Briefing Document: National decision-making framework for malaria vaccines

Analysis of the demand for a malaria vaccine: outcome of a consultative study in eight countries

This is one of seven briefing papers produced for a country consultation to develop a decision-making framework for the use of future malaria vaccines. It was developed under the guidance of the consultation steering committee: Alan Brooks, PATH Malaria Vaccine Initiative (MVI); Dr. Carter Diggs, US Agency for International Development; Sarah Ewart, MVI; Dr. Dorothée Kinde-Gazard, Minister of Health, Benin; Annique Lennon, MVI; Dr. Rose Macauley, World Health Organization (WHO) Regional Office for Africa (AFRO); Dr. John Marshall, Consultant to PATH; Dr. Zarifah Reed, WHO; Dr. Magda Robalo, WHO AFRO; and Dr. Rick Steketee, PATH Malaria Control and Evaluation Partnership in Africa.

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1. Introduction

In 2004, the PATH Malaria Vaccine Initiative (MVI) worked with The Boston Consulting Group (BCG) to conduct a consultative study of demand for a malaria vaccine in eight countries where malaria is endemic. The primary goals of the study were to quantify the global demand for malaria vaccines with given sets of characteristics and to determine the factors that would drive demand, the obstacles that would impede demand, and the political scenarios that would affect demand. This paper summarizes the findings, with a focus on the public sector in Africa (where the need is greatest) and the factors that may influence demand in sub-Saharan Africa when a vaccine becomes available.

2. Study overview

The study looked at factors such as: size of at-risk populations, levels of active malaria transmission, health care expenditures per capita, and how different geographies and cultures assess need for, access to, and attitudes toward health care, immunization, and malaria control interventions. Eight countries were selected that represent a broad range of global demand: Brazil, Mozambique, Ghana, Nigeria, Senegal, Tanzania, India, and Thailand. The study team conducted more than 200 interviews in these countries, with representatives from the ministries of health and finance, hospitals, local companies, and in-country donors and nongovernmental organizations. The team also interviewed key opinion leaders outside of these eight countries, including donors, policymakers, and military and travel advisors.

The study team used the results to build an interactive model for understanding and estimating vaccine demand and uptake under a wide range of different scenarios and parameters, such as vaccine characteristics, access to target population, funding levels, and adoption strategies. The study targeted four sectors that can influence or are invested in malaria vaccine development and introduction: public, private, military, and travel. The public sector is easily the most important and is therefore the focus of this summary.

3. Key findings: focus on Africa

3.1. A vaccine with partial efficacy could play a valuable role in the portfolio of malaria interventions

Results from the study indicate that governments in the areas of West Africa where malaria is highly endemic would adopt a vaccine with clinical efficacy of 30 percent as part of their malaria control efforts. Provided that sufficient financing is available to fully support its use, a vaccine with 50 percent efficacy[1] against clinical and severe disease would be administered to some 70 million people globally in 2025; a similar vaccine with 80 percent efficacy would reach 154 million people.

[1]The study assumed a vaccine targeting *Plasmodium falciparum*, with the following features:

- Fifty percent efficacy against clinical and severe disease, and duration of effectiveness of one year.
- Protective for individuals of all ages, excluding pregnant women.
- Three-dose schedule, followed by an annual booster.
- Cost of US$7 per dose, plus a $5 delivery cost.
- Five-year delay between licensure and first introduction in Africa.
- Uptake modeling DTP-3 and availability in public markets only.

3.2. The target population for malaria vaccine differs by geography

Although a vaccine that protects against *Plasmodium (P.) falciparum* is attractive worldwide, the population that will benefit most is different in different regions. Children and pregnant women are the principal target population for a malaria vaccine in Africa, where entire countries are endemic and where adults develop a partial immunity to the disease. In Asia, the target group includes all ages.

3.3. Minimum active duration of protection to achieve uptake is one year

Interview subjects from all eight regions agreed that a vaccine's duration of protection must be at least one year to achieve significant adoption. Although a vaccine that requires yearly booster vaccination may be acceptable, related costs and compliance issues would have a negative influence on levels of uptake. An injectable (rather than oral) vaccine would be accepted.

3.4. A malaria vaccine should be offered via existing immunization services

Many countries in sub-Saharan Africa considered it essential that a malaria vaccine immunization program make use of existing Expanded Programme on Immunization (EPI) infrastructure.[2] The corollary is that for universally wide uptake of a malaria vaccine, EPI levels will need to be substantially higher than they are now in many countries.

3.5. Among vaccine-profile characteristics, efficacy has the greatest influence on demand

In West Africa, where the malaria burden is highest, a vaccine with approximately 30 percent efficacy against clinical disease (and approximately 50 percent efficacy against severe disease) would likely offer enough benefit that the government and public health officials would wish to introduce it. In East Africa, the barriers to vaccine introduction are a little greater, and a vaccine would need to have approximately 50 percent efficacy against clinical and severe disease to be accepted. For Southeast Asia and South America, where the malaria burden is not as great and resources are more ample, approximately 80 percent efficacy was considered the lowest acceptable level.

3.6. Cost is a significant hurdle to introduction

A cost of US$1 to $3 per dose is unaffordable for the majority of the populations in the developing world. Government representatives who participated in the study said that they would evaluate the cost-effectiveness of a malaria vaccine against their existing malaria control and immunization portfolios. Because most governments have inadequate financial resources within their health care budgets, uptake will be severely limited without commensurate donor funding. Representatives from some countries emphasized that their governments would need to be sure its use was sustainable before they would be willing to introduce a malaria vaccine.

[2] Although the current Expanded Programme on Immunization coverage in many African countries is less than 70 percent, it is a reasonable expectation that by 2010 (with continuing work by the Global Alliance for Vaccines and Immunization) coverage in almost all countries will have reached at least 70 percent.

3.7. Influencer support is crucial to increasing uptake and reducing introduction lag time

Countries and donors rely on key opinion leaders and recommendations from organizations such as the World Health Organization (WHO) to determine which public health interventions to introduce. A vaccine's credibility and successful introduction depend on the level of support it receives from these groups.

On the other side of the coin, there is a nearly universal need to increase awareness of disease burden and educate the populations in developing countries about the advantages of different interventions in the malaria portfolio. Before introducing a malaria vaccine, it will be important to communicate credibly and effectively the benefits conferred by a partial-efficacy vaccine so that individuals who need the vaccine will participate in immunization programs.

3.8. Donor funding plays a critical role in vaccine uptake

Current levels of funding are enough to bring a malaria vaccine to fewer than five million people in Africa. However, this number could be increased by up to ten times by 2025 with substantial additional donor funding (more precise and specific projections can be made by MVI for differing assumptions using the demand model developed by BCG for this study). A vaccine that is not backed by sustainable funding is unlikely to be successfully introduced, and obtaining adequate and sustained funding presents significant global challenges.

4. Issues and challenges

- Having a vaccine with duration of protection of at least one year is necessary. To have substantial value Africa-wide, vaccines should also have at least 50 percent efficacy against clinical and severe disease.
- Improving access to immunization (and EPI coverage) is necessary for widespread malaria vaccine coverage.
- Enhancing understanding of disease burden and educating the population about the advantages of different interventions in the malaria portfolio is important.
- Educating end users about the benefits and attributes of a partial-efficacy vaccine is critical in order to avoid damaging the credibility of other EPI vaccines.
- Substantial additional donor funding is needed to increase the number of people who would receive a vaccine, potentially by as much as ten times, by 2025 (with current funding levels, fewer than five million people would receive a malaria vaccine).

5. Implications for decision-making

5.1. Vaccine profile, influencer support, and donor funding are critical to the success of a malaria vaccine

Efficacy and cost are key drivers in whether a malaria vaccine is accepted and successfully introduced. In all countries surveyed, study participants said that vaccines must be effective against *P. falciparum* and have duration of protection of at least one year to be successful.

Influencers such as the WHO and key opinion leaders (including scientists) are essential in vaccine introduction. Interview participants described these two groups as key in making decisions about which interventions to support and in reducing the lag between licensure and introduction.

Donors can stimulate early adoption and improve uptake through advocacy and implementation support. The sustainability of funding is critical for both supply and uptake; suppliers need secure, sizable, long-term demand to justify investment. Poorer countries in particular need to have a sustainability plan before adopting new vaccines.

5.2. Vaccine efficacy levels will have a significant role in demand, and therefore on supply

Demand is greatest for a vaccine with high levels of efficacy. Governments and other funders will be more willing to dedicate resources once a highly efficacious vaccine becomes available. Greater demand requires not only more money for vaccine supplies, but also larger, early investments in production capacity and greater infrastructure for delivery.

5.3. Understanding and acting on the factors that influence demand and uptake are critical for a vaccine to see significant use

These factors, which can be both drivers and obstacles (depending on their actual status), include product profile, available funding, infrastructure improvements, and stakeholder advocacy.

5.4. Advocacy and support for improved implementation of a vaccine are critical for the largest impact

At current funding and coverage levels, tens of millions of people in Africa would not be reached. To ensure that these children are immunized, effective global and local advocacy and additional financial support will be essential.