

RTS,S malaria vaccine, a promising new tool in the fight against malaria, will require strategic planning to mitigate implementation challenges

The vaccine will be integrated with existing prevention and control methods



A child receives the malaria vaccine.
Credit: Beatrice Adwoa Afari (GHS)

The RTS,S malaria vaccine, recommended for use in children by the World Health Organization (WHO)¹ in October 2021, is a historic breakthrough in the fight against this disease. The vaccine will be in high demand in malaria-endemic Sub-Saharan African countries. However, in the short term, supply will be limited.

Given these initial supply challenges, as well as the vaccine's unique characteristics, country governments will need to consider how to prepare for RTS,S vaccine introduction. The financial and programmatic needs will have to be thoroughly analyzed with planning for operational roll-out and resource mobilization. Countries and partners should also apply the experiences and lessons learned from implementing and scaling up new vaccine programs in recent years to optimize the rollout and uptake of this vaccine.



RTS,S malaria vaccine is a historic breakthrough in malaria control

When the WHO recommended the vaccine in October 2021, Dr Matshidiso Moeti, WHO Regional Director for Africa, reflected on the importance: “We have long hoped for an effective malaria vaccine and now for the first time ever, we have such a vaccine recommended for widespread use. [The WHO’s] recommendation offers a glimmer of hope for the continent which shoulders the heaviest burden of the disease, and we expect many more African children to be protected from malaria and grow into healthy adults.”

In the past two decades, global efforts to end the malaria epidemic through a multi-pronged approach of prevention and control measures — insecticide-treated bed nets, indoor spraying with insecticides, seasonal malaria chemoprevention, and timely testing and treatment — have made unprecedented progress, with an estimated 7 million deaths averted.

Nevertheless, progress has stalled in recent years, and morbidity and mortality remain high in African children. In 2019, 386,000 people died from malaria in Africa, of which 274,000 were children under five years old.² The malaria death rate in Africa surpassed that of COVID-19 during the same time.³

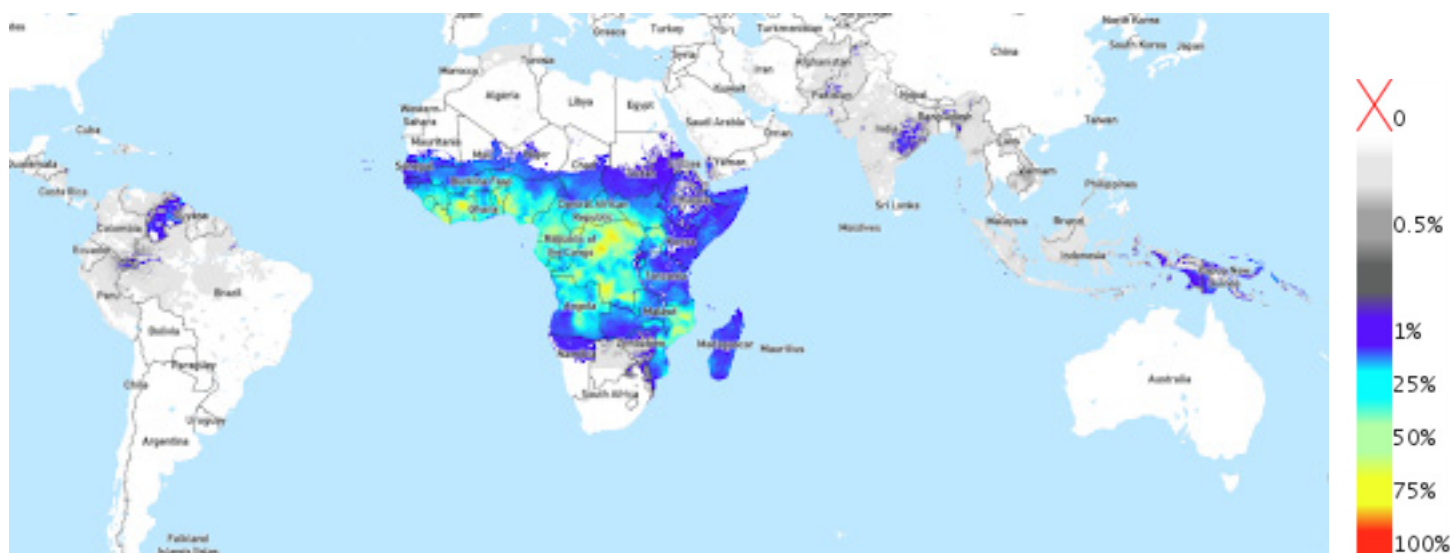
RTS,S — the first malaria vaccine to be recommended by the WHO — represents a historic breakthrough in the fight against this disease, adding to existing preventive tools.

1 WHO. 2021. WHO recommends groundbreaking malaria vaccine for children at risk. WHO. Available at <https://www.who.int/news/item/06-10-2021-who-recommends-ground-breaking-malaria-vaccine-for-children-at-risk>

2 Whiting, K. 2021. WHO: What you need to know about the new malaria vaccine. World Economic Forum. Available at <https://www.weforum.org/agenda/2021/10/new-malaria-vaccine-explained-by-the-who/>

3 Whiting, K. 2021. WHO: What you need to know about the new malaria vaccine. World Economic Forum. Available at <https://www.weforum.org/agenda/2021/10/new-malaria-vaccine-explained-by-the-who/>

Plasmodium falciparum Parasite rate in 2-10 year olds globally, 2019 (Malaria Atlas Project)



Developed over 30 years by GSK in partnership with PATH and a network of 11 African research centers, the vaccine acts against *P. falciparum*, the most deadly malaria parasite globally and the most prevalent in Sub-Saharan Africa. The WHO recommends its widespread use in areas with moderate to high malaria transmission in Sub-Saharan Africa.

The RTS,S dosing schedule is different from other childhood vaccines. The vaccine is recommended to be given in four doses: the first three doses between 5 and 9 months of age, and the fourth dose around age 2. This will require adjustments with the traditional infant vaccination schedule that is currently used for routine immunization service delivery in most countries.

RTS,S also requires reconstitution of the RTS,S lyophilized antigen with a liquid adjuvant for the vaccine doses, with the associated need to ensure that health staff have the competencies and support to ensure the bundled delivery and correct vaccine mixing and administration.



The Malaria Vaccine Implementation Programme examines the performance and impact of RTS,S

Following a decade of clinical trials led by the African research centers in seven African countries, as well as a positive scientific opinion from the European Medicines Agency in 2015, the Malaria Vaccine Implementation Programme (MVIP) began in 2019 in Ghana, Kenya, and Malawi. This WHO-coordinated program has been working to

understand the vaccine's performance in real-world settings and its impact on malaria transmission and moderate to severe disease. Gavi, Unitaids, and the Global Fund to Fight AIDS, Tuberculosis, and Malaria provide funding for MVIP, which will continue through 2023.

With over 2.3 million doses administered, MVIP has demonstrated a significant reduction (30 percent) in deadly severe malaria, even when introduced in areas where bed nets are widely used and communities have good access to diagnosis and treatment.⁴ While this efficacy is lower than other vaccines, the impact of the vaccine, used in conjunction with other malaria interventions (such as bed nets), is much higher. In Ghana, for example, combining bed nets and the vaccine resulted in more than 90 percent of children benefiting from at least one intervention.⁵



Critical considerations for RTS,S malaria vaccine implementation

Countries in Africa that plan to introduce this vaccine must thoroughly consider supply, funding, and programming needs in advance of implementation, as outlined below:

1. Supply considerations

As with most new vaccine introductions, there is a limited initial supply. GSK has to date committed to producing 15 million doses of RTS,S annually up to 2028 at a cost of production plus no more than a five percent margin. The WHO projects that demand for the malaria vaccine will be 50

4 WHO. 2021. WHO recommends groundbreaking malaria vaccine for children at risk. WHO. Available at <https://www.who.int/news/item/06-10-2021-who-recommends-ground-breaking-malaria-vaccine-for-children-at-risk>

5 WHO. 2021. WHO recommends groundbreaking malaria vaccine for children at risk. WHO. Available at <https://www.who.int/news/item/06-10-2021-who-recommends-ground-breaking-malaria-vaccine-for-children-at-risk>

million to 110 million doses per year by 2030 if it is deployed in areas with moderate to high transmission of the disease.

Country regulatory authorities must move as quickly as possible to approve the vaccine. Ministries of Health will need to compile and assess evidence so that national immunization technical advisory groups (NITAGs) can make policy decisions while national regulatory authorities consider approval of use.

Once more countries approve the vaccine, larger advance market commitments can be made to enable increased production of the vaccine for wider-scale use. However, this process will likely take a few years. This means that **vaccine supply will initially need to be prioritized and distributed to endemic areas/countries** that are above a certain threshold of *p. falciparum* prevalence. Testing and case tracking data should be assessed to determine where the need is greatest, prioritizing children in high-risk populations.

Countries will need to work with their stakeholders and partners to develop and implement an advocacy and resource mobilization plan in advance of RTS,S malaria vaccine introduction.

3. Programmatic considerations

As mentioned above, some of the key programmatic activities to be conducted in advance of RTS,S introduction include regulatory approval, procurement and supply management, microplanning, training of health workers, and community engagement. An additional consideration is the opportunities and challenges presented by the vaccine's non-traditional dosing schedule.

Securing country regulatory approval will require the Ministry of Health to work with the NITAG and regulatory authorities to ensure that the review and approval processes move as quickly as possible while remaining rigorous. Advocacy among stakeholders at the national level will help to facilitate this.

Dr Seth Berkley, CEO of Gavi — whose Board approved an investment to support introduction, procurement, and delivery of RTS,S in December 2021 — emphasized Gavi's role in helping to fund this vaccine program: “The vaccine is an important additional tool to control malaria in Africa, alongside other interventions ... We look forward to working with global malaria stakeholders to make sure that countries are able to implement this promising tool in the fight against malaria.”

2. Financial considerations

Gavi support processes will take time and will not be sufficient for RTS,S malaria vaccine introduction, particularly for lower-income countries. **Broader engagement will be needed to secure local resources and additional funding commitments** to enable countries to introduce this new vaccine and sustain its use long-term.

Preparing to introduce a new vaccine requires funding that will adequately cover activities such as:

- Procuring the vaccine and managing the supply to ensure availability and quality
- Ensuring adequate cold chain capacity
- Microplanning (planning at the facility and district levels that is tailored to local needs) to map local communities, determine how and where to provide immunization sessions, and update data collection and analysis tools
- Training health workers to administer the vaccine
- Developing communication and engagement plans to provide focus communities with information about the vaccine and to drive demand

Managing the supply chain is crucial for vaccines because they are made with living (or inactivated) organisms and require temperature-controlled storage and transport throughout the supply chain. Countries will need to forecast the vaccine supply needed for initial focus populations and determine whether existing cold chain equipment is sufficient or needs to be expanded. Countries should also consider whether RTS,S can be linked to existing supply chains for other vaccines or other malaria commodities.

Developing RTS,S introduction plans will require immunization and malaria control programs to be well-coordinated and engage with stakeholders, partners, local leaders, and community members to conduct detailed district and facility microplanning. Involving community members in planning before the introduction of the vaccine leads to stronger, more informed plans that meet specific local context and needs.

Because the initial limited vaccine supply will be prioritized for endemic areas, some countries that do not meet this criterion nationally will have to consider sub-national introduction in high-risk regions. This will need to be taken into account during planning.

If the initial focus populations are hard to reach due to remote location or mobility, countries will need to work with partners and community members to adapt existing microplanning, map target community locations, and determine the most effective approaches to reach them. The updated micro plans should also include plans to update data collection tools and monitor data to continually address challenges and implement improvements.

Another key area of RTS,S introduction planning will be integrating the vaccine with other malaria interventions. It is important to protect the funding and programming for other prevention and control approaches in the malaria toolkit and to introduce RTS,S as an additional measure rather than a standalone approach. Because of the lower efficacy of this vaccine, it is critical for it to be used in conjunction with these other measures.

One of the recommendations of the RTS,S MVIP in Malawi was that the EPI program should revise, print, and distribute all data recording and reporting tools to all facilities before the vaccine introduction, which helps to ensure high-quality data collection and overcome funding challenges for facilities to create these tools.

Training health workers at each level of the health system will be needed to orient them on malaria vaccination, notably the unique characteristics of the RTS,S vaccine, such as the use of a liquid adjuvant to reconstitute the vaccine and the non-traditional dosing schedule. Health workers will also need training on administering the vaccine, managing storage and transport of the supply, engaging with communities to create demand and ensure attendance at all vaccination sessions, and collecting data. Supportive supervision should also be planned to support health workers during vaccine rollout.

The **Malawi** MVIP found that providing written feedback on the issues observed during supervision, as well as providing actionable points, is helpful in establishing ongoing improvements.

Resourcing and coordinating communication among immunization programs, malaria control and prevention programs, NITAGs, and interagency coordinating committees (ICCs) is critical. Programs should build on outreach services and use data to ensure that caregivers are connected with services so that they know when and where to bring their child for all doses. Communication about the vaccine should also be integrated with the communication programs for other malaria interventions.

Communication materials should be developed with caregiver and community input (for example, using human-centered design approaches) and must ensure that messages about the vaccine are informative, confidence-building, and easy to understand for local communities.

These materials should answer anticipated questions from the public, with a focus on the communication needs of caregivers. Materials should at a minimum address when the vaccine will be available; why certain groups will receive it first; the four-dose schedule, which requires additional contacts with the child in the first two years of life; the lower efficacy of RTS,S than other vaccines; and the vaccine's health benefits and potential side effects.

Technical guidance should also be developed to support health workers in reconstituting, administering, storing, and handling the vaccine.

Communication planning is one area where community members should have a voice. In the RTS,S MVIP in Kenya, with support from PATH, community members reviewed communications materials before they were distributed, which helped to ensure effective and appropriate messaging. Questions and answers were also translated into local languages before materials were developed.

Preparing the immunization system for the vaccine's non-traditional dosing schedule means that RTS,S introduction will require updating immunization cards and reporting tools, as well as developing a more comprehensive strategy for the additional first-year and second-year vaccination sessions. The additional RTS,S sessions required in the first year of life create an opportunity to space out immunization injections and optimize other vaccines. The fourth dose in the second year of life also provides an important contact with the health system for other health checks.

One of the biggest programmatic challenges will be to ensure communities are reached with all four doses of the RTS,S malaria vaccine for optimal public health impact. The fourth dose is critical for increased protection against malaria. The MVIP countries used different schedules for the fourth dose within the second year of life. In Kenya and Ghana, the fourth dose was given at 24 months while in Malawi this was given at 22 months.

The RTS,S MVIP in **Malawi** found that communities need to be engaged more to ensure follow-through with the fourth dose, since it takes place about 15 months after the first three doses. The RTS,S MVIP in **Kenya** showed that community health workers play a critical role in creating and sustaining demand for the malaria vaccine. These findings speak to the importance of training health workers on community engagement approaches.



The art of implementation: JSI's experience with new vaccine supply, financing, and programming

Countries often need assistance from a technical partner experienced in introducing new vaccine programs from



Credit: Beatrice Adwoa Afari (GHS)

national to community levels. This will be useful in advance of RTS,S malaria vaccine implementation, to help ensure a successful introduction and lay a strong foundation for program scale-up.

For vaccine introductions, **JSI's specific support includes:**

- Helping national governments prepare for the grant application to Gavi
- Advocating for regulatory approval
- Integrating new vaccines into countries' routine immunization system
- Engaging with and coordinating multi-sector partners and civil society
- Developing communication and social mobilization initiatives
- Analyzing vaccine delivery and readiness of the cold chain/logistics system, and providing technical assistance on meeting any supply chain needs for the new vaccine
- Analyzing and updating data tracking tools to manage the vaccine supply and document doses administered
- Providing technical assistance for training and capacity building of health care workers
- Providing supportive supervision and monitoring during introduction and post-introduction

JSI offers [decades of experience](#) and specific competencies to support countries with RTS,S introduction. We are **world leaders in strengthening effective routine immunization systems**, introducing new vaccines in over 40 countries, and improving the quality and use of immunization data at facility levels to reduce inequities and increase vaccination coverage. We support countries to strengthen sustainable immunization programs, integrate health services as appropriate to improve reach and make the best use of resources.

For **non-traditional vaccine introductions like RTS,S**, JSI has supported many countries in assessing the challenges and considerations, developing plans and solutions, and successfully starting up these vaccine programs. As the lifecycle of vaccination programs has expanded beyond the first 12 months of life, JSI has supported vaccination programs — such as those for human papillomavirus (HPV), meningococcal A, measles second dose, and COVID-19 — in adapting to new dosing schedules outside the traditional childhood schedule. RTS,S would also be adapted to this expanded lifecycle.

The introduction of the RTS,S vaccine will also require changes to a country's home-based records (HBR) system. JSI recently provided technical expertise to [improve the availability and use of HBRs](#) in four countries. This included the redesign, monitoring of stock management, data triangulation and use, and capacity building of health workers in Benin, Democratic Republic of the Congo (DRC), Nepal, and Zimbabwe (building off of decades of work in other countries as well). This also links with innovations such as the [My Village My Home data tracking tool](#) (which we have supported in several countries), which empowers village leaders to collaborate with village health workers and health facilities to monitor children's immunization progress.

Since 2013, with funding from Gavi, **JSI has provided technical assistance to seven countries introducing the HPV vaccine nationwide —Cameroon, Kenya, Madagascar, Malawi, and Mozambique, Tanzania, and Zimbabwe.** JSI also supported HPV vaccination demonstration projects in **Niger, Madagascar, and Zimbabwe.** Additionally, in several countries over the last 10+ years, JSI has been involved in the introduction of pneumococcal conjugate and rotavirus vaccines, (including India's [nationwide roll-out](#) of these

vaccines), as well as measles second dose and inactivated poliovirus vaccine, leveraging a wide range of funding sources.

Since the emergence of COVID-19, **JSI has been engaged at the forefront of the global response, including [COVID-19 vaccine introduction](#)**. At the global level, we are an advisor with the COVID-19 Vaccine Delivery Partnership, providing immunization expertise worldwide for COVID-19 vaccination and country implementation. JSI has developed global guidance, such as co-authoring the [WHO COVID-19 vaccination operational microplanning](#). We are actively supporting more than 15 countries in Africa and Southeast Asia to ensure a smooth introduction, effective supply chain systems, trained providers delivering immunization services at facilities and in communities, and targeted communications to build confidence and acceptance of the new vaccines.

Targeted technical assistance for vaccine introduction is based on the needs and national rollout plans in each country and is conducted in close collaboration with the Ministry of Health's Expanded Program on Immunization (EPI), other relevant government programs, Gavi, WHO, UNICEF, and other partners, including civil society organizations. JSI equips local providers with the tools and technical expertise to support and expand their programs and apply their unique knowledge to tailor solutions to local needs.

Now is the time for countries to think through the steps needed to prepare for RTS,S vaccine introductions. RTS,S promises to be a gamechanger in the fight against malaria, but it has to be provided as part of a comprehensive strategy and through health systems that can support effective, equitable distribution.

For more on JSI's immunization work, [click here](#). Learn more about JSI and our nonprofit, JSI Research & Training Institute, Inc., at www.jsi.com.