# Bridging the policy-action gap: a scoping review of climate-resilient malaria control policies in Kenya and Zambia with recommendations for strengthening the WHO framework

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**Introduction:** Malaria remains a significant public health challenge in Kenya and Zambia, with climate change exacerbating its spread through altered rainfall patterns, temperature shifts, and extended mosquito breeding seasons. Both countries have implemented climate-resilient policies to mitigate malaria risks, including Kenya's National Malaria Strategy and Zambia's Climate Change and Health Action Plan. However, implementation gaps persist due to inadequate funding, weak enforcement, integrating and aligning actors to common malaria policies, and policy coordination challenges. This study explores the policy-action gaps on climate-resilient policies on malaria in Kenya and Zambia.

**Methods:** The study adopted extended literature review through the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA model). The authors adopted an inclusion-exclusion criteria that captured peer-reviewed articles published since 2010. Literature search was through use of key words from leading scholarly sources, notably, Google Scholar, Web of Science, Science Direct, EBSCOhost, PubMed and African Journals Online. Thematic analysis was carried out. Policy documents were also reviewed and included. A summary table capturing the related climate-resilient policies was presented, along with supporting discussions.

**Results:** Of the 274 articles identified, nineteen articles were included in the review. Key policies were identified in the two countries, and their implementation gaps and potential challenges in their implementations. Some identified policy-action gaps were related to weak health system infrastructure, inadequate resource allocation, and limited integration of climate data into malaria response. Implementation challenges arise due to misalignment among actors, lack of intersectoral collaboration, and fragmented stakeholder engagement, hindering effective policy execution. Lastly, the absence of clear implementation metrics, well-defined

responsibilities, and cross-cutting indicators in key policies weakens monitoring and evaluation, leading to inefficiencies in achieving malaria reduction targets.

**Conclusion:** The study concluded that significant policy-action gaps exist, which need strengthening multi-sectoral collaboration, integrating climate data into policies, adequate financial support, improving surveillance systems, and mainstreaming climate adaptation into malaria control programs for long-term success.

# Introduction

Malaria remains a significant public health challenge in sub-Saharan Africa, with climate change exacerbating its transmission. Rising temperatures, erratic rainfall, and extreme weather events have expanded malaria-endemic regions, necessitating adaptive strategies and policies in malaria control. Kenya and Zambia have adopted national policies integrating climate considerations into malaria programs, yet a gap persists between policy adoption and on-the-ground implementation (1, 2). This paper examines this policy-action gap and offers recommendations to enhance climate resilience within World Health Organization (WHO) guidelines. The guidelines focus on scaling up the capacity of healthcare facilities to adapt and withstand climate-related risks, while improving health of communities in a changing climate. The WHO guidelines focus on climate resilience and environmental sustainability.

Kenya and Zambia have implemented various malaria control policies and programs, focusing on addressing the impacts of climate change on malaria transmission. Both countries have made significant strides in incorporating climate change considerations into their malaria control strategies. Kenya emphasizes leveraging climate data for predictive systems, vector management, and infrastructure planning, while Zambia focuses on regional adaptation, surveillance, and large-scale vector control interventions (3, 4). Both nations highlight the importance of continued research, integration of climate-smart practices, and tailored interventions to address the dual challenges of malaria control and climate resilience.

Malaria in Kenya is endemic to regions with favorable climatic conditions for mosquito breeding and malaria transmission. According to Kioko and Blanford (5), there is the lake and coast endemic areas, covering areas surrounding Lake Victoria, and Coastal areas that have had high rates of malaria infections. In recent years have witnessed an uptick in malaria outbreaks in the highland areas of western Kenya, including Kericho and Nandi counties, regions previously considered low-risk (6). This shift is attributed to climate change, which has led to rising temperatures and altered rainfall patterns, creating favorable conditions for

mosquito breeding and survival at higher altitudes. Climate change has exacerbated this burden by altering temperature and rainfall patterns, creating conditions that expand malaria-endemic zones and prolong transmission seasons (7). In response, Kenya has recognized the importance of integrating climate resilience into malaria control policies to mitigate the impact of climate variability on malaria transmission.

Climate-resilient policies in Kenya focus on strengthening health systems by incorporating climate-sensitive surveillance, improving early warning systems, and promoting adaptive interventions to prevent and control malaria (8). These policies align with Kenya's broader commitments under global and regional frameworks such as the WHO's Global Technical Strategy for Malaria 2016-2030 (9) and the African Union's Agenda 2063, which emphasize climate-adaptive health interventions. Further, the Kenya Malaria Strategy (2019-2023) aimed to reduce malaria incidence and deaths by 75% of 2016 levels by 2023, a number which has not yet been realized. While not explicitly focused on climate change, its objectives align with broader goals influenced by climate variability (Malaria Journal, 2023). Kenya has also prioritized predictive systems through the implementation of climate-based early warning systems, which utilize climate data to forecast potential malaria outbreaks and enable timely interventions. Additionally, the integration of climate-smart agricultural practices like conservation agriculture, greenhouses and organic farming, which reduce mosquito breeding sites, fosters synergy between health and agriculture (10). The development of climate-resilient infrastructure integrates malaria control considerations into infrastructure planning, addressing both health and environmental challenges. Ongoing research and development efforts further support the advancement of climate-resilient malaria control technologies and strategies, focusing on long-term solutions to mitigate the impacts of climate change.

On the other hand, Zambia has launched the National Malaria Elimination Strategic Plan, guiding efforts toward the realization of a malaria-free nation. This plan emphasizes regional adaptation, surveillance, and large-scale vector control interventions (11). The country has also developed a Multisectoral Action Guide to End

Malaria, which recognizes the importance of collaboration between different sectors, including the energy sector, to combat malaria effectively (12). Furthermore, Zambia has been building climate-resilient health systems to address the impact of climate variability on health outcomes, including malaria. Climate-sensitive diseases like malaria have persistently increased mortality and morbidity rates in urban and rural Zambia, with malaria having the highest incidence (13, 14).

Malaria is a major public health concern in Zambia, with transmission being heavily influenced by climatic factors such as temperature, rainfall, and humidity (15). Climate change has further complicated malaria control efforts by shifting transmission patterns, increasing the frequency of extreme weather events, and expanding malaria-endemic zones. For instance, Mtonga and Nawa (16) note that Muchinga, Luapula and Northern Provinces are malaria endemic. Recognizing these challenges, Zambia has developed policies and strategic frameworks to integrate climate resilience into malaria control programs. Further, climate-resilient malaria policies aim to strengthen disease surveillance, enhance vector control strategies, and integrate climate data into decision-making processes. These policies align with Zambia's commitments to the World Health Organization's Global Technical Strategy for Malaria (2016–2030) and the United Nations Sustainable Development Goals (SDGs), particularly Goal 3 on good health and well-being. Zambia has recognized the critical need to integrate climate-resilient strategies into its malaria control programs to address the increasing challenges posed by climate change. However, several gaps hinder effective policy implementation in both Kenya and Zambia, hence the need to explore the policy-action gaps in malaria control policies.

# Materials and methods

## Study design

The study adopted scoping review, with an inclusion of policy review, to identify peer reviewed journals and secondary information sources relating to climate resilient policies and their implementation. The secondary sources were sourced and reviewed through the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis) model. Similarly, the review of the reference materials followed the Center for Reviews and Dissemination (CRD) Guidelines. Policy analysis was also done, where national malarial control strategies and policies, climate adaptation plans and WHO guidelines were reviewed and analyzed.

## Literature search

The study adopted a search strategy using Population, Concept and Context (PCC) framework. Population was the malaria-affected people/regions in Kenya and Zambia, while the concept was climate-resilient malaria control policies and their implementation in the two countries. The context was the national and sub-national malaria

control strategies in Zambia and Kenya, aligning with WHO malaria and climate frameworks. From defining the search strategy, the next step was developing clear inclusion and exclusion criteria, which was described in the next section.

The authors conducted search from both peer-reviewed literature databases and grey literature sources. The peer-reviewed literature databases included Google Scholar, Web of Science, Science Direct, EBSCOhost, African Journals Online, and PubMed to select plausibly eligible journal articles. The grey literature sources were WHO Institutional Repository for Information Sharing (IRIS), Ministry of Health websites for Zambia and Kenya, National Malaria Control Programme (NMCP) reports, Climate and Health Working Group archives, Google scholar, and UN repositories.

The researchers used Boolean operators "OR" and "AND", phrase searching (""), and truncation symbols (*) to perform key searches. One search string was constructed which was used across the peer-reviewed literature databases.

The key words to the search included "climate change," "malaria control," "climate-resilient policies," "Kenya" and "Zambia." Other key search words included; "Climate change and malaria control," "Status of climate change-malaria policy implementation," "Malaria control policies," "Kenyan government malaria control policies," and "Zambia government malaria control policies." For instance, the search string used for the Science Direct was as follows;

> ("malaria control" OR "malaria elimination" OR "malaria prevention") AND
>
> ("climate change" OR "climate resilience" OR "climate adaptation") AND
>
> ("policy" OR "strategy* implementation" OR "governance" OR "action plan") AND
>
> ("Kenya" OR "Zambia") AND
>
> ("World Health Organization" OR "WHO framework" OR "Global Malaria Programme" OR "GPIRM" OR "GAP")

The adapted search terms used for grey literature were; "Malaria policy Kenya site: who.int," "Climate change malaria policy Zambia site: gov.zm," and "Malaria implementation gap site: path.org."

The authors did manual screening for eligible articles from other scholarly engines like COCHRANE and Web of Science to add to the already identified articles. There were two stages in screening and selection, where the first stage was based on title and abstract, and the second stage was based on full-text of the article to confirm relevance. Duplicate entries were identified using EndNote tool. The search process was documented using the PRISMA-ScR (PRISMA- for Scoping Review) flow diagram as shown on Figure 1, to enhance transparency and reproducibility.

## Eligibility criteria

The study embraced an inclusion-exclusion criteria. For the inclusion criteria, peer-reviewed studies done in both Kenya and

**FIGURE 1**
Studies included in the scoping review.
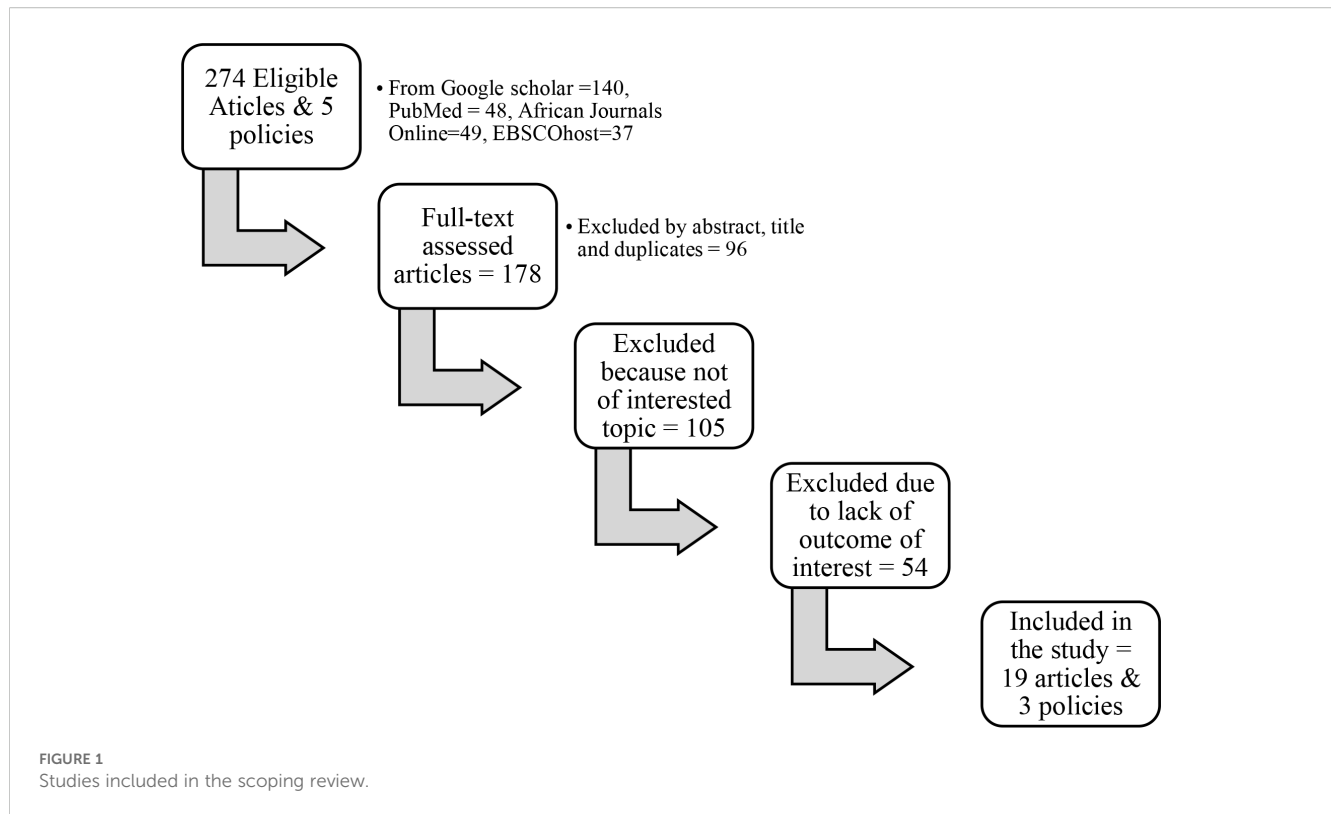
Zambia were included. The review focused on studies done from 2010 onwards. Further, studies focusing on climate change and resilient, and with a component on control of malaria were included. Similarly, studies included were either reviews of the current climate resilient policies in Kenya and/or Zambia, or meta-analysis of policies related to control of climate and malaria. In addition to the scoping review, included were grey literature, like policy reviews on climate change from the two countries. Peer-reviewed publications in English were included in the study. Government updates on the policies and positional statements were also included in the study, along with the enacted policies/guidelines for climate control and malaria eradication.

The exclusion criteria included those studies not done on climate resilient policies on malaria control in the two countries. The review included studies done before 2010 were excluded.

## Study selection and data extraction

The authors used Mendeley reference manager to identify and manage the search. The use of Mendeley referencing enables exclusion of identical studies, followed by exclusion of irrelevant articles. The authors screened all appearing articles' titles and their abstracts to identify their relevance. The potentially relevant articles were then reviewed to further determine their viability and inclusion in the study. The extracted information summary included the name of the author, title of the paper, the study design, country the study was done, findings and recommendations from the study. For the policies and climate-change frameworks, the status of implementation was also mentioned as it informed whether there was a policy-action gap.

In ensuring high quality and eliminating bias, three independent reviewers (initials: JMM, SK and JK) screened the titles and abstracts of all retrieved studies to determine eligibility based on the inclusion and exclusion criteria. Full texts of potentially relevant studies were then assessed independently. Any conflicts or discrepancies in inclusion decisions were resolved through discussion and, if needed, consultation with a fourth reviewer (IN) to reach consensus. Further in data extraction, the three reviewers used a standardized extraction form to ensure consistency. To validate accuracy and minimize bias, cross-checking of extracted data was conducted between the two reviewers. Inter-rater reliability was assessed, and inconsistencies were clarified through re-examination of the original articles, ensuring a transparent and reproducible process.

## Quality assessment

The authors assessed for potential bias in the selected eligible studies through the Joanna Briggs Institute (JBI) checklist. The selection of JBI checklist was due to the hybrid nature of the scoping review, including the policy reviews (grey literature). The authors ensured all the studies eligible for the study met the criterion and were vetted before inclusion in the final study.

## Data synthesis and analysis

The study used qualitative synthesis of the main findings observed from the included articles. To further identify the policy-action gaps and the recommendations from the study, thematic analysis was done, where similar emerging themes were grouped together. Thematic analysis was conducted using Braun and Clarke's (17) six-step method, beginning with familiarization of the data, followed by generating initial codes, searching for themes, reviewing, defining, and naming themes. The researchers employed an inductive approach, allowing themes to emerge directly from the data without imposing a pre-existing framework. Where overlapping themes occurred, they were carefully reviewed by two independent coders and discussed until consensus was reached. In some cases, overlapping content was assigned to multiple themes if conceptually justified. A summary table capturing the related studies and their findings is also presented.

## Results

### Study selection

The authors retrieved 274 papers from the initial search of four databases; Google Scholar, PubMed, African Journals Online and EBSCOhost. From the 274, there were 96 duplicates which were excluded, leading to 178 articles and 5 policies. Further, there was exclusion of 105 articles which were considered irrelevant and not touching on the key words. Further screening was done where another 54 articles were dropped due to lack of the outcome of interest, leading to 19 articles that focused on climate change policies and malaria control in Kenya and Zambia. The summary of study selection is shown on Figure 1.

### Policies and status of implementation in Zambia and Kenya

Through the identified studies, several policies were evaluated on their connections with malaria in both countries. This study summarized the policies covering the period they are in existence, the focus, the year the policy was enacted, status of the implementation and the potential implementation gaps and challenges.

The findings show that the two countries have enacted different strategies and policies geared towards controlling malaria. For instance, Kenya has the Kenya Health Policy 2014–2030, Kenya Climate Change and Health Strategy 2023–2027 and the Kenya Malaria Strategy 2019–2023 which have guided the country on integrating climate change and disease control, including malaria. Specifically, the Kenya Malaria Strategy 2019–2023 has had focus on a wide scope of controlling spread of malaria in malaria-endemic regions in Kenya. The strategy links its policy action to the Global Technical Strategy for Malaria 2016-2030, hence providing key strategies and action plans towards ending malaria. The findings on

the status of implementation of malaria policies are shown in Table 1 (for Kenya) and Table 2 (for Zambia).

Kenya has also implemented climate-based early warning systems using climate data to predict potential malaria outbreaks and take precautionary measures. The country has adopted climate-smart agricultural practices, like integrated water management and drainage systems, conservation agriculture, greenhouses and organic farming, that contribute to malaria control (10). Further, the government of Kenya has incorporated malaria control considerations into climate-resilient infrastructure planning. There are also ongoing Research and Development (R&D) efforts to provide climate-resilient malaria control technologies and strategies. With the development of vector control strategies, there is reduced adverse impacts from specific mosquito species, hence reducing malaria incidences.

In Zambia, the National Malaria Elimination Strategic Plan (NMESP) 2022–2026 has been implemented to reduce malaria mortality through improved case management and vector control measures. This plan aligns with the WHO Global Technical Strategy for Malaria 2016–2030 and the Southern Africa Malaria Elimination 8 (E8) Initiative, while acknowledging the influence of climate variability on malaria transmission trends (National Malaria Elimination Centre [NMEC], 2022). The Climate Change Adaptation Initiatives outlined in Zambia's National Adaptation Plan (NAP) emphasize the need for climate-sensitive measures, recognizing climate change as a driver of persistent malaria incidence in certain areas. These measures include addressing vulnerabilities in climate-sensitive health outcomes and improving resilience to climate impacts (UNFCCC, 2023). Particularly, the National Malaria Elimination Strategic Plan 2022–2026, National Climate Change Policy and National Health Strategic Plan (NHSP) 2022–2026 are considered key in addressing the endemic nature of malaria in Zambia. The policies have been enacted and periodically updated to cater for the dynamic nature of risks associated with malaria prevention.

To enhance intervention effectiveness, Zambia has implemented large-scale Vector Control Measures, including the distribution of insecticide-treated nets (ITNs) and indoor residual spraying (IRS). These measures remain critical in combating malaria amidst changing climatic conditions and have demonstrated a significant impact on malaria morbidity and mortality (Malaria Journal, 2023). Zambia has also improved its Surveillance and Monitoring Systems to better track malaria trends across the country, enabling accurate assessments of climate-related transmission patterns. The National Malaria Monitoring & Evaluation Plan 2022–2026 provides a comprehensive framework for monitoring malaria interventions and their effectiveness (18).

Zambia has also implemented of tailored interventions which have facilitated the development of region-specific malaria control strategies, addressing the varying impacts of climate conditions. For example, the NMEC has deployed sub-district micro-planning to assign targeted distribution of long-lasting insecticidal nets (LLINs) and IRS to health facility catchment areas based on local needs (Malaria Journal, 2023). These initiatives demonstrate Zambia's commitment to integrating climate change considerations into its

TABLE 1  Overview of malaria control strategies/policies and climate change integration in Kenya.

| Policy/Program | Year enacted | Focus on malaria | Status of implementation | Implementation gap | Potential challenges |
|---|---|---|---|---|---|
| Kenya Malaria Strategy 2019–2023[1] | 2019 | This strategy aimed to reduce malaria incidence and mortality by scaling up interventions such as insecticide-treated nets (ITNs), indoor residual spraying (IRS), and prompt diagnosis and treatment. It acknowledged the role of climate variability in malaria transmission and emphasized the need for climate-informed planning. | Concluded in 2023 | The strategy achieved progress in reducing malaria prevalence; however, it lacked explicit integration of climate resilience measures. This omission limited the program's ability to address climate-induced shifts in malaria transmission patterns. While the strategy recognized climate factors, it lacked detailed mechanisms for integrating climate data into malaria control operations. The absence of robust early warning systems limited proactive responses to climate-induced malaria outbreaks. | Limited capacity for climate data analysis within health institutions and insufficient collaboration between health and meteorological departments. |
| Climate Change Act, 2016 | 2016 | This legislation provides a framework for enhancing climate resilience and low-carbon development across all sectors, including health. It mandates the integration of climate change considerations into national and county planning processes | Currently active | Despite its comprehensive framework, the act's application in the health sector, particularly in malaria control, has been limited. There is a lack of specific guidelines on operationalizing climate resilience within disease control programs. | Inadequate awareness and technical expertise among health policymakers to mainstream climate considerations effectively. |
| National Climate Change Action Plan (NCCAP) 2018–2022 | 2018 | The NCCAP outlines strategies to mitigate and adapt to climate change impacts, highlighting health as a vulnerable sector. It emphasizes strengthening health systems to cope with climate-related diseases, including malaria. | Concluded in 2022. | While the plan identifies health impacts, it lacks detailed actions for integrating climate resilience into specific health programs like malaria control. The absence of clear monitoring and evaluation frameworks hinders assessment of progress. | Resource constraints and competing priorities within the health sector impede the implementation of climate-resilient initiatives. |
| Kenya National Adaptation Plan 2015–2030[2] | 2015 | This plan aims to enhance adaptive capacity and resilience to climate change across sectors. In the health sector, it focuses on reducing vulnerability to climate-sensitive diseases, including malaria, through improved surveillance and response systems. | Currently active | The plan provides broad strategies but lacks specific, actionable steps for malaria control programs. Limited integration of climate data into health information systems persists. The NAP identifies health as a key area for adaptation but lacks detailed strategies for integrating climate resilience into malaria control programs. | Weak intersectoral coordination and collaboration; and limited funding for implementing adaptation measures in the health sector. |
| Kenya Health Policy 2014–2030 | 2014 | This policy provides a framework for attaining the highest possible health standards in Kenya. It acknowledges climate change as a determinant of health and calls for the development of adaptive strategies to address climate-related health risks, including malaria. | Currently active | Despite recognizing climate change impacts, the policy lacks detailed guidance on integrating climate resilience into disease-specific programs. There is a need for operational frameworks to translate policy into practice. | Limited technical capacity and insufficient funding to develop and implement climate-resilient health interventions. |
| Kenya Climate Change and Health Strategy 2023–2027 | December 2023 during COP28 in the UAE | The strategy outlines comprehensive plans to address health impacts of climate change, including malaria and other diseases. | Currently in effect. | The policy provides a broad overview but lacked detailed action plans, particularly concerning health-related climate adaptation measures. | Challenges such as limited funding, inadequate infrastructure, and insufficient integration of climate data into health planning may hinder effective implementation. |
| National Climate Change Framework Policy 2016 | 2016 | The framework establishes a foundation for climate action, with mitigation measures. | Currently active | The policy lacks specific directives for the health sector. The absence of clear guidelines for integrating climate considerations into health programs results in inconsistent implementation across sectors. | Lack of funding and clear achievable goals. |

malaria control strategies, ensuring that interventions are tailored to the evolving challenges posed by climate variability.

## Issues related to existence of policy-action gaps among the identified policies

The authors, through thematic analysis, established the several key themes in relation to malaria control in Kenya and Zambia. One of the emerging themes was the weak health system infrastructure to support the implementation of the policies in both countries (as observed in 36.8% of the studies). The inadequate healthcare infrastructure limits malaria response during climate-induced outbreaks. For instance, Ippolito et al. (19) in Zambia notes of some districts not able to handle malaria outbreaks during their peak outbreaks, challenging the national and international goals of reducing malaria by 90% in 2030 (Global technical strategy for malaria 2016-2030). Similarly, in Kenya, Elnour et al. (20) notes of some weak infrastructure to contain malaria, especially in the malaria-endemic areas of western and coastal Kenya.

Implementation of the policies has been a challenge, especially in relation to integrating and aligning actors to common goals. For instance, Schue (21) in Zambia mentions climate action strategies not aligning with malaria control and in some cases, implementing strategies in climate mitigation seen not to contribute significantly to malaria control. Dekens et al. (22) in Kenya notes that some actors, especially foreign aided actors, have pre-determined area/scope of operation, hence not fitting into the set climate-resilient malaria control goals.

Further, 36.8% of the reviewed studies point to inadequate resources allocated to the implementation of the policies. For instance, Githure et al. (3) note that limited financial and human resources hinder the full implementation of climate-resilient malaria control measures. The theme of funding constraints as indicated by insufficient financial support was found to impede large-scale implementation of climate-adaptive malaria control measures (8). Funding constraints was mentioned by 47.4% of the reviewed studies, making a significant barrier towards realization of the enacted policies in both Kenya (23) and Zambia (15).

There were six studies out of nineteen, about 31.6%, which noted that lack of integrating climate data into malaria control amounted to significant policy-action gaps (24, 25). While efforts have been made to incorporate climate data into malaria programming, there is still a need for more comprehensive integration. There was lack of enhanced collaboration between health authorities and meteorological departments (26, 27), which is considered essential to predict and respond to climate-related malaria transmission patterns effectively.

There were 42.1% of academia resources citing challenges with stakeholder and community engagement and buy-ins. Implementing integrated community case management (iCCM), which captures

climate-related mitigations, has faced barriers such as socio-cultural incompatibilities and inadequate community health worker incentives (19, 28). These challenges impede the program's effectiveness in delivering malaria care at the community level, especially under changing climate conditions.

A theme related to community and stakeholder engagement in relation to achieving full policy implementation was the deficient community engagement leading to low community awareness of climate-induced malaria risks hinders effective intervention adoption (29, 30). This was mentioned by 26.3% of the reviewed studies, highlighting the importance of understanding the impact of climate on malaria spread and trends. Community awareness of connection between malaria and climate is conceptualized to lead to support of policy implementations among the affected areas. World Health Organization (11) also recommends that supportive community aids in realizing strategy implementations.

Another emerging theme was policy coordination challenges, as also influenced by lack of intersectoral collaborations (36.8% of the reviewed studies). Fragmented inter-agency collaboration affects policy coherence and execution, depicting some of the challenges policy implementers face in actualizing climate-resilient policies. This was mostly identified in the National Malaria Elimination Strategic Plan 2022–2026 for Zambia and the Kenya Malaria Strategy 2019–2023 in Kenya. As Likwa (26) notes, actualization of the National Malaria Elimination Strategic Plan, the Climate Change Adaptation Project and Vector Control Measures in Zambia need concerted efforts from all the players. From the reviewed studies, the policy-action gap was attributed to weak coordination between health, environment, and meteorological sectors limits the effectiveness of integrated approaches to malaria control (20, 23).

Lack of elaborate cross-cutting indicators was mentioned as a major challenge for implementing the climate-resilient malarial policies in both Kenya and Zambia (by 21.1% of the studies, n=4). Leal Filho et al. (31) and Kyomuhangi et al. (27) notes that most of the policies have general proclamations, with strategic actions to meet the targets but do not mention the actors, metrics of evaluating their implementation and the resources needed. For instance, National Health Strategic Plan (NHSP) 2022–2026 for Zambia does not have clear statement on all the actors, collaborators and evaluation matrices. National Climate Change Framework Policy 2016 for Kenya does not have clear achievable goals. This has led to lapses in achieving the full implementation of the policies.

## Discussion

This scoping review focused on the bridging the policy-action gaps on climate resilient malaria policies targeting both Kenya and Zambia. Our scoping review identified a number of climate-resilient policies that have dictated how each of the two countries have managed malaria. In executing this study, the results were classified into two; first the policies/guidelines linking climate change and malaria in the two countries, and secondly the factors that caused the status of the lagged implementation of the policies.

From the identified policies, Kenya and Zambia have recognized the critical intersection between climate change and

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1  https://fountainafrica.org/wp-content/uploads/2020/01/Kenya-Malaria-Strategy-2019-2023.pdf.

2  https://www4.unfccc.int/sites/NAPC/Documents%20NAP/Kenya_NAP_Final.pdf?utm_source=chatgpt.com.

TABLE 2 Overview of malaria control strategies/policies and climate change integration in Zambia.

| Policy/Program | Year enacted | Focus on malaria | Status of implementation | Implementation gap | Potential challenges |
|---|---|---|---|---|---|
| National Malaria Elimination Strategic Plan 2017–2021 | 2017 | This plan aimed to transition from malaria control to elimination, emphasizing universal coverage of interventions such as insecticide-treated nets (ITNs), indoor residual spraying (IRS), and improved case management. | Superseded by subsequent strategies | While the plan achieved progress in reducing malaria prevalence, it lacked explicit integration of climate resilience measures, limiting its effectiveness against climate-induced transmission changes. | Resource constraints and limited integration of climate data into malaria control strategies. |
| National Malaria Elimination Strategic Plan 2022–2026[3] | 2022 | Building upon previous efforts, this plan emphasizes adaptive strategies to address climate-related shifts in malaria transmission, including enhanced surveillance and targeted interventions in high-risk areas. | Currently active | The plan outlines strategies for malaria elimination, but it lacks explicit integration of climate resilience measures. This omission may limit the program's ability to address climate-induced shifts in malaria transmission patterns. Challenges include limited funding for climate-specific interventions and insufficient capacity for climate data analysis within health systems. | Ensuring effective intersectoral collaboration and securing sustainable financing for climate-resilient initiatives. |
| National Climate Change Policy | 2016 | This policy provides a framework for addressing climate change across sectors, including health, by promoting adaptive capacity and resilience. | Currently active | Although it recognizes health as a vulnerable sector, the policy lacks detailed strategies for integrating climate resilience into disease-specific programs like malaria control. | Limited cross-sectoral collaboration and inadequate resource allocation for health-specific adaptation measures. |
| National Health Strategic Plan 2017–2021 | 2017 | Aimed to strengthen health systems and improve service delivery, with some acknowledgment of climate change impacts on health. | Superseded by subsequent plans | The plan did not comprehensively address climate resilience in malaria control, leading to reactive rather than proactive responses to climate-induced health challenges. | Inadequate integration of climate considerations into health planning and limited capacity for implementation at the local level. |
| National Health Strategic Plan (NHSP) 2022–2026 | 2022 | The NHSP outlines broad health objectives, including disease (like malaria) prevention and control. | Currently active. | The policy does not specifically address the integration of climate resilience into malaria control programs, leading to potential vulnerabilities in managing climate-induced health risks. | There is a lacuna in the specifying actors and actions needed to mitigate the potential vulnerabilities arising from climate change. |
| National Adaptation Programme of Action (NAPA) | 2007 | Identified immediate adaptation needs to address climate change impacts, including those related to health and malaria. | Served as a foundation for subsequent adaptation strategies | While it highlighted the vulnerability of health to climate change, specific actions for malaria control were limited, and implementation was constrained by resource limitations. | Securing funding and building institutional capacity to implement identified adaptation actions effectively. |
| National Climate Change Response Strategy (NCCRS) 2010 | 2010 | The NCCRS provides a framework for addressing climate change impacts across various sectors, including health. | Currently active. | The policy does not offer detailed strategies for integrating climate resilience into disease-specific programs like malaria control. | Inadequate funding, lack of integrating climate-resilient measures into malaria control. |

malaria transmission, leading to the development of policies aimed at integrating climate resilience into malaria control efforts as

supported by evidence by Parry et al. (32) and Schwerdtle et al. (33) The reviewed policies show strong determination and considerable efforts by the two countries to control malaria through addressing risks associated with climate change.

The availability of the Kenya Malaria Strategy 2019–2023 shows the Kenyan government determination to reduce malaria incidence

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3 https://millionssaved.cgdev.org/case-studies/zambias-national-malaria-control-program.

and deaths by 75% of 2016 levels by 2023, and align with the WHO global strategy for malaria elimination. The findings are supported by observations by Githure et al. (3) and Likwa (26). Similar observations were made for Zambia, which has the National Malaria Elimination Strategic Plan 2021–2026, which outlines Zambia's commitment to eliminating malaria, with an emphasis on integrating climate considerations into malaria control programs (15).

The findings elsewhere by Mwenesi et al. (30) and Gwaza et al. (25) show that some of the shortcomings in achieving policy-action goals is failure to integrate and align actors to common policy goals. As observed by Amoako (34), aligning of actors to the policy goals presents a golden chance of actualizing health-related policies. For instance, National Adaptation Plan (NAP) 2015–2030 in Kenya, and National Malaria Elimination Strategic Plan 2021–2026 in Zambia have not fully integrated climate data into health sector hence there is limited capacity to predict and respond to climate-induced malaria transmission effectively.

Other studies elsewhere, for instance, Ippolito et al. (19) and Githure et al. (3) support the observation that having adequate resources allocated to the implementation of the policies determines their success. For instance, the Ministry of Health in Kenya notes a 50% resource gap needed to fully implement the Kenya Malaria Strategic Plan. Reduced policies-action gaps are realized when the governments second adequate and efficiently trained staff, finances and facilities for the implementation of the policies. For instance, Lacey et al. (23) in their conclusion cited the need to build adaptive capacity within the health sector to address climate-induced health challenges associated with the climate-resilient malaria policies.

Studies by Elnour et al. (20) and World Health Organization (24) also collaborate with the findings in this current study in that weak health system infrastructure has led to sluggish implementation of the policies in both countries. Weak health system infrastructure link to delayed service delivery, and missed opportunities to tackle climate change and its risks in alleviating malaria incidences (35). Similar findings correlate with Lubinda (4) in Zambia who found that the lack of resilient infrastructure leads to service disruptions during extreme weather events, such as floods and droughts, which are becoming more frequent due to climate change. Leal Filho et al. (31) from study in sub-Saharan Africa notes that there is need for the governments to strengthen health system infrastructure and consequently achieve the target intentions/goals of the policies.

Further, studies by Mutero et al. (36) in Kenya, Uganda and Tanzania; Fambirai et al. (1) in a scoping review; and Siachisa (2) in Zambia agree with this current study on the need to engage a wide scope stakeholders and community for the policy buy-in. As observed elsewhere by Ng'ang'a et al. (28), when there are strong collaborations from all potential stakeholders, non-governmental organizations, and communities, achievement of the set targets in the policies becomes achievable. In some areas, climate change disrupts communities, affecting their capacity to implement effective malaria control measures, such as bed net usage and indoor residual spraying. When some stakeholders are not included, then some vulnerable populations may be less equipped to adapt to shifting malaria dynamics, compromising the

achievement of the set goals. Similarly, Oladipo et al. (29) agree with this study that having insufficient coordination among relevant institutions compromises achievement of the climate-resilient malarial policies. Aligning malaria control strategies with climate adaptation policies requires cohesive governance structures and clear roles and responsibilities.

Lastly, previous studies by Lacey et al. (23) in Kenya and Ma et al. (15) in Zambia also corroborate with this current study conclusions on the need to iron out policy coordination challenges that are caused by lack of cross-cutting indicators. Key climate change indicators need to be linked to malaria control for the policy implementors to track achieves attained within specified periods.

# Conclusion and recommendations

Despite commendable policy frameworks in Kenya and Zambia, substantial gaps remain in translating policy objectives into practical malaria control measures (37). Strengthening the link between climate adaptation strategies and malaria interventions is crucial for sustainable disease control.

Climate-resilient policies play a critical role in mitigating the impact of climate change on malaria transmission in Kenya. While Kenya has made commendable progress in policy formulation, challenges in funding, intersectoral collaboration, and implementation persist. Strengthening these policies through enhanced resource allocation, improved data integration, and increased community participation will be crucial in achieving sustainable malaria control in the face of climate change.

Zambia has made significant progress in recognizing the link between climate change and malaria, with various policies emphasizing climate resilience in health programs. However, challenges such as resource constraints, weak intersectoral collaboration, and slow policy implementation hinder full realization of climate-resilient malaria control. Strengthening these policies through enhanced funding, improved data integration, and stronger community involvement will be key to sustaining malaria control efforts in the face of climate change.

By addressing these gaps, Kenya, Zambia, and other malaria-endemic countries can effectively mitigate climate change's impact on malaria transmission and strengthen global efforts toward malaria elimination.

From the findings, the authors recommend the following;

1. **Improve policy coordination and collaborations:** The two countries, Kenya and Zambia need to foster better coordination among governmental and non-governmental institutions to align malaria control efforts with climate resilience initiatives, ensuring cohesive policy implementation. Strengthening collaborations is recommended to bridge the gaps in implementing the policies. A review of the potential collaborators and stakeholders is recommended, to foster efficient coordination in their implementation.

2. **Improving stakeholder and community participation**: Engage local communities through targeted education and participatory malaria control initiatives. Knowledge of climate change and its influence on malaria incidences is vital for community support. Further, there is need to implement targeted programs to support vulnerable communities in adapting to changing malaria transmission patterns, ensuring effective use of control measures. A number of the identified policies are silent on engaging communities and underscoring their contribution towards realization of the policies.

3. **Strengthening early warning systems**: This study established that there exist discorded policies on climate change and malaria control. There is need to improve collaboration between meteorological and health agencies for predictive malaria surveillance. There is need to establish and operationalize early warning systems that utilizes climate and health data to predict malaria outbreaks, enabling timely interventions.

4. **Securing sustainable financing**: Slightly over half of the policies were not fully implemented due to lack of resources. There is need for the governments in Kenya and Zambia to mobilize domestic and international funding to support climate-resilient malaria programs.

5. **WHO framework enhancement**: There is need for the two governments and other concerned players to advocate for WHO to incorporate explicit climate resilience indicators in its malaria control evaluation metrics. The indicators will allow policy implementers to track progress in achieving the set goals.

6. **Enhance data integration:** Strengthen collaboration between health and meteorological departments to incorporate climate data into malaria control planning and response strategies.

7. **Strengthen infrastructure:** Invest in building and upgrading health facilities to be climate-resilient, ensuring they can operate effectively during extreme weather events.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding authors.

## Author contributions

## Funding

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Generative AI statement

The author(s) declare that no Generative AI was used in the creation of this manuscript.

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