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RESEARCH ARTICLE

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An Evaluation of Factors Responsible for a Stable Malaria Transmission in Andara District of Namibia

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ABSTRACT

Malaria remains a leading cause of morbidity and mortality in many countries, with an estimated 249 million cases and 435,000 deaths occurring globally in 2022. This infectious disease is caused by plasmodium parasites which are spread by the female anopheles mosquitoes mainly in countries in the tropical regions. Geographically Namibia is partly in the tropics and subtropic. Because of this geographical location, most districts of Namibia do not have malaria whereas others are endemically affected. Over the years Namibia has been trying to eliminate malaria in the affected districts including Andara in Kavango region with no success.

This study was conducted to identify factors responsible for a stable transmission of malaria in Andara District in Kavango East Region of Namibia, and how these may be addressed. A cross-sectional randomized sampling method was employed to select 360 respondents. A self-administered structured questionnaire comprising both closed- and open-ended questions was used to collect data. The questionnaire consisted of three sections: A: biographical information, B: Knowledge about factors that impede the elimination of Malaria in Andara district, C: Likert scale questions on malaria elimination. Data were analyzed using SPSS version 27.0 which included descriptive statistics to generate frequencies and percentages. Qualitative responses were thematically reviewed and integrated with quantitative findings for combined presentation.

The study revealed the following factors to be responsible for a stable malaria transmission in Andara District: limited research on traditional malaria prevention methods, uncontrolled cross border human movement, favorable environmental conditions for mosquito breeding, climate change, resistance of mosquitos to insecticides and poor surveillance of malaria transmission hotspots. Among these factors some are modifiable and, if addressed timeously, transmission of malaria may be reduced or eliminated completely in Andara district.

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Introduction

Malaria is an acute febrile illness characterized clinically by paroxysms of fever headache, joint pains chills and in some cases vomiting and diarrhea. These are the consequence of asexual reproduction by the malaria parasite, *Plasmodium Falciparum*, within red blood cells. Malaria is transmitted by the bite of female *Anopheles* mosquito infected with *Plasmodium Falciparum*. It is always a serious disease and may be fatal.

Malaria continues to pose a significant public health challenge in many parts of Africa, including Namibia, where it has been endemic for decades. Despite substantial global efforts aimed at malaria control and elimination, the disease remains a leading cause of morbidity and mortality, particularly among vulnerable populations such as young children and pregnant women [1]. The Kavango East Region, specifically the Andara District, is one of the most affected areas in Namibia.

The history of malaria in Namibia has been shaped by various socio-economic and environmental factors [2]. Following independence in 1990, the Namibian government prioritized malaria control, implementing initiatives such as the use of insecticide-treated bed nets (ITNs), indoor residual spraying (IRS), and community awareness campaigns [3]. Despite these efforts, the Kavango East Region has experienced fluctuating malaria incidence rates, particularly during the rainy seasons when conditions favor mosquito breeding. The persistence of malaria in the Andara District, despite national and regional control programs, raises critical questions about the effectiveness of current strategies to stop its transmission [4].

Limiting malaria transmission can be achieved through effective public health interventions, community engagement, and a robust healthcare system [1]. Hence, identifying and understanding the challenges to limiting malaria transmission

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in the Andara District is crucial for tailoring interventions to address the specific needs of the community.

Previous studies identified barriers including healthcare access, community awareness, environmental conditions, and socio-economic factors [5]. However, these studies relied on desk research data and overlooked the complex, lived experiences of community members and healthcare providers. In this study we collected first-hand information from the participants through a survey. This offers an opportunity to explore these perspectives in greater depth, providing insights that can inform more effective strategies to limit or even eliminate malaria transmission [6].

The greatest challenge Andara District faces is limited healthcare facilities. Many residents live in remote areas and have to travel significant distances to receive medical care. This infrastructural barrier delays early diagnosis and treatment, exacerbating malaria morbidity as well as its transmission [7]. Furthermore, the Andara District Hospital and other clinics in Andara District such as Omega, Mutjiku and Bagani clinics, just to mention a few, have limited resources needed to eliminate malaria including shortages of trained healthcare workers and essential antimalarial supplies [8].

Background

Malaria, a potentially fatal illness, is primarily present in tropical regions and is transmitted to people by certain species of mosquitoes [9]. In humans, malaria is primarily transmitted by bites from infected female Anopheles mosquitoes. Other transmission routes include blood transfusion, organ transplant, transplacental transmission, and, to a smaller extent, by contaminated needles especially among intravenous drug abusers. The initial signs and symptoms of malaria may be obscure, resembling many other feverish conditions but affected individuals present with fever, malaise, headache, joint pains, vomiting and diarrhea. If P. falciparum malaria is not treated, it can cause severe sickness and death in as little as 24 hours [9]. An estimated 627,000 persons in sub-Saharan Africa lost their lives to malaria in 2020. Malaria control activities have quickly risen over the past ten years due to an increase in partners and resources. With the millions of lives saved and the 36% reduction in malaria mortality from 2010 to 2020 brought about by this scaling up of interventions, plans for elimination and eventually eradication have been sparked. Through its cooperative activities in numerous malaria-endemic nations and regions, the CDC contributes its technical expertise to assist these efforts [10]. Nevertheless, in sub-Saharan Africa, Namibia included, malaria still poses a big problem. Between 2019 and 2020, estimated malaria cases increased from 213 million to 228 million, and deaths from 534 000 to 602 000 in the WHO African Region. This region accounted for about 95% of cases and 96% of deaths globally; the biggest toll, 80%, being children aged under 5 years [11]. The deaths from malaria were exacerbated by Covid -19 between 2019 and 2020 [4]. Increasing malaria cases means increasing family expenditure hence increasing the financial burden to families which eventually reduces overall treatment efficiency [12]. We carried out this study to acquaint ourselves and also share the reasons that have stagnated the efforts to eliminate malaria in Andara district in Kavango East region of Namibia.

Study Methods and Design

A cross-sectional quantitative and qualitative study design was employed to identify barriers to malaria elimination in the Andara District. This design was chosen because it allows for statistical analysis of participants' experiences and perceptions, enabling a systematic understanding of the challenges faced.

Study population

The target population of this study was 30,508 residents of Andara District, Kavango East Region, Namibia. This included community members, healthcare providers, and local leaders in the Andara District.

Sampling Method

A purposive stratified random sampling was employed to ensure representation across demographic groups, whereby a total of 360 participants were recruited to ensure adequate representation across different genders, age groups, and socio-economic backgrounds. The sample size was determined using Yamane Formula:

$$\text{n (sample size)} = \frac{N\ (total\ population)}{1+N\times e^2} \text{ where}$$

n= is the sample size, N is the total population, and e= the Standard deviation 5% or 0.05.

Study Setting

The study was conducted in the Andara District of the Kavango East Region, situated in north-eastern of Namibia, in Mukwe Constituency, bordering Angola, a country that receives an over average rainfall most of the seasons. The district is located 200 kilometers east of Rundu and it is inhabited primarily by the Hambukushu tribe. Andara District was identified as malaria-endemic, exhibiting high transmission rates, especially during the rainy season [13]. The people on either side of the border speak similar languages and they constantly cross the border to go to either side of the countries. The local population in this district primarily engages in subsistence farming and traditional livelihoods and are significantly impacted by health issues such as malaria.

Data Collection and analysis

Data were collected between March and June 2024 using a pre-tested structured questionnaire comprising both closed- and open-ended questions. The questionnaire included three sections i.e. Section A: Demographic characteristics, Section B: Knowledge and experiences related to malaria elimination in Andara District, Kavango East Region, Namibia, and Section C: Likert-scale items assessing attitudes toward malaria elimination. Data were analyzed using SPSS version 27.0. Descriptive statistics were used to generate frequencies and percentages for demographic and key study variables. Qualitative responses were thematically reviewed and integrated with quantitative findings for combined presentation.

Results

Socio-demographic characteristics of the study participants

A total of 360 questionnaires were distributed, completed and

returned from Andara district, achieving a response rate of 95%. Of these, 64% had completed ordinary level education, 21% held diplomas, 8% had general or honors degrees, and only 2% had master's degrees. Regarding marital status, 43% were single, 34% were married, 15% were widows, and 8% were divorced. 73% were in informal employment, 14% were formally employed, and 13% were unemployed. Majority, 27%, of the respondents were aged between 31-40, 23% were aged between 41-50. 18% were aged between 51-60, 12% were aged 61 years and above whilst 4% were aged between 18-20 years old. See Figure 1.

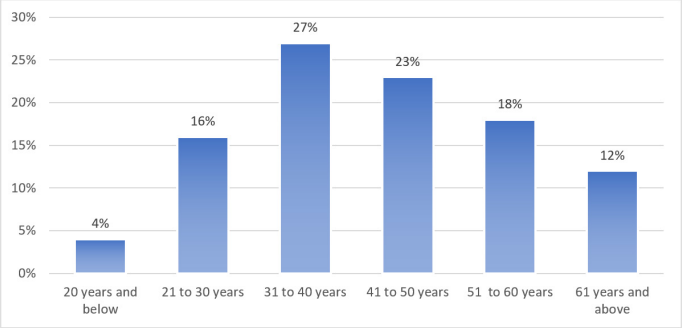

Figure 1: Age distribution of the respondents.

Challenges impeding the elimination of malaria in Andara District

The study revealed a complex interplay of factors that hinder effective control and prevention of malaria transmission efforts, Figure 2.

Discussions

The aim of the study was to identify and investigate challenges that impede the elimination of malaria in Andara District, Kavango East Region in Namibia. Like most African countries, following a decrease in local malaria transmission, Namibia is currently experiencing an epidemiological shift and it is expected to eradicate local transmission by 2030. The findings in this study, however, highlight potential gaps in health literacy that may affect understanding and engagement in malaria prevention efforts [1]. In a context where knowledge about disease transmission and prevention is crucial, low levels of formal education could hinder the community's ability to adopt effective health behaviors, thereby perpetuating the cycle of malaria transmission. Individuals based in Andara district with precarious employment situations may be more vulnerable to the health and economic burdens of malaria, as they are less likely to afford treatment or preventive measures. The high prevalence of informal employment raises concerns about community resilience, as it indicates a workforce that is not only economically vulnerable but also potentially less equipped to cope with health crises [14].

The challenges impeding malaria elimination in Andara District are multifaceted and reveal a complex interplay of environmental, social, and operational factors. The fact that favorable environmental conditions was cited by 26% of respondents as a major challenge indicates that local ecosystems may be conducive to mosquito breeding. This aligns with existing literature emphasizing the need for targeted environmental management as a critical component of malaria control strategies [6]. Factors such as stagnant water and poor drainage systems can create ideal breeding grounds for mosquitoes especially during rainy seasons, necessitating tailored interventions that address these specific environmental issues.

This study found uncontrolled cross-border migration, highlighted by 23% of respondents, raising concerns about the dynamics of malaria transmission in a globalized context. Migrants can introduce malaria into areas where it has been previously controlled, thereby complicating existing control efforts [15]. Other studies conducted in Kenya, Tanzania, and Uganda reported similar results. Unregulated cross-border migration can have a substantial impact on malaria transmission in a number of ways [16]. In this study we also found that public health surveillance systems face difficulties from unregulated migration between some nations. Because of this, it is difficult to identify and follow malaria cases between different nations, particularly when they affect individuals who are constantly on the move and lack a fixed address. Since these people are constantly on the move, they lack reliable access to healthcare. Delayed treatment for malaria cases father potentiates the transmission of the malaria. There is therefore need for coordinated regional strategies that address the unregulated cross border human movement as a measure to control malaria.

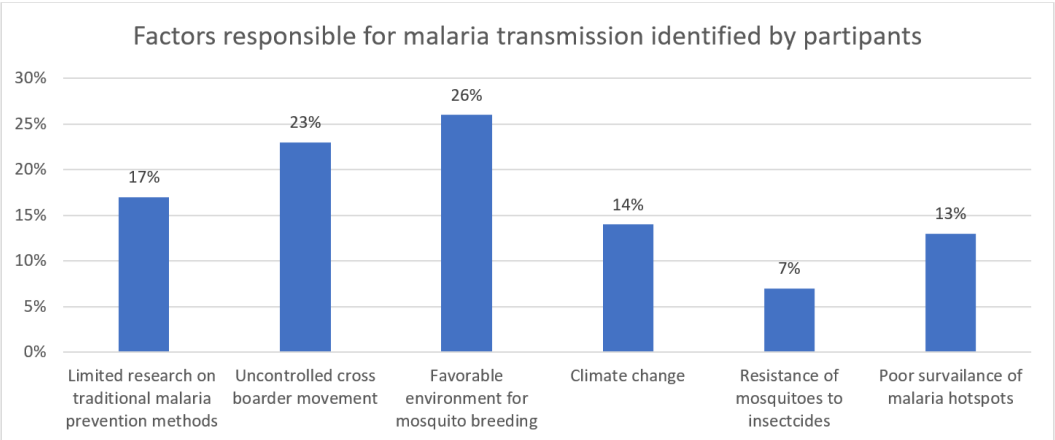

Figure 2: Factors identified by the respondents to favor malaria transmission in Andara district, Namibia.

Effective collaboration between neighboring districts and/or countries can facilitate shared resources and information, enhancing surveillance and response efforts [17].

Seventeen percent (17%) of the participants in this study noted that there is limited research on traditional malaria prevention methods. Some of these methods may be effective at preventing malaria in the communities and integrating them with the modern approaches may enhance community engagement and expedite malaria elimination [9]. Similarly, a study conducted in Kampala, Uganda, found that many traditional practices, such the use of herbal treatments and/or certain ceremonies, had been practiced for years without undergoing a thorough scientific analysis. However, it is uncertain if they are useful in preventing malaria due to a dearth of study [18].

Surveillance of malaria transmission hotspots is one of the interventions for monitoring treatment and elimination processes. However, 13% of the study participants reported that there is poor surveillance of the malaria hotspots in Andara district. Effective surveillance systems enable timely responses to outbreaks and ensure that resources are allocated where they are most needed. This is an indication of deficiencies in monitoring systems that are crucial for identifying and targeting interventions in areas with high transmission rates [19]. Enhancing surveillance, possibly through community involvement and training, could lead to better identification of transmission dynamics.

Twenty six percent (26%) of participants identified favorable environmental conditions for mosquito breeding as a factor for a stable malaria transmission. The local ecosystem in Andara district consists of a floodplain, thick vegetations and a warm and moist weather. This is quite conducive to mosquito breeding leading to the availability of mosquitoes almost throughout the year thus making it difficult to control malaria transmission. This is a big challenge for Andara district malaria control program compared to other districts of Namibia.

Global warming has affected most parts of the world leading to colder areas becoming warmer whilst dry areas are getting above normal rain falls. This may have a significant change in the behavior of the malaria parasite transmitting vector, the anopheles mosquito. Indeed (14%) of the study participants pointed out that climate conditions favor mosquito breeding and this makes the transmission of the malaria causing parasite worse. Changes in temperature and rainfall can significantly impact mosquito populations and their breeding cycles. Climate change is projected to alter the geographic distribution of malaria vectors, thereby necessitating adaptive strategies that respond to shifting climatic patterns [20]. Understanding local climate dynamics can inform the timing and type of interventions to be implemented.

Seven percent (7%) of the study participants raised the issue of resistance of mosquitoes to insecticides. Long term use of the insecticides eventually leads to the deployment of insecticide resistant mosquitoes. Controlling malaria-transmitting Anopheles mosquitoes with pyrethrum insecticides such as deltamethrin is becoming increasingly challenging because of widespread resistance amongst vector populations. This poses a significant barrier to effective vector control. Resistance of the mosquitoes to the available insecticides undermines the effectiveness of current interventions and necessitates the development of alternative strategies or the use of new insecticides [21]. Continuous monitoring of resistance patterns is essential to inform and adapt vector control strategies, ensuring that they remain effective over time.

Eliminating malaria is a top priority for the health agenda, the best chance of achieving quick, efficient, and long-lasting results is to take an integrated approach that addresses every aspect of the malaria transmission, advances knowledge, develops local capacity, and improves the health of the community [16].

Conclusions

For decades malaria has been and still is a problem to communities especially in the tropics, with the sub-Saharan Africa being more affected. The biggest toll to malaria is among the children under 5 years and pregnant women. The transmission route, being a bite by an infected anopheles mosquito, is well known and many countries including Namibia have strategies in place to break this transmission. But over the years elimination of malaria in Andara district of Namibia has failed. This study endeavored to find why this is so and some, if not all, of the factors have been identified. The onus now is on the government of the Republic of Namibia to address them to save the lives of the people of Andara district. Since Andara district is at the border with Angola, sharing information, particularly regarding cross border movement of the people and implementation of the screening exercise for malaria may be vitally important in the fight against malaria in Namibia particularly in Andara district, as most of the cases are imported.

Conflict of interest

The authors declare no conflict of interest. The authors received no funding from any external funder to conduct the study reported in this article.

References

1. World Bank. Malaria resources and economic analyses. World Bank. 2019.
2. Banek K, Lalani M, Staedke SG, Chandramohan D. Adherence to artemisinin-based combination therapy for the treatment of malaria: A systematic review of the evidence. Malar J. 2014; 13.
3. Ministry of Health and Social Services (Namibia). National malaria strategic plan 2017–2022. Windhoek: MoHSS. 2017.
4. World Health Organization. World malaria report 2022. WHO. 2022.
5. Carrasco-Escobar G, Fornace K, Benmarhnia T. Mapping socioeconomic inequalities in malaria in Sub-Saharan African countries. Sci Rep. 2021.
6. Parham PE, Hughes DA. Climate influences on the cost-effectiveness of vector-based interventions against malaria in elimination scenarios. Philos Trans R Soc Lond B Biol Sci. 2015; 370(1665).

7. Tavares W, Morais J, Martins JF, Scalsky RJ, Stabler TC, eta al. Malaria in Angola: Recent progress, challenges and future opportunities using parasite demography studies. Malar J. 2022; 21(1): 396.
8. Hlongwana KW, Sartorius B, Tsoka-Gwegweni J. Malaria programme personnel's experiences, perceived barriers and facilitators to implementing malaria elimination strategy in South Africa. Malar J. 2018; 17(1): 21.
9. Mousa A, Al-Taiar A, Anstey NM, Badaut C, Barber BE, et al. The impact of delayed treatment of uncomplicated P. falciparum malaria on progression to severe malaria. PLoS Med. 2020; 17(10).
10. Ippolito MM, Gebhardt ME, Ferriss E, Schue JL, Kobayashi T, et al. Scientific findings of the Southern and Central Africa International Center of Excellence for Malaria Research: Ten years of malaria control impact assessments in hypo-, meso- and holoendemic transmission zones in Zambia and Zimbabwe. Am J Trop Med Hyg. 2022; 107(4): 55-67.
11. World Health Organization. Malaria elimination: Geneva: WHO. 2021.
12. Cogswell I, Maddison E, Pedroza P, Zhao Y, Tsakalos G, et al. Examining the relationship between malaria burden and domestic spending on malaria in 106 countries, 2000–2019. Lancet Glob Heal. 2022; 10(S28): 123-134.
13. Ministry of Health and Social Services (Namibia). National malaria strategic plan 2023–2027. Windhoek: MoHSS. 2023.
14. Roberts KW, Gueye CS, Baltzell K, Ntuku N, McCreesh P, et al. Community acceptance of reactive focal mass drug administration and reactive focal vector control using indoor residual spraying: A mixed-methods study in Zambezi region, Namibia. Malar J. 2021; 20(1): 162.
15. Kailembo D, Gavana T, Kasagama E, Bernard J, Molteni F, et al. Large-scale intermittent larviciding intervention and associations with key malaria epidemiological parameters in Tanga Region, Tanzania. Malar J. 2025; 24(1): 350.
16. Nghipumbwa MH, Ade S, Kizito W, Takarinda KC, Uusiku P, et al. Moving towards malaria elimination: Trends and attributes of cases in Kavango region, Namibia, 2010–2014. PHA. 2018; 8(1): 24-28.
17. Malaria Consortium. Annual malaria report 2024: Uganda malaria reduction and elimination strategic plan (UMRESP) 2021–2025. Kampala: Ministry of Health Uganda. 2025.
18. Zambia National Malaria Elimination Centre. Zambia malaria indicator survey 2024. Ministry of Health Zambia. 2024.
19. Bansil P, Yeshiwondim AK, Guinovart C, Serda B, Scott C, et al. Malaria case investigation with reactive focal testing and treatment: Operational feasibility and lessons learned from low and moderate transmission areas in Amhara Region, Ethiopia. Malar J. 2018; 17(1): 449.
20. World Health Organization. World malaria report 2020. WHO. 2020.
21. Degarege A, Fennie K, Degarege D, Chennupati S, Madhivanan P. Improving socioeconomic status may reduce the burden of malaria in sub-Saharan Africa: A systematic review and meta-analysis. PLoS One. 2019; 14(1).