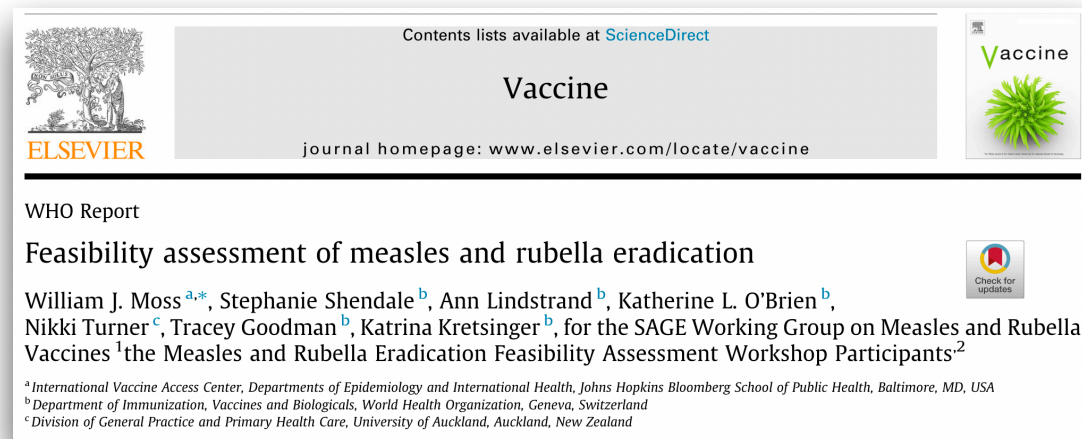


Various scenarios on resetting the target date for M&R elimination: Findings from modelling

14 March 2023

Introduction

This group conducted similar work for the WHO in 2018/2019



Contents lists available at [ScienceDirect](#)

Vaccine

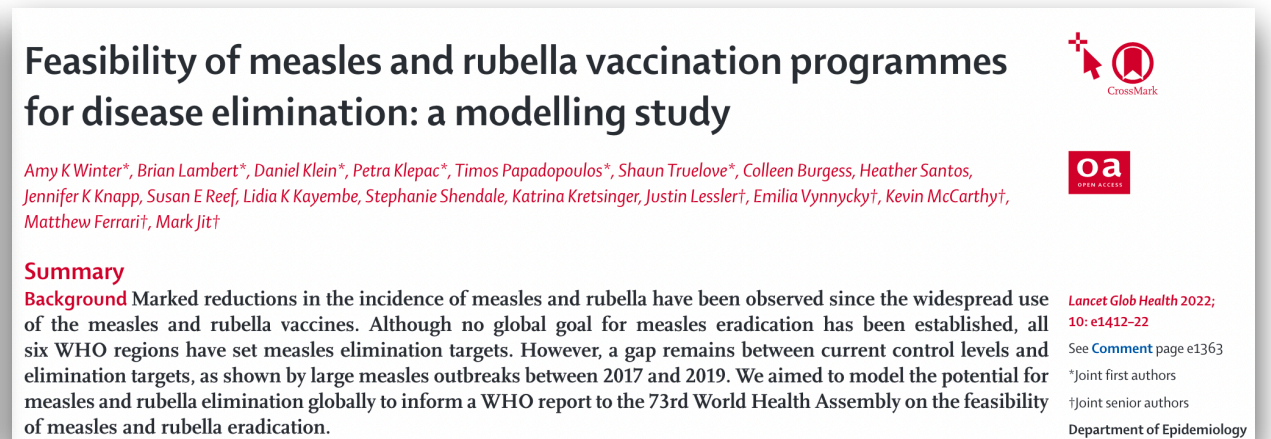
journal homepage: www.elsevier.com/locate/vaccine

WHO Report

Feasibility assessment of measles and rubella eradication

William J. Moss^{a,*}, Stephanie Shendale^b, Ann Lindstrand^b, Katherine L. O'Brien^b, Nikki Turner^c, Tracey Goodman^b, Katrina Kretsinger^b, for the SAGE Working Group on Measles and Rubella Vaccines¹ the Measles and Rubella Eradication Feasibility Assessment Workshop Participants²

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Feasibility of measles and rubella vaccination programmes for disease elimination: a modelling study

Amy K Winter^{*}, Brian Lambert^{*}, Daniel Klein^{*}, Petra Klepac^{*}, Timos Papadopoulos^{*}, Shaun Truelove^{*}, Colleen Burgess, Heather Santos, Jennifer K Knapp, Susan E Reef, Lidia K Kayembe, Stephanie Shendale, Katrina Kretsinger, Justin Lessler[†], Emilia Vynnycky[‡], Kevin McCarthy[†], Matthew Ferrari[†], Mark Jit[†]

Summary
Background Marked reductions in the incidence of measles and rubella have been observed since the widespread use of the measles and rubella vaccines. Although no global goal for measles eradication has been established, all six WHO regions have set measles elimination targets. However, a gap remains between current control levels and elimination targets, as shown by large measles outbreaks between 2017 and 2019. We aimed to model the potential for measles and rubella elimination globally to inform a WHO report to the 73rd World Health Assembly on the feasibility of measles and rubella eradication.

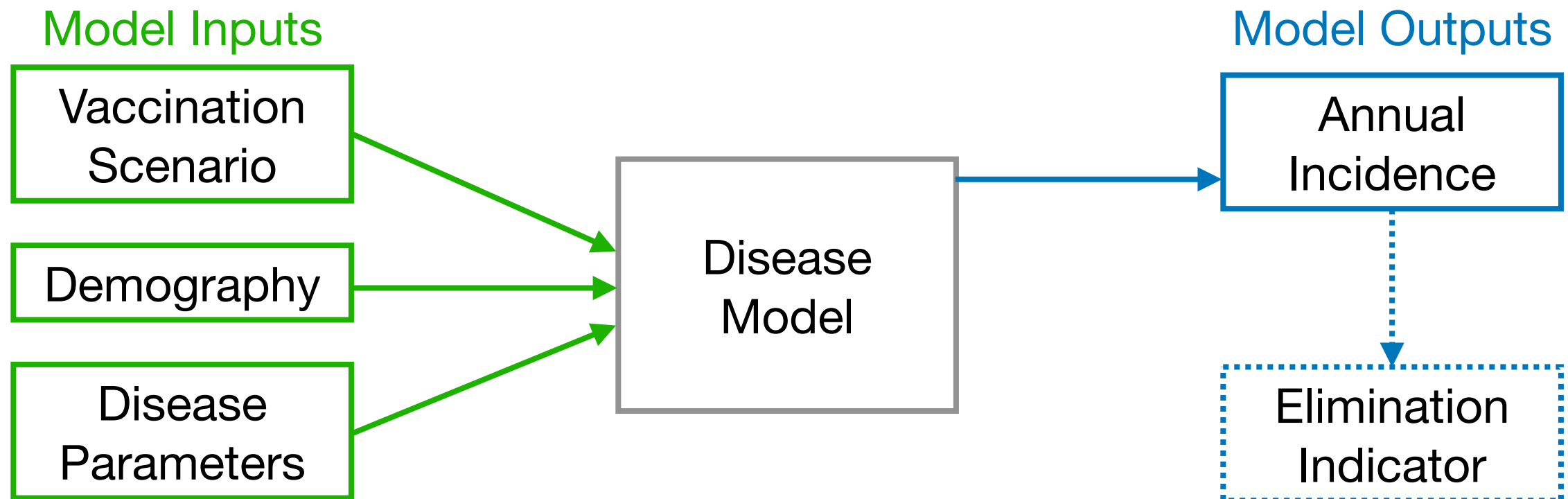
Lancet Glob Health 2022; 10: e1412-22
See [Comment](#) page e1363
^{*}Joint first authors
[†]Joint senior authors
Department of Epidemiology

Vaccine Impact Modelling Consortium (VIMC)

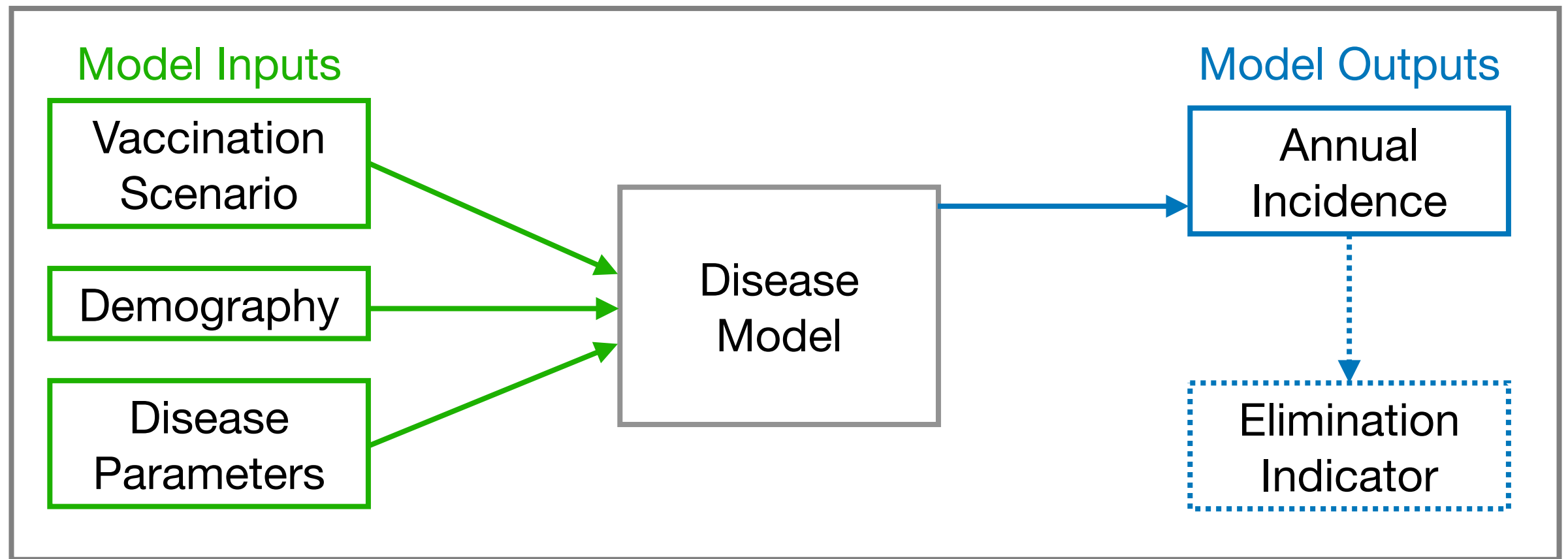


- Measles: Pennsylvania State University (PSU)
- Measles: Dynamic Measles Immunisation Calculation Engine (DynaMICE)
- Rubella: University of Georgia (UGA)
- Rubella: UK Health Security Agency (UKHSA)

Overview of the modelling work



Overview of the modelling work



200 model runs (i.e., simulations) for each country

Conditions for achieving elimination

Elimination Indicator:

Are the conditions for elimination achieved?
 ≤ 5 annual infections per million people

Achieving Elimination vs Maintaining Elimination

(getting to zero)

(staying at zero)

Conditions for achieving elimination

Elimination Indicator:

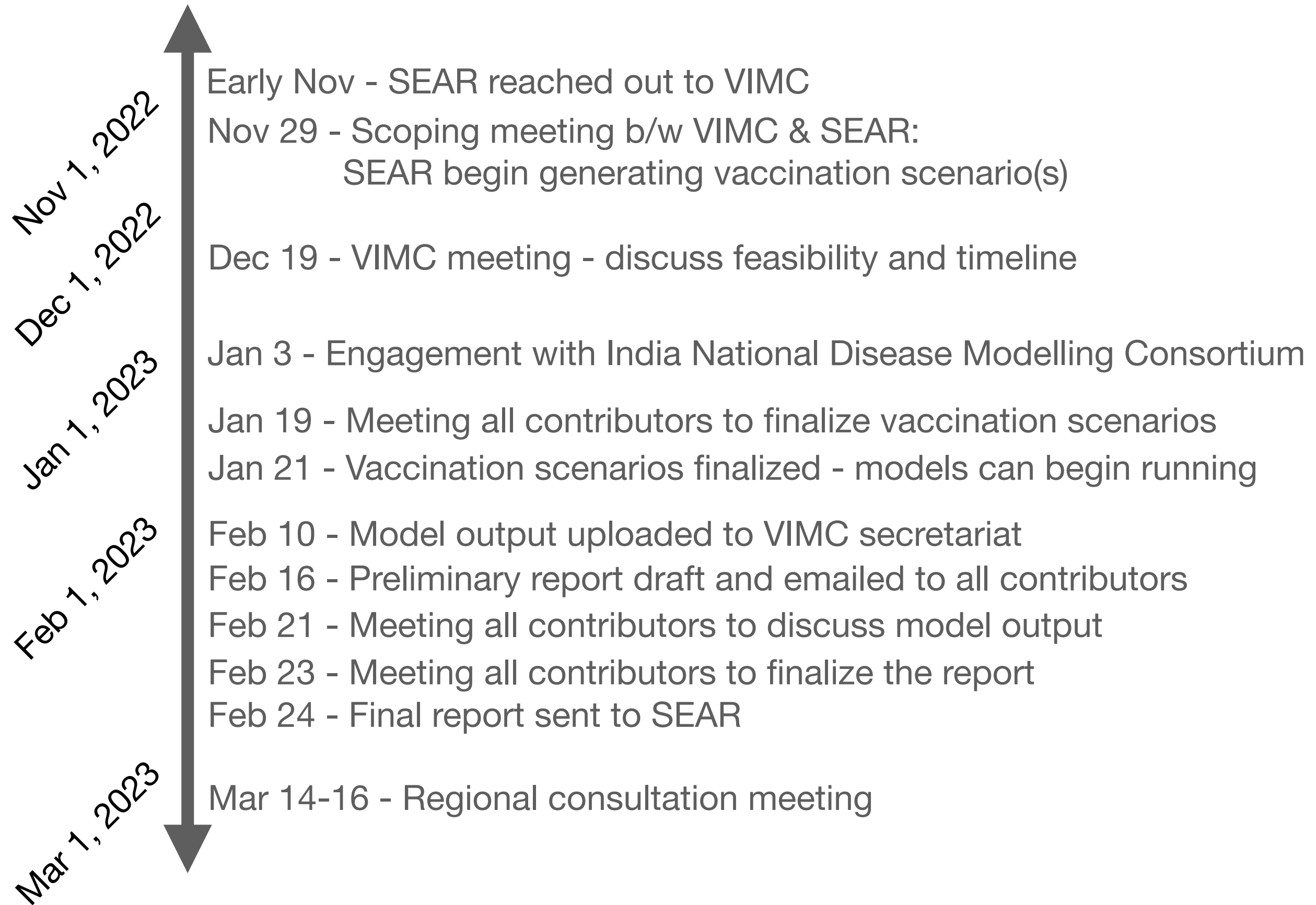
Are the conditions for elimination achieved?
 ≤ 5 annual infections per million people

Summarized in two ways:

1. **The probability that conditions for elimination are met in any given year** - the year-specific proportion of 200 simulations in which the annual incidence is less than or equal to 5.
2. **The cumulative probability that the conditions for elimination have been met by a given year** - the proportion of 200 simulations in which the annual incidence of less than or equal to 5 has been met by a given year

SEAR Measles and Rubella Elimination Project

Project Timeline



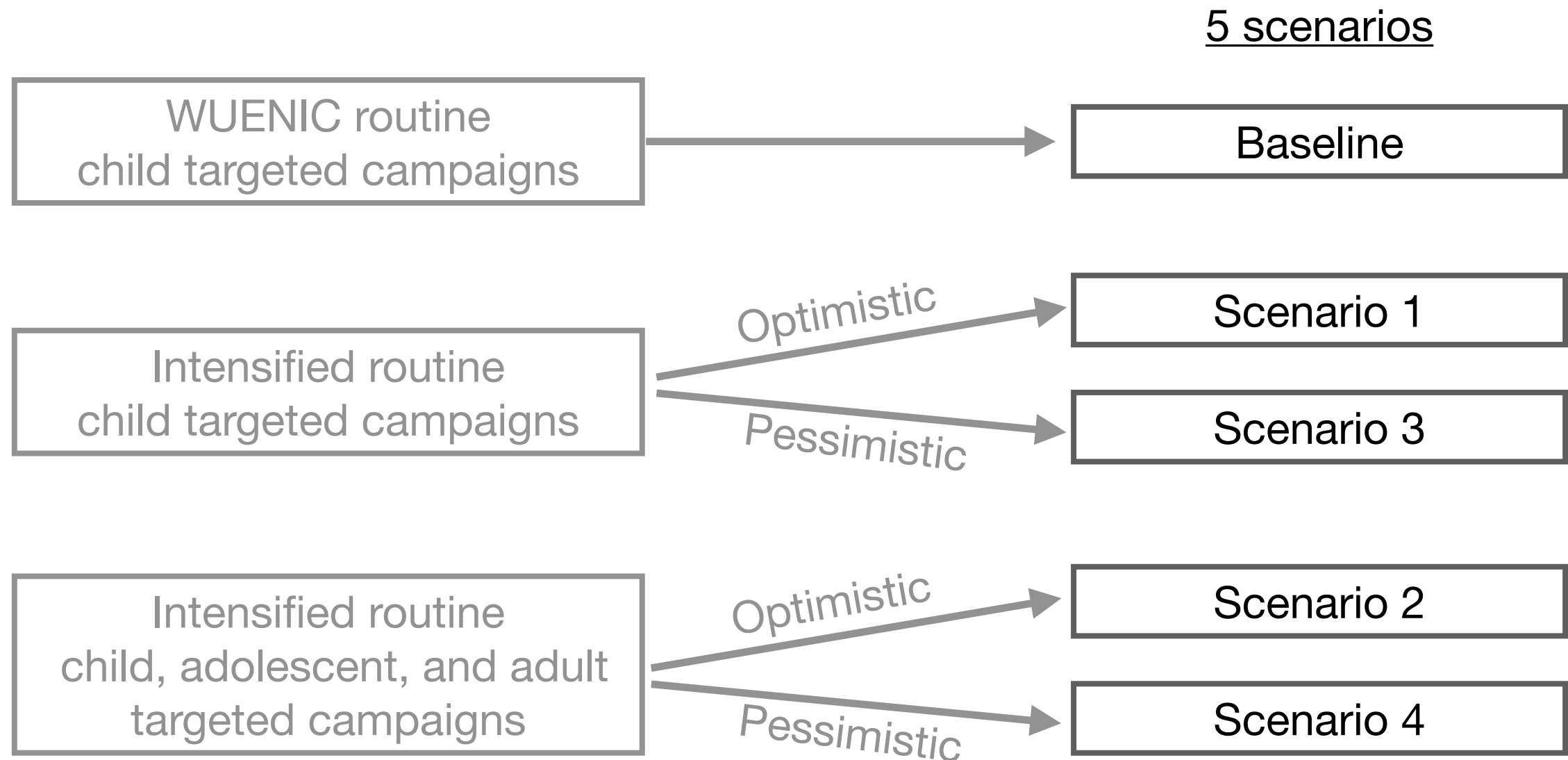
Project Details

- Time of interest: 2022 to 2040
- Countries of interest: Bangladesh, India, Indonesia, Myanmar, Nepal, Thailand
- 2 models for each disease simulated 200 times for each country
- 5 vaccination scenarios

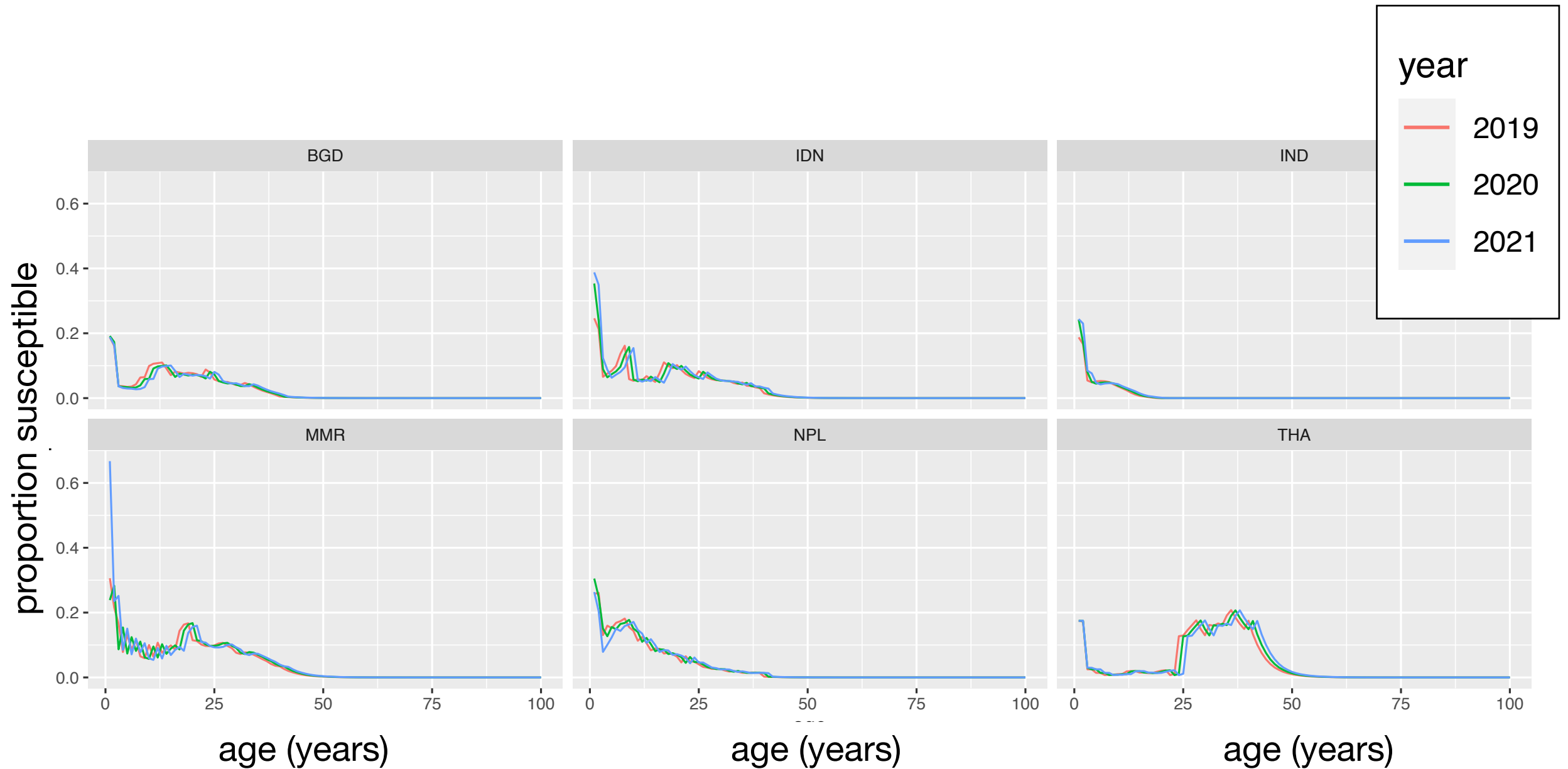
Vaccination Scenarios

The vaccination scenarios specify:

- routine (MR1 and MR2) vaccination coverages
- MR vaccination campaign timing, age targets, and coverage



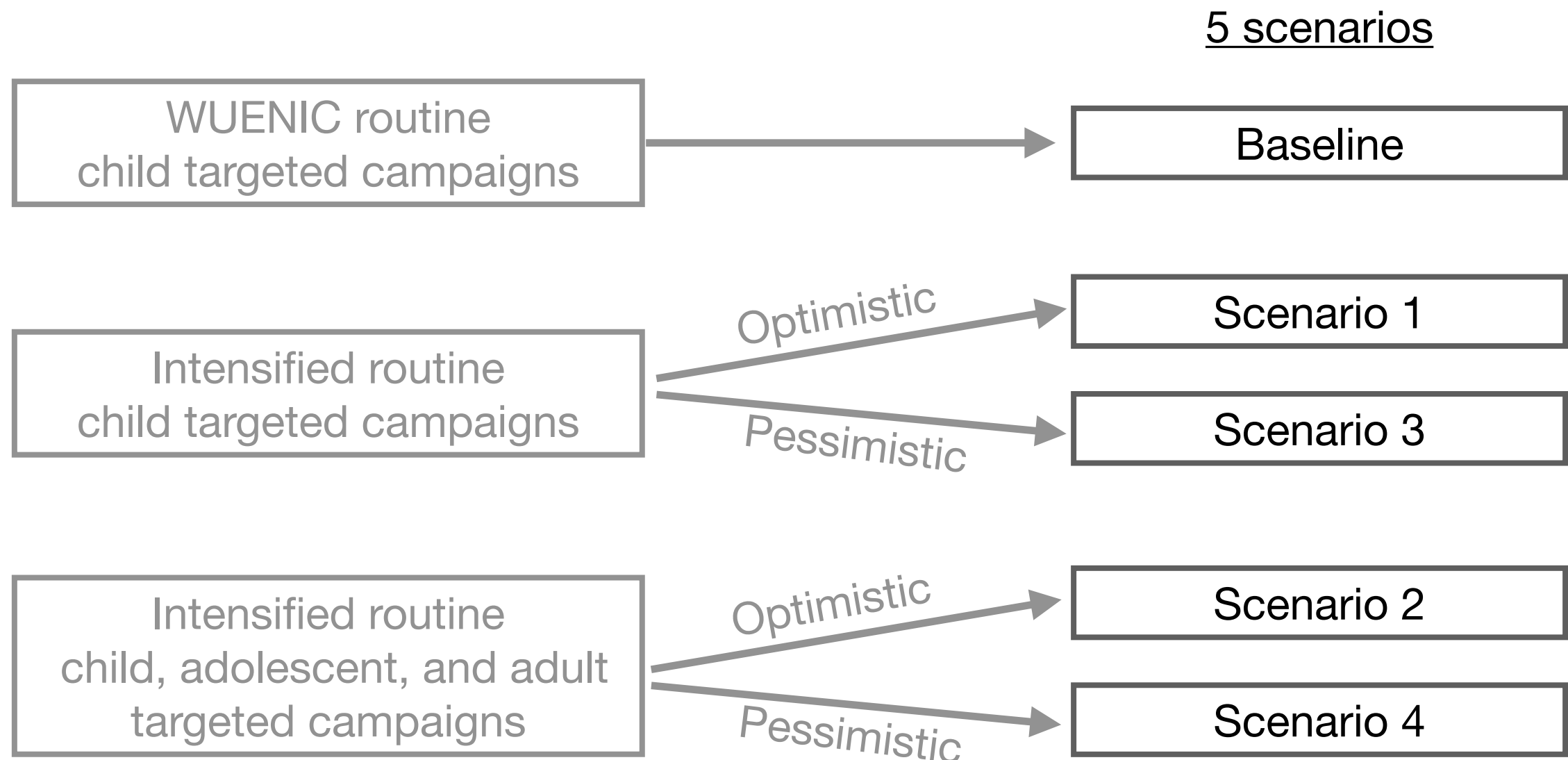
Measles Nowcast: Age-Specific Proportion Susceptible by country 2019-2021, per the PSU model



Vaccination Scenarios

The vaccination scenarios specify:

- routine (MR1 and MR2) vaccination coverages
- MR vaccination campaign timing, age targets, and coverage



Conclusions

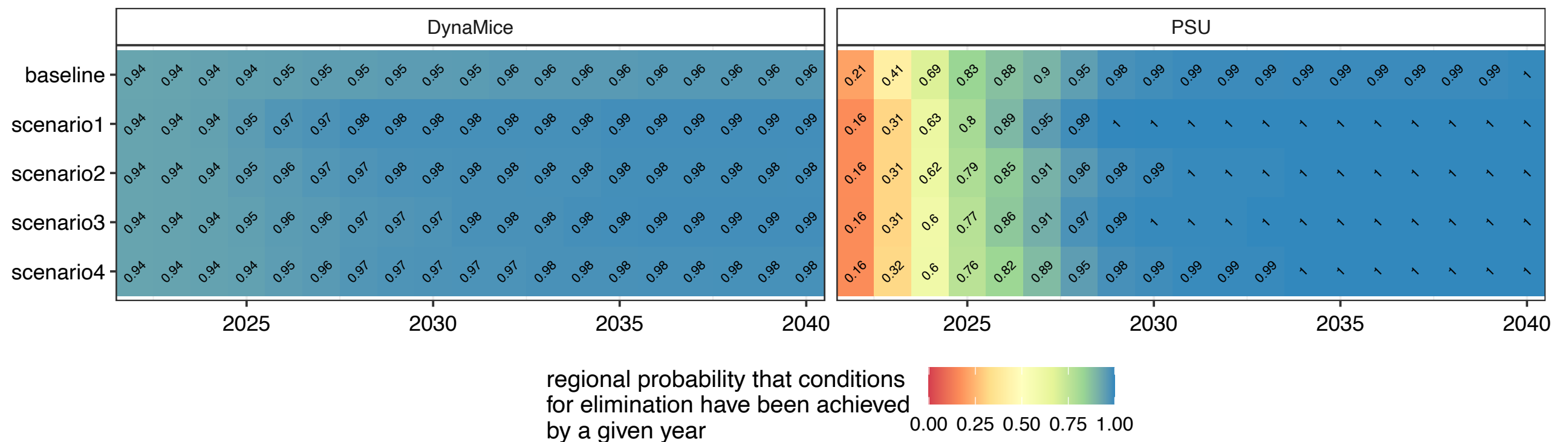
1. Achieving the conditions necessary for rubella elimination is highly probable for all vaccination scenarios by 2025

2. Achieving the conditions necessary for measles elimination is probable under these vaccination scenarios.

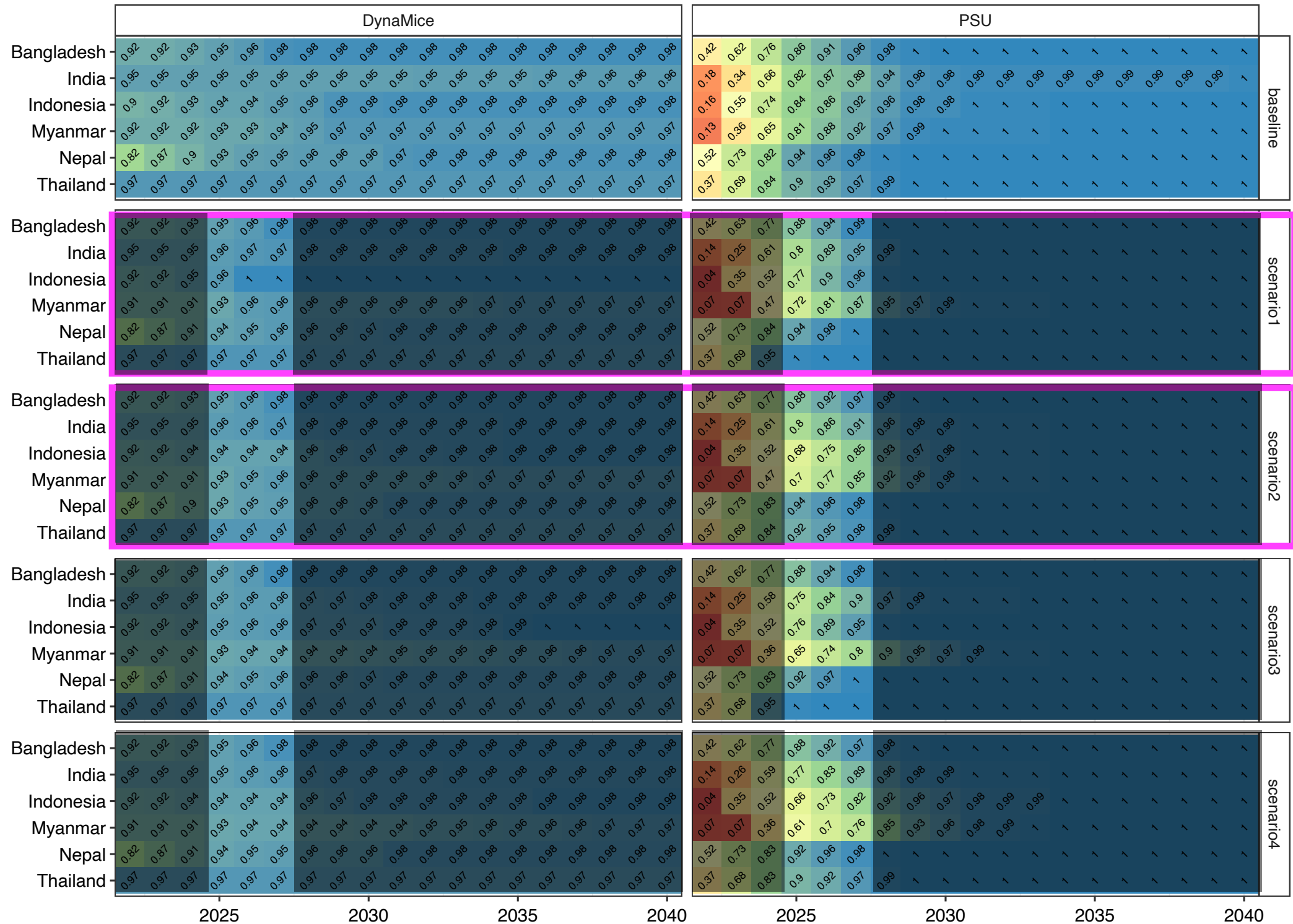
- By 2025 and 2026, the regional probability of achieving the conditions for elimination for all vaccination scenarios are at least 76% and 89%, respectively
- The timing and probability of achieving the conditions for elimination differ across vaccination scenario for each country

Regional Probability of Achieving the Conditions for Measles Elimination by a Given Year

The regional probability of a population-weighted average of country-specific probabilities that elimination is achieved by a given year



Country-Specific Probability of Achieving the Conditions for Measles Elimination by a Given Year

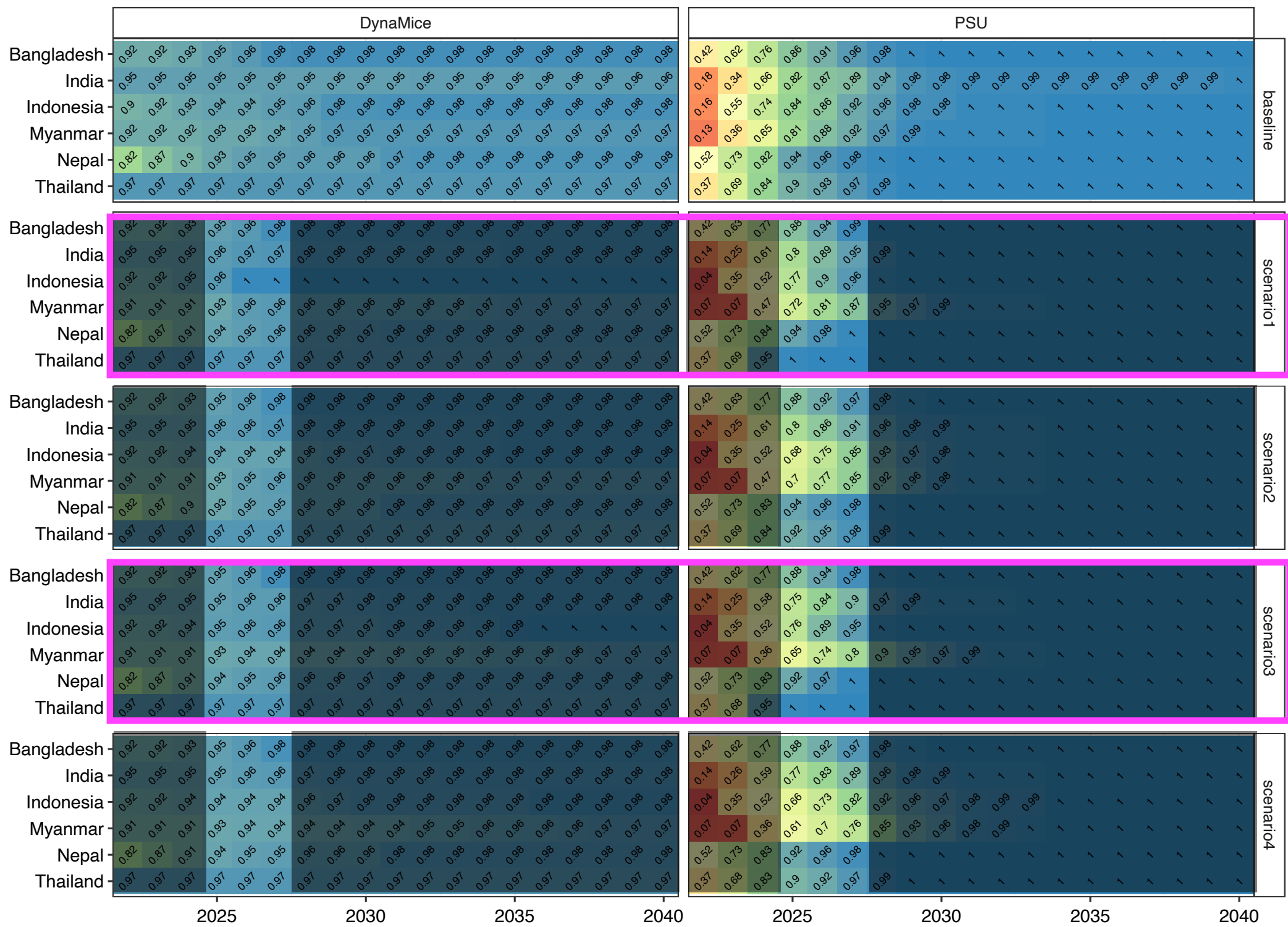


Optimistic Scenarios

probability that conditions for elimination have been achieved by a given year

0.00 0.25 0.50 0.75 1.00

Country-Specific Probability of Achieving the Conditions for Measles Elimination by a Given Year



Adult/Adolescent Scenarios

probability that conditions for elimination have been achieved by a given year

0.00 0.25 0.50 0.75 1.00

Conclusions

1. Achieving the conditions necessary for rubella elimination is highly probable for all vaccination scenarios by 2025

2. Achieving the conditions necessary for measles elimination is probable under these vaccination scenarios.

- By 2025 and 2026, the regional probability of achieving the conditions for elimination for all vaccination scenarios are at least 76% and 89%, respectively
- The timing and probability of achieving the conditions for elimination differ across vaccination scenario for each country

Contributors

WHO South-East Asia (Sudhir Khanal, Sunil Bahl, Patrick O'Connor)

US Centers for Disease Control and Prevention (Michelle Morales)

Bill and Melinda Gates Foundation (Arindam Ray, Niket Thakkar)

India National Disease Modelling Consortium (Siuli Mukhopadhyay, Rama Pal)

Vaccine Impact Modelling Consortium (Caroline Trotter, Kim Woodruff, Anna-Maria Hartner, Matt Ferrari, Emilia Vynnycky, Timos Papadopoulos, Mark Jit, Han Fu, Amy Winter)

Funding: The Bill and Melinda Gates Foundation, Gavi the Vaccine Alliance

Supplemental Slides

Figure 1: Probability that the conditions for rubella elimination (≤ 5 infections per one million population) have been achieved by a given year (x-axis) for each country (y-axis), scenario (panel rows), and model (panel columns)

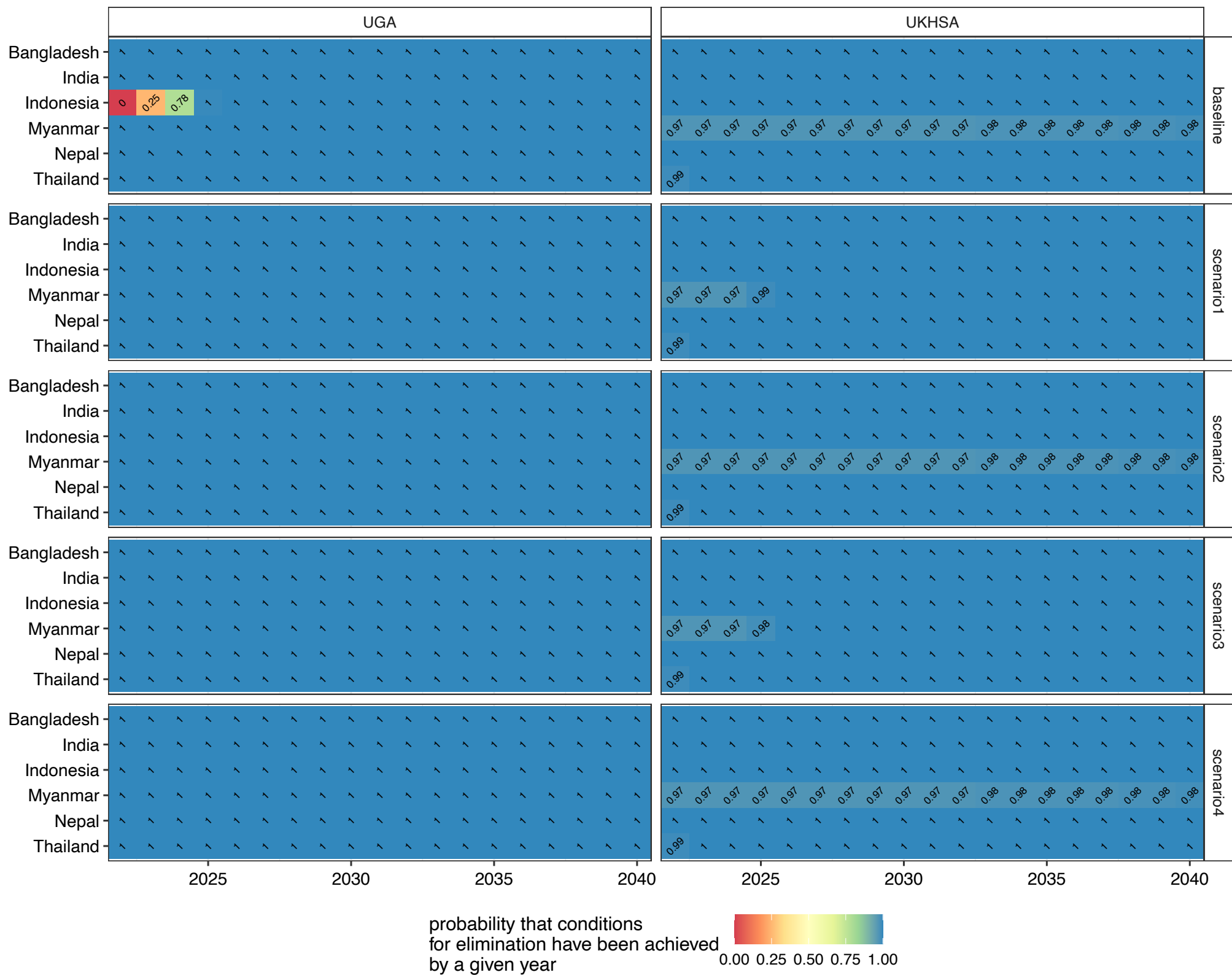


Figure 2: Annually estimated mean number of CRS cases (2022 - 2040) for each scenario (panel rows), model (panel columns), and country (colors)

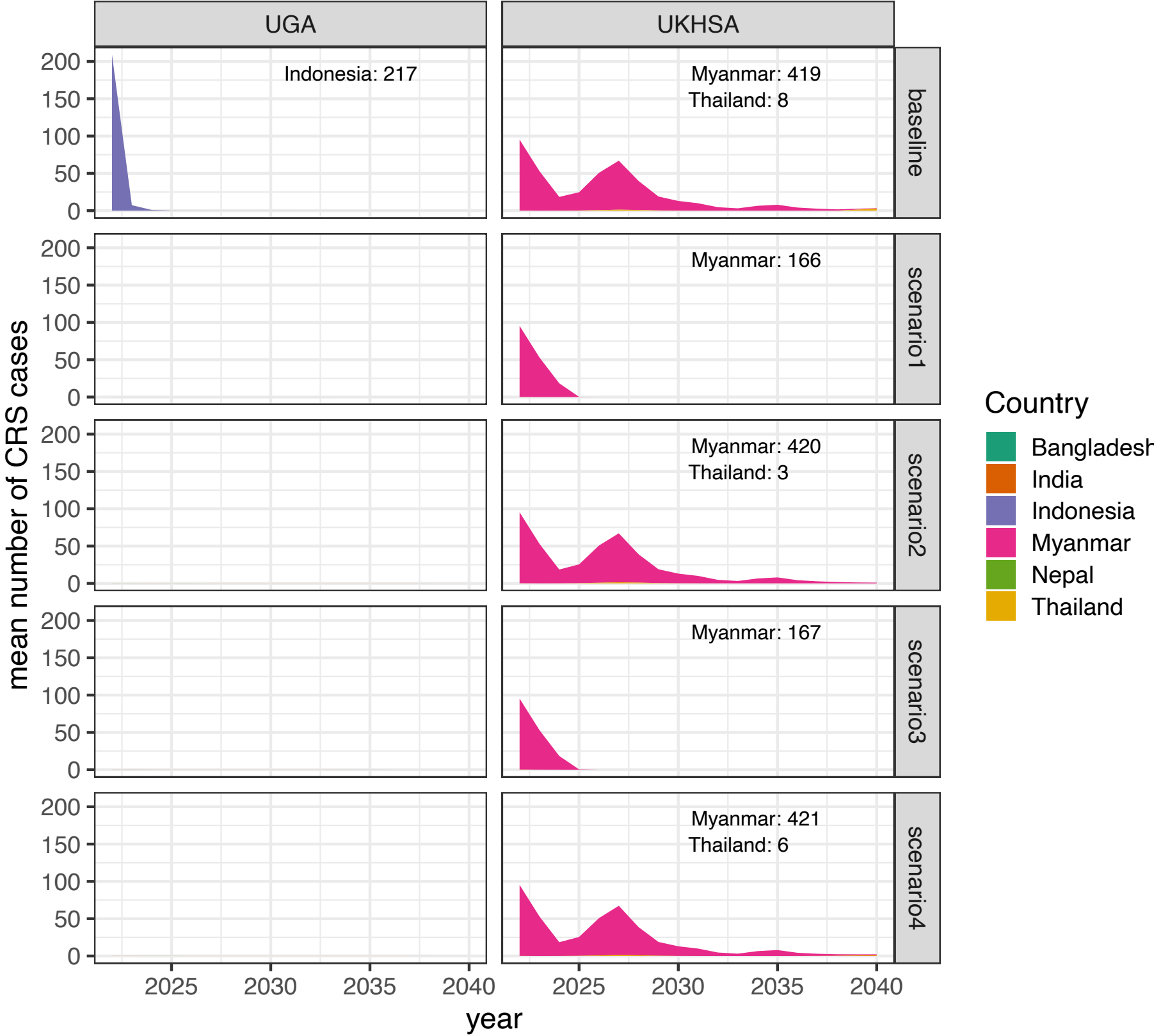


Figure 3: Annually estimated mean number of measles infections (2022 - 2040) for each scenario (panel rows), model (panel columns), and country (colors)

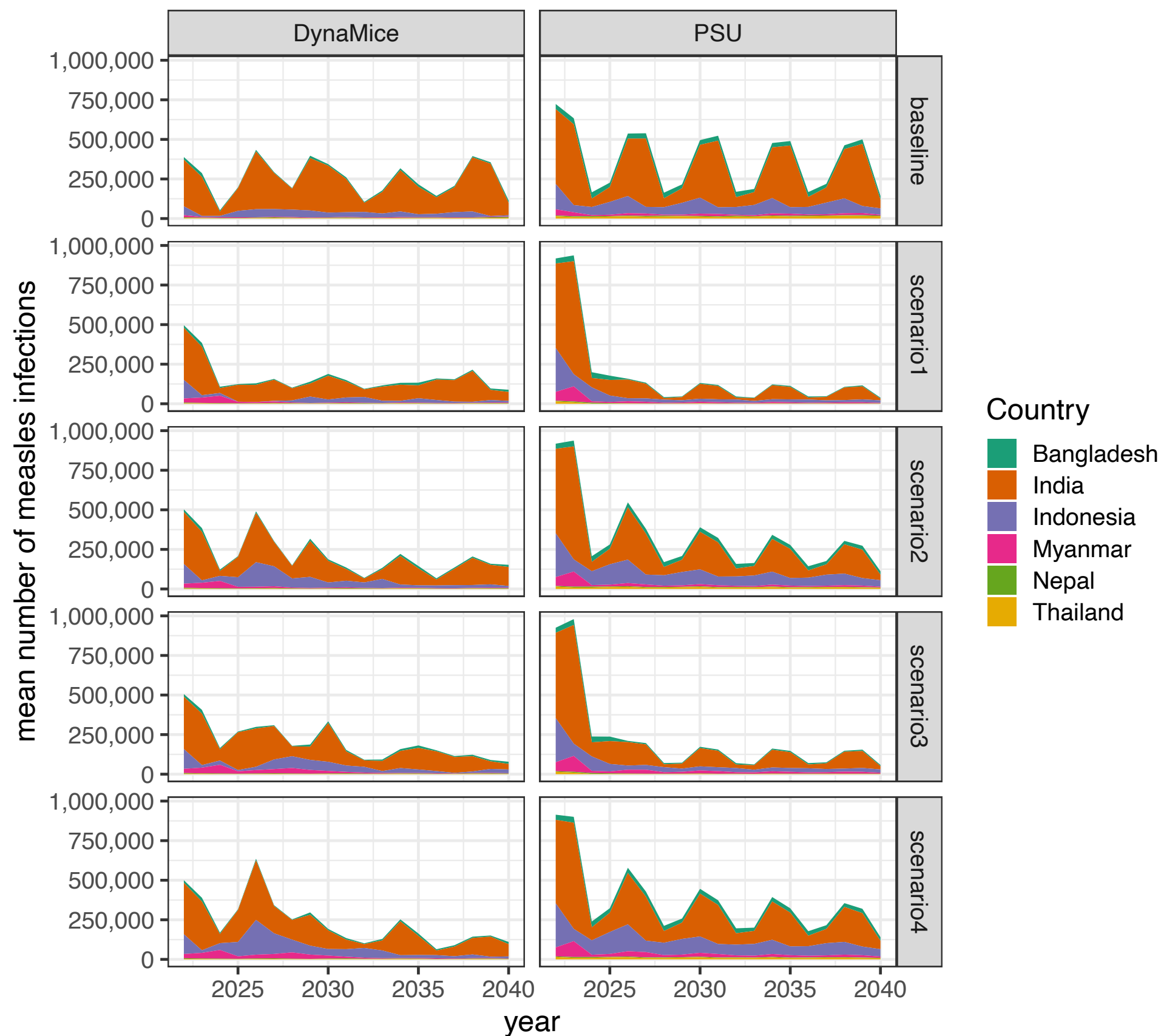
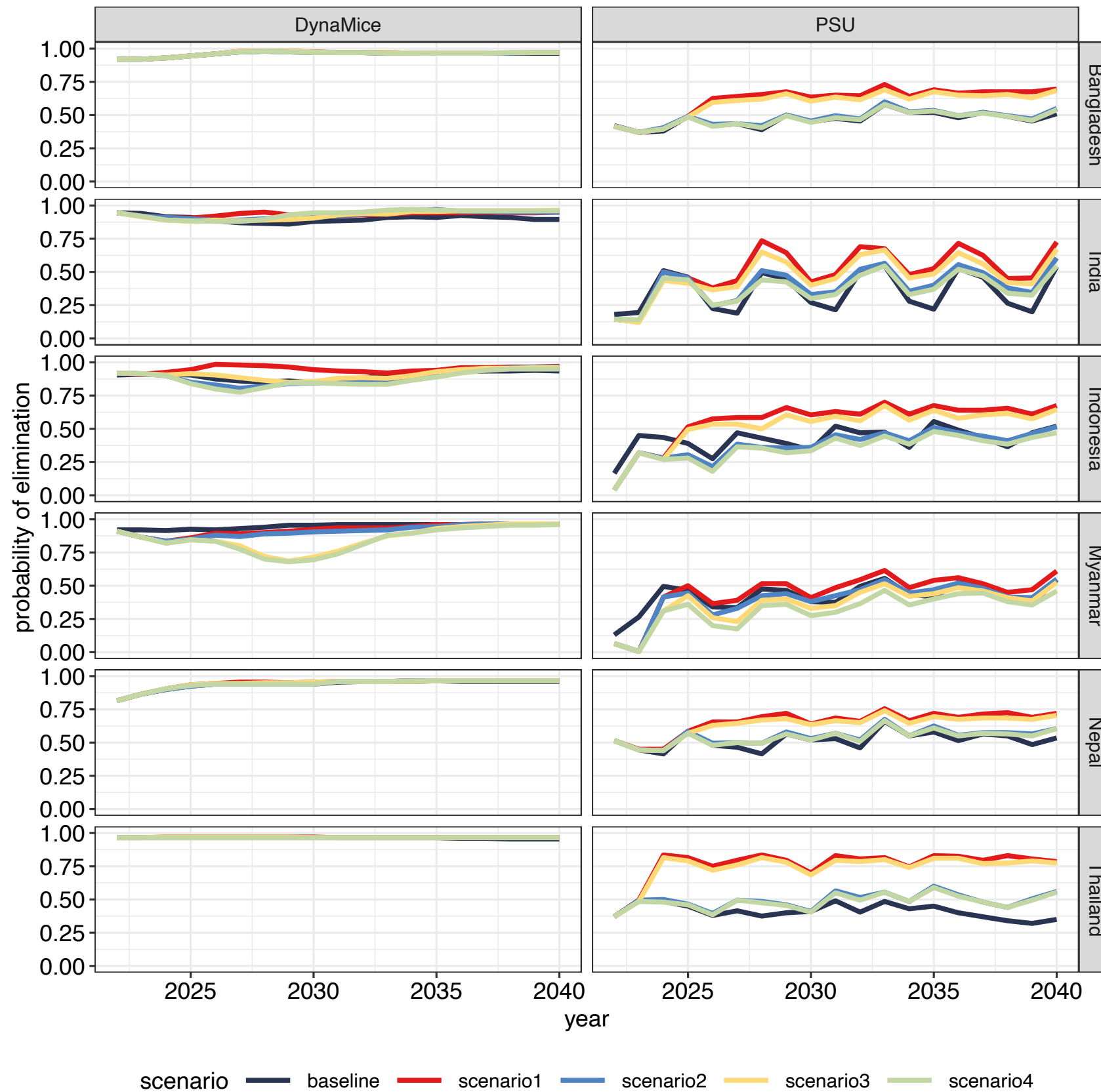
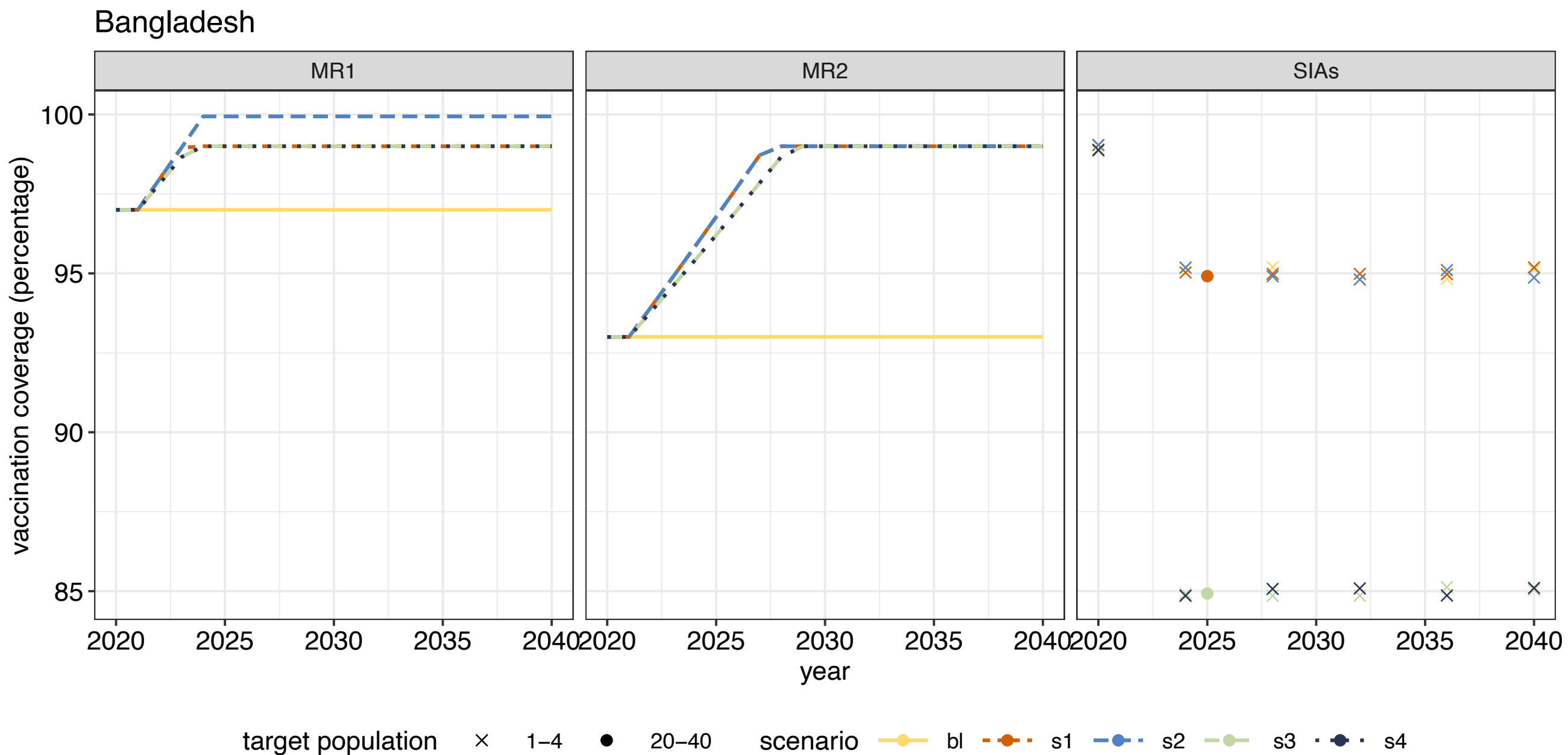


Figure 4: Annually estimated mean probability of achieving conditions for measles elimination (≤ 5 infections per one million population) (2022 - 2040) for each country (panel rows), model (panel columns) and scenario (line colors)



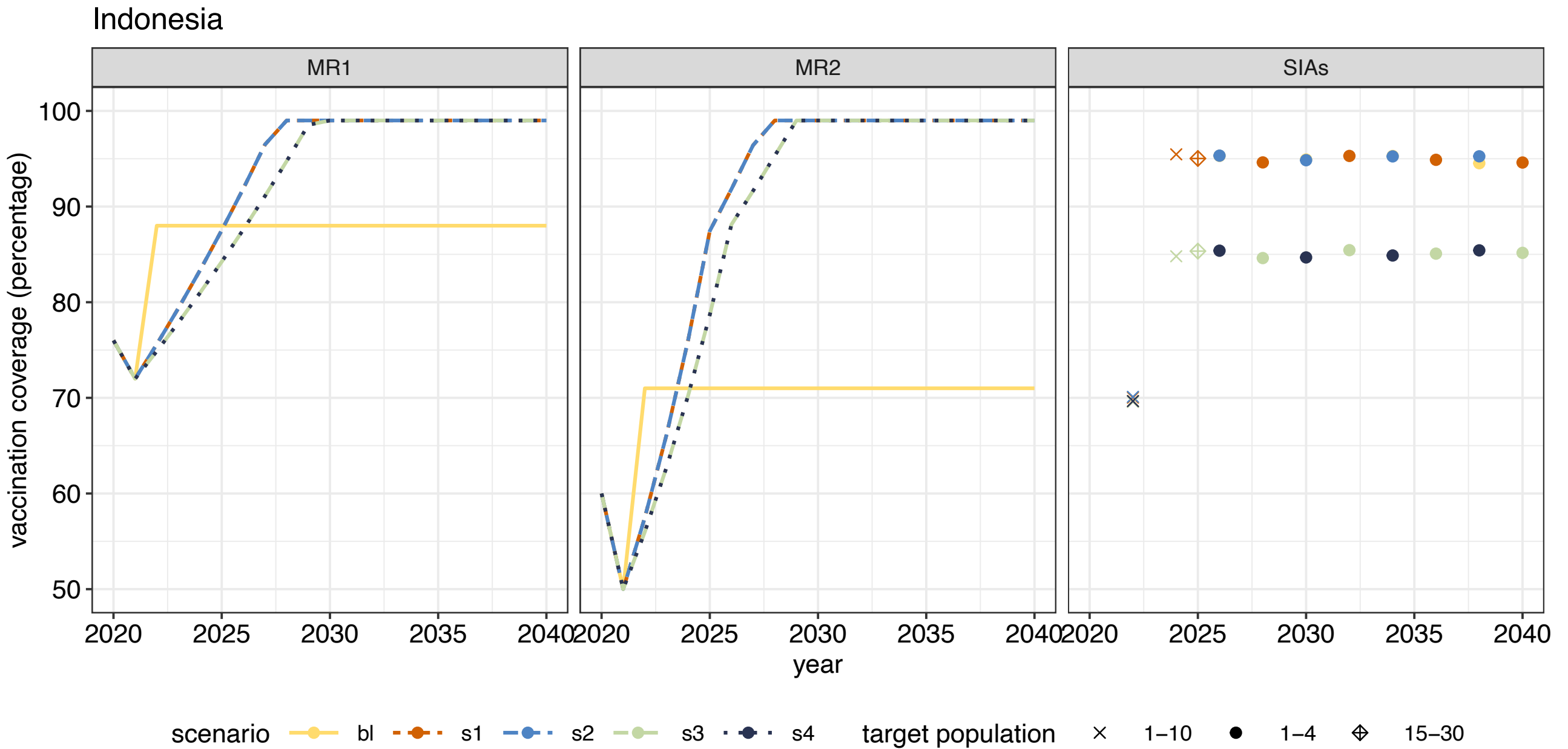
Bangladesh

Vaccination Scenarios (Baseline, Scenario1, Scenario2, Scenario3, Scenario4)



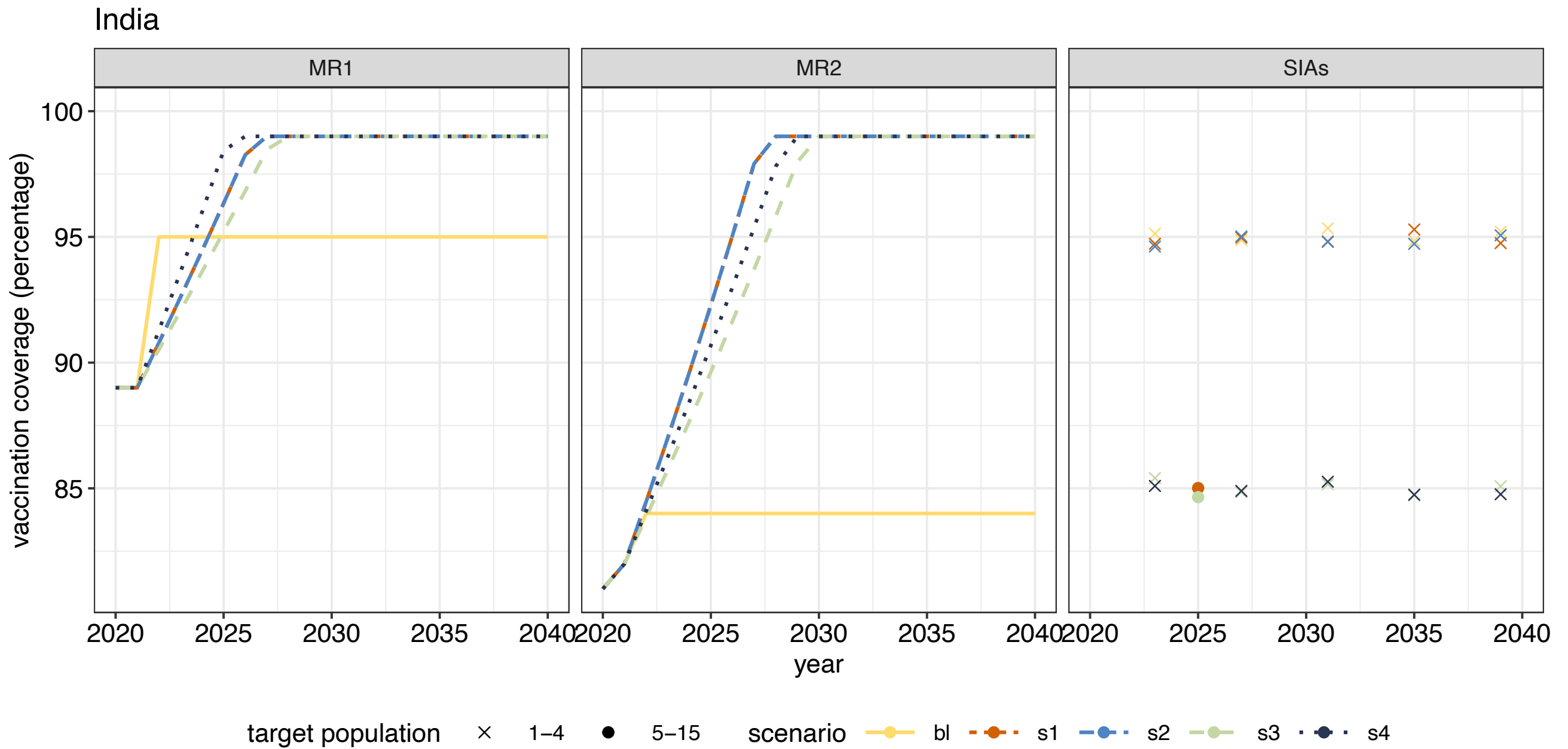
Indonesia

Vaccination Scenarios (Baseline, Scenario1, Scenario2, Scenario3, Scenario4)



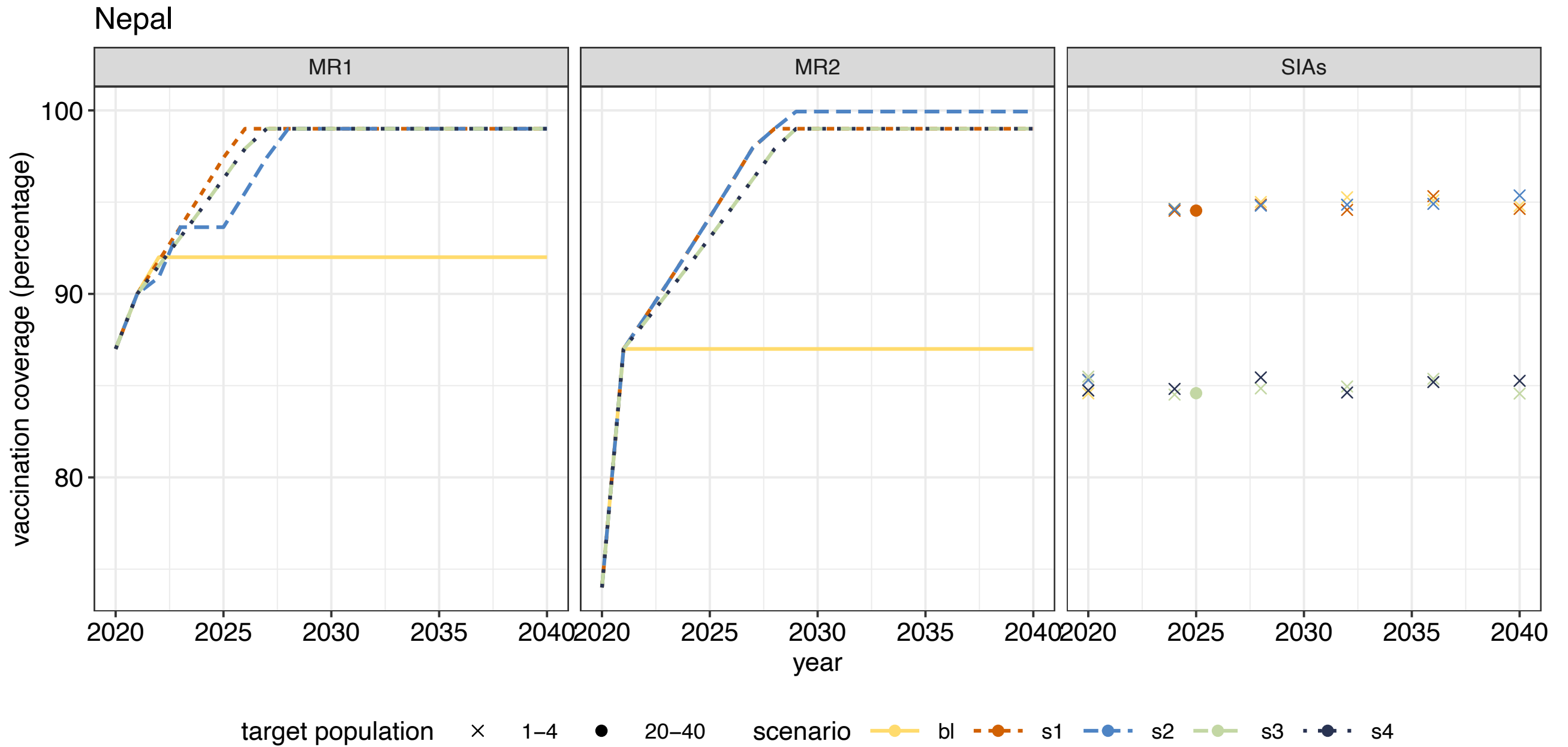
India

Vaccination Scenarios (Baseline, Scenario1, Scenario2, Scenario3, Scenario4)



Nepal

Vaccination Scenarios (Baseline, Scenario1, Scenario2, Scenario3, Scenario4)



Thailand

Vaccination Scenarios (Baseline, Scenario1, Scenario2, Scenario3, Scenario4)

