# Malaria incidence and death rates among under-five children (2014-2024) and pregnant women (2018-2023) in Rwanda

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## EXECUTIVE SUMMARY

Malaria continues to pose a public health threat to under-five children and pregnant women in Rwanda, despite progress in reducing cases through strategies like insecticide-treated nets and prompt treatment. This report presents an analysis of malaria surveillance data from 2014 to 2024.

•Malaria incidence among under-five children was consistently highest in Eastern and Southern districts, particularly Kayonza, Ngoma, Gisagara, and Ruhango, likely due to environmental conditions and socio-economic vulnerabilities.
•The burden of severe malaria (characterized by organ failure and metabolic abnormalities) and malaria-related deaths peaked in 2016. However, following the scale-up of interventions such as the distribution of long-lasting insecticidal nets (LLINs), indoor residual spraying (IRS), and community-based fever management, cases and deaths declined significantly. By 2023, under-five malaria incidence dropped from 345 cases (2018) to 40 cases (2023) per 1,000 population representing an 88% reduction.
•Among pregnant women, malaria incidence was highest in 2018, especially in the Eastern Province but fell to fewer than 10 cases per 1,000 by 2023, reflecting the successful integration of intermittent preventive treatment in pregnancy (IPTp) within routine antenatal care services.
•Despite national gains, disparities persist at the subnational level. Some districts continue to report higher incidence of morbidity and mortality than others among children under five, which has not declined at the national rate, suggesting possible gaps in severe case management and access to timely treatment.

Rwanda's comprehensive response, particularly the 2016 Malaria Contingency Plan, has yielded clear benefits. Sustained progress will depend on intensified efforts in high-burden districts, continuous LLIN and IPTp coverage, improved case management, and a deeper investigation of environmental drivers, including irrigation systems and climate variability.

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## INTRODUCTION

Globally, the World Health Organization (WHO) reported 263 million cases in 2023, an increase of 11 million when compared to cases in 2022. Additionally, the WHO estimated 597,000 malaria deaths in 2023, a decrease of 3,000 when compared to deaths in 2022 [1]. In 2023, 94% of global cases and 95% of global deaths were from the Sub-Saharan African region (SSA). Of those deaths, 76% were observed in children under five [2]. Malaria affects 13.3 million pregnant women in SSA annually and is responsible for 10,000 maternal deaths worldwide [3]. Rwanda is targeting the elimination of malaria by 2030, and is implementing community interventions, including distribution of long-lasting insecticide nets (LLINs), indoor residual spraying (IRS), and early diagnosis to control malaria [4,5]. The interventions decreased malaria cases from 345 per 1,000 in 2018 to 40 per 1,000 in 2023 [6]. Children under five years old and pregnant women are still the most vulnerable populations in Rwanda. The most affected area is the Eastern region, followed by the southern part of the country [7].

This surveillance report presents the patterns and trends of malaria cases among children under five years (2014-2024) and pregnant women from 2018 to 2023. This report provides insights to improve interventions to achieve the country's target of zero malaria cases by 2030.

## METHODS

This was a retrospective analysis of malaria surveillance data from 2014 to 2024, focusing on children under five years and pregnant women in Rwanda. Data were sourced from the District Health Management Information System (DHMIS). Variables include demographic data, case numbers, deaths, and severity of malaria (characterized by organ failure and metabolic abnormalities). For consistency and completeness, data were cleaned before analysis. The population was calculated using 2022 census data. According to the 2022 census, 1,708,460 children are under five years old, and 3,445,665 women are of reproductive age [8]. Descriptive statistics using Excel were employed to calculate malaria prevalence and death rates by district, and year to identify trends over the decade.

*Severe malaria:* In this report, severe malaria refers to malaria cases in under-five children or pregnant women that progress to life-threatening conditions as defined by the World Health Organization (WHO). These include clinical or laboratory evidence of complications such as cerebral malaria, severe anemia (Hb <5 g/dL), respiratory distress, metabolic acidosis, hypoglycemia, shock, acute kidney injury, jaundice, or multi-organ failure.

*Malaria-related death*: A malaria-related death is defined as the death of a child under five or a pregnant woman with confirmed malaria (by rapid diagnostic test or microscopy) where malaria was the direct or underlying cause of death.

## POPULATION DISEASE TRENDS

**Malaria incidence rate in Rwanda**: The map (Figure 1) presents malaria incidence rates per 100,000 population across Rwanda's districts from 2014 to 2024, calculated as the average per district in the study period. The highest burden is observed in the eastern and southeastern districts of Ngoma (262 per 100,000), Kayonza (243 per 100,000), and Ruhango (164 per 100,000), indicating concentrated transmission in these areas. In contrast, several northern and western districts, including Musanze, Nyabihu, and Burera, reported incidence rates below 2 per 100,000, reflecting effective control efforts or lower transmission risk.

**Severe malaria cases and malaria-related deaths among under-five children**: Figure 2 illustrates the trends in both severe malaria incidence and malaria-related death rates among under-five children in Rwanda from 2014 to 2024. The severity rate peaked in 2016 at nearly 391 cases per 100,000 children before steadily declining to under 40 by 2024. Similarly, the death rate decreased from 9.3 per 100,000 in 2014 to just 0.2 by 2024, reflecting improvements in early diagnosis, access to treatment, and overall child health services. The concurrent downward trends in both indicators demonstrate the effectiveness of Rwanda's integrated malaria control strategies over the past decade.

**Malaria incidence rate and trend among pregnant women in Rwanda (2018-2023)**: Figure 3 is a heatmap that illustrates malaria incidence rates among pregnant women across Rwandan districts from 2018 to 2023, expressed


**Figure 1:** *Average incidence rate (per 100,000) of malaria cases among children under five years per district in Rwanda (2014-2024)*

per 100,000 women of reproductive age. In 2018, several districts such as Kayonza (99 per 100,000), Rwamagana (73 per 100,000), and Rusizi (56 per 100,000) reported comparably high incidence rates. By 2020, incidence rates in nearly all districts dropped below 50 per 100,000, with Ngoma, Gatsibo, Musanze, and Nyaruguru approaching or reaching zero. Nonetheless, districts such as Nyarugenge and Gasabo maintained comparably higher incidence in 2023.

The national average malaria incidence rate among pregnant women in Rwanda showed a consistent and sharp decline from 2018 to 2023.

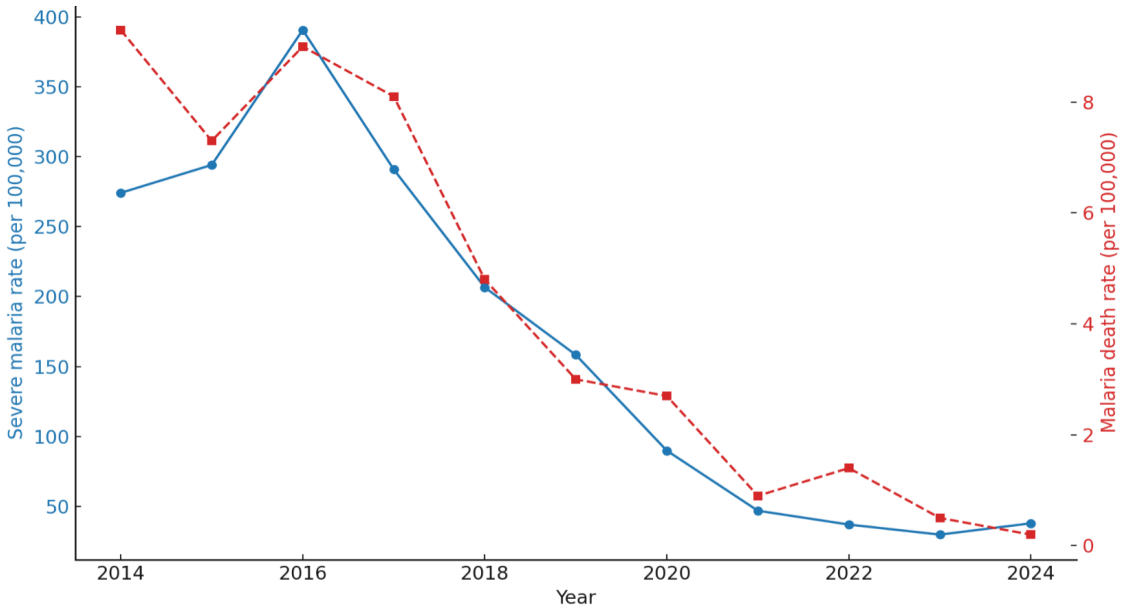


**Figure 2:** *Trends in Severe Malaria Cases and Malaria–related deaths Among Under-Five Children in Rwanda (2014–2024).*
*Severe malaria: Life-threatening malaria with complications (e.g., severe anemia, cerebral malaria, respiratory distress, hypoglycemia, shock, kidney injury, jaundice, multi-organ failure). In DHMIS, it is flagged when organ failure or metabolic abnormalities are reported.*

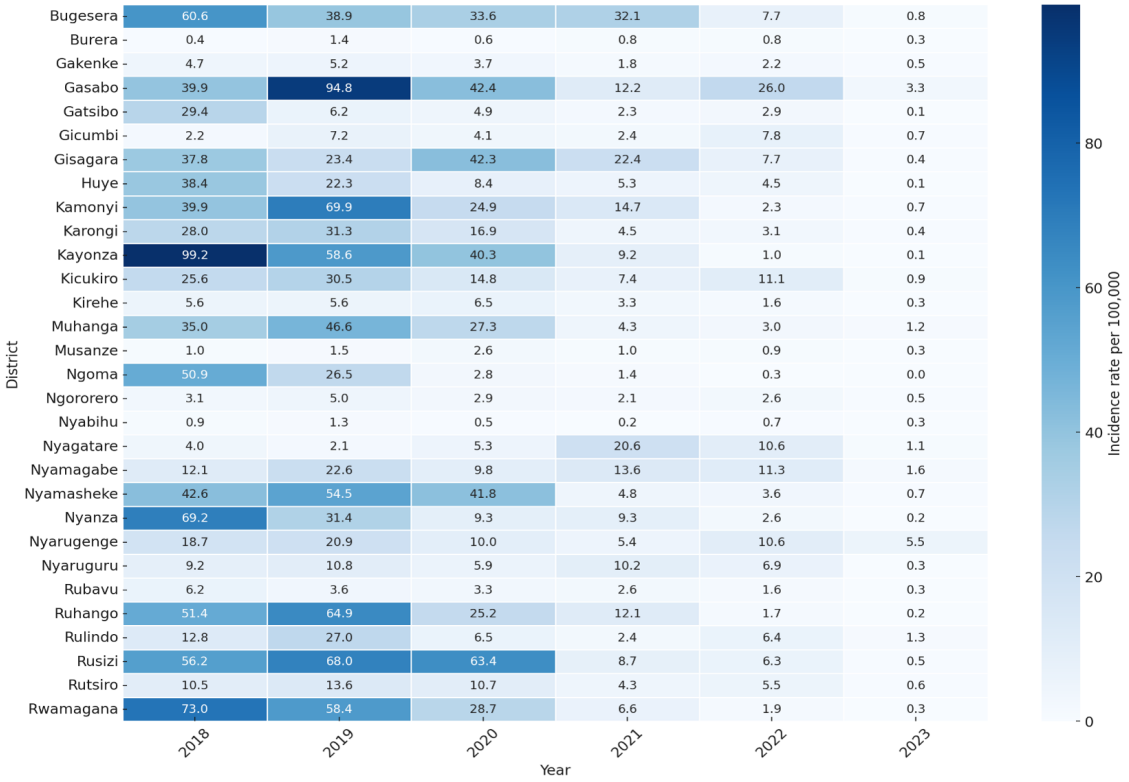


**Figure 3:** *Incidence cases of malaria among pregnant women in Rwanda (2018-2023)*

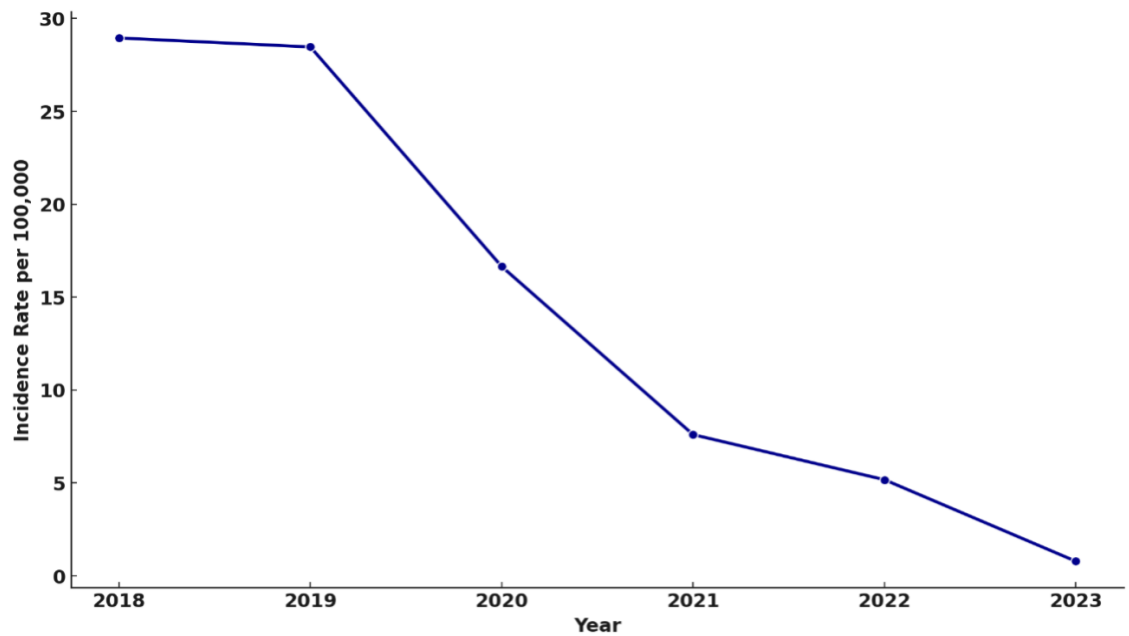


**Figure 4:** *Incidence rate of malaria cases among pregnant women in Rwanda (2018-2023)*

## DISCUSSION

The observed decline in malaria cases and deaths among under-five children and pregnant women in Rwanda from 2014 to 2024 reflects the success of the country's targeted interventions. However, the persistence of regional disparities warrants enhanced interventions.

The results for children under five years demonstrate substantial progress in malaria control in Rwanda between 2014 and 2024. Malaria incidence in this group was initially highest in the Eastern and Southern districts, with severe malaria cases peaking in 2016 at nearly 391 per 100,000.

The higher incidence rates among under-five children in the eastern and southern districts, such as Kayonza and Gisagara, suggest underlying factors that require further investigation and targeted interventions. These districts are mostly rural and may be more prone to malaria than urban areas due to a combination of factors related to the environment, socioeconomic conditions, and access to healthcare [11]. While national-level progress is evident, regional disparities necessitate a localized approach to malaria control. The persistent number of deaths among under-five children, despite the decrease in the number of malaria cases, emphasizes the need for continued vigilance and enhancement of existing control measures to prevent any resurgence. Additionally, disparities in healthcare access and income levels could contribute to these regional differences, as is the case in other SSA countries [2].

The observed decline in malaria cases among pregnant women in Rwanda, from high rates in 2018-2019 to significantly lower levels by 2022-2023, underscores the effectiveness of implemented malaria control strategies. This downward trend highlights the cumulative impact of strengthened malaria prevention and control efforts, including improved antenatal care services, widespread distribution of insecticide-treated nets, and increased community awareness. The progressive reduction reflects a successful public health response and signals ongoing progress toward malaria elimination among high-risk populations. Similarly, the sustained reduction in malaria-related mortality among under-five children over the past decade indicates the success of interventions such as improved treatment access, ITN usage, IRS, and community-based strategies including drone delivery of medicines and household surveillance to identify and treat index cases [5,9]. Rwanda's subsequent decline in cases can be attributed to the implementation of the 2016 Malaria Contingency Plan, which emphasized community-based fever management, widespread distribution of Long-Lasting Insecticide-Treated Nets (LLINs), and IRS [4,5]. These interventions are consistent with WHO recommendations, which highlight LLINs and IRS as cornerstones of malaria control in high-burden regions [10].

The sharp decline in malaria cases among pregnant women after 2019 mirrors the findings from other SSA countries that scaled up IPTp and antenatal care [12]. Rwanda's integration of IPTp into maternal health services likely played a critical role.

Rwanda's overall success in reducing malaria cases aligns with global trends, where intensified control measures have led to declines in morbidity and mortality [10]. However, the country's progress surpasses that of many SSA nations, where stagnation or resurgence has been reported due to insecticide resistance and funding gaps [10]. For instance, while Rwanda achieved a 90% reduction in cases by 2023, neighboring countries like Tanzania reported slower progress (55% reduction) [13,14,15].

**Limitations:** While this report provides valuable insights, some limitations should be acknowledged. Reliance on DHMIS data may introduce reporting biases, as underreporting is common in resource-limited settings. We could not include environmental (e.g., rainfall, land use) and socio-economic (e.g., household income, education) data, which limits the ability to fully explain regional disparities. Finally, the lack of data on malaria-related maternal deaths prevents a comprehensive assessment of the disease's impact on pregnant women.

## RECOMMENDATIONS

The Ministry of Health (MoH) is recommended to maintain and reinforce successful strategies that reduced malaria cases and deaths (prompt access to treatment, ITN use, IRS, breeding ground destruction, and epidemic response). The MoH also should maintain a focus on pregnant women and children under five years through integration of malaria prevention into maternal, newborn, and child health services. The Rwanda Biomedical Centre (RBC) needs to keep prioritizing and strengthening malaria control interventions in high-burden districts (Kayonza, Ngoma, Ruhango, Rusizi, Gisagara), accounting for environmental and population risk factors. It has also to strengthen and expand community-based strategies, including Community Health Workers (CHWs)-led fever management and household surveillance, to

reduce severe malaria among children under five. District health facilities and local governments should implement targeted malaria control actions in high-incidence districts, adapt interventions to local environmental and socio-economic conditions, and mobilize communities to sustain LLIN usage, IRS acceptance, and environmental management. The CHWs would support early diagnosis and treatment of fever cases at the community level, and promote consistent ITN use, IPTp uptake during pregnancy, and timely care-seeking behaviors.

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