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Editorial

Malaria Vaccine for Children in Sudan: Commencing Midst the Gloom of War

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Malaria is a serious illness in many tropical countries, causing a considerable burden on health service facilities in 84 countries and territories and often leading to severe disease and a high mortality rate [1]. In Sudan, malaria is recognized as the leading cause of outpatient visits and hospital fatalities [2]. In 2023, the country recorded approximately 3.4 million cases of malaria, causing 7900 deaths. *Plasmodium falciparum* was the predominant species responsible for malaria infection in 67.6% of all malaria cases [3].

The health situation in Sudan has drastically deteriorated since last year due to the ongoing war, which led to the largest displacement and refugee crises worldwide; as a result, 4.6 million children were forced to leave their homes, and around one million children to cross the border into the neighboring Chad, Egypt, Ethiopia, and South Sudan [4].

The Sudanese health authority has recently introduced the malaria vaccine, R21/Matrix-M, developed at Oxford University and manufactured by Serum Institute of India (Figure **1**).

The World Health Organization (WHO) recently approved and recommended the vaccine for children residing in areas with moderate and/or high malaria transmission. It is produced by expressing the recombinant HBsAg virus-like-particles in Hansenula polymorpha with the CSPs central repeat and the C-terminal fused to the N-terminal of HBsAg [5]. According to the WHO recommendations, the vaccine is administered in four fragmented doses starting from 5 months of age and repeated monthly for two months, followed by the fourth dose at 18 months. The vaccine demonstrated high efficacy of up to 75%, offering protection against clinical malaria episodes in areas with moderate malaria transmission for one year following the last dose [6]. The vaccine exhibits mild adverse effects such as fever, reaction, and swelling of the injection site. However, some vaccinated children may develop serious adverse events within seven days such as febrile convulsions, that require high medical care [7].

According to the WHO, the malaria vaccine R21/Matrix-M has been tested rigorously and proved to be a safe vaccine with high efficacy. It is capable of decreasing the number of malaria cases and fatalities among young children [8].

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Figure 1: Historical photo of Adan Mohammed Khalil, the first Sudanese child to receive malaria vaccine in Sudan on November 4, 2024. Photo taken by WHO Malaria office, Ms. Mariam Adam.

Although the Sudanese health authority has introduced the R21/Matrix-M malaria vaccine as part of the national vaccination program, other preventive measures are required such as distributing insecticide-treated bed nets and implementing mass treatment of malaria [9]. To ensure the success of the immunization program, a strong national community awareness campaign is crucial to educate the local community about the significance of the vaccine for their children's health. Health workers need intense training to ensure effective vaccine delivery and address parents' concerns.

Introducing the malaria vaccine for children in Sudan presents a huge challenge, especially in the critical condition of the health infrastructure and the unprecedented humanitarian war crisis that started 18 months earlier. The scale of this challenge is far greater than what Sudan can manage alone. Approximately 70% of health facilities in war-affected areas, including the capital Khartoum, are partially operational or nonfunctional. Furthermore, those that are functioning are overwhelmed by the influx of millions of internally displaced persons (IDPs) from the war zone. In addition to the logistic demand for vaccination programs which included four divided doses, the health authority in Sudan was confronted with a crisis affecting 3.5 million children suffering from malnutrition, of whom 700,000 showed signs of acute malnutrition, 7.4 million had no access to safe drinking water, and 3.4 million are suffering the risk of watery diarrhea, measles, and cholera [10]. Sadly, Sudan's health authority cannot deal with this devastating health situation without assistance from the international community, which has been below expectations till now.

In conclusion, introducing the malaria vaccine represents a significant step in controlling and potentially eradicating malaria in Sudan. This vaccination program requires huge efforts to strengthen Sudan's health infrastructure initially for

successful implementation of the malaria vaccination program, ultimately leading to improved health outcomes for the children in Sudan.

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