Towards a vaccine for *Plasmodium vivax*

Beena Bhamani*

*Malariar Eradication Scientific Alliance (MESA) - Barcelona Institute for Global Health (ISGlobal), Barcelona, Spain

**INTRODUCTION**

Malaria is a life-threatening disease that affected 228 million people and caused more than 0.4 million fatalities around the globe in 2018 (1). Most of these cases were caused by two Plasmodium species i.e. Plasmodium falciparum and Plasmodium vivax. Although the cases have reduced after 2000, experts believe that eradication is not possible without new approaches and tools and one such tool considered is vaccines. The only vaccine available for malaria provides protection against *P. falciparum*, whereas the work towards a *P. vivax* vaccine has just begun.

**OBJECTIVE**

The aim of this study was to describe the landscape of current research in vaccine for Plasmodium vivax, compare it to opportunities and gaps identified in the Malaria Eradication Research Agenda (miera) and gauge the likelihood of having vaccine for *P. vivax* by 2035.

**METHODS**

Data on recent and ongoing research activities/projects was systematically collected between February 2020 to May 2020 from open source databases of grants and validated with the principal investigators (Pis).

The results have been published, in a dedicated webpage with the title “Towards a vaccine for Plasmodium vivax”, in MESA track, an online database which provides research projects and institutions’ research portfolios in malaria elimination and eradication. An expert opinion survey was conducted to assess the probability of having a highly efficacious and long-lasting vaccine for *P. vivax* by 2035. Questions regarding the research gaps and research opportunities for the next five years identified in miera were also included.

**RESULTS**

Research project in *P. vivax* vaccine – Eligibility flow diagram

- **Discovery and basic science phase (24/53)**
  - Antigen and target protein discovery (13)
  - Immune Response (11)
  - High throughput studies (4)
  - Model for *P. vivax* (3)
  - In-vitro culture, assessment of adjudicant and genotype diversity (1 each)

Development and pre-clinical phase or GMP manufacture (12/53)

- Pre-clinical evaluation (10), GMP manufacture (2)

Clinical evaluation (7/53)

- PV/OBPPI in Malaria M1, PV/OBPPI in GLA-SE, ChvD3/MA/PV/PB: *P. vivax* irradiated sporozoite, PyCSP

**NUMBER OF PROJECTS**

- Validated and published (n=53)
- Excluded (n=103)
- Duplicate (n=50)
- Too much information missing (n=12)
- Project discontinued (n=1)

**Progress on research gaps identified in miera**

- Incomplete understanding of the development and maintenance of immunity to *Plasmodium vivax* antigens (55/146)
- Antigenic diversity of many malaria vaccine targets (54/146)
- Limited information on immune correlates (49/146)
- Efforts to generate knockout libraries to understand gene function (49/146)
- Methods to increase sporozoite availability (47/146)
- Lack of in vitro culture system for *P. vivax* (42/146)

**Progress on research opportunities identified in miera**

- Nothing done yet (15/53)
- <5% (6/53)
- 5-25% (9/53)
- 25-50% (11/53)
- >50% (11/53)

**REFERENCES**


**ACKNOWLEDGEMENT**

Elisabet Marti Coma-Cros (MESA Officer - ISGlobal Barcelona)
Kate Whittled (MESA Coordinator – ISGlobal Barcelona)

CONCLUSION/RECOMMENDATION

The main conclusion that can be drawn from this review is that we are still behind when it comes to research in *P. vivax* vaccine, starting from basic science to vaccine development. The major roadblocks affecting the research in *P. vivax* vaccine identified via systematic data collection and expert opinion are:

1. Unavailability of in vitro blood-culture system
2. Lack of knowledge on immune response
3. Limited antigen discovery
4. Funding gap & lack of commitment

Furthermore, with the current available tools and gaps identified by the experts, prospects of having highly efficacious vaccine by 2035 is fairly unlikely i.e. on numerical scale average came out around 50%.

The main recommendation derived from this study is the realization of the importance of a vaccine for *P. vivax* to progress towards elimination and eradication. But this requires dedication, commitment and interest from all agencies involved, from developers of policies to donors.

**Deep Dive “Towards a vaccine for Plasmodium Vivax”**