Malaria Burden Among Vulnerable Populations in Rwanda, 2018–2022: Trends in Incidence, Mortality, and Geographic Distribution

Christian Nsanzabaganwa[1,*], Anastase Muhashyi[1], Jeanne d'Arc Nyinawankusi[1], Tuyishimire Moise[1], Marie Claire Dusengiyera[1], Kimberly Koporc[2], Edwin Masese Machie[2], Andrew Ancharski[2]

[1]Rwanda Biomedical Centre, Kigali, Rwanda
[2]CDC Foundation, Atlanta, USA

*Corresponding author:
Dr. Christian Nsanzabaganwa

Research Innovation and Data Science Division, Rwanda Biomedical Centre, Kigali, Rwanda

Email: nsanzechriss@gmail.com

EXECUTIVE SUMMARY

Malaria control is a priority for the Ministry of Health in Rwanda, which is implementing community interventions, including distribution of long-lasting insecticide nets (LLINs), indoor residual spraying (IRS), and early diagnosis to control malaria. As the number of overall cases decreases, the focus on special populations is key to further reducing the number of cases and deaths. Special populations include children under five years, pregnant women, and the elderly. This report uses surveillance and mortality data of 5 years (2018-2022) to identify priorities for interventions. Key findings are presented below.

•The Southern districts recorded higher incidence rates among children under five years of age of over 400 cases per 10,000 persons.
•Medical facilities reported decreasing deaths in both genders and all age groups in the last 5 years (2018-2022)
•Women were diagnosed with malaria in medical facilities half as frequently as men.
•People over the age of 65 years account for 21% of the deaths due to malaria, while representing only 3% of the population

Rwanda's continued decline in malaria cases and deaths between 2018 and 2022 demonstrates the effectiveness of sustained national control efforts, including LLIN distribution, IRS, and community-based interventions. However, persistent regional disparities (particularly in the southern districts and areas around Kigali) and the disproportionate mortality among the elderly underscore the need for more targeted and equitable approaches. Strengthening data systems, refining intervention coverage, and addressing gender and age-specific vulnerabilities will be key to accelerating progress toward malaria elimination and safeguarding gains achieved so far.

INTRODUCTION

Malaria is a vector-borne parasitic disease caused by the protozoan parasites of the genus Plasmodium. It is considered a major public health problem with high morbidity and mortality [1]. According to the World Health Organization (WHO) report of 2022, there are over 240 million annual cases of malaria with over 500,000 deaths. Children under 5 years of age are most at risk for

severe disease and death. Malaria is endemic in 85 countries. However, 95% of the malaria cases occur in the WHO African Region [2].

In Fiscal Year (FY) 2022-2023, Rwanda saw progress in malaria control. Malaria incidence dropped by 38%, from 76 to 47 per 1,000 people. The Slide Positivity Rate decreased from 22% in FY 2021-2022 to 14% in FY 2022-2023. Uncomplicated malaria cases declined by 38%, with 58% managed at the community level. Severe cases fell by 28%, from 1,831 to 1,316. Malaria-related deaths also dropped by 28%, from 71 to 51 [3]. These reductions reflect the country's strengthened efforts in malaria prevention and management. Rwanda has made significant strides in controlling the disease through implementation of various control interventions including: mass and routine distribution of long-lasting insecticide nets (LLINs), indoor residual spraying (IRS) in high endemic districts, adoption of mandatory laboratory confirmation prior to the treatment, use of Artemisinin-Based Combination Therapies (ACTs) in the treatment of uncomplicated malaria cases, national scale up of community based management and improvement in routine surveillance, and monitoring and evaluation platforms [3], [4].

This report focuses on the most at-risk populations for malaria with a focus on children under 5, and the elderly in Rwanda. Rwanda currently has 1,708,460 children under 5 years old, all of which are considered at risk for malaria. The report aims to relay information on current trends and identify areas for intervention for malaria.

METHODS

A retrospective descriptive epidemiological analysis was conducted using routine malaria surveillance and mortality data from health facilities across Rwanda for the period 2018–2022. Data were analyzed to assess temporal trends, demographic distribution, and geographic patterns of malaria among special populations, including children under five years, pregnant women, and the elderly. Descriptive statistics were generated to calculate incidence and mortality rates by age, gender, and region. Trends were visualized through charts and maps to identify high-burden areas and population subgroups at elevated risk. All analyses, data aggregation, and visualizations were performed using Microsoft Excel.

POPULATION DISEASE TRENDS

Cases
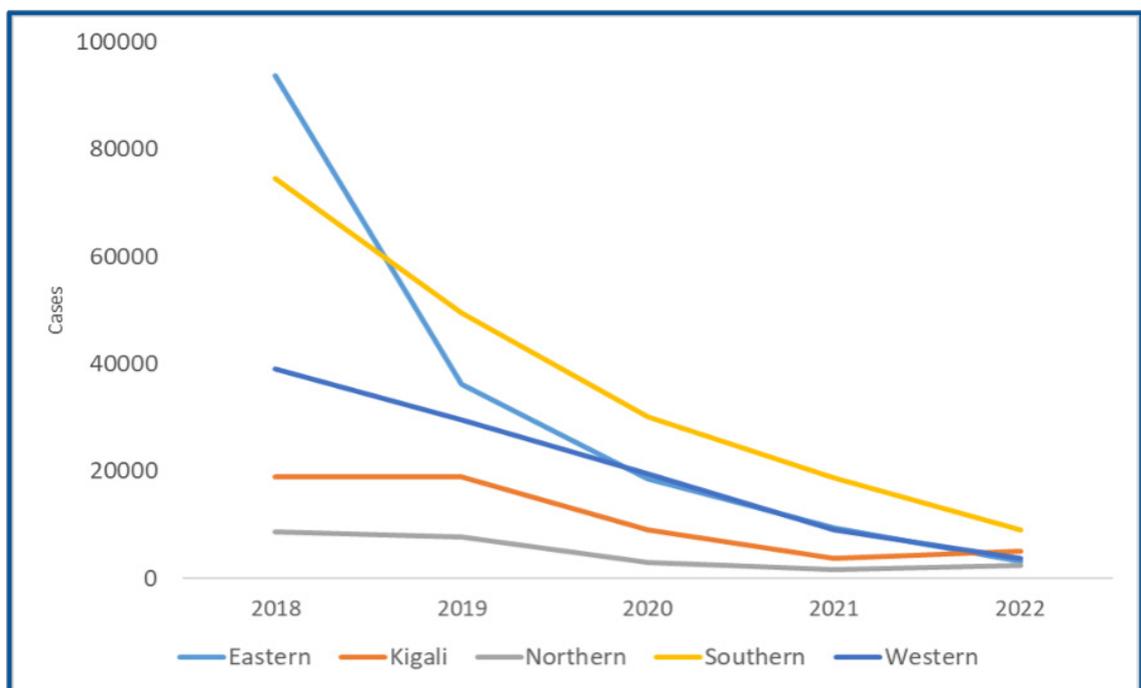Malaria decreased in all regions during the last 5

Figure 1: *Rwanda malaria cases under 5 years of age by region from 2018-2022*
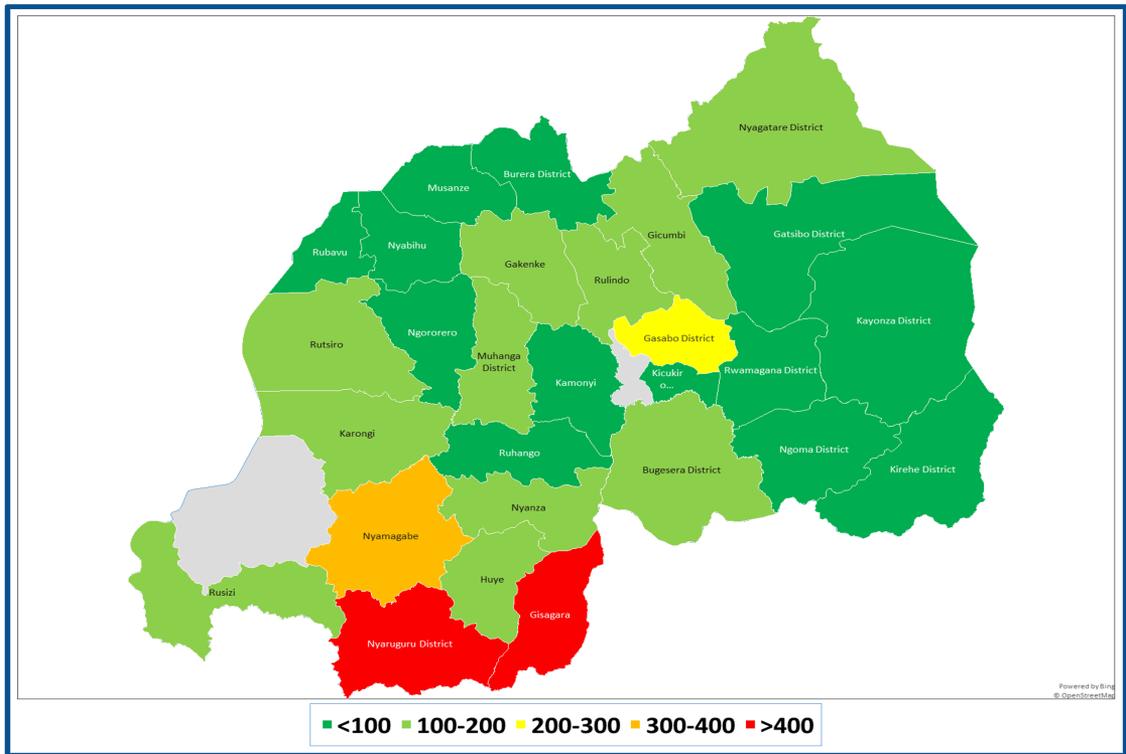
Figure 1: *Rwanda 2022 malaria infection rate per 10,000 children under 5.*

years of complete data (2018-2022) across all age groups, including children under 5. In 2022 there were 23,551 among children under 5, a decrease of 45% from 2021 (42,803 cases in 2021). The largest decreases in overall case numbers were coming from the Southern and Northern regions (Figure 1). The Southern region of Rwanda and areas around

Kigali compared to other regions of the country reported the highest number of cases of Malaria in children under 5 years of age (Figure 2).

Figure 3 shows the year-to-year percentage change in malaria infection rates among children under five across Rwanda's districts. Between 2021 and 2022, malaria rates among children
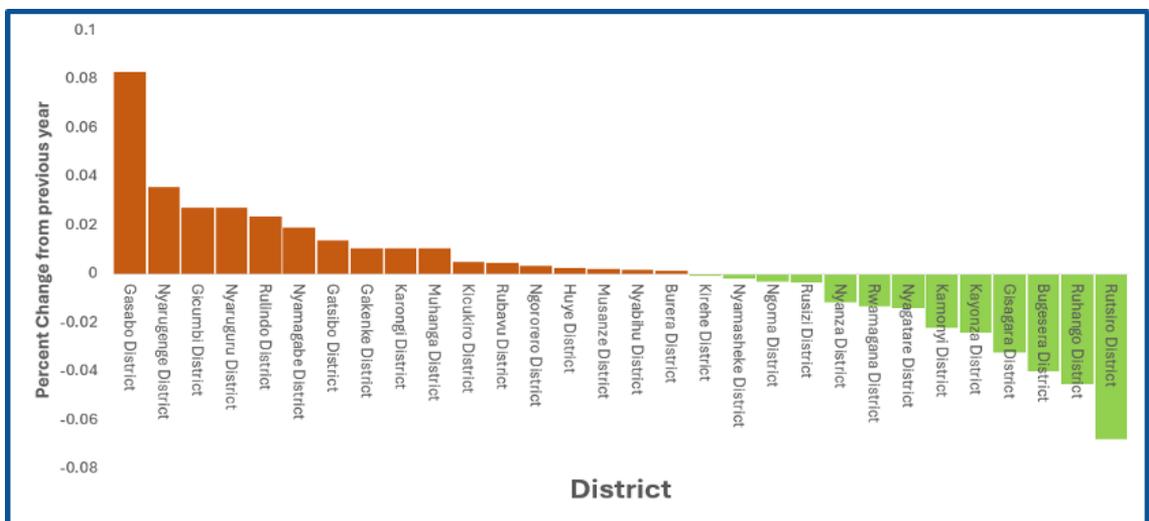

Figure 3: *Rwanda malaria under 5 rate change by district 2022 vs 2021*

Figure 3: *Incidence cases of malaria among pregnant women in Rwanda (2018-2023)*

Region	Eastern	Southern	Western	Northern	Kigali	Unknown	Total
Gender							
Female	15 (0.51)	17 (0.42)	16 (0.57)	4 (0.25)	7 (0.39)	1 (0.25)	60 (0.44)
Male	14 (0.49)	24 (0.58)	12 (0.43)	12 (0.75)	11 (0.61)	3 (0.75)	76 (0.56)
Age							
Under 5	10 (0.345)	9 (0.22)	8 (0.29)	4 (0.25)	3 (0.17)	2 (0.5)	36 (0.26)
5–14	3 (0.10)	7 (0.17)	5 (0.18)	4 (0.25)	0 (0)	1 (0.25)	20 (0.15)
15–49	4 (0.14)	9 (0.22)	5 (0.18)	6 (0.375)	10 (0.555)	1 (0.25)	35 (0.25)
50–64	2 (0.07)	9 (0.22)	1 (0.03)	0 (0)	4 (0.22)	0 (0)	16 (0.12)
65 and over	10 (0.345)	7 (0.17)	9 (0.32)	2 (0.125)	1 (0.055)	0 (0)	29 (0.22)
Total	29 (0.22)	41 (0.30)	28 (0.21)	16 (0.12)	18 (0.13)	4 (0.03)	136 (1)

under five showed heterogeneous trends across Rwanda's districts. Notably, Gasabo, Nyarugenge, and Gicumbi recorded increases, while Ruhango, Bugesera, and Gisagara experienced declines.
Mortality
In 2023, Rwanda recorded 136 malaria deaths across all districts with 36 of those being in children under 5 years of age (26% of total cases). People over 65 years of age also account for 29 reported deaths in Rwanda (22% of total cases) (Table 1).

Though malaria mortality in all age groups was decreasing, Figure 4 highlights a discrepancy in deaths reported at facilities by gender, where of the 136 malaria deaths reported, 76 were male (56%) and 60 were female (44%), compared to the

almost equal mortality reported at the community level among men (36) and women (39).

DISCUSSION

The decline in malaria cases and deaths can be attributed to Rwanda's robust control measures, including LLINs, IRS, and community-based management [3]. However, the persistence of hotspots in the southern region and around Kigali may reflect challenges in intervention coverage or emerging mosquito resistance to insecticides. The higher incidence of malaria in children under five in the southern region and areas around Kigali is also consistent with global trends where children in endemic regions remain disproportionately affected due to underdeveloped immunity [2].
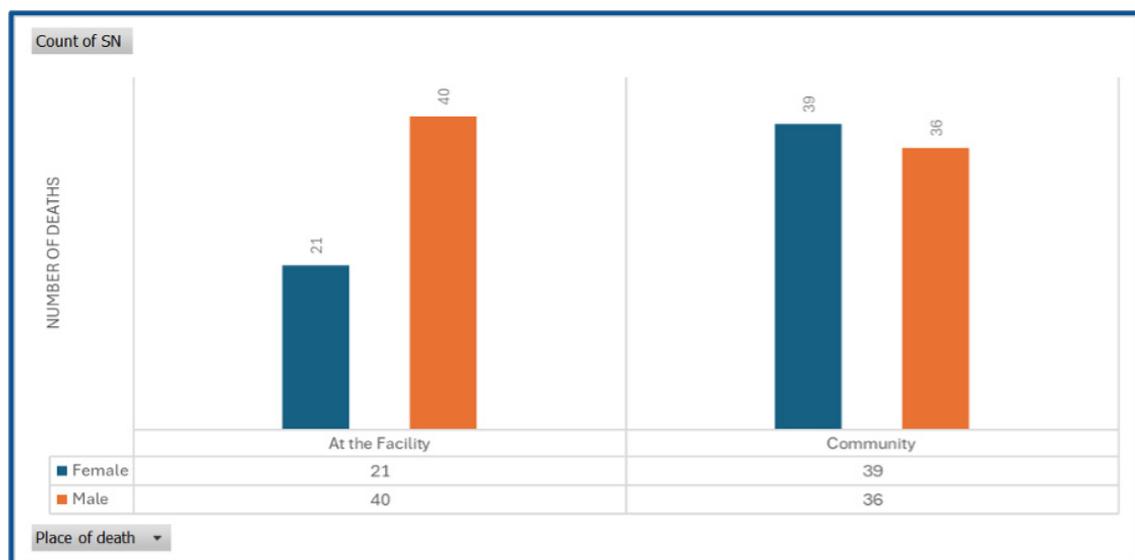
Figure 4: *Figure 4. Rwanda 2023 malaria deaths by gender and reporting type*

However, the observed 45% reduction in cases from 2021 to 2022 underscores the success of Rwanda's targeted interventions, such as LLINs and IRS, which have been shown to significantly reduce transmission in similar settings [3]. The geographic variation in cases, particularly the higher rates in the southern region, may reflect ecological factors like elevation and rainfall, which influence mosquito breeding [5,6]. This aligns with other studies emphasizing the role of environmental determinants in malaria transmission [7,8]. The heterogeneous year-to-year trends in 2021 and 2022 in malaria infection among children under five suggest localized variations in intervention coverage, vector ecology, and environmental factors. Increases in Gasabo, Nyarugenge, and Gicumbi may reflect urban breeding sites micro-climate differences, or population mobility, while declines in Ruhango, Bugesera, and Gisagara likely reflect stronger intervention coverage through LLINs and IRS. Environmental and socioeconomic heterogeneity influence these outcomes [2,7,8].

The report reveals a concerning disparity in malaria mortality among the elderly, who accounted for 21% of deaths despite representing only 3% of the population. This contrasts with the global focus on under-five mortality and suggests a gap in addressing malaria in older populations. Literature indicates that aging populations in endemic regions may face increased susceptibility due to comorbidities and declining immunity [9,10]. The findings call for tailored interventions for this demographic, an area often underrepresented in malaria control strategies.

Another critical finding is the gender disparity among elderly population in facility-reported malaria deaths, with females less likely to be recorded than males compared to the community-based reporting. This discrepancy may stem from sociocultural factors, such as healthcare-seeking behavior, where women may prioritize care for children over themselves. Alternatively, systemic biases in data recording or access to healthcare for women could contribute, as noted in studies from similar contexts [11].

Limitations: Mortality data completeness remains challenging, which may affect the accuracy of mortality estimates. Additionally, the analysis relied on facility-based reporting, potentially underestimating community deaths, particularly among women and rural populations. Future studies should incorporate community surveys to capture unreported cases and deaths.

RECOMMENDATIONS

Rwanda's overall malaria infection rate in the last decade has decreased dramatically and thus deaths have followed that pattern as well. With smaller numbers of cases in the country, there can be a transition from broad to targeted interventions. Looking at differences in malaria among vulnerable populations becomes increasingly valuable. Higher rates of infection in children under 5 in the southern region of Rwanda and areas around Kigali demonstrate a need for more resources to prevent malaria infection. LLINs and IRS interventions should be increased in these areas while maintaining current levels in the rest of the country. A review of facility deaths for malaria should confirm the difference in mortality by gender. An assessment of where women are dying and if there are reporting differences by gender could aid in determining the root cause of reporting variation. A study on how to increase awareness on the impact of Malaria in the elderly +65 population may prevent deaths in the age group.

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