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How helpful is the R21 malaria vaccine?

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Abstract

Have you ever heard of malaria? It's a serious disease spread by mosquito bites and affects millions of people each year. Scientists have developed vaccines to help stop malaria. The new R21 vaccine looks very promising. We tested it on 5,139 kids in Africa to see if it works and if it's safe.

We found that the vaccine worked really well. It prevented 73% of malaria cases overall. It worked best for younger kids, stopping 78% of cases. Moreover, most side effects were mild, like a sore arm or a fever, and serious problems were rare.

This vaccine could help save many lives if used more widely in places where malaria is common.

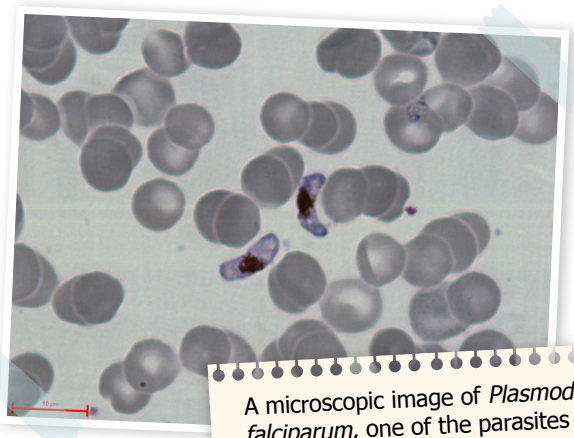
Introduction

Did you know that malaria is one of the deadliest diseases out there? It affects more than 220 million people! And sadly, it kills more than 620 thousand each year. A tiny **parasite** causes malaria, and it infects people through a mosquito bite. Scientists have tried various methods to control malaria. And while many have been helpful, the best way to control this infectious disease is through a **vaccine**!

The World Health Organization has already recommended the use of one malaria vaccine (called RTS). It shows good results in children under 1.5 years old in areas where malaria is common. Yet the **efficacy** is a bit low (58%) and decreases over time, which is of course a problem.

Another vaccine, called R21, has shown promising results. Earlier tests (Phase 2 trials) showed 75% efficacy in children under 1.5 years old. But malaria is most dangerous to children under 5 years old. In fact, 80% of malaria deaths in Africa occur in children under 5 years old. This is why we wanted to see the efficacy of this vaccine in a broader age group. We also wanted to see if it was safe enough.

For the curious: ***Vaccines go through a set of trials to become approved. Before testing on humans, scientists do experiments in the lab and on animals. This is called the preclinical phase. Phase 1 trials are tests on a small group of healthy volunteers. In Phase 2, a larger group of people (several hundred) receive the vaccine. The scientists test the safety and efficacy of the vaccine. In Phase 3 trials, several thousand people receive the vaccine. The researchers confirm if it is effective and safe. If it is, the vaccine can be approved.***



A microscopic image of *Plasmodium falciparum*, one of the parasites that causes malaria. **Image:** Stefan Walkowski, CC BY-SA 4.0.

Methods

The study took place in four countries in Africa: Burkina Faso, Mali, Kenya, and Tanzania. These are places where malaria is very common. In parts of Burkina Faso and in Mali, malaria occurs in certain seasons, while it occurs all year round in Kenya, Tanzania, and other parts of Burkina Faso.

In total, we enrolled 5,139 children and divided them into two groups. One group received the R21 vaccine. The other group received a **control** vaccine that doesn't protect against malaria. The children got three doses of the vaccine four weeks apart and a **booster dose** 12 months later.

The doctors and nurses didn't know which vaccine each child received. Neither did the children nor their parents. This is important so that the study is fair and unbiased! We wanted to avoid anyone being influenced by their expectations.

Our main goal was to see how well the R21 vaccine prevented malaria. We looked at how many children got the disease starting 14 days after their third dose. We continued to check for a year. We also wanted to see how well the vaccine worked against severe malaria. Did it reduce hospital visits due to malaria? Safety was also an important part of the study.

Results

From April 2021 to June 2022, we enrolled 5,139 children. Out of these, 3,252 children received the R21 vaccine. The others got the control vaccine. The results showed that the R21 vaccine was very effective in preventing malaria for one year. In areas with seasonal malaria, the vaccine prevented 75% of malaria cases. In areas with year-round malaria, it prevented 67% of cases. Combining all the data, the vaccine was 73% effective overall!

The vaccine worked better in very young children (5–17 months), with an efficacy of 78% (Figure 1). For older

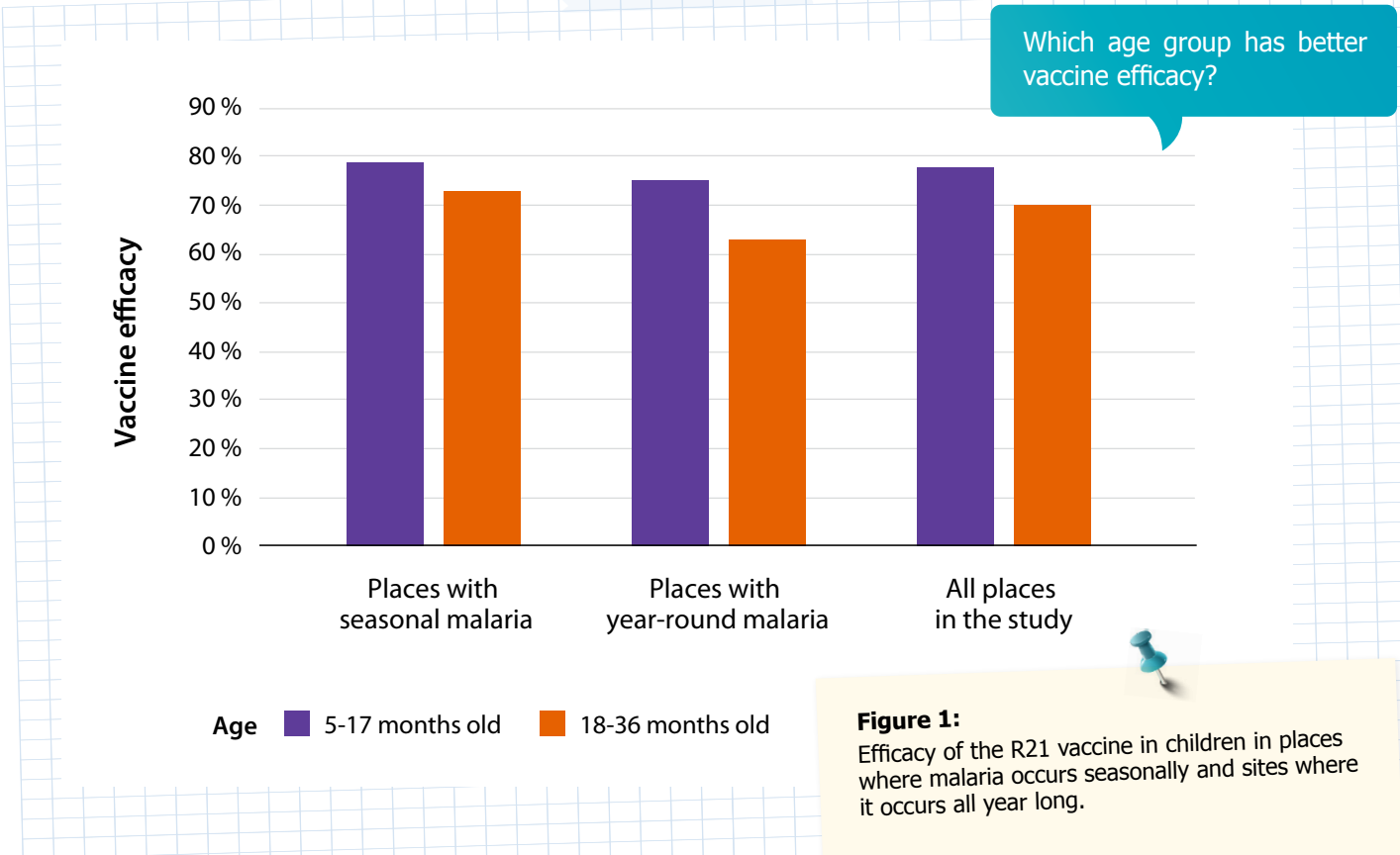


Figure 1:
Efficacy of the R21 vaccine in children in places where malaria occurs seasonally and sites where it occurs all year long.

toddlers (18–36 months), the efficacy was 70%. Although the vaccine's efficacy decreased slightly over time, it still prevented more than 60% of malaria cases after 12 months.

As there were only a few cases of severe malaria, we couldn't assess the vaccine's efficacy against it. The same was true for hospitalizations.

In terms of safety, most side effects were mild to moderate. The most common side effects were pain at the injection site and fever. Serious side effects were rare. There was no significant difference between how many children in the vaccine and control groups died during the study period.

Discussion

The results of this study are very promising. The R21 vaccine is very good at preventing malaria in young children. This is important because malaria is particularly dangerous for children under 5. Also, it's more effective in younger toddlers (5-17 months), compared to older ones (18-36 months). This is actually good news, since usually by that age kids should have already received the vaccine. It works well in both places where malaria occurs in certain seasons and where it can happen anytime. Even though the vaccine's power gets a little weaker over time, it still protects kids well by the end of the year.

We also found the vaccine to be safe, with most side effects being mild and like those of other vaccines. Its ability to maintain high effectiveness over a year is encouraging. This is especially true for younger children.

If governments start using this vaccine it could help save many lives! It could also reduce the number of malaria cases in areas where the disease is common.

There are still some things we should find out. For example, how well the vaccine works over a longer period. It's good to know if it can reduce the spread of malaria in other parts of the world.

Conclusion

Malaria is only one of many mosquito-borne diseases. There are many more out there, although none cause as many deaths. Vaccines are great at preventing diseases, but they are not always available. So, it's important to prevent mosquito bites as much as you can!

- Cover your skin by wearing long sleeves and pants.
- Use repellents – there are sprays you can use on your skin and also some you can use on your clothes.
- Don't forget that mosquitoes like water. Remove any stagnant (still) water from the area around your house.

Glossary of Key Terms

Booster dose - an extra shot of a vaccine you get after the initial doses. It's like a reminder for your body to keep fighting the disease so you stay protected for a longer time.

Control group - a group that is not affected by the thing being tested. Scientists use the control to make comparisons in an experiment. In our case, the control group was the people who received another vaccine (against rabies).

Efficacy (of a vaccine) - a measure of how well the vaccine protects the person who gets it.

Parasite - a tiny organism that lives on or inside another living thing (like a person or animal), called the host. Parasites get their food from their host. This can make the host sick. Several tiny parasites cause malaria, but the most prevalent is *Plasmodium falciparum*.

Vaccine - an injection of a killed or weakened pathogen (or even just a piece of the pathogen's genetic code), in order to stimulate the immune system against it. A pathogen is something that makes you sick. This means that the immune system can recognize those pathogens if they ever come back, and destroy or disable them, preventing disease.

Check your understanding

1. How is malaria spread? Can you think of any other diseases spread in the same way?

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2. Why is it important to have a control group in a vaccine study (and other experiments)?

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3. Compare the results of the R21 vaccine in areas with seasonal malaria versus year-round malaria. What might be a reason for the difference in efficacy?

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4. What mosquito-borne diseases are there in your country? How is your government trying to control them?

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