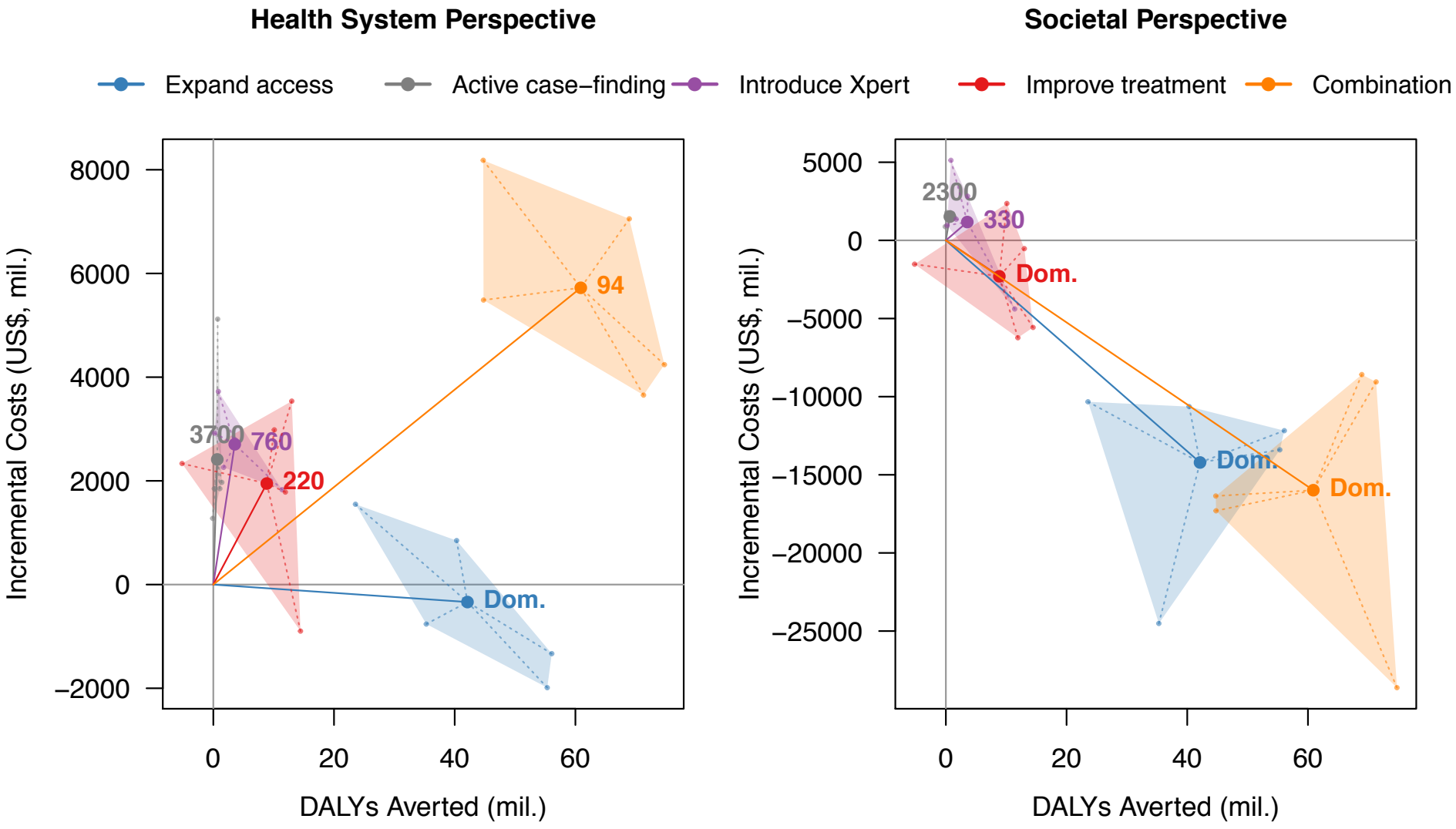


Cost-effectiveness, China

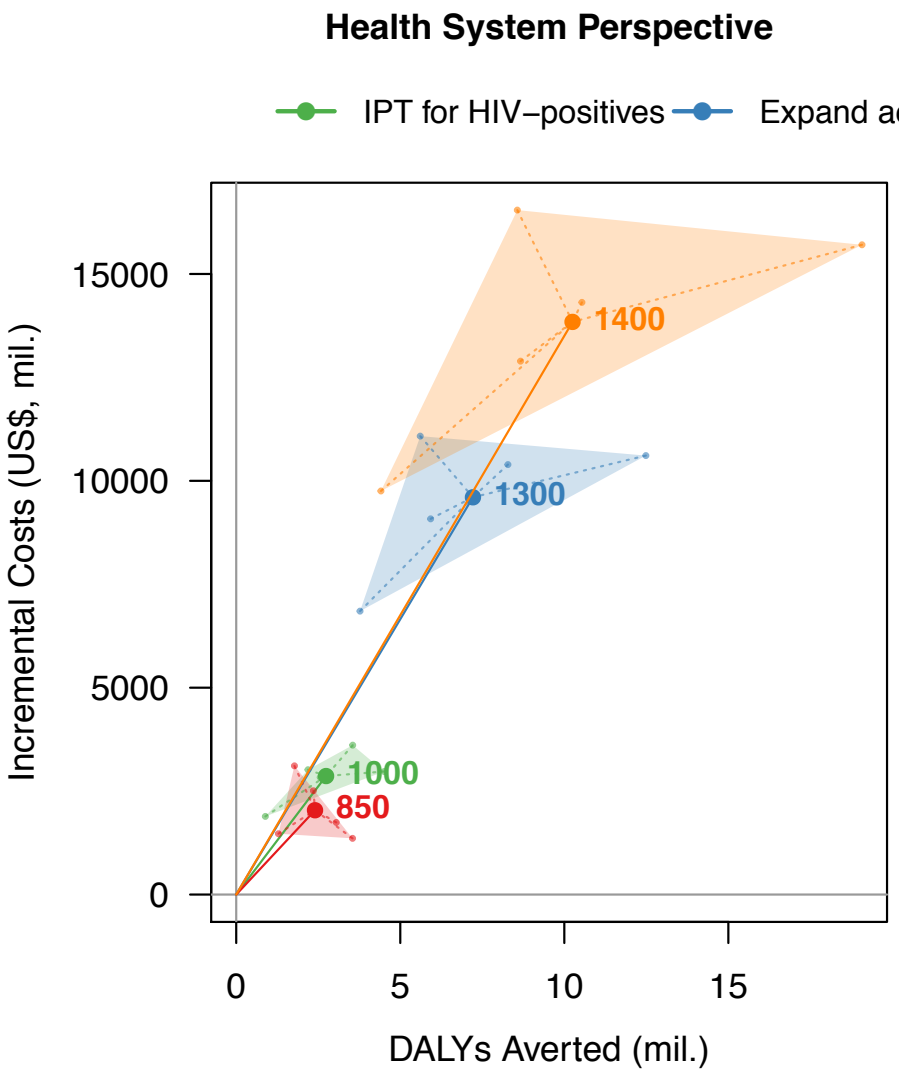


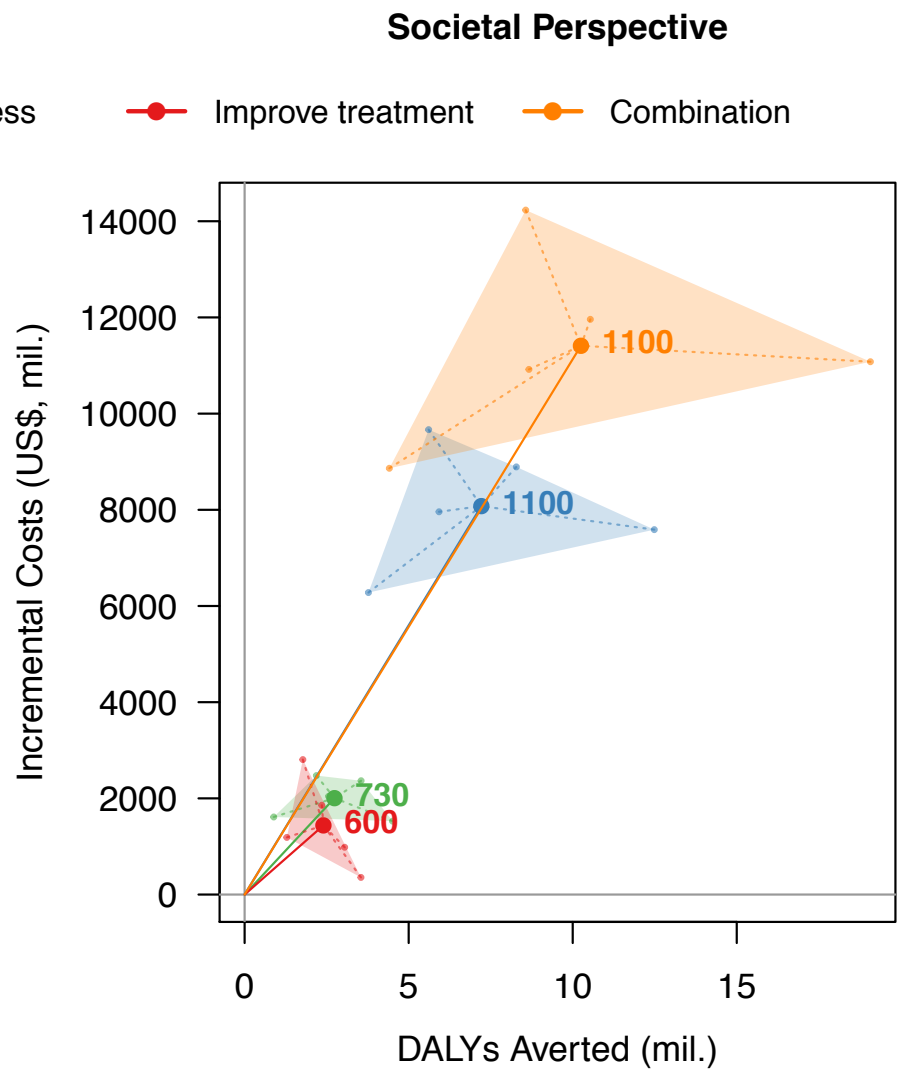


Cost-effectiveness, India

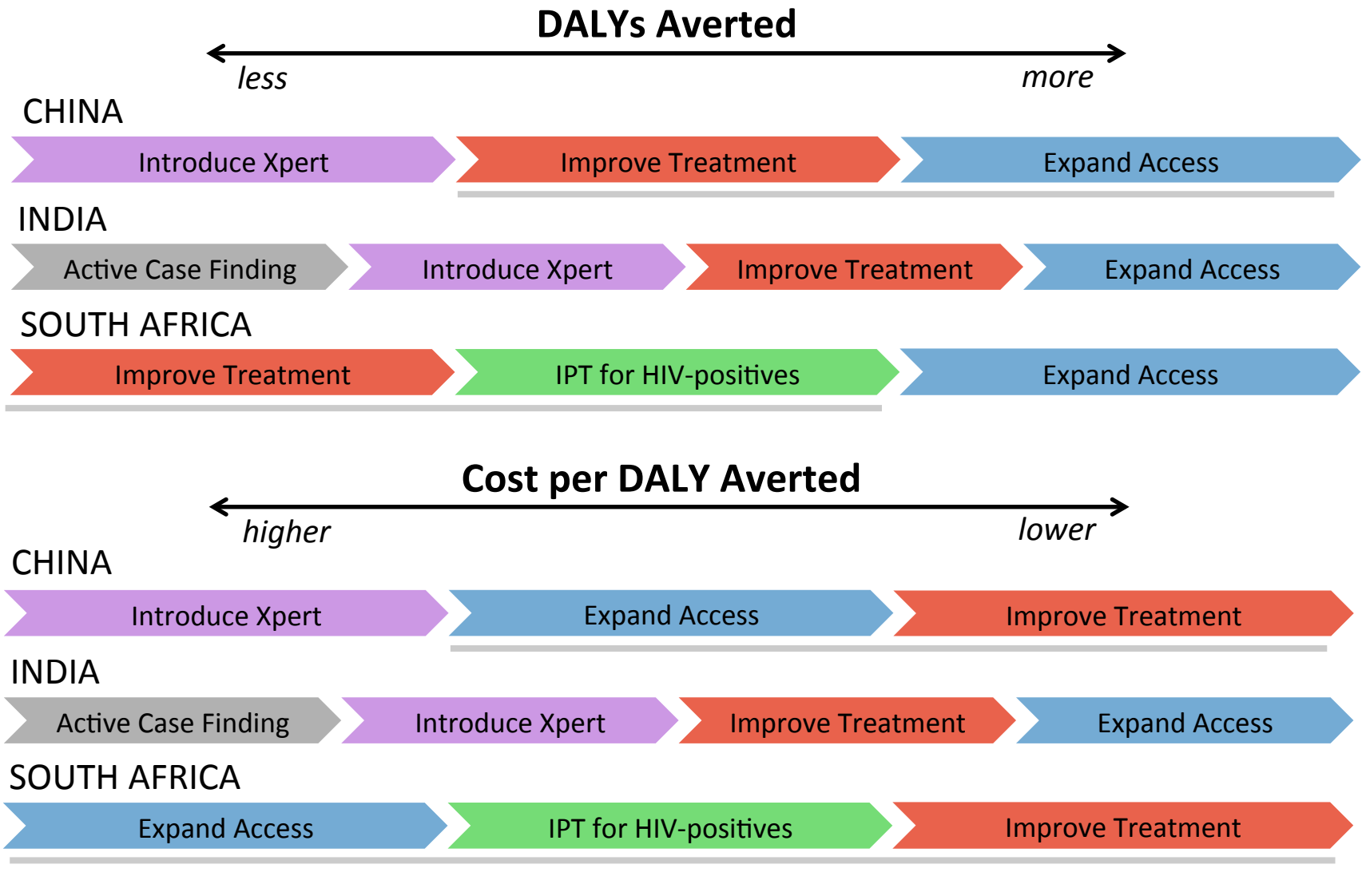


Cost-effectiveness, South Africa

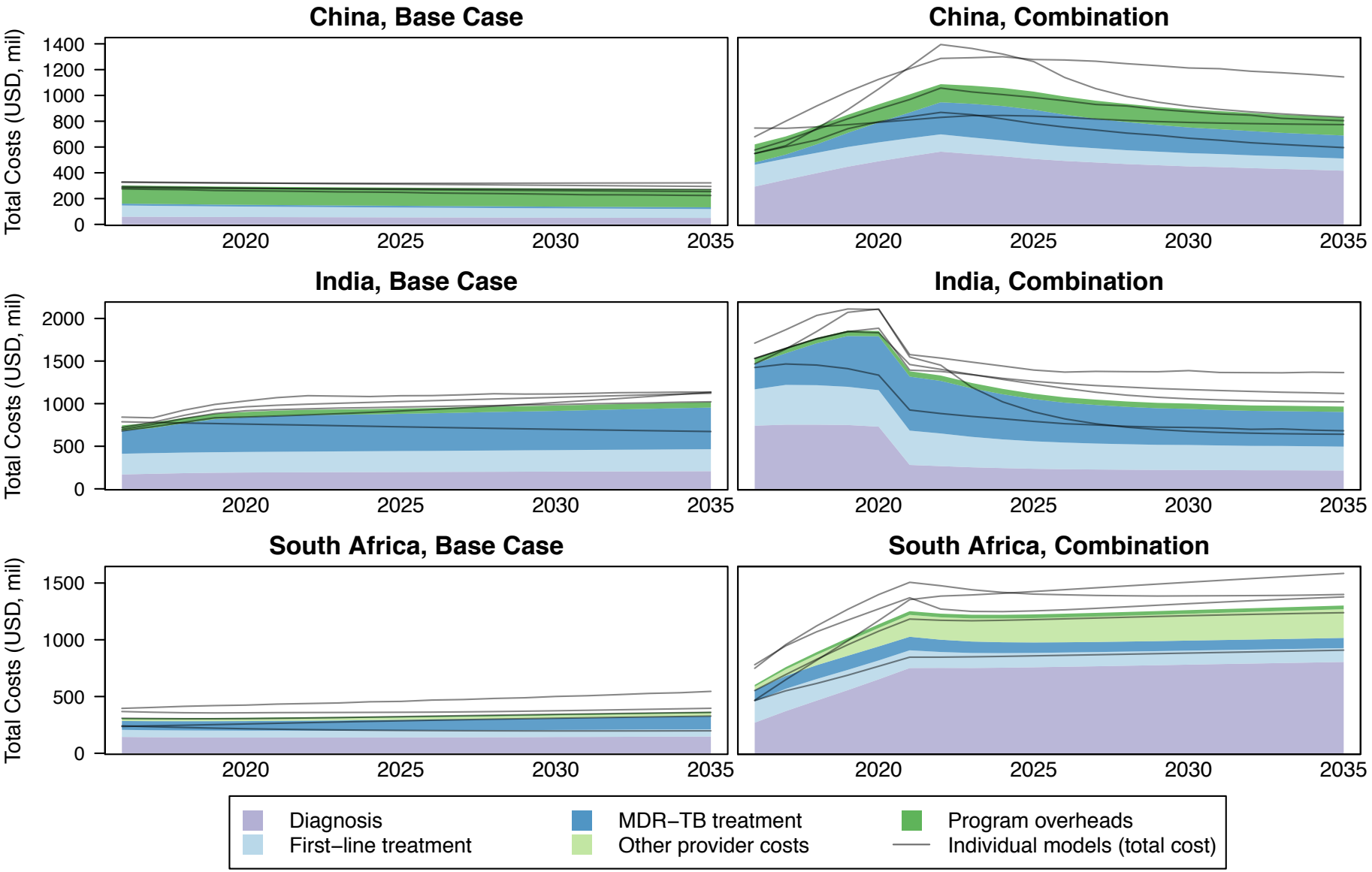




Rankings: impact, cost-effectiveness



Affordability?



Conclusions I

- Details of expanded TB control likely very different between countries
- Expanding access to care generally both impactful and efficient
- Impact of Xpert contingent on quality of MDR-TB treatment
- In general, aggressive TB control produces substantial reductions in patient economic burden

Conclusions II

- Many approaches appear 'highly cost-effective' vs. conventional CE thresholds, but…
- Substantial extra funding needed

  → Opportunity cost likely higher than default WTP, affordability questionable
- Substantial variation across models used for analysis

  → What we don't know matters to decision-making
- Comparisons = stylized example of decision problem countries face

  → Need to ask questions in context of local policy process

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