

INNOVATION & COLLABORATION IN VACCINES

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Lead Innovation

VACCINE-PREVENTABLE DISEASES



Available Vaccines (25)

Cholera	Meningococcal
COVID-19	meningitis
(corona virus)	Mumps
Dengue	Pertussis
Diphtheria	Pneumococcal
Hepatitis	disease
<i>Haemophilus</i>	Poliomyelitis
<i>influenzae</i> type b	Rabies
(Hib)	Rotavirus
Human	Rubella
papillomavirus	Tetanus
(HPV)	Tick-borne
Influenza	encephalitis
Japanese	Tuberculosis
encephalitis	Typhoid
Malaria	Varicella
Measles	Yellow Fever

Pipeline vaccines(16)

Chikungunya
 Enterotoxigenic Escherichia coli
 Group A Streptococcus (GAS)
 Group B Streptococcus (GBS)
 Herpes Simplex Virus
 HIV-1
 Improved Influenza Vaccines
 Malaria
 Neisseria gonorrhoeae
 Nontyphoidal Salmonella Disease
 Norovirus
 Paratyphoid fever
 Respiratory Syncytial Virus (RSV)
 Schistosomiasis Disease
 Shigella
 Tuberculosis
 Mpox

= 11% of
Pipeline vaccines

GLOBAL BURDEN OF TB IN A GLANCE

TB Is the World's Second Deadliest Infectious Disease

Estimated number of deaths from infectious diseases worldwide in 2022

1.24 million
Covid-19*

1.13 million
Tuberculosis (TB)

0.63 million
HIV/AIDS**

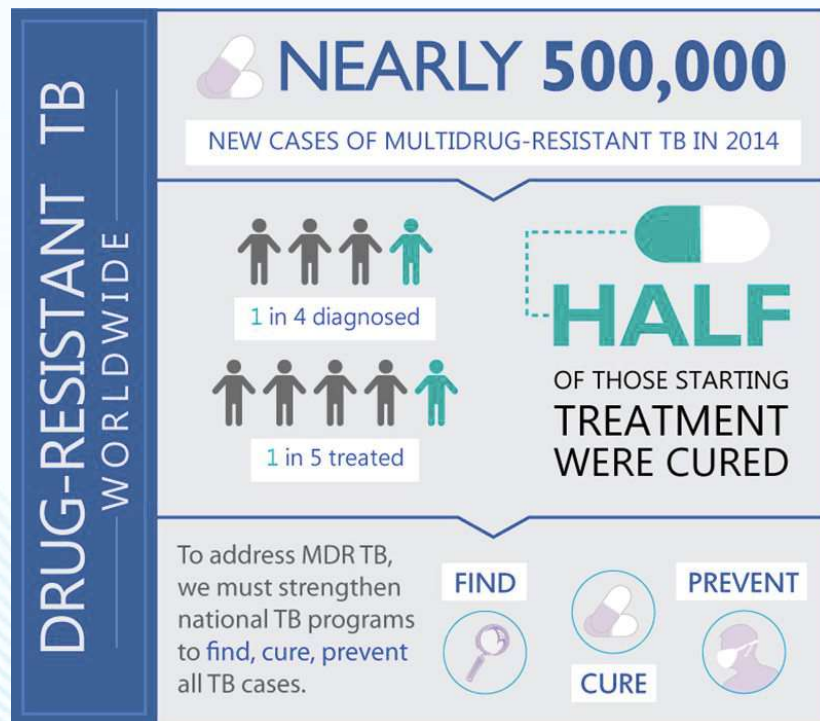
0.62 million
Malaria

Malaria: 2021 data

* Officially reported number of deaths

** Deaths from TB among people with HIV officially classified as deaths from HIV/AIDS

Source: WHO



Source: CDC, [Drug-Resistant TB Worldwide](#)

CHALLENGES IN THE DEVELOPMENT OF A TUBERCULOSIS VACCINE

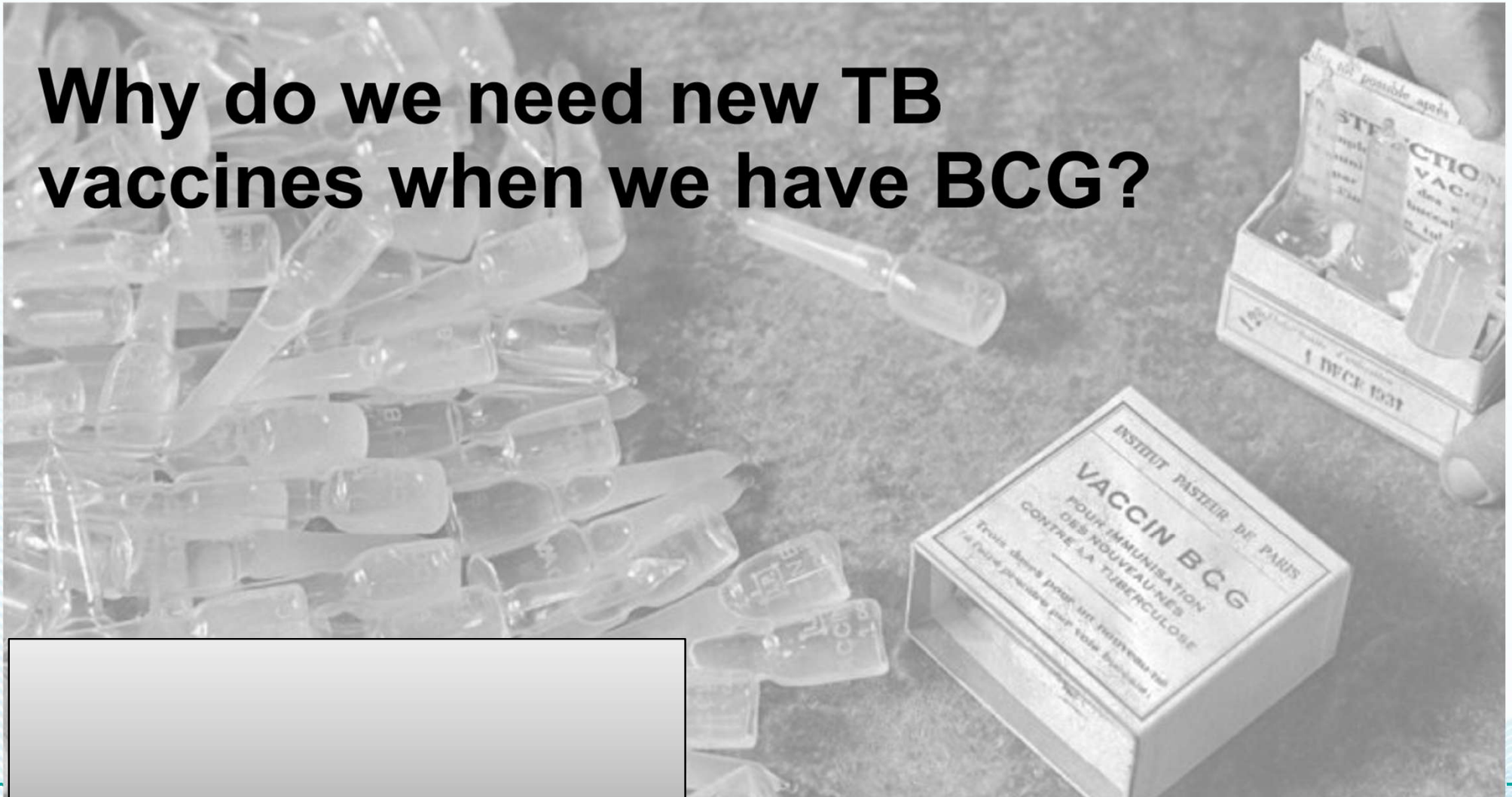
≈1/4 of the world's population has latent TB infection (LTBI)

- Show no clinical symptoms, and ~ 90% of LTBI patients do not progress to TB disease
- Unclear pathogenic mechanisms of MTB
- Limitations of animal models
- IGRA and PPD skin testing is not 100% predictive

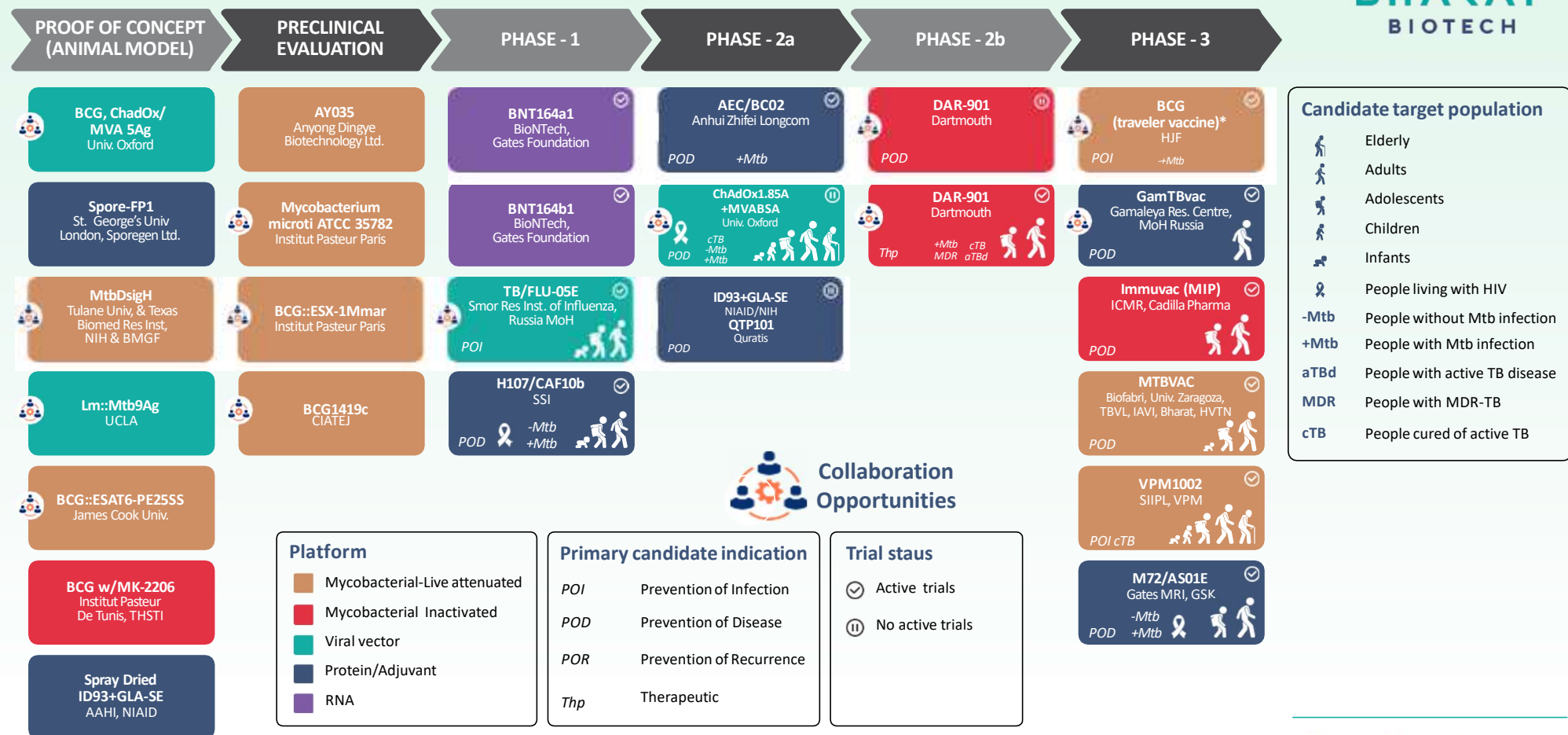
Endpoint Strategy

- POI: 1/4th already infected; the relationship between latent TB and vaccine response clouds things.
- POD: 1/4th already infected; amongst those infected only. In 10 develop disease in their lifetime.

Why do we need new TB vaccines when we have BCG?



TB VACCINE PIPELINE



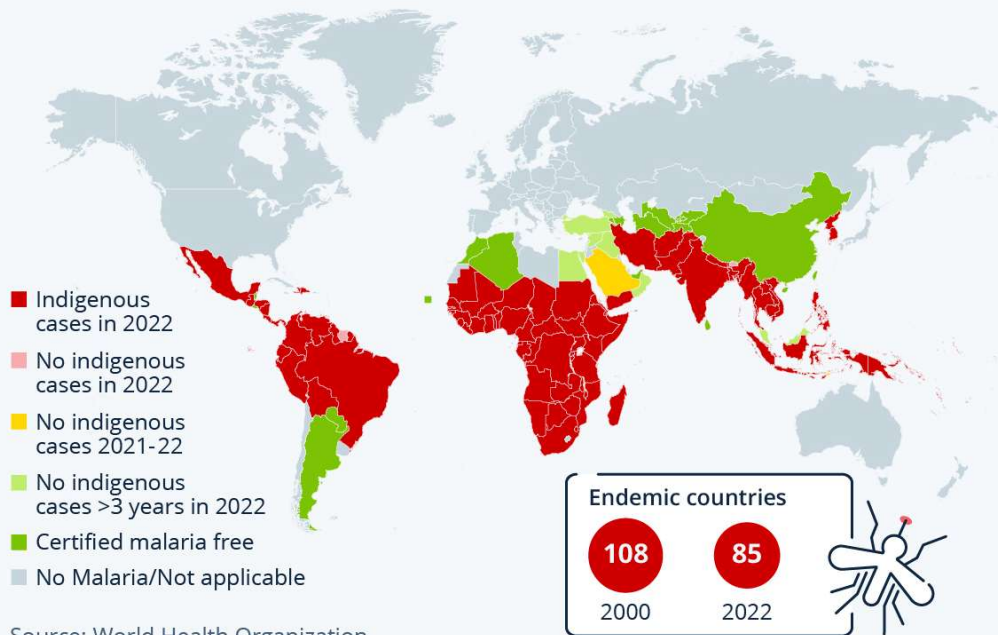
www.bharatbiotech.com

GLOBAL BURDEN OF MALARIA IN A GLANCE

An estimated 600 K deaths per year

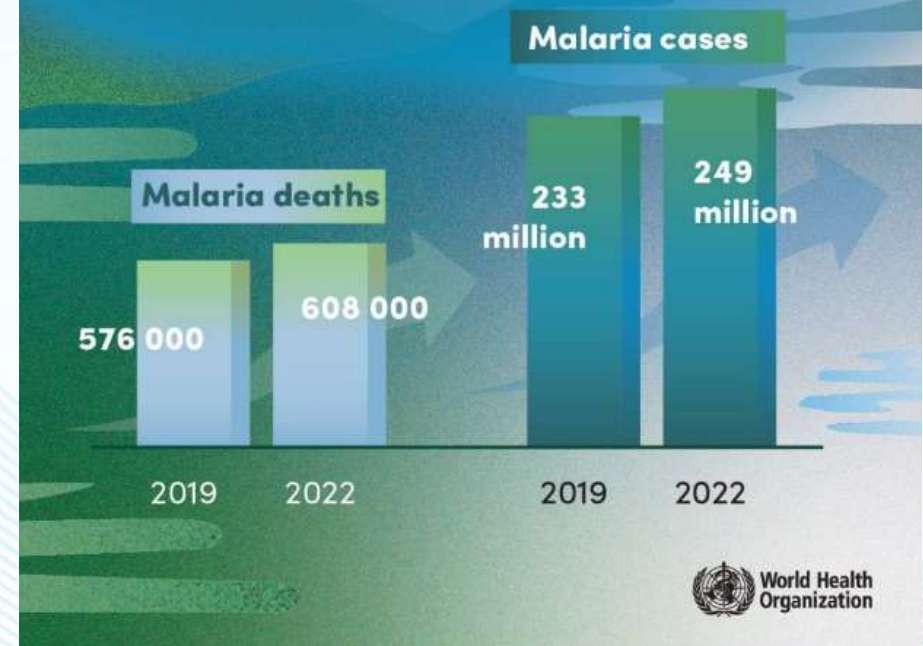
Malaria Is Still Endemic in 85 Countries

Status of indigenous malaria cases in 2022 in countries which had at least one case in 2000



Source: World Health Organization

In 2022, the number of malaria cases and related deaths was significantly higher than 2019



CHALLENGES IN THE DEVELOPMENT OF A MALARIA VACCINE

Antigen
polymorphism

1. Unique biological characteristics of malaria parasites

a) Genome Sequence containing ~ 5,300 proteins

CoP?

2. The protective immune correlates are not established.

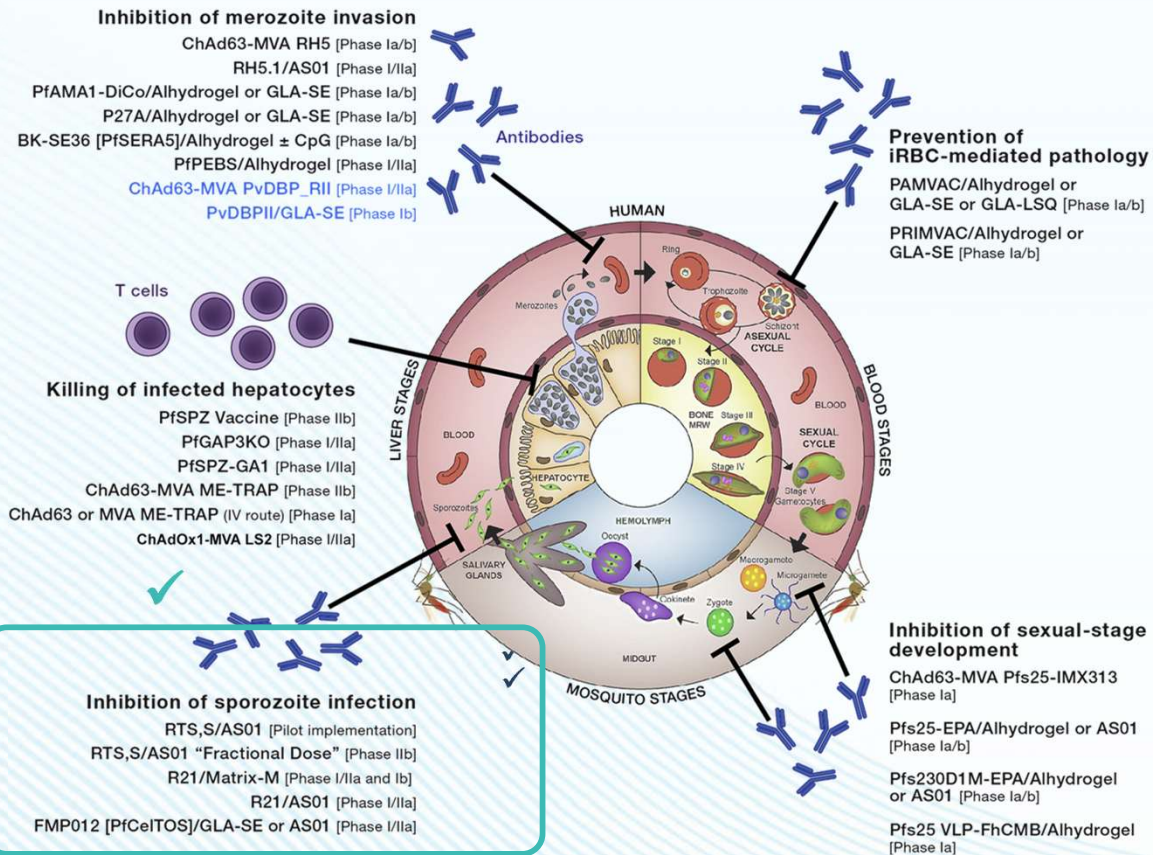
Redundancy
in invasion
pathways

3. Multiple immune suppression and escape strategies used by malaria parasites.

MALARIA VACCINE CANDIDATES

Pre-erythrocytic vaccines (targets liver stage)

- Whole sporozoite vaccines (WSV)
- Subunit blood-stage vaccines



Erythrocytic vaccines (targets the blood stage)

Transmission - blocking vaccines

ACTIVE MALARIA VACCINES IN DEVELOPMENT (MARCH 2024)

PHASE - 1	PHASE - 2	PHASE - 3	PHASE - 4
 ACT-1239 Alfred Research And Medical Education Precinct (AMREP); Burnet Insti.	 BNT165e BioNTech SE	 R21/Matrix M1 Univ. of Oxford; Medical Research Council, Serum Institute of India Ltd.	 RTS,S/AS01E GlaxoSmithKline (GSK); PATH; US Department of Defence (DOD); Bill and Melinda Gates Foundation (BMGF)
 BK-SE36/CpG Nobelpharma; Osaka Univ.; European Vaccine Initiative (EVI); Centre National de Recherche et de Formation sur la Paludisme,	 ChAd63-MVA PvDBP Univ. of Oxford	 RTS,S/AS01E-Half Dose GlaxoSmithKline (GSK); PATH; Bharat Biotech International Ltd.	
 BNT165b1 BioNTech SE	 MSP3-CRM-Vac4All/Alhydrogel Univ. of Bamako; Vac4All		
 Chemically attenuated Pf7G8 Griffith Univ.	 Pfs230D1M-EPA/AS01B US National Insti. of Allergy and Infectious Diseases (NIAID); Univ. of Bamako		
 FMP013/ALFQ Walter Reed Army Insti. of Research; U.S. Army Medical Research and Development Command	 Pfs230D1M-EPA/Matrix M1 US National Insti. of Allergy and Infectious Diseases (NIAID); Univ. of Bamako; Novavax		
 FMP014/ALFQ U.S. Army Medical Research and Development Command; Walter Reed Army Insti. of Research	 PfSPZ Vaccine US National Insti. of Allergy and Infectious Diseases (NIAID); Malaria Research and Training Center, Bamako, Mali; Univ. of Science Techniques and Technologies of Bamako; Sanaria		
 MSP1/GLA-SE Swiss Tropical & Public Health Insti.; Ifakara Health Insti.	 PfSPZ-Cvac US National Insti. of Allergy and Infectious Diseases (NIAID); Univ. of Bamako		
 Pfs25-IMX313/Matrix M1 Univ. of Oxford; Ifakara Health Insti.	 PvCSP/ISA 51 Malaria Vaccine and Drug Development Center (MVDC), Colombia		
 Pfs48,45/Matrix M1 Univ. of Oxford	 PvDBP11/Matrix M1 Univ. of Oxford		
 Pvs230D1M-EPA/Matrix M1 US National Insti. of Allergy and Infectious Diseases (NIAID)	 Rh5.1/AS01B Univ. of Oxford		
 Pvs25-IMX313/Matrix M1 Univ. of Oxford	 Rh5.1/Matrix M1 University of Oxford; Ifakara Health Institute; European and Developing Countries Clinical Trials Partnership (EDCTP)		
 R21/AS01B Univ. of Oxford			
 rCSP/AP10-602 US National Insti. of Allergy and Infectious Diseases (NIAID)			
 VLP M01 VLP Therapeutics			



Collaboration Opportunities

-  Synthetic Peptide/ Virus-like particle
-  Recombinant Subunit
-  Recombinant Subunit, Virus- like particle
-  Recombinant Viral Vector
-  RNA
-  Self Assembling nano-particle
-  Whole Parasite

Overall: **133 vaccines**

Clinical trials: **221(196 done)**

Only 29 Vaccines are active, 104 Vaccines are inactive

Only 2 WHO recommended and prequalified vaccines.

- 123 are against *P. falciparum*
- 10 against *P. vivax*.

My Beginner ChatGPT Skills.....



NEWS | HEALTH

First malaria vaccine slashes early childhood mortality

Huge analysis of RTS,S in Africa shows it decreased toddler deaths by 13%

24 OCT 2023 • 1:50 PM ET • BY [MEREDITH WADMAN](#)



Thank You