Understanding Malaria
Strategies for Managing Malaria
Transcript

Narrator: Throughout history, malaria has claimed millions of human lives. Even by the year 2000, more then 800,000 people around the globe continued to die every year from the parasite symptoms. Most of them lived in South Asian and African countries: poorer nations where the climate and dense populations created the perfect conditions for the parasite and its mosquito carrier to breed. As we emerge into a new century, malaria's mortality rates have finally begun to fall. Today, the number of deaths per year totals less than half a million, thanks to efforts to control the parasite spread.

But it's been a long fight against the disease, and it's one that will continue for some time. Caroline Maxwell works for the charity group Malaria No More. She explains how far the disease once stretched around the globe.

Caroline Maxwell: Throughout history, we've seen the disease in many different countries, even in the U.K. and Australia. There were cases of malaria in the U.K. reported in World War I; the U.K. at the time, there was a lot of marshland, and so on, and as we know mosquitoes like breeding in stagnant, wet conditions. Even in Australia, it wasn't until the 1950s that they were able to eliminate malaria. And a key point in history was in 1955, when the World Health Organization set up a global eradication campaign, and that was a massive effort to control and eliminate this disease. Now unfortunately, that campaign didn't include sub-Saharan Africa and many other countries that do have high rates of this disease. So that campaign was stopped. But since then, there's been more research, more innovation to understanding this disease and how we can control it, but eventually eliminate it.

Narrator: Some of the most effective methods for reducing malaria in many parts of the world have involved simply destroying the populations of *Anopheles* mosquitoes that carry the parasite. The mosquito life cycle requires an aquatic phase, which is why malaria is typically a problem in areas with wetlands and pools of still or slow-moving water. Getting rid of the water is one strategy, but it isn't always affordable or practical. Doctor Colin Sutherland from the London School of Hygiene and Tropical Medicine points out simpler ways to interfere with the mosquito's life cycle.

Understanding Malaria
Strategies for Managing Malaria
Transcript

Dr. Sutherland: The main strategies that have been used include trying to stop the larvae from surviving in water. So, as many of your viewers will know, mosquitoes come from these little wrigglers that develop in water. And you can prevent them surviving to adulthood by putting a layer of oil or some other substance on the surface of the water, so that the adult mosquitoes can't properly land and lay eggs, and also can't emerge once the larvae have hatched.

Narrator: Unfortunately, coating the surface of water is a lot harder for flowing sources of water, meaning this only works for some locations. Where this solution isn't suitable, it might be possible to get a helping hand from a natural predator.

Dr. Sutherland: When I was a kid growing up in Australia, I had a fishtank full of these little fish called *Gambusia*, which are called the mosquito fish. And I used to feed them mosquito larvae, just for fun. I didn't realize I was going to work in malaria at that stage, it was just I liked having fish in my bedroom.

Narrator: Introducing a new species to an ecosystem where they're not usually found isn't always advisable. Adding *Gambusia* to a local waterway isn't going to rid the world of mosquitoes. James Tibenderana from the Malaria Consortium explains why.

Dr. Tibenderana: Mosquito fish have been used to control mosquito larvae and pupae. The challenge with the fish is that they do affect the other fish in that ecosystem, and so they have been discouraged, and they have been proven not to be as effective as people thought in the beginning.

Narrator: Chemical pesticides have been a far more effective way to control mosquito populations in the past. One of the most well known has been as controversial as it is effective. Better known as its shorter name, DDT is a pesticide developed over a century ago. This chemical has been used as a spray in many parts of the world to destroy whole regions of mosquito. Unfortunately, the chemical was found to have a downside.

Understanding Malaria
Strategies for Managing Malaria
Transcript

In 1962, the American conservationist, Rachel Carson, published her book *Silent Spring*, bringing the environmental impact of DDT to the public's attention. The chemical was found to affect more than just insects, such as mosquitoes. Animals higher up the food chain would consume the prey containing DDT, where it would build up in their own tissues. In carnivorous birds, the pesticide can interfere with their egg development, making the shells fragile. The results were a drop in bird populations, making DDT a major problem for the ecosystem. For some, this might be an acceptable compromise in the face of a killer like malaria, but DDT is still a poor choice for many communities.

Dr. Tibenderana: DDT was highly effective and, with a combination of diagnosis and treatment, was able to eliminate malaria in those countries. DDT was not used in Africa and, because of the fact that the mosquitoes developed resistance to DDT, it became an ineffective insecticide.

Narrator: Other insecticides, such as permethrin and malathion, are now commonly used in Africa instead. Some are mixed in with paints, which are then coated on the inside of walls of buildings. These prevent mosquitoes from coming inside, but they also come with disadvantages. Being expensive and considered intrusive, residents often don't want to spray in their house.

Dr. Tibenderana: Repellents have also been used to prevent mosquitoes from coming in contact with the skin. They are useful, for example, when going out or when mosquitoes may be biting outdoors. They have to be used consistently. They are a bit expensive so they're not a sort of tool that can be used in a rural area, for example, with a poor community. But they're a very useful tool for travelers or tourists who go to countries where malaria is endemic.

Narrator: A far more common measure that helps keep mosquitoes at bay is a simple net treated with chemicals to kill or repel mosquitoes. These simple tools have contributed to a 70% decline in malaria in recent decades.

Understanding Malaria
Strategies for Managing Malaria
Transcript

Dr. Tibenderana: Nets are very effective and are a critical tool in the control and elimination of malaria. One challenge with nets is that some mosquitoes bite outdoors, and so if a person uses a net indoors and the mosquito is biting outdoors, then it makes the net ineffective. This is one of the challenges that we have for malaria control in Southeast Asia because the mosquitoes in Southeast Asia tend to bite outdoors. People have developed nets called hammock nets, which can be used outdoors, but we still need more effective tools for preventing outdoor biting.

Narrator: Forms of natural repellent are common in Western countries. Many people keep mosquitoes from biting at summer barbecues by burning fragrant incense, for example. They might help to reduce the chance of bites, but according to the experts, they're not the answer to eradicating malaria.

Dr. Sutherland: Some people think that eucalyptus is useful. I think koalas like eucalyptus. I'm not sure what it does to mosquitoes, really. I've seen plenty of mosquitoes under eucalyptus trees. There are some repellents such a citronella, which are kind of generically unpleasant to mosquitoes, and they can help. But in general, most malaria people would say you need a physical barrier with an insecticide on top. So, we will advocate nets, clothing that covers your body, and a bit of repellent around your wrists and hands. Long-sleeve shirts, long trousers—even though you're often in a hot country—it's still better than getting malaria.

Narrator: Attacking the carriers of the parasite is one option. Another is to deal directly with the parasite itself, such as by taking medication that prevent them from causing an infection.

Dr. Sutherland: The first medicine that Europeans used was quinine, which was made from a bark that was used by indigenous people in South America. And the Spanish Jesuit priests discovered this use of the bark and found that it helped cure their fevers. And that led to the whole industry around the quinine and the bark of the tree, the cinchona tree. What the Jesuits and the Europeans didn't realize is that a thousand years before that, Chinese medicinal experts had discovered a plant that also cured malaria. And this plant, called *Artemisia annua*, is the source of our most important drug now, which is called artemisinin.

Understanding Malaria
Strategies for Managing Malaria
Transcript

And we use that combined in a tablet with one of the other malaria drugs, and that's the important combination drug that is saving lives in Africa, Asia, and the Americas today.

Narrator: Taking drugs your entire life to prevent malaria isn't a cost-effective option. So treating the disease is often the better choice. Some drugs are up to 95% effective at killing the invading parasites. Unfortunately, as the short life cycle of the parasite means that it rapidly evolves, they can quickly develop resistance to drugs. This is one problem facing a number of regions in Southeast Asia. Developing better drugs and safer, more effective repellents are just two ways technology is helping win the war against malaria. Genetic engineering promises a completely new approach.

Samantha O'Loughlin is a researcher at Imperial College, London. Her work involves using genetic technology to develop new strains of mosquito that could help control populations in the wild.

Dr. O'Loughlin: There's two ways that we're looking at to try to actually achieve this reduction in the mosquito populations. And one of them is to create mosquito strains that are male biased, so they would only produce male offspring.

Narrator: Since it's the female that transmits malaria by sucking blood to feed her offspring, this would mean fewer parasite-carrying insects. There is also another advantage to making a population mostly male. It would see the population collapse over time with fewer females to breed with. There is a second way this kind of genetic technology might be able to help control wild populations.

Dr. O'Loughlin: The other one that we're trying to develop is to target a gene that affects the fertility of the female mosquitoes. So what you would do is disrupt a female fertility gene in your lab strain. And then when you introduce that into the wild, it will spread through the wild population and reduce the fertility of the female mosquitoes. And again, that will have the result of reducing mosquito population.

Narrator: Both approaches rely on changing genes in mosquitoes grown in the laboratory. Genetic engineering has big advantages over pesticides, but it's still in its test phase.

Understanding Malaria
Strategies for Managing Malaria
Transcript

Dr. O'Loughlin: When it comes down to it, we're hoping that we will have our strain ready and that we'll be ready to do field trials in about another 10 years' time. So we're looking at about 2028 for our first field releases. So it's quite a long way off, and everybody still needs to keep using their bed nets, and needs to keep using their insecticide spraying. But we're looking at our method as a long term, hopefully, an efficient tool for long-term use.

Narrator: To put an end to malaria once and for all, we'll need all the tools we can get our hands on. Finding effective vaccines that can identify the elusive parasite and turn immune systems against them are progressing, but are still a few years away. New ways to visualize landscapes in a changing global climate using spatial technology, the Mapping Malaria Risk in Africa project has spent decades collecting data on the disease's distribution across the African continent. As malaria's borders change due to factors such as global warming and migration, it's important to know where the risks lie, and who is best suited to manage them. Perhaps one day, those at risk of dying from this disease will be zero, and the deadly illness we know as malaria will be a part of history.