Gemma Ware: Hello, this is Gemma Ware. Today, we’ve got a special episode of The Conversation Weekly for you that was actually produced several months ago, but we’ve been waiting for the news to be officially announced. And it was. On the 2nd of October, The World Health Organization approved the use of a new vaccine for malaria, days after promising provisional study results were published in the Lancet Medical Journal. This vaccine has been a long time in the making. And today, you’ll get to hear from some of the people behind it. This episode was produced while I was on maternity leave and before my former co host Dan Marino left The Conversation. So today you will hear again from Dan and from Nehal El-Hadi. We hope you enjoy.

Dan Merino: Hello, I am Dan Merino in San Francisco.

Nehal El-Hadi: And I’m Nehal El-Hadi in Toronto. Welcome to The Conversation Weekly.

Dan Merino: This week, we are exploring an exciting new development in the fight against malaria. Malaria is a parasitic infection that people can get from mosquitoes. So just a bit of context first, according to The World Health Organization, in 2021, there were an estimated 247 million cases of malaria that led to around 619,000 deaths, mostly, unfortunately, in children.

Nehal El-Hadi: That’s, that is a massive, I didn’t expect the number to be that huge.

Dan Merino: And I think it’s, at least for me, it’s particularly frustrating and sad when it’s a preventable disease, right? And in fact, has been more or less eradicated from the global north.

Nehal El-Hadi: We’re also coming off the COVID 19 global pandemic, where vaccines saved the day. Why has there been no vaccine for malaria yet?
Dan Merino: Well, people have been working on one for quite a while now, and that’s actually what we’re going to be talking about today. The Jenner Institute at Oxford University in the UK has announced the results of a phase 3 clinical trial of a new vaccine called R21, and it’s looking very promising. This is the second malaria vaccine approved within the last few years. A vaccine known as RTSS was approved back in October 2021.

Today, we’re going to be talking to the scholars who developed and tested the R21 vaccine. We’re going to explore why it took so long to get a malaria vaccine, and what this vaccine might mean for the fight against malaria going forward.

So, for this conversation, it helps to first understand what malaria is, why it’s such a hard parasite to fight, and how it’s different from other diseases. So I reached out to Faith Osier. Faith is a medical physician and co-director of the Institute for Infection at Imperial College London in the UK, where she also has a chair in Malaria Immunology and Vaccinology. Faith began her career training as a pediatrician in her native Kenya, where she saw firsthand the devastation malaria could cause.

Faith Osier: When things really hit me was when I went to work in the sticks. I went to a district hospital, so I was going further out, away from the city. And that’s when I realized, oh my gosh, this is serious because on a single night, I would be admitting like five children, five young kids to a high dependency unit on a single night in desperate conditions, in desperate situation.

And on the ward during the malaria transmission season, when it’s raining a lot, there’s a lot of malaria. The ward would just be jam-packed. And so that’s when it began to dawn on me as a young doctor, what a serious problem malaria was. So until then, I hadn’t really taken stock of the numbers or realized what a big deal this was, millions of kids in Africa. So if you fast forward today, what are the numbers? In Africa alone, it’s over 200 million cases every year. So of the global burden, over 90% of it is in Africa.

Dan Merino: Beyond the tragedy of the deaths caused by malaria every year, Faith notes that there are many other costs of the disease as well.

Faith Osier: When you just think about people in clinic, there are others languishing at home. There’s so much time lost. There’s so much school and learning lost. There’s so much productivity and work time lost. It’s a huge, huge economic waste for the continent. So those numbers are just staggering.
Dan Merino: Explain roughly how the malaria parasite works, because I think a lot of people are familiar now with viruses from the pandemic, of course, and it’s a little different than a bacteria, but the malaria parasite is very complex and very advanced in terms of a parasite.

Faith Osier: So you get an infection with malaria, it begins with a mosquito bite. And that mosquito injects what we call sporozoites, a stage of the malaria parasite that get carried in your circulation into the liver, and then it develops there. So all this time, it’s about 7-10 days, it will develop in your liver. And you wouldn’t really know that anything’s amiss, but about two weeks, 10 days, two weeks from the time you’ve got the mosquito bite, the parasites appear in the blood, but not the same stage that was in the mosquito. And they’re maturing into a different stage as part of their development. And they are increasing in number, so they are multiplying exponentially. And they’ve morphed into a different structure.

So when you look at a sporozoite, it’s quite a distinct and different thing that you’re looking at, compared to if you look at a merozoite, which is what’s emerged in the blood. They’re S shaped, almost like a sickle, like a little snake, a short little snake. Whereas, the merozoites have the shape of an egg. But the thing is, these parasite stages are packed with proteins, different proteins. And this is why the vaccine development’s difficult. On the merozoite surface alone, we estimate that there are about 800 different proteins.

Dan Merino: So for a vaccine to be effective, it would need to imitate one of those proteins or a combination of them in order to provoke an effective immune response. Once the body has developed an immune response, it will be better able to fight off the malaria parasite if it ever encountered one. Choosing the right protein or combination of proteins to target is difficult in creating any vaccine. This was especially true with malaria, as it changes so much during the course of its life, so creating a vaccine was a frustrating and time-consuming process of trial and error.

Faith Osier: So we started with a sporozoite. It’s got a lot of proteins and it changes into something else, which is called the merozoite in the blood stage. And that has its own set of proteins. Some of the proteins overlap with the previous stage, but many of them are just distinct to that stage.

Dan Merino: And what is the merozoite doing in the body at this time? When there’s, you know, eruption of merozoites out of the liver?
**Faith Osier:** So the merozoites is now when the real deal begins. That’s when stuff hits the fan is when the merozoites get into the blood because now they invade red blood cells. So your circulation. And once they’re in there, they make themselves at home within the red cell, and they take in nutrients and they multiply. And then they burst out once they’ve eaten up everything, there’s nothing else. And the children are hungry, they burst out and they get into other red cells. So in each cycle, one merozoite becomes 20 to 30, those 20 to 30, each of them becomes 20 to 30.

And so now, that’s when you develop the clinical symptoms. That’s when you have fever, headache, malaise, tummy ache. The symptoms actually feel like you maybe you have a bad flu when it’s just beginning. But then if you don’t have immunity or if you don’t go on to get treatment, then you continue destroying your red blood cells, and that makes your blood count drop. So some of the children I would be admitting to the hospital, they would be, we would call it paper white, because their blood count had dropped so low because of the infection. You’re literally losing your blood to the parasites.

**Dan Merino:** At this point, a malaria infection will enter its next stage as the parasite changes yet again.

**Faith Osier:** So, in the blood, it multiplies, and that’s a big problem. But then, as it matures within the blood, it also puts proteins on the surface of the red cell. Imagine you’ve got an orange and you put colored pins and you stick them all around so that there are all these parasite proteins on the red cell. And what happens to a red cell that’s like that, is that it gets stuck within the blood vessels, for example, in your brain. Yeah, so the blood flow becomes slow and sluggish because these things are now sticky.

**Dan Merino:** So it’s almost like a coagulant in a sense.

**Faith Osier:** Exactly. It blocks your blood flow. And so children present with cerebral malaria. So they’re in coma, basically, because these parasites are now hiding inside their organs, including the brain with that stickiness on the red cell. So that’s how the disease takes you downhill if you don’t get treatment.

**Dan Merino:** With malaria, time is critical. Faith says that if treatment comes too late, the damage to a patient’s body and brain can be irreversible, even if their life is saved.

**Faith Osier:** So you can clear the parasites, but some people, that inflammatory process within the body has already gone too far. And even with the best
treatment, you don’t really get them back. So it’s really important to treat people early before things go bad.

**Dan Merino:** Even this far into a malaria infection, the parasite continues to change even more.

**Faith Osier:** Once it’s in the blood and it’s going through that multiplication, some of those stages become boys and girls. We call them gametes, and that’s a different stage. So these are now what we also call sexual stages. So again, they look different from what was in the skin, going to the liver, from what was in the blood. What was on the surface of the red cells. These ones also look distinct. But these ones are the ones that mosquitoes then feed on. And then the parasite goes and develops a little bit more in the mosquito and they fertilize in the mosquito and that’s how the full cycle happens.

**Dan Merino:** One of the key challenges in developing a vaccine for malaria has been trying to figure out what stage to even target in order to stop the parasite.

**Faith Osier:** Do you catch it at the skin stage, that skin to liver stage? Do you catch it in the blood? Do you catch it when it’s a merozoite? Do you catch it when it’s on the surface, when it’s the sticky orange bit? Or do you catch it when it’s the gametocyte, yeah? And all those have their pros and cons of why would you go for this? What’s common to all of them—and this is why it’s quite different from a virus—what’s common to all these stages is that there are thousands of proteins. That’s complicated enough. Each protein can be variable. So you know how with the strains you had that Covid strains. You had alpha, you had beta, you had omicron. So imagine now each of your genes that encodes those parasite proteins has built in some variability.

**Nehal El-Hadi:** That sounds so incredibly complicated. All the different variables, the life stages, the different forms that the malaria parasite can take. No wonder it’s been really challenging to develop a vaccine.

**Dan Merino:** And given that malaria has been around for the entire history of humanity, there’s been a lot of evolutionary back and forth between our two species. The arms race, the immune system fighting it off, and malaria figuring out how to evade it, right? This is a complicated bug.

**Nehal El-Hadi:** So you had mentioned that most of the deaths caused by malaria are in children, and Faith had said that most of the cases that she saw were in children. Why’s that?
Dan Merino: I had the exact same question, Nehal, and I was lucky enough to be able to speak with Adrian Hill, the director of the Jenner Institute at the University of Oxford in the UK. He is the leader of the team that developed the R21 vaccine, and he was able to explain why adults tend to be more immune to the effects of a malaria infection.

Adrian Hill: Just getting infected once by malaria doesn’t give you protection against the next infection because in the areas of malaria where we test our vaccines in Africa, some children get up to eight to ten episodes in three or four months. So they get quite unwell with the first and three weeks later, they’re having a second and so on.

So natural immunity doesn’t work until you’ve had a lot of different infections. And usefully, that’s why adults are generally protected against malaria and don’t become very unwell but the people who die of malaria in an endemic area are the young children, who may never have been infected before and die with their first infection when they’re say one year of age. Or they might have had one or two episodes, but that wasn’t enough to give them sterilizing immunity.

We know that malaria has been around for tens of millions of years. So it has adapted and evolved really well, not necessarily to kill the host, but to live in the host. So there are tens of millions of people out there today who were infected by malaria. Happily, the majority of them are well, because they’ve been infected before and they have some immunity. And that’s great for the malaria parasite. It carries on living in them, and the lifecycle continues.

So it’s a very wily parasite and has developed immune escape mechanisms of all sorts. So when you try to vaccinate, you suddenly find there’s some way the parasite gets around that. And it’s only when you get up to really extraordinarily high levels of antibodies that the parasite has never seen during its evolution. These are levels that are the product of modern biotechnology that the vaccines begin to work and make a difference and stop people becoming unwell.

Dan Merino: It has taken a long time for biotechnology to get to a point where researchers could even begin to fight malaria.

Adrian Hill: It wasn’t until the 1980’s when we could actually begin to sequence the genes in the parasite that new candidates appeared. And then within 10 years we had 5,000 candidates because everyone thought the gene they had sequenced might be a malaria vaccine, and of course most of those failed. And really what we’ve learned over the last 30 years or so, is to protect against malaria, you need extremely high levels of immunity, specifically
antibodies against those sporozoites. So to give you a scale on that, we reckon that the level of antibody you need to protect against malaria is probably about 10 times higher than you need to be protected well against Covid.

Nehal El-Hadi: So the challenge that doctors and immunologists are up against is that, this is an extremely old parasite that predates humanity, that has evolved to change itself constantly inside its hosts to avoid their natural immune responses. It’s also passed from host to host by the ever- and increasingly abundant mosquito. I’m starting to get why it’s taken so long to find a vaccine.

Dan Merino: Yeah. And I do want to be clear that while today we’re focusing mostly on the scientific and biological challenges, there have certainly been political and economic considerations, too. The market for this vaccine is generally resource-poor sub-Saharan African nations. That influences how the scientific research is funded because drug companies aren’t likely to make as much money as they could doing something else. But those considerations aside, as you just said, Nehal, the science behind this is extremely complex and difficult.

Nehal El-Hadi: So how did they come up with this new vaccine? How does it work? How did they develop it? How effective is it?

Dan Merino: Adrian and his team at Oxford have just released the results of their phase three trial of the R21 malaria vaccine. So I’ll let him explain what they found.

Adrian Hill: We’ve been targeting the sporozoite, which is the form that the mosquito inoculates into your skin. And we’re trying to trap it before it can get to the liver and carry on the life cycle. And luckily, there are no symptoms of malaria at that stage. It’s a silent infection until it gets into the blood and starts multiplying inside your red cells.

Dan Merino: This is that initial spore stage that Faith mentioned. After a person gets infected from a mosquito bite, they usually have about 7-10 days without symptoms.

Adrian Hill: And intriguingly, very few parasites get inoculated by a typical mosquito bite, maybe twenty. Compare that to Covid, where you might have thousands or tens of thousands of virions going into your throat.
Dan Merino: Interesting. So you mean only like 20 or 30 individual malaria parasites get inoculated with a single mosquito bite that could be the thing that triggers your infection?

Adrian Hill: Correct. Yes. And if you can wipe out those 20 within minutes of the inoculation with the immune system’s antibodies, then you’re fine.

Dan Merino: So given that it’s possible to halt an infection really before it starts, a vaccine that can target this stage of the infection would be incredibly effective.

Adrian Hill: So the R21 vaccine has been around for about 10 years. It was made in the lab here at the Jenner Institute in Oxford by a graduate student, Catherine Collins, for a very successful PhD thesis. And she showed that in mice, it would produce these extremely high levels of antibodies when she combined it with something called an adjuvant.

Now, most vaccines you’ve had have some type of adjuvant in them. This is a very potent one called Matrix M, that really amplifies those antibody levels to super high levels. And in mice, where she had an animal model of protection against malaria, she could get very high level protection that appeared to be durable at least for many months. So we were so encouraged by that and further work in the lab here that we decided to go ahead and try and prepare material for a clinical trial.

Dan Merino: Adrian explained that while the elements of the R21 vaccine aren’t new, it is the composition and shape of the vaccine that set it apart from previous attempts.

Adrian Hill: Over the years, we had compared a whole variety of different vaccine types including DNA vaccines, RNA vaccines are now being tried, but the vaccine that we are using as R21 is a protein based nanoparticle. So it’s about 20 nanometers in diameter. It’s obviously microscopic.

Dan Merino: The R21 vaccine nanoparticles consist of an inner core that is composed of the Hepatitis B vaccine with an outer layer of circumsporozoite protein.

Adrian Hill: It’s right on the surface. So it’s coating the outside and even better, part of that protein has little repeats of just four amino acids, 20 even 30 times in different strains. So if the parasite mutates to try and avoid the vaccine, it’s got to do a lot of mutating and will probably damage itself by doing that. So
way back in 1984, when this said gene was first cloned for the circumsporozoite protein, the optimists said, “Great, we’ll have a malaria vaccine in five years”. That didn’t happen because of the problem of making really strong antibody responses.

**Dan Merino:** It’s the spherical shape of the nanoparticles that makes R21’s antibody titers more potent and more immunogenic than previous versions of the vaccine.

**Adrian Hill:** It has a structure, it’s rather spherical. And that nanoparticle sphere generates higher antibody titers than just the protein on its own. And that was the key to this antigen that we call the circumsporozoite protein, being the most protective part of the malaria parasite, at least in trials so far. So that protein wasn’t a new guess, if you like. It had been tried in the clinic before and failed.

**Dan Merino:** Once they had gotten these promising results in the lab, it was time to organize a clinical trial. One of Adrian’s collaborators in setting up and implementing the clinical trials for the R21 vaccine is Alassane Dicko. Alassane works at the Malaria Research and Training Center at the University of Bamako in Mali. As a child growing up in Mali, Alassane witnessed the harm of malaria firsthand.

**Alassane Dicko:** It’s just a disease that people live with. If you take people of my age, at that time there is even no access to, there is no bed net. The access to health care was very limited when we are young. So we have a lot of our friends, our brothers, sisters who have died from malaria.

I realized the problem of malaria really when they go to medical school and they start to go to the clinics and when I went for pediatric training. And if you see the parent crying with their children on their hand in the coma, unconscious, you know, several malaria cases. All the day, the clinic is getting full of children during the rainy season. Full, full, full. The door is just opening, people are entering with several malaria cases. So we are running, trying to provide care to those children. And you quickly realize this is really the number one problem in the country. And, you know, based on other experience that they say, I think if I want to contribute in the health in any way that should be focused on malaria.

**Dan Merino:** Alassane studied with the National Institutes of Health and the Center for Vaccine Development at the University of Maryland in the U.S. Later, he returned to Mali to bring his experience back to the University of
Bamako, where he has partnered with immunologists from around the world to carry out clinical trials of various malaria vaccines, including the R21 vaccine.

**Alassane Dicko:** On the ground, what you do is, for those vaccines, when you test them, you have to follow a very rigorous protocol. You have to lay out exactly what you are doing in a protocol, and this has to go to the regulatory bodies everywhere in the country where it’s being tested, but also people will approve it later if the results are correct. So this is the first step. The second step is that we have to develop for each, what we call the standard operating procedure. For each procedure, even taking the temperature, making a clinical examination, analyzing the blood for the paradigm. Every activities that you do in the clinic has a specific procedure that have to be written. People have to be trained on that. So you do all this together.

**Dan Merino:** And how many participants did you have?

**Alassane Dicko:** We have 1,200 in Mali and in overall we have 4,800 for all the sites combined. So basically Mali had one fifth of the participants.

**Dan Merino:** So you’ve got a thousand people and what’s it look like when they come in to get the vaccine or the placebo? What are the kind of processes? You said you check for their temperature, you check the blood for the parasite. Can you walk me through, kind of that, basic process?

**Alassane Dicko:** The R21 is being tested in children because as I told you, children has the highest burden of malaria. So it’s being tested in children, but the age group that we are testing in is five month to 36 month of age. So we have to explain to the parent and get their permission. They have to agree that they want their children to participate. That’s the first step.

The second step is that a clinician will look to see if those are, you know, not children who have, for example, let’s say that he have a chronic disease. You don’t want to have those. So you screen, you look at the eligibility criteria, you want to make sure that the age range, okay, has to have five or at least. Okay. And should not be older than 36 months. So you look at all those criteria and you select the participant based on that. And then after that, they are randomized, there is a system that randomly allocated some to either the malaria vaccine or the control vaccine.

**Dan Merino:** So once you select these participants, do you bring them into the clinic and then you just give the baby a shot, I imagine?
**Alassane Dicko:** Exactly. So once people, they get the shot, okay. And they were followed up for what we call the safety, meaning that we have met to make sure if they get some adverse event or not. So people will go to visit the children at home, every day for the six day possible vaccination. And at the same time in our clinic, we have clinicians that are 24 hours available to see any children who have any disease. So we went to see first whether there is any side effect of the vaccine.

Secondly, we went to see what is the effect of the vaccine on the disease and the infection. So therefore we look, when they get sick, they come, they’re evaluated, and we’ll be able to determine either they have malaria, they have respiratory infection. And it’s based on now the result of this follow up for one year or for two years that you put together, you compare what happened in the group who have received the vaccine and the group who have received the control vaccine. So we have followed the children now for more than one year.

**Dan Merino:** So as I mentioned before, the R21 vaccine isn’t the only malaria vaccine trial that Alassane has run. But the reason we’re talking about it today is that the results of the R21 phase 3 trials were just released. And those results are incredibly exciting. So let’s return to Adrian.

**Adrian Hill:** So the short summary is we’re seeing about 75% efficacy of our vaccine. In other words, diminishing the number of clinical episodes that, say, a child would get by 75%, compared to children who have not been vaccinated. And that’s over one year. And timing is important here because most vaccines wane a bit over time because malaria needs such high antibody levels, sometimes you see waning immunity more quickly. So we now have data over three years in our phase two trial, showing that the efficacy stays up pretty well. About 73% over three years, which is really encouraging.

**Dan Merino:** Alassane offered even more detail about what they found.

**Alassane Dicko:** If you just take the group of 5-17 months of age, which is where the groups that were currently identified for the RTSS, the efficacy is even higher. We have 80% efficacy.

**Dan Merino:** Oh, really? Wow.

**Alassane Dicko:** Yeah.

**Dan Merino:** So even better for, the kind of, the most vulnerable age range here.
**Alassane Dicko:** Exactly. And if you take the site-specific data, you know, like our site, the efficacy is also 80%.

**Nehal El-Hadi:** That’s huge, especially when you’re talking about life saving impacts.

**Dan Merino:** Right? That kind of efficacy is a game changer.

**Nehal El-Hadi:** I want to go back to something you mentioned earlier, that there was another vaccine that had come out just over a year ago.

**Dan Merino:** Yes, the RTSS vaccine.

**Nehal El-Hadi:** So, we’ve been looking for a vaccine for decades, and suddenly we’ve just found two? How did that happen?

**Dan Merino:** That is a great question, and I asked Adrian about this as well. And there’s a mix of a few factors. Obviously, like all science, malaria vaccine research has benefited from more time and more research. Science gets better as we do more of it. Different researchers have been approaching this problem from different angles and trying to destroy the parasite in different phases of its life cycle, seeing what works and what doesn’t. And technological advancements have certainly helped as well.

Adrian also said that over the last 20-25 years, the infrastructure for running trials in sub-Saharan countries has also vastly improved, which really is important if you’re trying to measure the efficacy of a vaccine. So both of the new vaccines, the RTSS and the R21, have benefited from a lot of factors. Despite the fact that these two vaccines have come out in close succession, there are some key differences between them.

**Adrian Hill:** The best vaccine prior to this was about 50% over a year and lower than that over three years. So we see this as a material improvement, but that’s not the main improvement, I would argue. It’s great to get higher efficacy, of course. But the big difference here with this vaccine is how you can manufacture it at a scale that is really needed to protect most of the children who need a malaria vaccine in Africa.

There are probably 40 million children born every year in malarious areas who would benefit from a vaccine. Ours is a four-dose vaccine over two years. So you need about 160 million doses. We can do that, meaning the Serum Institute of India, our manufacturing and commercial partner over in India, they can
produce hundreds of millions of doses of this vaccine. Whereas the previous vaccine that’s just been licensed by GSK in the first couple of years, we’ll have 6 million doses a year. So that’s a really material difference in terms of the public health impact you can have, having 200 million doses, for example, compared to 6 or 10. So the efficacy is also better.

And the third real advantage of this vaccine is its cost. We were well aware we were making malaria vaccines over many years that we couldn’t produce a $100 vaccine. It wouldn’t fly for international agencies supporting the purchase and distribution of a vaccine in very low income countries. So where we are now is a price that will vary according to the scale, but at high volume it would be $3-4 a dose. Compared to another vaccine at about $9 a dose. So it really has to be affordable and it has to be distributable at scale. So you’ve got to have vials that are convenient. You can’t require minus 70 freezers in rural parts of low income countries. And we think we tick all of those boxes now with this new vaccine.

**Dan Merino:** So, where do we go from here? Is malaria solved? Well, of course not. And there is still more work to be done on malaria vaccines too. Having multiple vaccines, which we now do, is incredibly beneficial. That each triggers slightly different immune responses and can build on each other. And of course, when availability of one is limited, as we saw with Covid, any vaccine is better than none. And as we’ve learned, malaria is a very complex parasite that causes a very complex disease. Because of this, there is certainly room to make an even better vaccine in the future.

**Adrian Hill:** People have developed other vaccines, some of which look very promising indeed. My colleague here in Oxford, Simon Draper, has a vaccine against the blood stage parasite. Which works in a totally different way, stopping parasites multiplying inside red blood cells or getting into them, at least. And obviously, it’s occurred to us to put those together. So we are now planning next year to put together his RH5 blood stage vaccine and the R21 vaccine that’s looking so promising and make a multi stage vaccine, if you like. And my guess is that that will improve further.

**Dan Merino:** And I want to ask you, you mentioned this here, but the R21 is not the end of the vaccine goal, obviously, 75%, excellent. Other vaccines, you mentioned this blood stage one, what role will this play? Combination, or will there be something for adults to reduce illness, or where do we see the kind of next steps in vaccine development for malaria, and why?

**Adrian Hill:** Yeah, I think the key word is combination. We now have good anti-spzorozoite vaccines being licensed and beginning to be rolled out. We have blood stage vaccines catching up quickly. There’s even a transmission blocking
vaccine from a group at the NIH in the U.S, that is looking very promising. Putting all of those together is possible.

In principle, you might get more thorough protection in the community if you were to vaccinate everybody. That’s a little bit more expensive, of course, than just vaccinating the children. But people are already thinking about adding vaccines to other interventions that are standard of care, if you like, bed nets and anti-malarial drugs during the peak of the malaria season and insecticide spraying. So I think most people would agree that we need all the tools that we can get that are of a certain efficacy level to be deployed to try and control firstly malarial disease, which is what this R21 vaccine definitely does, but then the next stage is controlling transmission and trying to reduce the amount of malaria, initially in small areas, small regions, maybe parts of a country. And then eventually there’ll be a campaign, probably working from the less high-transmission areas into the heartlands of malaria, say in the Democratic Republic of the Congo, where there’s very high transmission. And we will further narrow down the range of malaria in the world.

So there’s been great progress in controlling malaria outside of Africa. Several countries have actually eradicated in the last five years. And, I think we’re going to see more and more emphasis once we knock the disease burden down to what you might call a tolerable number, so tens of thousands rather than hundreds of thousands of deaths, you’ll see a focus on elimination in more and more countries.

**Dan Merino:** Is it really the case that if you can essentially get transmission or infection in human populations down to zero, that that’s it?

**Adrian Hill:** Yes, in principle, that’s the good news. Now remember, we’ve eliminated malaria from many countries, including the country I’m sitting in. There was malaria in England, there was obviously malaria in Southern Europe. There was a lot of malaria in the United States, near D.C. for example.

So you can do, and it’s much easier to do that in countries where the mosquitoes find it hard to live or get by. We know that’s possible in other large countries like Sri Lanka, they’ve eliminated malaria twice. They did so in the 1950’s, then it came back again, and it’s recently been eliminated again.

So you can do this. It takes a lot of resource. It takes a variety of tools. We’ve never had a malaria vaccine to help in that effort until now. So that’s real progress. But yes, the real answer to your question is the malaria that kills humans is only essentially found in humans. Malaria is very high on that list for
eradication. I don’t think it’s gonna happen in five years or ten years, but it should happen in something like 15 years. 2040 would be a reasonable target.

Dan Merino: Wow.

Adrian Hill: WHO have been more ambitious and said 2030, but I’m not sure most people believe that. So you will need new tools. There are better vaccines coming along as you have seen. There are other innovations like monoclonal antibodies that may well play a role. Several countries have actually eradicated in the last five years. And, I think we’re going to see more and more emphasis once we knock the disease burden down to, tens of thousands rather than hundreds of thousands of deaths, you’ll see a focus on elimination in more and more countries.

Dan Merino: That will do it for this week’s episode. Thank you so much to Faith Osier, Adrian Hill, and Alassane Dicko for speaking with us. You can find us on Twitter @tc_audio, on Instagram @theconversationdotcom, or email us podcast@theconversation.com. And if you like what we do here, please support the podcast and The Conversation more broadly. You can go to donate.theconversation.com.

Nehal El-Hadi: This episode of The Conversation Weekly was produced and written by Katie Flood. Sound Design was by Eloise Stevens, and our theme music is by Neeta Sarl. Mend Mariwany is our executive producer, and Stephen Khan is our global executive editor. Alice Mason runs our social media, and Soraya Nandy does our transcripts. I’m Nehal El-Hadi.

Dan Merino: And I’m Dan Merino. Thank you for listening.