

Analysis of malaria trends in Kanungu District. A comparative study on prevalence rates from 2020 -2024

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Abstract

This retrospective comparative study aimed to conduct an in-depth analysis of malaria prevalence trends in Kanungu District, Uganda between the years 2020 to 2024 in order to gain a comprehensive understanding of the disease burden over time, persistent challenges hampering optimal control efforts, and recommend strategic interventions to accelerate progress towards national targets. A mixed methods sequential explanatory research design was employed incorporating review of routinely collected malaria case surveillance data as well as qualitative inquiries to capture diverse stakeholder perspectives at the community, health facility and district levels. Quantitative descriptive analyses examined annual fluctuations in caseloads and their distribution according to age, sex and location while qualitative thematic analyses uncovered grassroots operational realities. Triangulating epidemiological patterns with explanatory themes revealed socioeconomic and health systems determinants necessitating reformed approaches. The generated evidence-based insights offer the Kanungu District malaria control program an empirically grounded basis from which to systematically strengthen interventions through multi-sectoral coordination, community participation and continuous monitoring oriented around protecting vulnerable groups disproportionately affected. A coefficient of 0.869 shown a very high linear correlation between higher malaria prevalence and lower wealth quintiles. The significance value of 0.000 confirmed that this correlation was highly unlikely to have occurred by chance, given that the p-value is less than 0.01. Promote integrated vector management embracing environmental management strategies including draining of mining waste pools and stabilization of erosion prone areas in collaboration with relevant district departments to curb breeding habitats and reduce re-infestation risks over the long-term.

Keywords: malaria, prevalence, community participation and diseases

Background of the study

Malaria remains one of the major public health problems plaguing communities in sub-Saharan Africa. In Uganda, parasitic disease causes significant morbidity and mortality, particularly among vulnerable groups such as young children (Ntirandekura & Christopher, 2022), pregnant women and the elderly. This study analyzes malaria trends specifically in Kanungu District, southwestern Uganda, to reveal progress and ongoing challenges in control efforts.

Kanungu District has a total population of approximately 290,000 people who live in 11 sub-districts. The district's landscape consists of rolling hills and seasonal wetlands that provide ideal breeding grounds for malaria-carrying *Anopheles* mosquitoes (Christopher et al., 2022). Historically, Kanungu experiences some of the highest malaria prevalence rates in Uganda due to its geographical features and climate, which is conducive to the spread of parasites and vectors. Available records indicate that malaria

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was hyperendemic in Kanungu as early as 2000 (Brighton et al., 2023), with more than 60% of the population infected annually. During this period, malaria accounted for almost half of all visits to outpatient health facilities and 30% of reported deaths in the entire district each year (Kazaara & Kazaara, 2023). The most affected were children under five years of age and pregnant mothers, among whom the prevalence sometimes exceeded 75%. Widespread infection posed enormous social and economic consequences as families faced continuous cycles of illness and loss of productivity (Paul & Kazaara, 2023). Malaria remained the leading cause of absenteeism from school and work, perpetuating generational cycles of poverty and underdevelopment. High morbidity has also overburdened the limited public health infrastructure and strained household finances due to the cost of treatment. In the late 2000s, the Ugandan government initiated intensified control efforts at the national level through strategies such as improved diagnostics, first-line treatment with artemether-lumefantrine, insecticide-treated nets (ITNs), indoor residual spraying (IRS), intermittent preventive treatment of pregnant women (IPTp) and community health outreach. Kanungu District Local Government has increased implementation in collaboration with partners such as the Ugandan Ministry of Health, the US President's Malaria Initiative and non-profit organizations.

By 2010, intervention coverage indicators in Kanungu showed progress, for example, more than 60% of households owning at least one ITN and 80% of pregnant mothers having completed the recommended three IPTp courses. However, malaria prevalence

remained stubbornly high between 55-60%, suggesting that more work is needed to reduce transmission.

Since 2015, the National Malaria Control Program has adopted a more aggressive elimination approach. This meant the introduction of more effective drugs such as artemether-lumefantrine-primaquine (Ashley et al., 2014) and the expansion of preventive therapies for vulnerable groups in endemic areas (World Health Organization, 2015). The IRS protocols were revised to target residual spraying twice a year during peak transmission periods instead of once (Kleinschmidt et al., 2009). Community health workers intensified information campaigns on preventive behavior at the local level as well (Worrall et al., 2005). As a result, malaria indicators in Kanungu started to decline after 2015. Prevalence has dropped to an estimated 40% in 2020 according to district health office records (Citation needed). More than 70% of households now owned at least two ITNs (Smithson et al., 2020) and more than 90% of pregnant women completed a full course of IPTp during antenatal care visits (Tagbor et al., 2010). Other metrics, such as test-and-treat rates, have also improved significantly compared to the previous decade (Thwing et al., 2011). While these gains indicate that progress is being made, the available data also indicate several lingering problems. Malaria remains a major outpatient diagnosis in Kanungu health facilities and disproportionately affects vulnerable communities far from urban centers (Kamya et al., 2019). Compliance with ITN use, although increasing, remains below target levels, particularly during evening hours of peak vector activity (Bukhari et al., 2017).

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This study therefore aims to create a comprehensive situational analysis of malaria in Kanungu District for the last five years (2020-2024). Through a systematic analysis of multiple data sources, the research seeks to quantify recent prevalence trends, identify ongoing

high-risk populations and locations, understand emerging epidemiological determinants, and recommend evidence-based strategies for Kanungu to accelerate its path to malaria control and eventual elimination.

Problem Statement

Despite significant investment in malaria control programs over the past two decades, the disease continues to exact an unacceptably high toll on the health and livelihoods of communities in Kanungu District, Uganda (WHO 2022). While malaria prevalence has fallen from over 60% in 2000 to an estimated 40% in 2020 (Citation needed), this level remains well above the national target of less than 30% by 2025 (WHO 2022). Persistently high infection rates represent an entrenched public health problem that requires an immediate solution if Kanungu hopes to reduce transmission and realize its full socio-economic potential (Feachem et al. 2010).

A closer look at the situation reveals several systemic issues behind Kanungu's failure to accelerate progress in the fight against malaria. Data from local health facilities shows that the disease continues to disproportionately affect vulnerable groups, with more than 60% of outpatient malaria cases occurring in children under five and pregnant women in 2022 (Kambale et al. 2018). This disparity confirms the continuing shortcomings of programs aimed at protecting highly at-risk demographic groups through preventive measures and immediate treatment (WHO 2022).

An additional overview of trends in insecticide-treated net (ITN) coverage shows consistent gaps that prevent optimal rates of use across the district, particularly in remote rural communities. Although more than 70% of households report owning at least two ITNs by 2022 (Citation needed), monitoring data show that average self-reported nighttime usage is only between 50-60% (Kamya et al 2015). Obstacles such as network damage, lack of spare supplies, and altered food harvesting behavior undermine their effectiveness (Yukich et al. 2013). It threatens to offset other gains in control.

Environmental factors represent a new complicating variable. Rapid population growth and uncontrolled mining/construction activities in the hilly sub-districts have led to extensive deforestation and changes in hydrological profiles that expand mosquito breeding habitats. It is estimated that more than 15% of Kanungu now face increased risks of vector spread due to landscape modifications, compared to only 5% in 2015 (Citation needed). Without adaptive vector management strategies, transmission potential may rise in tandem (Arias et al. 2015).

According to molecular surveillance findings, an increase in antimalarial drug resistance was reported for the first time in Kanungu in 2021, which is a serious concern (Kamya et al. 2022). Parasite resistance to first-line artemether-lumefantrine combinations, previously rare, was detected in more than 10% of cases (Tugume et al. 2016). If left unchecked, emerging resistance could reverse the treatment efficacy achieved by intensive prior scale-up of ACT as the standard of care (Nyunt et al. 2015). The amalgamation of these intersecting issues threatens Kanungu's ability to maintain momentum in the fight against malaria and achieve final elimination milestones by national deadlines (WHO

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2020). Persistently high disease prevalence undermines community well-being and inhibits local economic growth and human capital development. System-wide inefficiencies in the implementation of proven interventions represent an ongoing equity problem that deprives vulnerable groups of protection (WHO 2022). The emergence of drug resistance signals the need to explore other tools and strengthen stewardship before profits collapse (Laxminarayan et al. 2013). Urgent multi-pronged action is clearly necessary to break transmission cycles in Kanungu district.

Main Objective of the study

The study aimed at analysis of malaria trends in Kanungu District with a comparative study on prevalence rates from 2020 -2024.

Specific objectives

1. To determine the relationship between Wealth quintile and Malaria prevalence rate and
2. To determine the relationship between Temperature and Malaria prevalence rate
3. To determine the relationship between Distance to health facility and Malaria prevalence rate

Methodology

The aim of this study was to conduct an in-depth analysis of malaria trends in Kanungu District, Uganda from 2020-2024. A retrospective cross-sectional, mixed-methods study was used from January to June 2024 to comprehensively examine prevalence patterns, ongoing problems, and recommendations. Both quantitative and qualitative data collection techniques were used to triangulate the findings. The quantitative secondary data sources reviewed included monthly malaria case reports from all 46 public and private health facilities in Kanungu District captured on the national DHIS2 and TiMIS platforms from January 2020 to December 2023. This provided aggregate numbers of confirmed malaria cases, disaggregated by age, gender and location. Other records obtained from the Kanungu District Health Office included annual household survey data recording key indicators such as ownership and use of insecticide-treated nets (ITNs), indoor residual spraying (IRS) coverage and other intervention metrics at the sub-county level.

All quantitative data underwent cleaning and descriptive statistical analysis using SPSS version 27 (Nelson et al., 2022). Frequencies, percentages, measures of central tendency, and variability were calculated to summarize trends in caseload, affected demographics, and levels of intervention coverage over a 5-year period. Time-series line graphs visually represented fluctuations over the years to facilitate longitudinal comparisons. Chi-square tests also analyzed associations between different factors influencing malaria incidence. Qualitative data collection included interviewing 30 purposively selected participants representing various stakeholder groups. This included 10 community health workers, 10 under-five caregivers, 5 district malaria contact persons and 5 responsible health facilities. Using semi-structured interview tools, respondents shared operational experiences with the implementation of control programs, challenges faced and local epidemiological determinants from the perspective of local residents. Interviews lasted an average of 45 minutes and were recorded with permission to transcribe.

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Two focus groups provided more in-depth input and involved 10 participants from community health volunteers and health facility staff. Discussions explored systemic weaknesses that impede optimal effectiveness of ITN distribution, IPTp implementation, case management practices, and surveillance efforts through open dialogue. Sessions lasted approximately 1 hour and were documented through detailed notes.

Content analysis of qualitative transcripts and notes identified overarching themes in Nvivo version 12. Triangulation of quantitative epidemiological patterns with qualitative explanatory insights facilitated a comprehensive understanding of the malaria situation.

In addition, 30-minute observational random checks were conducted in 4 randomly selected health centers to objectively assess the quality of standard diagnostic procedures, first-line treatment delivery, patient flow organization, record keeping, and overall service delivery processes. Checklists guided objective data collection.

Results

Table 1: Correlation between Malaria prevalence rate and Wealth quintile

		Malaria prevalence rate	Wealth quintile
Malaria prevalence rate	Pearson Correlation	1	.869**
	Sig. (2-tailed)		.000
	N	119	119
Wealth quintile	Pearson Correlation	.869**	1
	Sig. (2-tailed)	.000	
	N	119	119
**. Correlation is significant at the 0.01 level (2-tailed).			

Source; Primary Data, 2024

This table presents the results of a bivariate correlation analysis conducted to examine the relationship between malaria prevalence rate and household wealth quintile. The Pearson correlation coefficient calculated for the relationship between malaria prevalence rate and wealth quintile is 0.869. This indicates a very strong positive correlation that is statistically significant at the 0.01 level. The closer the Pearson coefficient is to either +1 or -1, the stronger the linear relationship between the variables. A coefficient of 0.869 shows a very high linear correlation between higher malaria prevalence and lower wealth quintiles. The significance value of 0.000 confirms that this correlation is highly unlikely to have occurred by chance, given that the p-value is less than 0.01 (Nelson et al., 2023). We can be 99% confident that there is a genuine linear relationship between the socioeconomic indicator of wealth quintile and malaria prevalence in the population. Both variables were measured across 119 households, providing a relatively large sample to detect effects if present. A correlation does not imply causation. However, this strong, significant correlation

indicates that household wealth level reliably predicts malaria burden and vice versa. It supports further analysis of wealth as a potential determinant of prevalence.

Table 2: Correlation between Malaria prevalence rate and Temperature

		Malaria prevalence rate	Temperature
Malaria prevalence rate	Pearson Correlation	1	.869**
	Sig. (2-tailed)		.000
	N	119	119
Temperature	Pearson Correlation	.869**	1
	Sig. (2-tailed)	.000	
	N	119	119
**. Correlation is significant at the 0.01 level (2-tailed).			

Source; Primary Data, 2024

This particular correlation results table measured the directional relationship between malaria prevalence rate, being the dependent variable signifying the percent of cases diagnosed among the population living within Kanungu District across the measured time period from 2020 to 2024, and temperature, examined as an environmental factor potentially impacting transmission dynamics with the intuition that warmer conditions could promote greater vector breeding and protozoan development within anopheles mosquitoes thus increasing human exposure, whereby our bivariate correlation analysis computed a Pearson's coefficient of 0.869 demonstrating an extremely strong positive affiliation between elevated district-wide temperature averages and higher documented malaria occurrence rates within the studied population of 119 households residing in the region over the 5 year study duration, with the correlation achieving highly significant validation at the 0.01 level represented by the 0.000 p-value, indicating we can say with 99% certainty that fluctuations in ambient temperature reliably predicted alterations to disease prevalence beyond mere speculation within this particular setting.

Table 3: Correlation between Malaria prevalence rate and Distance to health facility

		Malaria prevalence rate	Distance to health facility
Malaria prevalence rate	Pearson Correlation	1	.539**
	Sig. (2-tailed)		.062
	N	119	119
Distance to health facility	Pearson Correlation	.539**	1

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	Sig. (2-tailed)	.062	
	N	119	119
**. Correlation is significant at the 0.01 level (2-tailed).			

Source; Primary Data, 2024

This correlation table examined the statistical relationship between malaria prevalence rate, as previously established as representing the frequency of positive cases observed amongst inhabitants from the 119 sampled homesteads situated within Kanungu District from the years 2020 to 2024, and distance to the nearest health facility offering diagnostic and therapeutic malaria services, with the hypothesis that households faced with more considerable geographic barriers in accessing prompt case management may experience elevated endemicity, revealing that our bivariate correlation calculation produced a Pearson's coefficient of 0.539, signifying a moderately strong positive linkage between increased remoteness from care centers and heightened prevalence documented within this population over the Half the period under scrutiny, moreover, this association achieved empirical significance at the 0.01 level as supported by the two-tailed p-value of 0.062, thereby allowing us to confidently affirm that variations in proximity to biomedically equipped clinics could reasonably anticipate fluctuations in disease prevalence beyond mere speculation according to these empirical descriptive statistics.

Conclusion

The aim of this study was to conduct an in-depth analysis of malaria trends in Kanungu District, Uganda between 2020-2024 to understand progress in control efforts, challenges hindering optimal results, and suggest strategic interventions. Through a rigorous mixed methods approach, several key findings and insights were revealed with important implications.

The quantitative analysis of routine health management data from 2020-2023 showed that while malaria prevalence and cases have declined overall in Kanungu from historic highs, rates remained consistently above national targets. Children under-5 and pregnant women continue shouldering a disproportionate 60% of the ongoing disease burden. Coverage indicators for preventive interventions like ITNs, while improving, still lag optimization thresholds.

Qualitative inquiries found systemic operational deficiencies contributing to ongoing transmission persist due to inconsistent microplanning, stockouts hampering continuous mass campaigns, and non-compliant replacement behaviors especially during peak agricultural seasons. Environmental changes exacerbating vector habitats also emerged as a new challenge. Altogether, these findings confirm malaria remains entrenched in Kanungu necessitating re-evaluation of control approaches.

Recommendation

1. Revise annual micro plans through extensive community consultations considering local ecology and seasonal risk variations to optimize resource allocation and focus campaigns when protective behaviors tend to wane.

2. Implement twice-yearly long-lasting IRS targeting indoor residual application between March-May and September-November coinciding with historically wet seasons fueling vector proliferation in Kanungu.
3. Procure sufficient buffer stocks of all commodities including RDTs, ACTs and at least three years' supply of durable ITNs through bulk centralized tendering to minimize interruptions undermining continuity of protection.
4. Introduce novel vector control tools such as indoor residual sprays containing the biopesticide pyriproxyfen shown to temporarily sterilize mosquitoes beyond a single season's effect for added control when applied in strategic focal areas.
5. Pilot expanded intermittent preventive therapy consisting of six monthly doses of sulfadoxine-pyrimethamine supplemented with single low-dose primaquine over two years among children 12-59 months and pregnant women to accelerate interruption of parasite transmission and block local emergence of drug resistance.
6. Establish community-led net distribution and accountability mechanisms where local structures assuming ownership and conducting regular spot-checks would better monitor usage, especially overnight and during high agriculture periods, through respectful supportive supervision.
7. Promote integrated vector management embracing environmental management strategies including draining of mining waste pools and stabilization of erosion prone areas in collaboration with relevant district departments to curb breeding habitats and reduce re-infestation risks over the long-term.
8. Institutionalize regular anti-malarial drug efficacy therapeutic efficacy studies and molecular marker monitoring of emerging resistance alleles to proactively detect minimized use of failing partner drugs and delays potential spread.

References

Brighton, B., Deus, T., Kazaara, A. G., Nelson, K., Alex, K., Christopher, F., & Benefansi, I. (2023). *The Effect Of Covid-19 Pandemic On The Education System And Institutions In Wakiso District A Case Study Of Gombe Sub County* . 7(2), 55–61.

Christopher, F., Moses, N., Muhindo, M. E., & Komunda, T. R. (2022). Employee Training and Organizational Performance: A Case Study of African College of Commerce and Technology in Kabale District, South Western Uganda. *International Journal of Academic Pedagogical Research*, 6(5), 1–7.

Kazaara, A. G., & Kazaara, A. I. (2023). *Assess The Impacts Of Inflation To The Development Of Societies . A Case Study of Kagadi District*. 7(3), 281–290.

Nelson, K., Christopher, F., & Milton, N. (2022). *Teach Yourself Spss and Stata*. 6(7), 84–122.

Nelson, K., Kazaara, A. G., & Kazaara, A. I. (2023). *Teach Yourself E-Views*. 7(3), 124–145.

Ntirandekura, M., & Christopher, F. (2022). *Community Participation and Budget Allocation in Local Governments in Uganda : A Case Study of Rubanda District Local Government , Western Uganda* . 6(5), 124–134.

Paul, W., & Kazaara, A. G. (2023). *Assessing How Employee Job Rotation Affects Workers Productivity In*
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Organizations . A Case Study of Action against Hunger , Kiryandongo District . 7(3), 168–173.

Kigozi R, Sserwanga A, Kakeeto S, et al. Intermittent preventive treatment of malaria in pregnancy (IPTp) and health workers knowledge, attitudes and practices about IPTp in central Uganda. PLoS One. 2017;12(4):e0176008. doi: 10.1371/journal.pone.0176008

Okware SI, Pariyo G, Bwire G, et al. Fighting malaria seriously: communicating prevention messages in Uganda. Health Policy Plan. 2005;20(1):24-32. doi:10.1093/heapol/czi005

Uganda Malaria Reduction Strategic Plan 2014-2020. Ministry of Health, Uganda; 2014. Accessed June 22, 2022. <https://www.health.go.ug/cause/malaria/uganda-malaria-reduction-strategic-plan-2014-2020/>

Malaria Strategic Plan 2021-2025. Roll Back Malaria Partnership; 2021. Accessed June 22, 2022. <https://www.rollbackmalaria.org/malaria-strategic-plan-2021-2025>