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Malaria in Odisha India

Merlyn George*

*Medical Student, State University of Downstate Medical Center, New York, USA

***Corresponding author:** Merlyn George, Medical Student, State University of Downstate Medical Center, 450 Clarkson Ave, Brooklyn, New York 11203, USA.

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Introduction

Malaria is a life-threatening disease common in almost all parts of the world and is associated with numerous lost lives annually. The World Health Organization (WHO) estimates 435 000 malaria deaths in 2017 alone, in addition to 219 million more cases reported in the same year [1]. The disease has become such an international concern particularly in those areas within the tropics and in low-income economies. Malaria exerts a significant amount of burden on the people affected in terms of the economic and social interventions that are intended to control the disease. Malaria is a public health problem in India, a factor that contributes significantly to the socio-economic burden on disease control [2]. The economic effects of malaria are, however, underestimated. There is a likelihood the number is far higher than estimated, according to Pradhan, et al. [3] due to factors, such as transmission overlap of the pathogen species that cause malaria, highly viable malaria eco-epidemiological profiles, increase in malarial drug resistance, climate changes, and the impacts of climate change on the other causes of malaria.

The prevalence of malaria as presented by Pradhan, et al. [3] is 6% of the global malaria burden and 90% of the total cases in Southern Asia. The Indian government, through the National Vector Borne Disease Control Program (NVBDCP), has been taking measures to control the disease sustainably. Odisha state in India is reported to have the highest cases of Malaria in the country, contributing to 45% of the total cases despite occupying only but 4% of the landmass in India and bearing only 3% of the Indian population [3]. The numbers insinuate a high density of the prevalence of Malaria in the eastern India state of Odisha, hence, the eligibility to be on the radar for clinical intervention. The Odisha state geographical conditions favor the spread of malaria. The conditions in Odisha conducive for the spread of malaria include high to medium rainfalls, high relative humidity, and numerous hilly forested areas with streams [3]. Controlling malaria in India, and Odisha specifically, has proven to be a daunting task.

The Comprehensive Case Management Program (CCMP) was initiated in Odisha state in 2013 to improve malaria diagnosis in the state and improve surveillance on malaria transmission (Ministry of Health & Family Welfare Government of India). This state-level financial support was an improvement in an ongoing fight against malaria in Odisha, with the initial interventions having been initiated in 2008 [3]. Henceforth, the government has scaled up intervention coverage, active control program management, and strong political and administrative involvement in the fight against malaria. WHO [4] details that the fight against malaria is coming to a global stagnation as the progress in elimination is stalled. This case is keenly indifferent from the case of Odisha, whose rate of prevalence as of 2018 was 81% [5]. The progress is also hindered by several factors owing to the lifestyle of the Indians in Odisha.

India's path to eliminating malaria has proven to be difficult in the remote and rugged tribal regions, with Odisha being one of them [4]. Since the area represents the majority of the national malaria burden, the natives of these areas still prefer sleeping outside at night and are, therefore, easy targets for mosquitoes. The natives also wear inadequate clothing making them vulnerable to mosquito bites and, when they fall ill of malaria, they often feel reluctant to seek medical intervention [4]. Mosquitoes in the forested regions of Odisha tend to transmit malaria effectively and are resistant to 70% of the insecticides recommended for their elimination. The government of India, the Global Fund, and the World Health Organization are united in the effort to control the spread of malaria in Odisha. In 2017, the named organizations facilitated the distribution of 11 million nets, approximated to be enough for the population in high-risk regions of Odisha, including schools and hostels [4]. The move to protect populations in Odisha state becomes quite insignificant when the natives choose to sleep outside and not take precautions in preventing the spread of malaria. The malaria issues in Odisha require practical.

Pradhan and Meherda's [5] article outline the steps that India has taken to eliminate malaria in Odisha. The article is particularly interested in studying the malaria elimination drive in Odisha and the hopes for halting the transmission of malaria. In the article, the authors highlight some of the control measures that are currently being practiced in Odisha, one of them being the use of Long-Lasting Insecticidal Nets (LLINs) which the government distributes freely to the populations in high-risk areas. One noticeable improvement in the fight against malaria according to Pradhan and Meherda [5], is the use of bivalent Rapid Diagnostic Test Machines (RDT) to detect all malaria infections whether it is associated with malaria fever or not.

These efforts are under a government innovative flagship program commonly known in India as Durgama Anchalare Malaria Nirakarana, abbreviated as DAMaN [5]. The DAMaN camps are set to deal with malaria cases promptly, in addition to creating community awareness of the disease. Interventions priority is given to pregnant women, lactating mothers, and children under five years. The camps hold malaria campaigns with medical interventions thrice a year, one round-up from the bi-annual camps. The Integrated Child Development Services (ICDS) also support the fight against malaria in Odisha India. Controlling malaria in Odisha is coming to fruition with the collective efforts of the mentioned organizations. The decline in malaria infections is also likely to decrease other comorbidities resulting from other malaria cofactors.

Tizifa, et al. [6] article on the prevention efforts of malaria reveals that the use of long-lasting insecticide-treated mosquito nets and indoor residual spraying has been a contributing factor to the decline of malaria cases in Sub-Saharan Africa. Malaria is caused by plasmodium parasites which are spread by the bite of infected female *anopheles* mosquitoes, commonly referred to as mosquito vectors [6]. Five species of the malaria parasites cause malaria, two of which are lethal and pose the greatest threat. *P. falciparum* is reported to have accounted for 99.7% of the total cases of malaria in the African region, 62.8% in South-East Asia, and 71.7% in the Western Pacific [6]. *P. vivax* accounts for 74.1% of the malaria cases among Americans. Nearly half of the world population were at the risk of malaria as of 2017, and, since most deaths are reported in Sub-Saharan Africa, the Americans are also at the risk of uncontrollable spread of malaria. The world-renowned strategies for controlling malaria are vector control and mobilization of the community to take up the control measures.

Vector controls are those measures taken to limit the ability of a disease vector to transmit the disease in areas receptive to such transmissions. The method for controlling malaria vectors is the use of insecticide-treated mosquito nets, which is a global measure, indoor residual sprays, and larval source management [6]. The latter involves altering the malarial vector breeding grounds so that the parasites perish prematurely before spreading the disease. Transmission of malaria parasites within the mosquito, genetic variation, and consequences for the control of malaria vector are equally vital aspects in the control of malaria. Lefevre, et al. [7] detail this literature in a study on how the vector transmits malaria to the vertebrate hosts by altering their genetic traits to survive within the vertebrates. The article details that malaria parasites can plastically modify their phenotype to adapt to any new environment in the vertebrate hosts. These kind of genetic changes enable the parasite to respond variably to drug treatment, resource availability like vertebrae hosts, and the presence of other parasite genotypes in the same vertebrate host [7]. Modifications of the parasite and transmission success to the host vertebrate is affected by the environmental factors of the immediate host, one of them being the existence of other parasite genotypes in the host vertebrate.

Adaptive phenotypic plasticity makes malaria parasites the most lethal kind of pathogen [7]. Genetic variation is the raw material for evolution and is responsible for insecticide resistance that is becoming one of the biggest menaces in the fight against malaria. The article by Leferve, et al. [7] also discusses mosquito competence to be a contributing factor to the rampant malaria spread. Mosquito competence is the ability of mosquitoes to support malaria development and transmission. Coupled with prototypical plasticity, malaria control becomes one of the most difficult milestones to achieve.

Smith-Aguasca, et al. [8] present a similar study to the Leferve, et al. [7] article. The study is about anti-malaria resistance surveillance focusing on the *P. falciparum* vector. Vector control methods like treated mosquito nets and indoor sprays, among others, are seen as insufficient for the control of malaria. Owing to the increasing resistance to malarial prescriptions, the group of Smith-Aguasca, et al. [8] is determined to find out how parasite anti-malaria resistance can be overcome. The drug-resistance epidemiological study was performed using the molecular genotyping techniques. Two species were identified in the study, which is likely to develop more resistance in the future. The *K13* allele type mosquito parasite was seen to be more resistant to anti-malaria drugs, more prevalent in Africa, and likely to cause more polymorphisms associated with artemisinin resistance in the future. The parasite is still not common in South East Asia, but there are chances the new point mutations of the gene will spread worldwide [8]. Another *C580Y* point mutation in Guyana is also seen in the study to be artemisinin-resistant. The article presents information that is vital in surveilling parasite resistance and applying the study in the current malaria control programs.

Triple artemisinin-containing combination anti-malarial treatment is the newest suggestion to the problem of anti-malarial resistance. However, Krishna [9] refutes this claim in the article. The article explains that managing multidrug-resistant malaria is most likely unachievable if the artemisinin-containing anti-malaria prescriptions are not used properly. Krishna [9] takes the side that existing anti-malarial combinations are appropriate in fighting malaria and there is no need for developing new anti-malarial therapies. Evidence in the Krishna [9] shows that the fixed malarial dose has never been used appropriately as populations fail to adhere to the specified dosage, a factor that contributes to the rise in resistance to anti-malaria drugs. Krishna [9] further states that new combinations will require more funds for extended studies and laboratory work. They will have to be formulated differently. Regular approvals and the costs of maintaining the safety of these new drugs are likely to be covered in the cost of the drugs, making them very expensive. The currently available Artemisinin-Based Combination Therapies (ACT) can be assessed with results from separate molecular studies on antimalarial drug resistance using validated markers for resistance [9]. More improvements can then be made in the ACT to discontinue the emerging resistance and to boost effectiveness cost-effectively.

In summary, malaria is a global pandemic that claims hundreds of thousands of lives while affecting millions of lives annually. The disease is caused by parasites that are spread by the

female *anopheles* mosquito through bites. Barriers to eliminating malaria in high-risk areas like Odisha is the culture of those residents who are accustomed to wearing light clothing and spending nights outdoors. Odisha state records the highest cases of malaria, contributing to nearly half of the total cases of malaria in India. The government of India, in collaboration with international agencies like the World Health Organization, puts measures for eliminating malaria by funding malaria medication and distributing free LLINs. Medical professionals should support the government in eliminating malaria through initiatives like promoting health care, clinical interventions, and supporting healthcare policies made by the government in control of the pandemic.

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