

# TB VACCINE R&D: STATE OF THE FIELD

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Stop TB Working Group on New Vaccines Annual Meeting  
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WHY ARE BETTER TB VACCINES URGENTLY NEEDED?

# TB IS A LEADING CAUSE OF DEATH GLOBALLY

*Effective vaccines are a critical unmet public health need\**

In 2022: 10.6 million new cases of TB and 1.3 million deaths

8-9% of TB cases and ~13% of TB deaths are in persons living with HIV

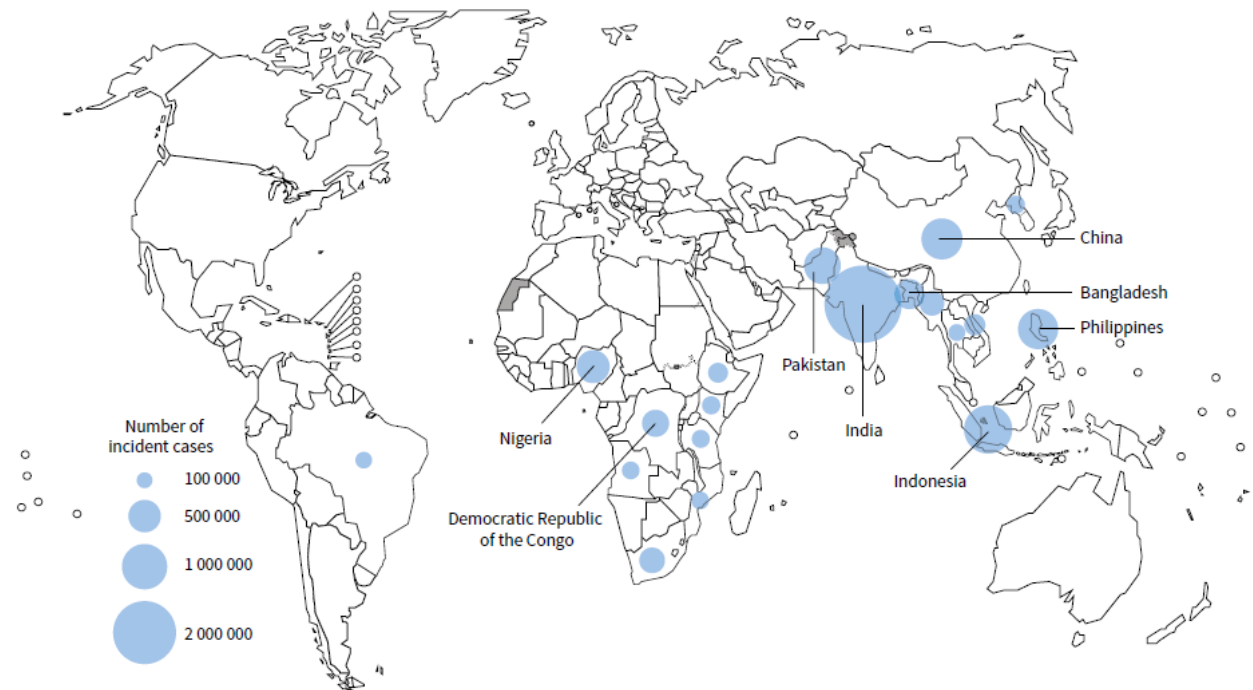
TB incidence **increased** by ~3.9% from 2020-2022

follows ~2% per year **declines** from 2010-2020

BCG helps protect young children from severe forms of TB

but does not reliably protect adolescents and adults and is not controlling the epidemic

Estimated number of incident TB cases in 2022, for countries with at least 100 000 incident cases<sup>a</sup>

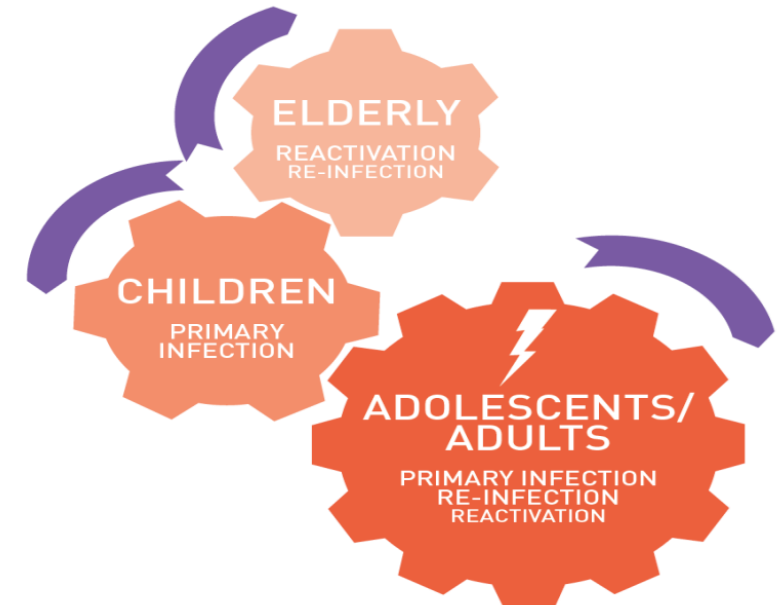
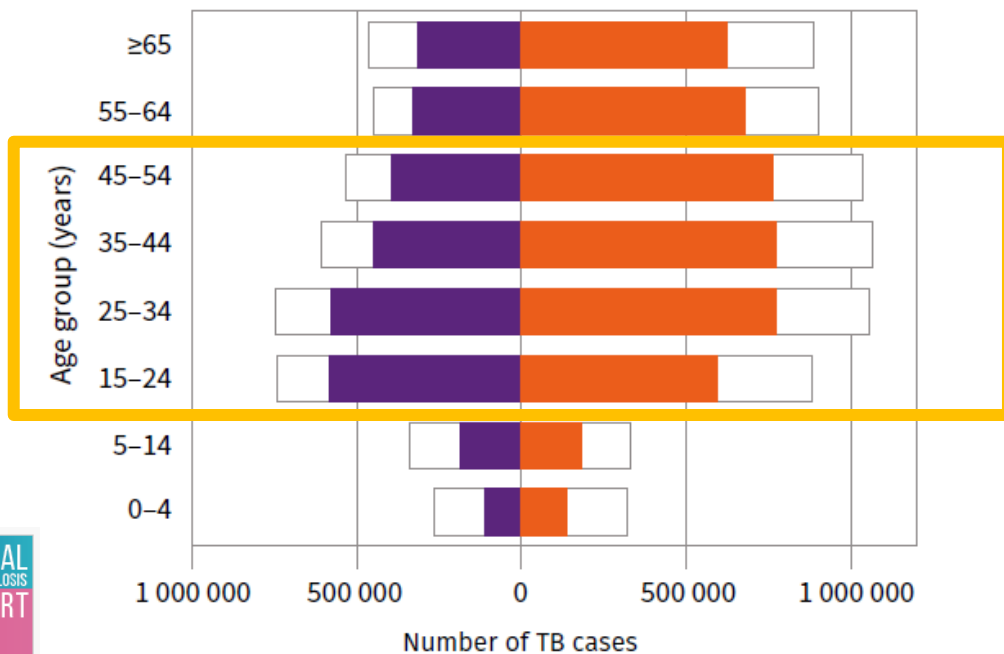


<sup>a</sup> The eight countries ranked in order from first to last in terms of numbers of cases, and that accounted for about two thirds of global cases in 2022, are India, Indonesia, China, the Philippines, Pakistan, Nigeria, Bangladesh and the Democratic Republic of the Congo.

# ADOLESCENTS AND YOUNG ADULTS ARE THE HIGHEST PRIORITY TARGET FOR TB VACCINES

*because they are the main source of M.tb transmission*

Global estimates of TB incidence (black outline) and case notifications of people newly diagnosed with TB disaggregated by age and sex (female in purple; male in orange), 2022



# THE GLOBAL CLINICAL PORTFOLIO OF TB VACCINE CANDIDATES






# 17 CANDIDATES IN CLINICAL DEVELOPMENT

## TB Vaccine Pipeline












### Vaccine candidates under clinical development

There are 16 vaccine candidates in the pipeline as of September 2023, of which 11 are in active trials. The candidates are placed under the phase which corresponds to the most advanced ongoing or completed trial.



#### Platform

-  Mycobacterial - Live attenuated
-  Mycobacterial - Inactivated
-  Viral vector
-  Protein/Adjuvant
-  RNA

#### Candidate target population

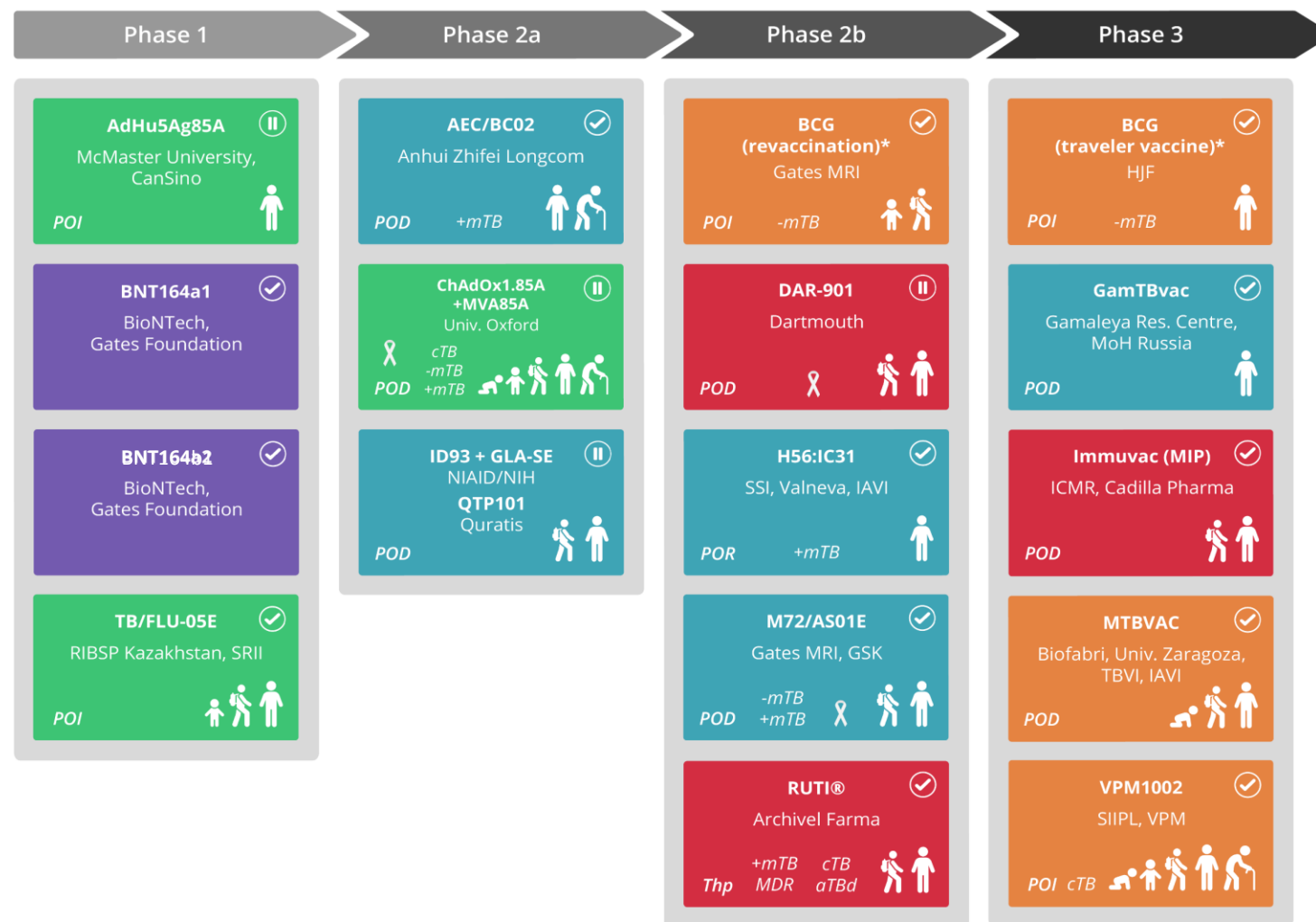
-  Elderly
-  Adults
-  Adolescents
-  Children
-  Infants
-  People living with HIV
-  People without mTB infection
-  People with mTB infection
-  People with active TB disease
-  People with MDR-TB
-  People cured of active TB

#### Trial status

-  Active trials
-  No active trials

#### Primary candidate indication

- POI* Prevention of Infection
- POD* Prevention of Disease
- POR* Prevention of Recurrence
- Thp* Therapeutic



\*BCG appears twice in the pipeline to distinguish between the investigation of its use in BCG-naïve individuals (traveler vaccination) and in individuals who have previously been vaccinated with BCG (revaccination).

# TB Vaccine Pipeline







## Active clinical trials of TB vaccine candidates

There are 11 active clinical trials across nine candidates as of October 2022.

### Platform

- Mycobacterial - Live attenuated
- Mycobacterial - Inactivated
- Viral vector
- Protein/Adjuvant
- mRNA

### Trial target population

-  Elderly
-  Adults
-  Adolescents
-  Children
-  Infants
-  People living with HIV
- mTB People without mTB infection
- +mTB People with mTB infection
- aTBd People with active TB disease
- MDR People with MDR-TB
- CTB People cured of active TB

### Primary trial indication

- Sf* Safety
- POI* Prevention of Infection
- POD* Prevention of Disease
- POR* Prevention of Recurrence
- Thp* Therapeutic



**Trials in planning:**

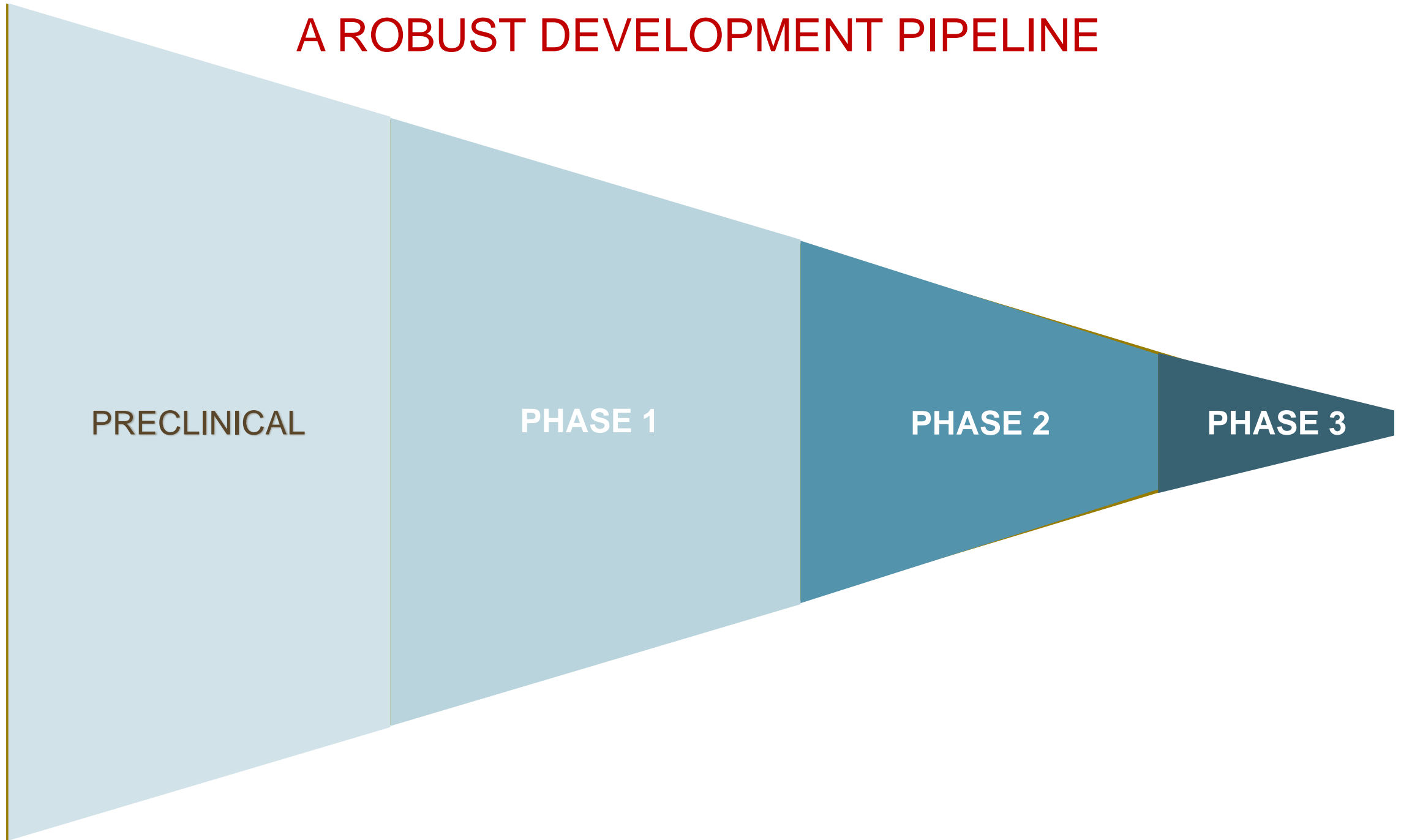
- H107/CAF10b Ph1a/b
- MTBVAC Ph2b (adols/adults)
- M72/AS01E Ph 3

# ANTICIPATED BOLUS OF EFFICACY RESULTS 2024-2028

Vx candidate	Trial endpoint	Trial phase	Trial population	Results due	Comments
VPM1002					
also, IMMUVAC (MIP)	POD	Ph3	HHC (~13,000)	2024	
	POR	Ph2/3	Adults on rx (~2000)	2024	
	POI	Ph3	Infants (~6900)	2026	Non-inferiority to BCG
MTBVAC					
	POD (infants)	Ph3	Infants (~7100)	4Q 2028	Superiority to BCG
	POD (adol/adult)	Ph2b	Adol/adult (14-45; ~4300)	IA:2027?	<i>In planning</i> – starting mid-2024-T
BCG revac	POI			Primary – 2024; final - 2026	
M72/AS01 <sub>E</sub>	POD	Ph3	Adol/adult (15-44; ~26,000)	IA: 2027-8?	Powered on HIV-IGRA+ T-starting 1Q 2024
H56:IC31	POR	Ph2b	Cured adults	2023-4	
ID93+GLA-SE / QPT101	POD	Ph2b/3	Adol/adult in S. Korea	?	<i>In planning</i> - Starting 4Q2023-T
	Rx-shortening	Ph2b	Adults on rx	?	<i>In planning</i>
RUTI	Adjunct to rx (improved outcomes)	Ph2b	Adults on rx	4Q 2025	
GAMTBVAC	POD	Ph3	HIV-, Mtb- adults 18-45 (~7100); TB incid.>30/100,000)	4Q 2025	



# A ROBUST DEVELOPMENT PIPELINE



# TB Vaccine Pipeline







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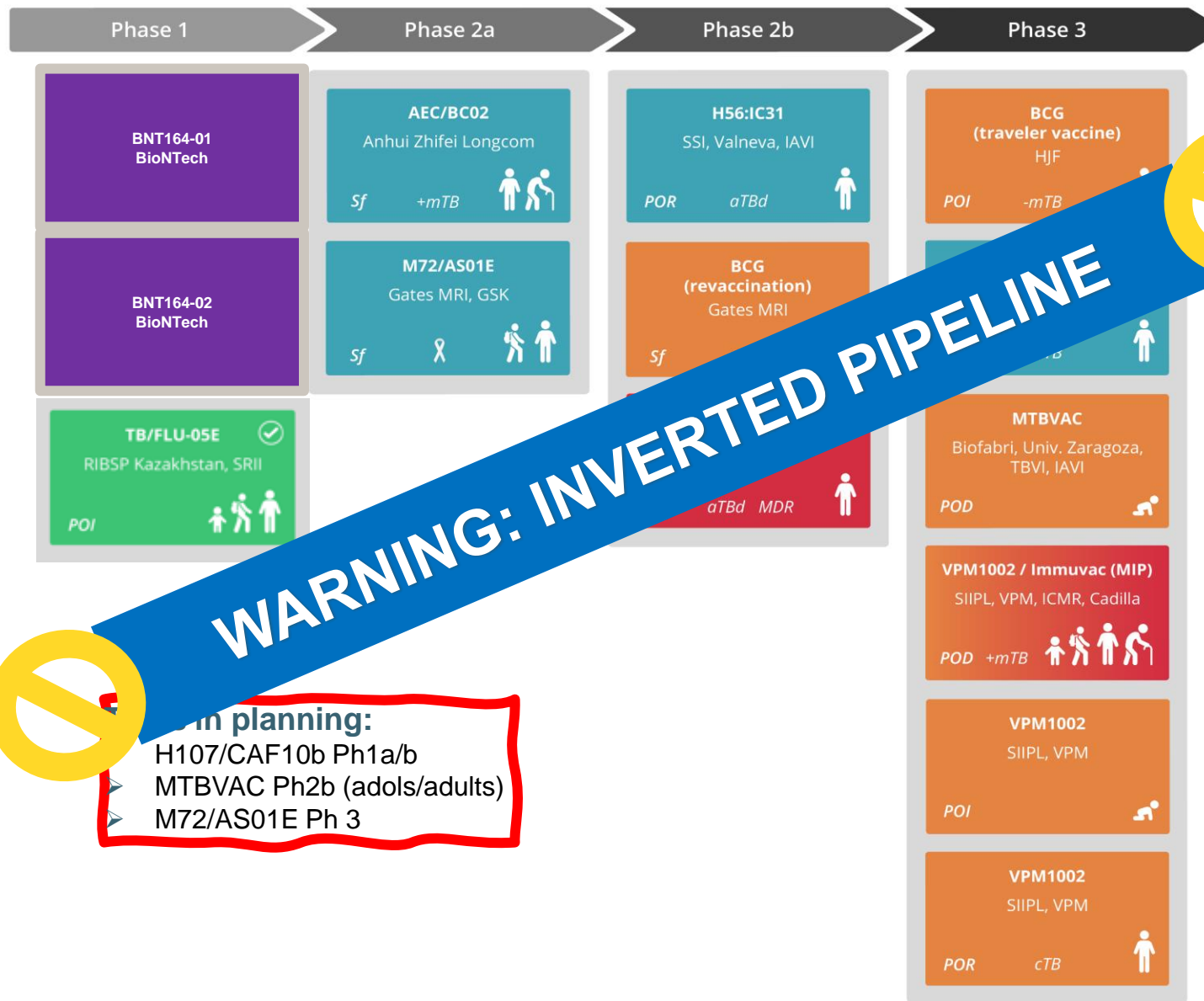
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- +mTB People with mTB infection
- aTBd People with active TB disease
- MDR People with MDR-TB
- cTB People cured of active TB

### Primary trial indication

- Sf* Safety
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**In planning:**  
 H107/CAF10b Ph1a/b  
 MTBVAC Ph2b (adols/adults)  
 M72/AS01E Ph 3



# MAJOR CHALLENGES AND GAPS IN TB VACCINE R&D

Complex pathogen expressing ~4000 antigens; protective epitopes/antigens largely unknown

To date, no identified vaccine-induced Correlate(s) of Protection in humans

Human protective immune responses only partially understood

No reproducibly predictive animal model(s) human challenge model established

Pipeline of candidates not adequately robust – inverted pipeline

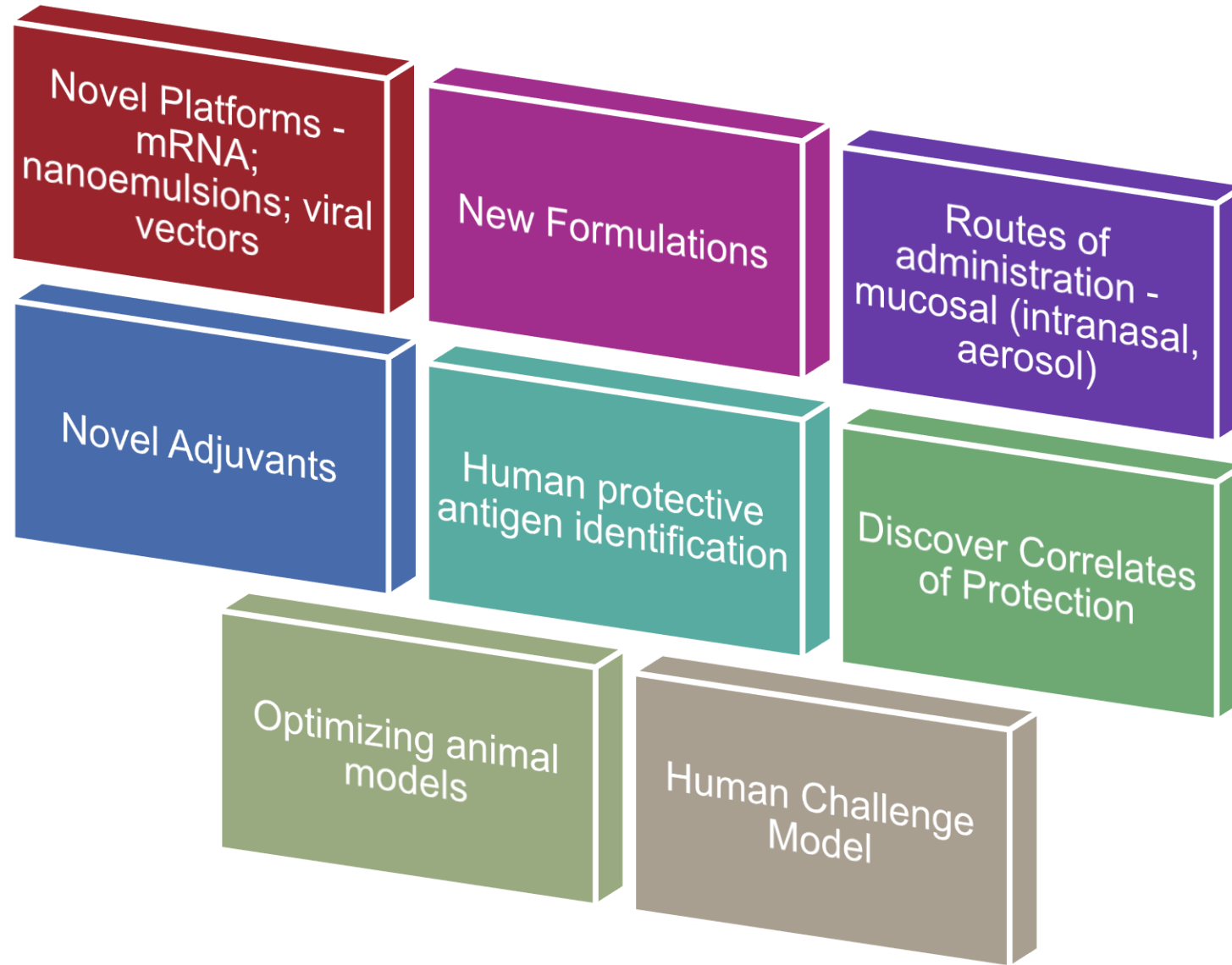
Effects of HIV status, infection (IGRA/TST) status, age and geography on vaccine efficacy must be determined for each vaccine

Inadequate capacity for multiple, overlapping registration-quality efficacy trials

Preparation for access, adoption and delivery to end users just beginning

Inadequate funding and political will

# BUILDING A MORE ROBUST “NEXT GENERATION” PIPELINE



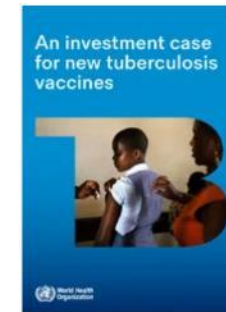
# END-TO-END DEVELOPMENT OF TB VACCINES

*Groundwork being laid:*



## Selected examples:

- Preferred Product Characteristics
- R&D Roadmap to Phase 3 (AIGHD, EDCTP)
- Roadmap from Licensure to Implementation (WHO)
- Investment Case for a New TB Vaccine (full value assessment) (WHO)
- Evidence Considerations for Vaccine Policy (WHO)
- TB Vaccine Market Analysis (Wellcome Trust)
- National TB Vaccine Policy Project (BMGF)
- TB Vx Implementation Planning Landscape and Gap Analysis (*underway with WHO*)



**THANK YOU!**

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