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Prevalence of Malaria in Sub-Saharan Africa

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Summary

Despite the eradication of malaria in several countries around the globe, malaria remains a deadly disease in Sub-Saharan Africa, killing over half a million people every year—most of which are young children. The climate of Sub-Saharan Africa is conducive to the spread of malaria year-round, and the inadequacy of health systems in many African countries makes it difficult for people who have been infected to receive the treatment that they need. Growing drug resistance also contributes to the difficulty of fighting malaria. Malaria not only kills but stifles economic growth and disables many of its survivors. Interventions like indoor residual spraying and insecticide-treated mosquito nets can reduce the risk of malaria.

Key Terms

Cerebral malaria—The most severe neurological complication of *Plasmodium Falciparum*, which is

characterized by the patient going into a coma.¹

Gestational malaria—A type of malaria caused when a pregnant woman contracts malaria, and the infected red blood cells sequester in the placenta. Pregnant women who contract malaria are 3 times more likely to contract severe malaria than their nonpregnant counterparts, and mortality rates among pregnant women with severe malaria can be as high as 50%.²

Indoor residual spraying—Coating the walls and other surfaces of a house with insecticides, which kill mosquitoes that land on the surfaces for several months.³

Insecticide-treated mosquito net—A mesh net that has been treated with insecticides under which a person can sleep to prevent mosquito bites at night.⁴

Microscopy—Using a microscope to see things too small to view with the naked eye—in this case, malaria parasites in a blood sample.⁵

Morbidity—Having a disease or a symptom of a disease.⁶

Plasmodium Falciparum—The deadliest species of parasite that causes malaria in humans.⁷

Severe malaria—A malaria infection complicated by serious organ failures or abnormalities in the patient’s blood or metabolism.⁸

Sub-Saharan Africa—The 48 African countries south of the Sahara Desert.⁹

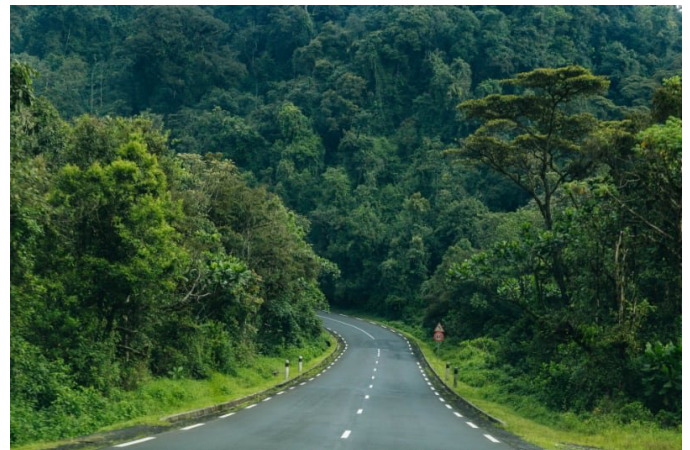
Uncomplicated malaria—A malaria infection not complicated by serious organ failures or abnormalities in the patient’s blood or metabolism.¹⁰

Context

Q: What is malaria?

A: Malaria is a serious, sometimes fatal, illness that is caused by a parasite and transferred to humans through mosquito bites. Malaria is most commonly transmitted by the bite of a female mosquito of the genus *Anopheles*.¹¹ When an infected mosquito bites a human, the parasite is transferred to that person and enters

their bloodstream. The parasite travels in the bloodstream to the liver, where it matures. The parasite then re-enters the bloodstream and attaches to the individual’s red blood cells.¹² Symptoms usually start within a few weeks of infection, with the most common being fever and chills.¹³ Because malaria infects the red blood cells, it can occasionally be spread in other ways—from a pregnant mother to her unborn infant, through a blood transfusion, organ transplant, or even shared use of needles.^{14, 15, 16}



Every year, there are over 200 million global cases of malaria, resulting in over 600,000 deaths annually.¹⁷ In 2017, every twelfth child that died was a victim of malaria; in other words, another child dies of malaria approximately every 2 minutes.^{18, 19}

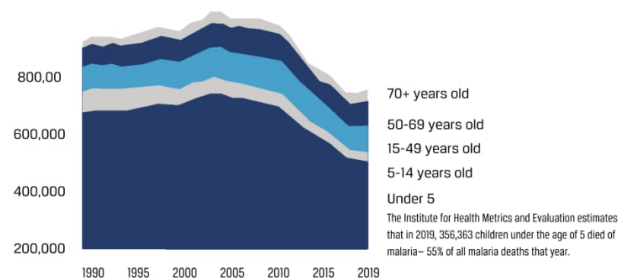
However, illness and death from malaria can usually be prevented with appropriate prevention measures and treatments.²⁰

Q: Who is most at risk for malaria?

A: While anyone can get malaria if bitten by an infected mosquito, the people most likely to get seriously ill and die are those with little or no malaria immunity. Malaria immunity is not well understood by the scientific community; however, it is clear that people who are regularly exposed to Plasmodium Falciparum malaria have some resistance to becoming seriously ill or dying from malaria.^{21, 22} The individuals most likely to be seriously ill from malaria include children, pregnant women, and travelers from countries who have never been exposed to malaria before.²³ People without access to healthcare are also at an increased risk of dying from malaria.²⁴



MALARIA DEATHS BY AGE, WORLD, 1990-2019



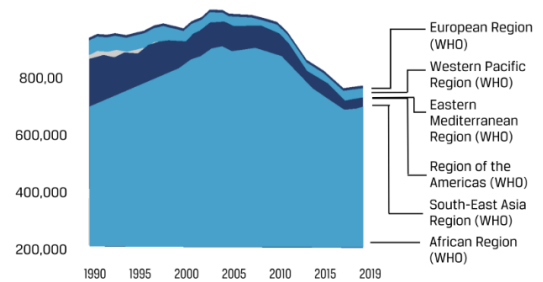
The Institute for Health Metrics and Evaluation estimates that in 2019, 356,363 children under the age of 5 died of malaria—55% of all malaria deaths that year.²⁵ The World Health Organization’s estimate is even higher, estimating that 67% of all people who died of malaria in 2019 were children under the age of 5.²⁶ Of the 33.8 million pregnancies estimated to have occurred in the WHO African Region during 2020, 34% of the mothers were

estimated to have been exposed to malaria infection during pregnancy.²⁷

Q: Where is malaria a problem?

A: It is estimated that over 90% of all malaria deaths occur in Sub-Saharan Africa.²⁸ One reason for these deaths is that Plasmodium Falciparum, the malaria parasite most likely to cause life-threatening illness, is very common in many Sub-Saharan African countries, in part because of a habitable climate.²⁹ The lack of healthcare access in many areas of Sub-Saharan Africa also leads to an increased number of malaria deaths.³⁰ In Nigeria in 2019, there were 191,106 deaths attributed to malaria. In contrast, there were no deaths attributed to malaria in the United States that same year.³¹ In 2020, just 4 Sub-Saharan African countries (Nigeria, the Democratic Republic of the Congo, Tanzania, and Mozambique) accounted for over half of all malaria deaths globally.³²

MALARIA DEATHS BY WORLD REGION, 1990-2019



Q: How is malaria prevented and treated?

A: Following the Second World War, the discovery and use of insecticides like Dichlorodiphenyltrichloroethane (DDT) and dieldrin (DLD) led to a sharp decline in malaria cases in some areas of Africa.³³ By the 1950s, malaria had been eliminated in the United States.³⁴ During this time, the price of chloroquine, an antimalarial drug, became more affordable, and chloroquine was widely used in Africa throughout the 1960s and 1970s. However, chloroquine-resistant parasites began to emerge in the 1970s, and by the 1980s, malaria was on the increase once again.³⁵ Since the early 2000s, artemisinin-based combination treatments (drugs that use artemisinin in combination with a number of other

drugs) have been generally accepted as the best first-line treatment for malaria.³⁶

Research shows that the use of insecticide-treated mosquito nets can reduce exposure to malaria-carrying mosquitoes by 25–30%.³⁷ Historical and program documentation has also shown that indoor residual spraying (IRS) can help prevent malaria; however, randomized control trials do not always show that IRS is an effective strategy.³⁸

After 30 years of development, the first vaccine for malaria has been developed. After pilot tests between 2016 and 2021, the WHO now recommends the use of the RTS,S malaria vaccine for children living in regions with “moderate to high transmission,” according to their definitions.³⁹

Q: How long has malaria been a problem?

A: The oldest reference to malaria is found in a Chinese document from

2700 BC; Mesopotamian clay tablets, Egyptian papyri, and Hindu texts throughout the centuries all refer to malaria as well.⁴⁰ The parasite was discovered in the blood of malaria patients by Alphonse Laveran, a French army officer working in Algeria, in 1880.⁴¹

In 2003, African malaria deaths peaked at over 960,000; fortunately, deaths have declined since then, though they have risen again slightly since 2017.⁴² In 2020, there were 602,000 recorded deaths from malaria on the African continent, making up 96% of the 627,000 malaria deaths globally.⁴³

Contributing Factors

Climate

The hot and humid climate of Sub-Saharan Africa contributes to malaria by providing an ideal environment for malaria parasites and malaria-carrying mosquitoes to thrive. Both the malaria parasite itself and the mosquitoes that

transfer malaria to humans can only survive in certain conditions, which the tropical and subtropical environments of Sub-Saharan Africa provide.^{44, 45}

The malaria parasite thrives at temperatures between 77°F (25°C) and 86°F (30°C).⁴⁶ The incubation time for the malaria parasite within a mosquito is highly dependent on temperature.⁴⁷

For example, the Plasmodium Falciparum parasite, which causes severe malaria, is unable to complete its growth cycle in malaria-transmitting mosquitoes at temperatures below 68°F (20°C).⁴⁸

Some scientists theorize that climate change is expanding the range in which mosquitoes can live by increasing areas that are hot enough for malaria parasites and mosquitoes to thrive.⁴⁹ In Cameroon, for example, the average temperature in 1901 was 75.47°F (24.15°C), while in 2021, the average temperature was 77.38°F (25.21°C).⁵⁰

The Republic of Congo's average temperature has increased from 75.6°F (24.22°C) in 1901 to 77.414°F (25.23°C) in 2021.⁵¹ The Central African

Republic's average temperature increased from 76.91°F (24.95°C) in 1901 to 78.404°F (25.78°C).⁵² As temperatures across Sub-Saharan Africa increase, more and more areas inch into the ideal temperature range for malaria parasites and mosquitoes. Malaria prevalence might increase as the climate continues to change to be more conducive to malaria transmission.

Some types of malaria-transmitting mosquitoes, such as Anopheles gambiae, reproduce in standing water caused by rainfall, which is plentiful in tropical areas of Sub-Saharan Africa.⁵³ One study in Kenya measured the rainfall in an area as well as the number of Anopheles gambiae mosquito larval habitats that could be detected in the puddles formed in the area's dirt tracks. The study found that the amount of rainfall was significantly correlated to the number of mosquito larval habitats detected in dirt tracks in the area, with a 1-week lag.⁵⁴ In other words, the higher the amount of rain that fell 1 week, the more mosquito larval habitats could be detected in the area the following week,

with this 1-week delay accounting for the time it takes for habitats to form and the time it takes for mosquitoes to develop from eggs to adults. The rainy climate in tropical areas of Sub-Saharan Africa provides the standing water necessary for malaria-carrying mosquitoes.

The prevalence and behavior of mosquitoes in an area are highly dependent on the climate of the area. Mosquitoes are affected by climate at every stage of their life cycle.⁵⁵ The climate of Sub-Saharan Africa is conducive to malaria transmission, which contributes to the prevalence of malaria in this region.

Inadequate Health Systems

Medical Facilities

The inadequate health systems in Sub-Saharan Africa contribute to the seriousness of malaria by making it difficult for people infected with malaria to receive appropriate treatment. According to WHO guidelines, before beginning treatment for malaria, the diagnosis should ideally be confirmed by a doctor using

microscopy (examining blood samples for the parasite). Then drugs should be administered to treat malaria, with different drugs used depending on the type and severity of malaria.^{56, 57} However, the lack of healthcare professionals in this region means that this ideal is not always the reality. In contrast to the Americas, which has a ratio of 24.8 health workers per 1,000 people, or the world, which has a ratio of 9.3 health workers per 1,000 people, Africa has a ratio of 2.3 health workers per 1,000 people.⁵⁸

THE RATIO OF HEALTH WORKERS PER 1,000 PEOPLE



THE AMERICAS



WORLD AVERAGE



AFRICA



In places where microscopy is unavailable to confirm the diagnosis of malaria due to scarcity of trained health professionals, presumptive clinical diagnosis is the only realistic option—that is, making an assumption that any patient with a fever has malaria and proceeding by administering antimalarial drugs.⁵⁹ Though an easy, quick, and cost-effective method of diagnosis, this tactic can result in misdiagnosis and mistreatment. In one study conducted in the Sahel region, the rate of overdiagnosis was as high as 46.1% in the rainy season (when malaria is more common in that location) and 95.5% in the dry season.⁶⁰ Overdiagnosis of malaria leads to overuse of antimalarial drugs and increased drug resistance.⁶¹

Medicine Vendors

Rather than attending a formal clinic, many people in Sub-Saharan Africa go to medicine vendors for drugs to treat malaria.⁶² In Togo, for example, only 20% of children under the age of 5 who had a fever were taken to a formal health clinic; 83% were treated at home using an antimalarial drug from a street or market vendor.⁶³ On the Kenyan coast, 69% of childhood fevers were first or solely treated with shop-bought medicine.⁶⁴ Medicine vendors are generally closer to home than formal health facilities.⁶⁵ A study of mothers in rural Kenya found that 87% lived within 1 kilometer of a medicine shop, while only 32% lived within 2 kilometers of a private clinic or government dispensary.⁶⁶



The lower cost of medicine from medicine vendors is also an important motivation.⁶⁷ For example, a different study of drugs used to treat fevers in Kenya found that the median cost of drugs prescribed by private hospitals was 215 Kenyan shillings (about \$2.84 USD), while the median cost of drugs from medicine vendors was only 17 shillings (about \$0.22 USD).⁶⁸ As over a third (35.6%) of Kenyans are living off less than \$1.90 USD a day, the inexpensive nature of drugs from medicine sellers can be a major benefit.⁶⁹ Unfortunately, the type or dose of drugs prescribed by medicine sellers is often inappropriate for the malady, which can be extremely dangerous.^{70, 71} Aspirin is often prescribed, but it is not safe for children, and a study in Kenya found that 22% of children who were prescribed aspirin by medicine vendors received potentially toxic doses.⁷² A study in Eastern Uganda found that while 94% of children showing symptoms of malaria were prescribed chloroquine, which is an antimalarial drug, only 34% of these children were prescribed an amount

that followed safety guidelines;⁷³ this finding is especially concerning because taking too much chloroquine can lead to death.⁷⁴ Sometimes medicine vendors prescribe additional unnecessary medicines; for example, 67% of the children in the study mentioned above were prescribed antibiotics, while a physical examination of the children revealed that in only about 18% of these cases would, an antibiotic prescription has been appropriate.⁷⁵ Counterfeits are also prevalent; for example, a study of 133 test samples of “chloroquine” randomly purchased from medicine sellers in Cameroon found that 42 (33%) of these samples did not have any detectable chloroquine.⁷⁶ The practice of going to medicine vendors instead of formal health clinics can limit people’s access to proper malaria treatment and cause more health problems than it solves. The inadequacy of health systems in Sub-Saharan Africa perpetuates this practice, contributing to the overall seriousness of malaria.

Drug Resistance

Drug resistance in the malaria parasite and malaria-carrying mosquitoes contributes to malaria in Sub-Saharan Africa by making eradication more difficult. Over time, malaria and mosquitoes adapt to become more resistant to drugs and insecticides that were once effective against them. This growing resistance has resulted in malaria re-emerging in places where it was once eradicated, such as India, Peru, and the Kenyan highlands.^{77, 78, 79, 80}

Over time, the malaria parasite (*Plasmodium*) develops resistance to antimalarial drugs. As the parasite reproduces, occasional mutations occur in the new parasites' genes. Some of these mutated genes happen to cause resistance to antimalarial drugs. Parasites with these genes are more successful at surviving long enough to reproduce, so as time goes on, the drug-resistant parasite becomes more and more common. This resistance causes a continuous cycle of new antimalarial drugs being used temporarily until they become ineffective and must be

replaced. For example, the original first-line drug used to treat malaria in the 1960s and 1970s was chloroquine, but resistance to that drug had emerged by the end of the 1970s.⁸¹ This growing resistance has caused 10 African countries to switch to a combination of sulphadoxine and pyrimethamine (SP) as a first-line treatment instead.^{82, 83} SP resistance is now increasing in Sub-Saharan Africa.⁸⁴ Studies in Tanzania and Kenya have shown high rates of resistance to SP in children being treated for malaria.⁸⁵ In a 2009 study conducted in Tanzania, SP failed to treat malaria successfully 82.2% of the time.⁸⁶ More recently, SP resistance has been detected in countries as varied as Gabon, Cameroon, and the Republic of Congo.^{87, 88, 89, 90} Another antimalarial drug used is artemisinin, to which resistance has been found in Southeast Asia.⁹¹ Many potentially effective drugs are too expensive to use, which limits the number of antimalarial drugs available for use when one becomes ineffective.⁹² For example, artemisinin combination therapy costs about \$2.50 USD per adult treatment course.⁹³ While

this cost may seem inexpensive, in 2017, 41% of the Sub-Saharan African population made less than \$1.90 USD a day.⁹⁴



Mosquitoes have also developed resistance against insecticides that are used to prevent malaria. There are 4 classes of insecticides: pyrethroids, organochlorines, carbamates, and organophosphates. In 2020, of the 82 countries with malaria, 28 detected resistance to all 4 of these insecticide classes, and 73 of these countries detected resistance to at least 1 insecticide class. Resistance to pyrethroids, the class of insecticides used to treat mosquito nets, was especially widespread, with resistance detected in 69.9% of sites where data was available.⁹⁵ As insecticide resistance

increases, it becomes more difficult for people to protect themselves from malaria-carrying mosquitoes. These instances of drug resistance lead to an increase in the prevalence of malaria in Sub-Saharan Africa.

Consequences

High Mortality Rates

Malaria is fatal for many people who contract it. Falciparum malaria, the most common strain in Sub-Saharan Africa, is extremely dangerous. In severe cases of malaria, fatality rates can be as high as 20%.⁹⁶

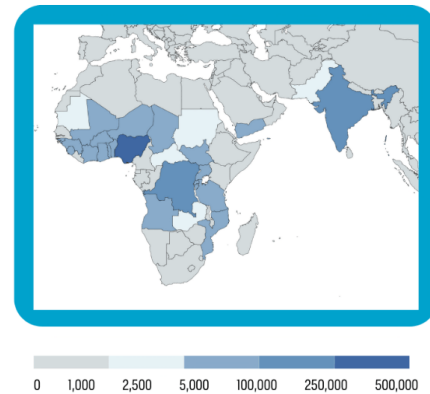
Blood cells infected with Falciparum malaria parasites bind to the blood vessel walls, damaging the tissue of the vessel wall and causing obstruction within the blood vessel.⁹⁷ If this infection happens in the brain, it leads to a coma.⁹⁸ If it occurs in the lungs, respiratory failure can occur; indeed, respiratory distress occurs in 40% of children and 25% of adults with severe Falciparum malaria.⁹⁹ If the host is a

pregnant woman and this process occurs in the placenta, it can cause maternal anemia, preterm labor, increased risk of stillbirth, and low birth weight.¹⁰⁰ In total, gestational malaria causes up to 200,000 infant deaths in Sub-Saharan Africa every year.¹⁰¹

Africa bears a disproportionate rate of the world's malaria deaths, in large part because of the prevalence of *Falciparum* malaria.¹⁰² While outside of Africa, malaria deaths have steadily declined since the 1980s, malaria deaths within Africa continued to increase until they reached 1.613 million deaths in 2004. Since then, malaria deaths have begun to decline but are still much higher than in other regions.¹⁰³ In 2019, an estimated 534,000 people died of malaria on the African continent, and 558,000 people died of malaria worldwide.¹⁰⁴ In 2020, 602,000 people died of malaria in Africa, making up 96% of the 627,000 malaria deaths globally.¹⁰⁵ This increase is attributed to the COVID-19 pandemic, which threatened the distribution of malaria prevention

services like indoor residual spraying and insecticide-treated bed nets.^{106, 107}

NUMBER OF DEATHS FROM MALARIA, 2019



Most of the people who die of malaria are under the age of 5.¹⁰⁸ In areas with *Falciparum* malaria—like Sub-Saharan Africa—the age group with the highest malaria mortality rate is children between the ages of 1 and 3.¹⁰⁹

Economic Setbacks

Countries with high rates of malaria are likely to have high rates of poverty and slower economic growth as malaria impacts the day-to-day functioning of a population and the expenditures of a country.¹¹⁰ Across the continent, Africa

loses an estimated \$12 billion USD annually due to malaria.¹¹¹ One study estimated that in 1985, 19 African countries lost 18% of their income to the economic growth penalty of malaria, with 10 others losing at least 1% of their income.¹¹² This trend has continued in the twenty-first century; a 2019 study found that between 2000 and 2017, “a 10% decrease in malaria incidence was associated with an increase in income per capita of nearly 0.3% on average and a 0.11 percentage point faster per capita growth per annum.”¹¹³ In 1995 the average GDP of countries with malaria was \$1,526.00 USD compared to \$8,268.00 USD in countries without malaria (adjusted for parity in purchasing power).¹¹⁴ With consequences this drastic, malaria is not only a health issue but an economic and development issue.

Malaria impedes economic growth as it causes children to miss school and adults to miss work.¹¹⁵ Studies in Mali, the Democratic Republic of the Congo, Kenya, and Senegal have all demonstrated a clear correlation between malaria and school

absenteeism among children.^{116, 117, 118, 119, 120} For example, in a school in Senegal, malaria was found to be the cause of up to 36% of medically-related school absences, depending on the seasonal prevalence of malaria.¹²¹ When malaria causes children to miss school, those children are then more likely to fail their classes, repeat grades, and drop out of school; this trend results in lost human capital, as those people are then less able to contribute to the economy.¹²²

Absenteeism due to malaria is also a problem for adults in the workforce. Whether adults miss work because they themselves are sick or because they need to care for a sick child, absenteeism due to malaria hinders the productivity of businesses.¹²³ For example, a study of businesses in 3 regions of Ghana found that businesses lost an average of 1,304 work days a year due to malaria.¹²⁴ A survey of 8,000 business leaders globally found that, among business leaders in Sub-Saharan Africa, 72% reported that malaria harms their businesses; 39%

reported serious detriments due to malaria.¹²⁵

On the micro level, malaria also causes individuals and households to become poorer. Poor households in Sub-Saharan Africa sometimes spend large proportions of their income on malaria treatment. Research estimates that the direct cost of one episode of malaria to a household is about \$6.87 USD in Ghana, \$4.80 USD in Uganda, and \$4.50 USD in Mali.¹²⁶ This cost is proportionally very expensive; as stated above, 41% of the Sub-Saharan African population makes less than \$1.90 USD a day.¹²⁷ A study in Malawi found that very low-income households, with an average annual income of \$68.00 USD, spent 32% of their annual income on malaria treatment.¹²⁸

Some economists have argued that malaria also hinders the economy through its effects on fertility, population growth, and foreign investment.¹²⁹ However, further data is needed to support this argument.

Morbidity

Even people who survive malaria may experience long-term health consequences after their recovery.

Long-term complications following cerebral malaria are especially well-documented. One serious aftereffect of cerebral malaria is neurological sequelae or damage to the central nervous system.¹³⁰ Five-point-six percent of children who had cerebral malaria and recovered were found to have long-term sequelae 6 months later, including hemiplegia or hemiparesis (weakness in one or both limbs on one side of the body), speech disorders, behavioral disorders, blindness, hearing impairment, cerebral palsy, and epilepsy.¹³¹ Epilepsy is an especially serious health issue because, if untreated, it may lead to other mental or physical impairments.¹³² The exact percentage of children who are left with neurological damage after surviving cerebral malaria is unknown; estimates vary from 2% to 25%.^{133, 134, 135, 136}

Anemia is a consequence of malaria. When children with malaria are given a blood transfusion to treat this anemia, they sometimes are given HIV through the blood transfusion. One study estimated that 19,000 children ages 0–9 had survived malaria but had acquired HIV through the blood transfusion they received.¹³⁷

One way to calculate the morbidity toll of a disease is by calculating the years of healthy life lost due to disability, or YLDs, in a population.¹³⁸ YLDs are calculated by assigning a disability weight between 0 (perfect health) and 1 (dead). This disability weight is multiplied by the number of cases in a region and the number of years lived with the disability on average.¹³⁹ YLDs have been criticized for the assignment of disability weight, which assumes that years lived with a disability are necessarily less valuable than years lived without a disability and that the lives of people with disabilities are, therefore, of less value.¹⁴⁰ However flawed, the YLD measurement is still widely used and is useful for the purpose of this paper in providing an

idea of the scope of morbidity caused by malaria. A study in Sudan found that in 2002 alone, 86,000 YLDs were caused by malaria—including both episodes of malaria and the anemia and neurological sequelae that malaria can cause.¹⁴¹ Between 2000 and 2016, 35,200 YLDs were caused by malaria in Ethiopia.¹⁴² Data from between 2001 and 2009 totals the YLDs of 18 African countries (chosen because they had complete data sets of malaria cases and deaths for these years) at 16,749.¹⁴³ ¹⁴⁴ This data means that, in total, people in these countries spent about 16,749 years with a disability caused by malaria between 2001 and 2009 alone.

A study conducted in Malawi found that while people there experienced these major disabling aftereffects of malaria, most people did not seek medical help for these disabilities, mainly due to poverty.¹⁴⁵ Another study in Uganda found that the family of only 1 out of 9 children with severe hearing impairments as a result of malaria could afford hearing aids.¹⁴⁶ Some researchers theorize that hundreds of

thousands of children in Sub-Saharan Africa have impairments from previous bouts of malaria. Many of these children may be out of school partially as a result of their disabilities, causing intergenerational socio-economic effects.¹⁴⁷

Practices

The US President's Malaria Initiative, or PMI, is the United States government initiative for fighting malaria worldwide. PMI was launched in 2005 by President George W. Bush as a 5-year initiative with the goal of reducing malaria in 15 high-burden African countries. Instead, PMI was expanded to become a long-term program and currently services 27 countries—24 in Africa and 3 in Southeast Asia.¹⁴⁸ PMI is funded by the United States Agency for International Development (USAID). PMI's goal is to "Work with PMI-supported countries and partners to further reduce malaria deaths and substantially decrease

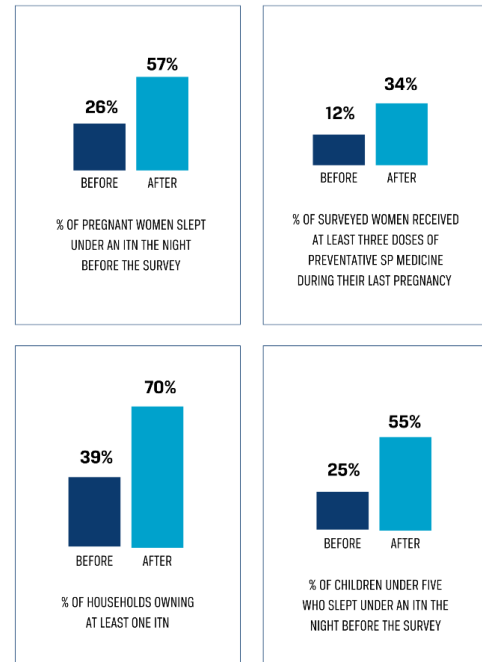
malaria morbidity toward the long-term goal of elimination."¹⁴⁹



PMI partners with countries to fight malaria through a variety of efforts: providing mosquito nets, spraying homes with insecticides, distributing preventative medicines, training health workers, and investing in malaria research.¹⁵⁰ Since 2005, PMI has helped to distribute 500 million insecticide-treated mosquito nets, and it works with community partners to promote the consistent use of mosquito nets.¹⁵¹ In 2022, for example, PMI delivered 3.5 million of these nets in Angola by going door to door in 1,000 3-person teams. The teams also provided information on how to care for the nets and shared key malaria prevention messages.¹⁵² Another way that PMI promotes mosquito net use is by training

healthcare providers like nurses and midwives in workshops.¹⁵³ In Nigeria, PMI trains health officials to use a malaria products logistic system, which helps the health officials track their stocks of medicine and ensure timely resupply.¹⁵⁴ Overall, PMI has funded 2.1 million trainings for healthcare workers.¹⁵⁵ PMI’s indoor residual spraying intervention is also large-scale, with 21.2 million people impacted by PMI’s spraying in 2021 alone.¹⁵⁶ In 2019 and 2020, PMI conducted indoor residual spraying in Tanzanian refugee camps before transitioning leadership to a local health team in 2021.¹⁵⁷

FREQUENCY OF MALARIA- PREVENTATIVE PRACTICES BEFORE AND AFTER PMI INTERVENTION

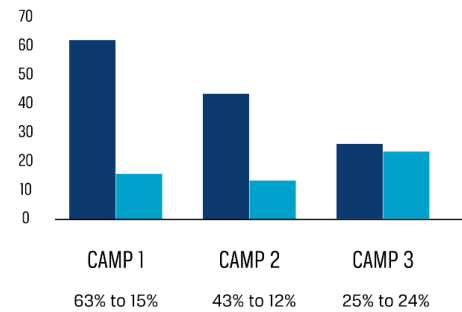


The PMI website lists a number of successes that its partner countries have experienced since its founding. On average, PMI’s partner countries have experienced a 26% decline in malaria case rates and a 43% decline in malaria death rates since 2006.¹⁵⁸ Baseline and endline surveys conducted in PMI’s partner countries indicate that in a majority of these countries, more households own insecticide-treated mosquito nets, more children and pregnant women sleep under insecticide-treated mosquito nets, and more pregnant women are receiving at

least 3 doses of preventative treatment during their pregnancies at the endline (after PMI’s interventions) than at the baseline (before PMI’s interventions). Outcomes vary based on the country. However, on average, the percentage of households who own at least one insecticide-treated mosquito net has increased from 39% to 70%; the percentage of children under the age of 5 who slept under an insecticide-treated mosquito net the night before the survey increased from 25% to 55%; the percentage of pregnant women who slept under an insecticide-treated mosquito net the night before the survey increased from 26% to 57%; and the percentage of women who received at least 3 doses of preventative sulphadoxine-pyrimethamine during their last pregnancy increased from 12% to

34%.¹⁵⁹

MALARIA RATES IN THREE REFUGEE CAMPS BEFORE AND AFTER INDOOR RESIDUAL SPRAYING



It is unclear how much of this change is due to PMI’s interventions.

Randomized control trials would be the ideal way to gauge the impact of its interventions, though comparing malaria rates in PMI countries vs. non-PMI countries might give a general idea of the interventions’ impact as well. Of the most recent interventions that PMI spotlights on their website—training health officials in Nigeria, providing mosquito nets in Angola, and spraying insecticides in Tanzanian refugee camps—only the project summary of indoor residual spraying in Tanzanian refugee camps included

rates of malaria before and after the intervention.¹⁶⁰ From 2018 (before the intervention) to 2021 (after the intervention had been going on for 2 years), malaria rates dropped from 63% to 15% in one refugee camp, 43% to 12% in a second camp, and 25% to 24% in a third.¹⁶¹ Ideally, PMI would include similar information for all of its interventions.

Endnotes

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