

R21/MM: A Breakthrough Malaria Vaccine

R21/MM is a new vaccine that was just announced. It has a 77% efficacy after four doses. Like RTS,S/AS01, it is a protein-based vaccine for only children. It is also in the trial phase. It may arrive within a few years and would be important in helping prevent malaria for children (11).

Malaria's Future

The **World Health Organization** has set a plan for tackling malaria. It includes monitoring and treating people that have malaria symptoms. By 2030, they plan to reduce malaria rates and mortality by 90%. They also plan to eliminate it in 35 countries (14).



Getting rid of malaria is one of the most important health goals today (15)

Think you have malaria? Ask your doctor today and stop it from spreading!

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Malaria: Know the Facts!



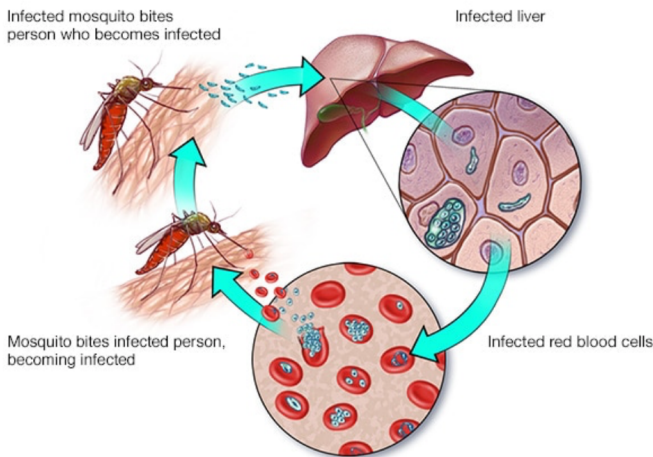
Anopheles mosquito infected with malaria (1)

Meet the mosquito

The bite of a female *Anopheles* mosquito spreads malaria to humans. This fly is a vector, which is something that can spread disease. It carries a parasite, a single-celled protozoan from the genus *Plasmodium*. Different species of parasites from this genus cause different types of malaria. For example, *Plasmodium falciparum* is the most dangerous one (2).

How does it cause disease?

Infected mosquitos spread malaria parasites. These parasites go to the liver. Then, they go to red blood cells to cause malaria symptoms. Since blood has these pathogens, malaria can spread from blood transfusions, needles, and pregnant mothers to their babies (3).



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Malaria infects red blood cells, causing symptoms (3)

What are the Symptoms?

Malaria symptoms include fever, chills, headaches, feeling tired, and vomiting. Infections can cause severe symptoms like coma, kidney failure, and death (4).

What is Malaria's Prevalence and Who is at Risk?

- There were 229 million cases and half of the world population was at risk in 2019
- Two of three malaria deaths are from children under the age of five
- In 2019, there were over 400,000 deaths from it
- It is a worldwide problem, but 94% of cases and deaths come from Africa
- Living in malaria-rich places like Africa and Central America is the biggest risk for being infected (5)

How is Malaria Diagnosed?

Malaria is diagnosed using in labs with molecular tests. **Polymerase Chain Reaction (PCR)** detects the malaria pathogen directly by looking for DNA sequences specific to *Plasmodium* in blood samples. These tests are highly sensitive and specific, but many rural facilities do not have the equipment needed for this task (2).

Rapid antigen tests also detect the pathogen directly in blood samples. They look for malaria antigens, which are parts of the pathogen, using anti-malaria antibodies,.

Serological antibody tests look for antibodies against *Plasmodium* in the patient's blood. Technicians are needed to look at these samples. These tests are not as accurate as PCR tests (2).

Microscopy can be used to look at blood smears. Blood is put on a microscope slide and a Giemsa stain is applied. A light microscope looks for blood cells with malaria parasites. This is a cheap way to identify malaria, but it takes a lot of time and work (2).



Blood smear of blood infected with ring-like *Plasmodium falciparum* (6)

Malaria is Treated using Antimalarial Drugs

Chloroquine phosphate is the primary antimalarial drug used against malaria parasites. If this drug does not work, **Artemisinin-based combination therapies** are used. This method uses two or more drugs together, like artesunate-mefloquine, to target the parasite. The amount of time for these treatments depend on things like age, the type of malaria, and symptoms (7).

A New Diagnostic Method: Rotating-crystal Magneto-Optical Detection

Scientists have found a new way of detecting malaria: **Rotating-crystal magneto-optical detection**. This innovation uses hemozoin crystals with lasers. It detects hemozoin that malaria parasites release into blood. It is cheap to use and easy to train staff with this method (8).



The RTS,S Vaccine (9)

RTS,S/AS01: An Effective Malaria Vaccine

As of March 2020, there is only one vaccine that significantly lowers the risk of malaria for African children: **RTS,S/AS01** (10). This is a recombinant vaccine that has a protein of the *Plasmodium* pathogen.

Researchers found that the vaccine was effective against malaria with a 55.8% efficacy after a year (11). But, they saw this efficacy go down to almost zero after four years. Another problem with this vaccine is that it is not easy to get. It is still in the trial phase and is only for children younger than 18 months old (12). More work needs to be done to find a good long-term vaccine against malaria for people of all ages (13).