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Community perceptions of malaria control measures in an urban malaria-endemic setting in Namibia: A qualitative study

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Abstract

Background

Malaria remains a major public health challenge in Namibia despite substantial progress towards elimination. While malaria control interventions have traditionally focused on rural populations, increasing urbanisation and persistent malaria transmission in urban settings highlight the need to understand community perspectives on the implementation of malaria control measures. This study explored community perceptions of malaria control measures in Katima Mulilo, an urban malaria-endemic setting in the Zambezi Region of Namibia.

Methods

An exploratory qualitative study was conducted among adults attending three public primary healthcare facilities in Katima Mulilo, Namibia. Fifteen participants were recruited through convenience sampling. Data were collected through semi-structured face-to-face interviews and analysed using Braun and Clarke's six-phase thematic analysis framework. Trustworthiness was enhanced through strategies addressing credibility, dependability, confirmability, and transferability.

Results

Four major themes emerged from the analysis: (1) awareness of the impact of malaria, (2) challenges in the implementation of malaria control interventions, (3) perceptions of malaria treatment, and (4) strategies for strengthening urban malaria control. Participants demonstrated good knowledge of malaria symptoms and recognised its health and socio-economic consequences. However, they perceived important gaps in the implementation of malaria control interventions within urban communities, including inconsistent indoor residual spraying, inadequate distribution of long-lasting insecticidal nets, and limited attention to environmental management. Participants generally expressed confidence in biomedical treatment while acknowledging the use of traditional remedies within some communities. They recommended strengthening urban-focused malaria interventions through improved environmental sanitation, wider coverage of preventive measures, and greater community engagement in malaria control activities.

Conclusions

Although participants demonstrated good knowledge of malaria and confidence in formal healthcare services, they perceived inequities in the implementation of malaria control interventions in urban settings. The findings highlight the need for malaria elimination programmes in Namibia to strengthen urban-responsive strategies, improve equitable access to preventive interventions, enhance

environmental management, and promote meaningful community participation. Incorporating community perspectives into programme planning may improve the effectiveness and sustainability of malaria control efforts in rapidly urbanising settings.

Background

Malaria remains one of the most significant public health challenges worldwide, with sub-Saharan Africa accounting for approximately 95% of all malaria cases and deaths [1]. Despite considerable progress in prevention, diagnosis, and treatment over the past two decades, malaria continues to impose substantial health, social, and economic burdens on endemic countries. According to the 2024 World Malaria Report, an estimated 263 million malaria cases and 597,000 malaria-related deaths were reported globally, with children under five years of age and pregnant women remaining the most vulnerable populations [2]. Although intensified vector control interventions and improved access to effective antimalarial treatment have contributed to reductions in malaria morbidity and mortality, sustaining these gains remains challenging in many endemic settings.

Historically, malaria has been regarded primarily as a rural disease because transmission is strongly associated with ecological conditions that favour mosquito breeding, including stagnant water, vegetation, and limited infrastructure [3]. Consequently, malaria control programmes have traditionally concentrated their efforts on rural communities. However, rapid urbanisation across sub-Saharan Africa has altered malaria epidemiology, leading to increasing malaria transmission in urban and peri-urban settings [4, 1]. Informal settlements characterised by inadequate drainage systems, overcrowding, poor waste management, and unplanned urban development provide favourable breeding habitats for Anopheles mosquitoes, creating conditions that sustain malaria transmission even within urban environments.

Namibia has made considerable progress towards malaria elimination through the implementation of evidence-based interventions, including prompt diagnosis and treatment, indoor residual spraying (IRS), long-lasting insecticide-treated nets (LLINs), larval source management, and strengthened disease surveillance [5]. Nevertheless, malaria remains endemic in the northern and north-eastern regions bordering Angola and Zambia, where approximately 72% of the population remains at risk of infection [6]. Recent surveillance data indicate an increasing number of malaria cases in urban centres, particularly within the Zambezi Region [7]. Reported cases in Katima Mulilo increased substantially between 2019 and 2021, highlighting an important epidemiological shift that challenges the traditional perception of malaria as predominantly a rural disease [8].

The effectiveness of malaria control interventions depends not only on their technical efficacy but also on their accessibility, equitable implementation, and community acceptance. Community perceptions influence the uptake and sustained use of preventive measures, health-seeking behaviour, and participation in vector control programmes [9]. Previous studies have demonstrated that perceived

effectiveness, trust in health services, and community engagement are critical determinants of successful malaria control programme. However, most available evidence has focused on rural populations, with comparatively limited research exploring how urban communities perceive existing malaria control interventions despite the growing burden of urban malaria [10].

Understanding community perceptions is particularly important within rapidly urbanising settings, where environmental, social, and infrastructural conditions differ substantially from rural communities and may require different malaria control approaches. Failure to recognise these contextual differences may contribute to inequitable implementation of interventions and reduce programme effectiveness.

In Namibia, little is known about how urban residents perceive existing malaria control measures or whether they consider these interventions adequate for addressing the changing epidemiology of malaria. This evidence gap limits the ability of policymakers and programme managers to design urban-responsive malaria control strategies that reflect local experiences and community priorities.

Therefore, this study explored community perceptions of the implementation of malaria control measures in Katima Mulilo, an urban malaria hotspot in north-eastern Namibia. Specifically, the study examined residents' awareness and experiences of existing malaria control interventions, their perceptions of the adequacy and effectiveness of these measures, and community-generated recommendations for strengthening urban malaria control. The findings provide context-specific evidence that can inform more equitable and responsive malaria control policies and contribute to Namibia's malaria elimination agenda.

Methods

Study design

This study employed a qualitative exploratory design to explore community perceptions regarding the implementation of malaria control measures in Katima Mulilo, Namibia. A qualitative approach was considered appropriate because the study sought to gain an in-depth understanding of participants' experiences, perceptions, and views regarding malaria control interventions within their local context. The study was guided by an interpretivist paradigm, which assumes that individuals construct meaning based on their lived experiences and interactions with their social environment. This approach enabled the researchers to capture rich descriptions of participants' perspectives on the adequacy, accessibility, and effectiveness of existing malaria control measures.

Study setting

The study was conducted at three public primary healthcare facilities located in Katima Mulilo town, namely Katima Mulilo Clinic, Mavuluma Clinic, and Ngweze Clinic. Katima Mulilo is the capital of the Zambezi Region in north-eastern Namibia and lies at the intersection of Angola, Zambia, Botswana, and

Zimbabwe. Owing to its geographical location, favourable climatic conditions, and frequent cross-border population movement, the region remains one of Namibia's malaria-endemic areas.

Katima Mulilo has experienced rapid urban growth in recent years, resulting in the expansion of informal settlements characterised by poor drainage systems, overcrowding, and environmental conditions that may facilitate mosquito breeding. According to the 2023 Population and Housing Census, the town has approximately 46,401 inhabitants [11]. The study setting was therefore considered appropriate because it represents an urban area experiencing persistent malaria transmission despite ongoing malaria control interventions.

Study population

The study population comprised adults seeking preventive or curative healthcare services at the three selected public health facilities during the data collection period. Participants were selected because they resided within the Katima Mulilo urban constituency and were considered capable of providing firsthand information regarding their experiences and perceptions of malaria control measures implemented within their communities.

Sampling strategy and sample size

A non-probability convenience sampling strategy was used to recruit participants attending the selected health facilities. Convenience sampling was considered appropriate because it enabled the recruitment of individuals who were readily available and willing to participate while ensuring representation of community members with recent experiences of malaria prevention and healthcare services.

Data collection continued until data saturation was achieved, defined as the stage at which no new themes or meaningful insights emerged from successive interviews. Saturation was reached after interviewing 15 participants, which is consistent with recommendations for qualitative studies involving relatively homogeneous populations.

Inclusion and exclusion criteria

Participants were eligible if they:

- Were aged 18 years or older;
- Resided within Katima Mulilo urban constituency;
- Were able to communicate in English or the local language preferred for the interview; and
- Voluntarily provided written informed consent.

Individuals younger than 18 years, visitors who did not reside in Katima Mulilo, and those who were unable or unwilling to provide informed consent were excluded.

Data collection

Data were collected using semi-structured face-to-face interviews conducted between June and July 2024. A semi-structured interview guide was developed specifically for this study by the research team, informed by study objectives and a review of the relevant literature. The guide was designed to explore participants' perceptions and experiences regarding malaria control measures while allowing sufficient flexibility for participants to elaborate on issues they considered important. The English version of the interview guide is provided as **Additional file 1**.

Interviews were conducted by both the principal and co- researchers in private consultation rooms within the participating health facilities to ensure confidentiality and minimise interruptions. Interviews were conducted in the language preferred by participants and lasted approximately 45–50 minutes.

With participants' permission, all interviews were digitally audio-recorded. Field notes documenting non-verbal communication, contextual observations, and emerging reflections were recorded immediately after each interview to complement the audio recordings.

Pre-testing of the interview guide

The interview guide was pre-tested two weeks before the commencement of the study among clients attending a health facility within Katima Mulilo that was not included in the main study. The pre-test evaluated the clarity, sequence, relevance, and comprehensibility of the interview questions.

Minor wording adjustments were made to improve clarity; however, no substantial changes to the content of the interview guide were required. Data obtained during the pre-test were excluded from the final analysis.

Data analysis

Audio-recorded interviews were transcribed verbatim and translated into English where necessary. The transcripts were checked against the original recordings to ensure accuracy before analysis.

Data were analysed using Braun and Clarke's six-phase thematic analysis framework [(12)], which involved:

1. familiarisation with the data;
2. generation of initial codes;
3. searching for themes;
4. reviewing themes;
5. defining and naming themes; and
6. producing the final report.

Coding was performed manually by the principal researcher. Emerging codes were continuously compared across transcripts to identify patterns and similarities. The research team met regularly to

discuss coding decisions, refine themes, and resolve discrepancies through consensus, thereby enhancing the credibility of the analysis.

Trustworthiness

Trustworthiness was ensured using the criteria proposed by Lincoln and Guba, namely credibility, dependability, confirmability, and transferability.

Credibility was enhanced through prolonged engagement with participants, verbatim transcription of interviews, and regular discussions between the researchers during data analysis.

Dependability was strengthened by maintaining a detailed audit trail documenting methodological decisions throughout the study.

Confirmability was achieved through reflexive note-taking, maintenance of field notes, and verification of emerging themes by both researchers.

Transferability was supported by providing detailed descriptions of the study setting, participants, sampling procedures, and research processes to enable readers to assess the applicability of the findings to similar contexts.

Researcher reflexivity

The principal researcher is a lecturer in nursing and public health with experience in malaria research and qualitative interviewing. Throughout the study, reflexive notes were maintained to acknowledge potential assumptions and minimise researcher influence during data collection and interpretation. Regular discussions with the co-author were used to challenge interpretations and enhance analytical rigour.

Ethical considerations

Ethical approval was obtained from the University of Namibia Decentralised Research Ethics Committee (Reference No. RUC00024) before commencement of the study. Permission to conduct the study was granted by the Namibia Ministry of Health and Social Services.

Written informed consent was obtained from all participants before participation. Participation was voluntary, and participants were informed of their right to withdraw at any stage without consequences.

Results

Fifteen participants were interviewed, and data saturation was achieved after the fifteenth interview. Participants ranged in age from **18 to 50 years**, with a mean age of approximately **30 years.** The sample comprised ten (**10) females and five (5) males**. Ten participants resided in informal settlements, five

lived in formal residential areas Most participants (n = 12) were unemployed, while two were formally employed, one was self-employed, and one was a student. *See table 1*

Table 1: Characteristics of participants

D	*Age*	*Gender*	*Marital status*	*Residential area*	*Employment status*
P-1	*22*	*Female*	*Single*	*Informal*	*Unemployed*
P-2	*40*	*Female*	*Single*	*Formal*	*Employed*
P-3	*21*	*Male*	*Single*	*Formal*	*Unemployed*
P-4	*18*	*Female*	*Single*	*Informal*	*unemployed*
P-5	*34*	*Female*	*Married*	*Informal*	*Unemployed*
P-6	*19*	*Male*	*Single*	*Informal*	*Unemployed*
P-7	*35*	*Male*	*Married*	*Informal*	*Unemployed*
P-8	*22*	*Female*	*Single*	*Informal*	*Unemployed*
P-9	*18*	*Male*	*Single*	*Informal*	*Learner*
P10	*48*	*Female*	*Married*	*Formal*	*Unemployed*
P11	*50*	*Female*	*Widow*	*Informal*	*Employed*
P12	*36*	*Female*	*Married*	*Informal*	*Unemployed*
P13	*40*	*Male*	*Single*	*Formal*	*Employed*
P14	*25*	*Female*	*Single*	*Informal*	*Self- employed*
P15	*19*	*Female*	*Single*	*Formal*	*Student*

Overview of themes

Thematic analysis generated four major themes and ten sub-themes describing participants' perceptions of malaria control measures in Katima Mulilo (See table 2).

Table 2. Major themes and sub-themes

Themes	*Subthemes*
Awareness of the impact of malaria	• *Knowledge and understanding of malaria* • *Socio-economic impact of malaria* • *Personal experiences and risk perception*
Challenges in the implementation of malaria control interventions	• *Perceived coverage gaps in urban areas* • *Urban versus rural disparities* • *Perceived effectiveness of control measures*
Perceptions of Malaria Treatment	• *Confidence in biomedical treatment* • *Role of traditional remedies*
Strategies for enhancing urban malaria control	• *Strengthening Preventive Interventions* • *Environmental management and sanitation*

Theme 1:Awareness of the impact of malaria

Participants demonstrated a high level of awareness regarding malaria and its consequences. They recognised malaria as a serious illness affecting physical health, household livelihoods, and daily activities. Their perceptions were informed by personal experiences, observations of illness within the community, and previous encounters with malaria.

Knowledge and understanding of malaria

Most participants correctly described common symptoms of malaria, including fever, weakness, vomiting, poor appetite, and difficulty sleeping. Malaria was generally perceived as a debilitating illness that limited an individual's ability to perform normal daily activities.

One participant explained:

"If you are having malaria, you won't feel well… sometimes you don't eat." (P2)

Another participant stated:

"*You cannot sleep if you have malaria… you will be awake the whole night." (P8)*

Socio-economic impact of malaria

Participants perceived malaria as having substantial social and economic consequences. They explained that illness interrupted employment, schooling, and household responsibilities, affecting both individuals and their families.

One participant remarked:

"*When you are sick, everything comes to a standstill." (P1)*

Similarly,

"You don't go to work nor school… you will not be able to do household chores." (P5)

Personal experiences and risk perception

Personal experiences strongly influenced perceptions of malaria risk. Participants who had experienced malaria or witnessed severe illness considered malaria a potentially life-threatening disease.

One participant reflected:

"*The experience of having malaria changed my perception… I am now afraid of malaria." (P2)*

Another participant recalled:

"This patient was very sick… later they said it was malaria, and he died." (P14)

Theme 2: Challenges in implementing malaria control interventions

Participants acknowledged the existence of malaria control programmes but expressed concerns regarding their implementation, accessibility, and effectiveness in urban areas.

Perceived coverage gaps in urban areas

Many participants reported that malaria prevention activities such as indoor residual spraying (IRS) and mosquito net distribution were inconsistently implemented and failed to reach all households.

One participant stated:

"They sprayed in some areas… but my house was not sprayed." (P6)

Similarly,

"*I heard they were giving mosquito nets… but I did not receive one." (P10)*

Urban–rural disparities

Participants consistently perceived malaria control interventions to be more visible in rural communities than in urban areas. Mosquito net distribution and indoor spraying were frequently described as prioritising villages rather than urban neighborhoods.

As one participant explained:

"*I did not see them in town, but they always provide mosquito nets in the village." (P13)*

Another participant stated:

"*They don't spray in town… I only saw them in the village." (P3*

Perceived effectiveness of malaria control measures

Although participants generally believed that malaria control measures were beneficial, many questioned their overall effectiveness because environmental sources of mosquito breeding remained unaddressed.

One participant commented:

"*The measures are helping in preventing malaria." (P1)*

However, another participant noted:

"*They only spray inside… mosquitoes stay in the grass outside." (P6)*

Similarly,

"*There is standing water… but I have never seen them treating it." (P10)*

Theme 3: Perceptions of malaria treatment

Participants generally expressed confidence in biomedical treatment and regarded healthcare facilities as the preferred source of malaria diagnosis and treatment.

Confidence in biomedical treatment

Most participants believed that hospital treatment was effective and indicated that they would seek medical care promptly if they suspected malaria.

One participant stated:

"*The treatment is effective." (P9)*

Another explained:

"If I choose, I will go to the hospital." (P8)

Similarly,

"I prefer hospital treatment." (P15)

Role of traditional remedies

Although participants acknowledged that traditional remedies were used within the community, they generally viewed these as complementary rather than substitutes for biomedical treatment.

One participant explained:

"*Some people claim that the neem tree can treat malaria." (P6)*

Another stated:

"*I heard the tree called sinunka-nunka can treat malaria, but I will choose hospital treatment." (P7)*

Theme 4: Strategies for enhancing urban malaria control

Participants proposed several approaches for improving malaria prevention and control within urban communities.

Strengthening preventive interventions

Participants recommended expanding access to mosquito nets and improving the coverage of existing malaria prevention programmes.

One participant suggested:

"*They should give us mosquito nets." (P1)*

Environmental management and sanitation

Participants believed that greater attention should be given to environmental management, including the treatment of stagnant water, improved sanitation, and vegetation control.

One participant remarked:

"*They should spray standing water, near bushes and sewers." (P6)*

Another suggested:

"*They should encourage people to build better houses… mosquitoes are fewer there." (P8)*

Discussion

This study explored community perceptions of the implementation of malaria control measures in Katima Mulilo, an urban malaria hotspot in Namibia. Four major themes emerged: awareness of the impact of malaria, challenges in the implementation of malaria control interventions, perceptions of malaria treatment, and community-recommended strategies for strengthening urban malaria control. Overall, participants demonstrated substantial knowledge of malaria and expressed confidence in biomedical treatment. However, they perceived significant gaps in the implementation and coverage of malaria control interventions within urban communities, particularly when compared with neighbouring rural areas. These findings suggest that while malaria control programmes remain active, their implementation may not adequately address the changing epidemiology of malaria in rapidly urbanising settings.

Before discussing the implementation of malaria control measures, participants described their knowledge, experiences, and perceptions of malaria. These contextual perspectives shaped how they understood and evaluated existing malaria control interventions and therefore formed an important foundation for interpreting subsequent themes.

Awareness of malaria and its impact

Participants demonstrated a high level of awareness regarding malaria symptoms, modes of transmission, and the broader health and socio-economic consequences of the disease. Malaria was consistently perceived as a serious illness that affected individuals' physical wellbeing, productivity, education, and household functioning. These findings are consistent with previous studies conducted in sub-Saharan Africa, which reported that communities living in malaria-endemic areas generally possess good knowledge of malaria because of continuous exposure to health promotion activities and personal experiences with the disease [13, 10].

The findings further suggest that personal experiences with malaria and witnessing severe illness or death significantly influenced participants' perception of risk. Individuals who had previously suffered from malaria expressed greater concern about future infection and were more likely to recognise malaria as a life-threatening disease. This supports the Health Belief Model, which proposes that perceived susceptibility and perceived severity influence individuals' willingness to adopt preventive behaviours. Strengthening community awareness programmes may therefore contribute to sustained engagement with malaria prevention strategies, particularly in urban populations where risk perception may differ across neighbourhoods.

Challenges in implementing malaria control interventions

The most important finding of this study is the widespread perception that malaria control interventions are implemented less comprehensively in urban communities than in rural areas. Participants consistently reported irregular indoor residual spraying (IRS), limited distribution of long-lasting insecticide-treated nets (LLINs), and inadequate environmental management within urban

neighborhoods. These findings highlight perceived inequities in programme implementation despite increasing malaria transmission in urban settings.

This observation reflects the historical focus of malaria control programmes on rural populations, where malaria has traditionally been considered most prevalent [4]. However, rapid urbanisation, population growth, informal settlement expansion, and environmental changes have altered malaria transmission patterns across many African countries. Similar findings have been reported in Malawi, Nigeria, and Ethiopia, where urban communities perceived lower intervention coverage despite increasing malaria risk [14, 10]. More recently, an exploratory qualitative study conducted in two Nigerian cities found that although malaria prevention and treatment services were available, urban residents continued to experience significant barriers related to socioeconomic inequalities, health system limitations, and environmental conditions that affected access to effective malaria control interventions [15]. The authors further argued that urban malaria programmes require interventions specifically designed for diverse urban settlements rather than adapting strategies originally developed for rural populations. The consistency of these findings with the present study suggests that rapid urbanisation across sub-Saharan Africa presents common implementation challenges that require context-specific malaria control strategies.

Participants also questioned the effectiveness of existing interventions because they perceived insufficient attention to mosquito breeding sites outside households. Although indoor residual spraying was acknowledged as beneficial, many participants believed that untreated stagnant water, overgrown vegetation, blocked drainage systems, and poor sanitation continued to facilitate mosquito breeding. These findings are consistent with evidence supporting integrated vector management, which recommends combining indoor interventions with environmental management and larval source control to achieve sustainable malaria prevention, particularly in urban environments [16, 2]. Similar observations have been reported in Mozambique, where communities identified environmental sanitation, drainage improvement, and the elimination of mosquito breeding sites as essential components of successful malaria control programmes [17]. Collectively, these findings reinforce the need for malaria programmes to move beyond household-based interventions and adopt integrated approaches that simultaneously address environmental determinants of malaria transmission.

Perceptions of malaria treatment

Participants' perceptions of malaria treatment emerged as an important component of their broader experiences with malaria control. Although the study focused primarily on preventive interventions, participants frequently discussed treatment services when reflecting on the effectiveness of malaria control within their communities.

Participants expressed strong confidence in biomedical treatment and consistently identified health facilities as their preferred source of malaria diagnosis and treatment. This finding is encouraging because early diagnosis and prompt treatment remain essential components of malaria elimination

strategies. High confidence in formal healthcare services may contribute to timely treatment-seeking behaviour, thereby reducing severe illness and interrupting malaria transmission.

Although some participants acknowledged the use of traditional remedies within their communities, these remedies were generally viewed as complementary rather than alternatives to biomedical care. This finding differs from reports in some malaria-endemic settings where traditional medicine continues to delay access to formal treatment [18, 19]. The preference for biomedical treatment observed in this study may reflect successful public health education and increased accessibility of malaria diagnosis and treatment within Namibia's primary healthcare system. Continued investment in accessible diagnostic services and uninterrupted availability of effective antimalarial medicines remains essential for sustaining public confidence in health services.

Strategies for strengthening urban malaria control

Participants proposed several practical recommendations to improve malaria control, including wider distribution of mosquito nets, expansion of indoor residual spraying, improved drainage systems, treatment of stagnant water, vegetation management, and improved housing conditions. These recommendations demonstrate that communities recognise malaria control as extending beyond healthcare services and requiring broader environmental and intersectoral interventions.

Participants' recommendations for strengthening environmental management are supported by recent evidence showing that vector control interventions achieve greater effectiveness when combined with active community participation and environmental sanitation. A qualitative study conducted in Mozambique reported that community members perceived environmental cleanliness, proper drainage, and consistent utilisation of malaria prevention measures as fundamental components of sustainable malaria control [20]. These findings reinforce the importance of integrated vector management approaches that combine biomedical interventions with community-driven environmental actions.

An important contribution of the present study is its demonstration that community members are not passive recipients of malaria interventions but active stakeholders capable of identifying implementation gaps and proposing practical solutions. This finding is consistent with recent qualitative research conducted in Ghana, which found that community participation, trust in malaria programmes, and perceived programme benefits strongly influenced the acceptability, ownership, and long-term sustainability of malaria interventions [20]. The Ghanaian study concluded that incorporating community perspectives during programme planning and implementation enhanced intervention uptake and strengthened local ownership of malaria control initiatives. These findings emphasise that successful malaria elimination requires meaningful community engagement rather than relying solely on top-down implementation approaches.

The findings further support the growing recognition that malaria elimination requires collaboration across multiple sectors, including public health, environmental health, local government, urban planning, and community development. Urban malaria cannot be effectively addressed through health-sector

interventions alone because many determinants of transmission, such as housing quality, waste management, drainage infrastructure, and land use, fall outside the health sector[21] . As rapid urbanisation continues to reshape malaria epidemiology across southern Africa, national malaria programmes should strengthen urban surveillance systems, prioritise high-risk neighborhoods, improve environmental management, and work closely with municipal authorities responsible for sanitation, housing, drainage, and waste management. Such intersectoral approaches are increasingly recognised as essential for sustaining progress towards malaria elimination and achieving equitable malaria control in rapidly urbanising settings

Public health and policy implications

The findings of this study have important implications for malaria control policy in Namibia. Participants consistently perceived inequitable implementation of malaria interventions between urban and rural communities despite increasing urban malaria transmission. This suggests that national malaria programmes should reconsider intervention planning to ensure that urban communities receive adequate attention based on epidemiological risk rather than historical assumptions about malaria distribution.

In addition, incorporating community perspectives into programme planning may improve acceptability, intervention uptake, and community participation. Policymakers should consider strengthening environmental management programmes, improving surveillance in urban settings, and promoting community engagement strategies tailored to informal settlements and other high-risk urban environments. Such approaches are likely to support Namibia's progress towards malaria elimination while ensuring equitable access to malaria prevention services.

The findings also support the growing recognition that malaria elimination strategies should explicitly incorporate urban health planning. Increasing urbanisation, expansion of informal settlements, and cross-border population movement are changing malaria transmission dynamics across southern Africa [15] . Consequently, malaria programmes should strengthen surveillance in urban settings, prioritise high-risk neighbourhoods, improve environmental management, and collaborate with municipal authorities responsible for housing, drainage, sanitation, and waste management. Such intersectoral approaches are increasingly recognised as essential for sustaining progress towards malaria elimination.

Strengths and limitations

A major strength of this study is that it provides one of the first qualitative investigations of community perceptions of malaria control measures in an urban Namibian setting. The use of in-depth interviews generated rich contextual information that would not have been captured through quantitative methods alone. Furthermore, the inclusion of participants from different residential settings enhanced the diversity of perspectives.

However, several limitations should be acknowledged. The study was conducted in one urban municipality using convenience sampling, which may limit the transferability of the findings to other settings. Participants' perceptions may also have been influenced by personal experiences or recall bias. Nevertheless, the study provides valuable insights into community experiences that can inform future research and programme development in similar urban malaria settings.

Conclusion

This study explored community perceptions of the implementation of malaria control measures in Katima Mulilo, an urban malaria-endemic setting in Namibia. Although participants demonstrated good knowledge of malaria and expressed confidence in biomedical treatment, they perceived significant shortcomings in the implementation and coverage of malaria control interventions within urban communities. In particular, participants reported inequities in the distribution of preventive measures, with interventions perceived to be more consistently implemented in rural than urban areas. They further highlighted environmental conditions, including poor drainage, stagnant water, and inadequate sanitation, as persistent contributors to malaria transmission.

The findings underscore the need for malaria control programmes to move beyond their traditional rural focus and adopt urban-responsive strategies that reflect the changing epidemiology of malaria. Strengthening equitable access to vector control interventions, enhancing environmental management, and promoting meaningful community engagement are likely to improve the effectiveness and sustainability of malaria control efforts in rapidly urbanising settings.

These findings provide context-specific evidence to inform malaria control policy and programme implementation in Namibia and similar malaria-endemic countries undergoing rapid urbanisation. Future research should evaluate the effectiveness of integrated urban malaria interventions and explore the perspectives of programme implementers and policymakers to support evidence-based malaria elimination strategies.

Abbreviations

Abbreviation Meaning

IRS Indoor Residual Spraying

LLIN Long-Lasting Insecticidal Net

WHO World Health Organization

MoHSS Ministry of Health and Social Services

UNAM University of Namibia

Declarations

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Availability of data and materials

The datasets generated and analysed during the current study are not publicly available because they contain information that could compromise participant confidentiality. De-identified data may be made available by the corresponding author on reasonable request, subject to approval by the relevant ethics committee and the Namibia Ministry of Health and Social Services.

Authors' contributions

MTS conceptualised the study, developed the methodology, collected the data, conducted the analysis, interpreted the findings, and drafted the manuscript. ECL supervised the study, contributed to the study design, data collection, reviewed the analysis, critically revised the manuscript for important intellectual content, and approved the final version of the manuscript. All authors read and approved the final manuscript.

Ethics approval and consent to participate

Ethical approval for this study was obtained from the University of Namibia Research Ethics Committee (Reference No. RUC00024). Permission to conduct the study was granted by the Namibia Ministry of Health and Social Services. Written informed consent was obtained from all participants before data collection. All methods were carried out in accordance with the relevant institutional guidelines and the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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