Original Article

Sustainability of Malaria Prevention Strategies in Uganda and Zimbabwe: A Systematic Review.

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Abstract

Background- Malaria is a parasitic infectious disease spread through the bite of an infected female Anopheles mosquito. Presently two vector control strategies play a pivotal role in the control of malaria – Indoor Residual Spraying and treated bed nets.

Preventive and control measures have been put in place in Zimbabwe and Uganda to eliminate this menace. However, the efforts are proving futile as the number of cases continues to increase annually.

Objective- The review was aimed at determining the ability of indoor residual spraying and long-lasting insecticidal nets to continue achieving malaria elimination over time in Zimbabwe and Uganda.

Methods- A systematic review was conducted according to the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses. A literature search based on Patient, Intervention, Comparison, and Outcomes was used on the Web of Science, EBSCO host and Science Direct databases for the best relevant results. Thirty-six full-text articles were passed to the systematic review. Factors that were evaluated include vector resistance to insecticides, the reported extent of community involvement, sustainability prospects, and the impact of indoor residual spraying and long-lasting insecticidal nets in malaria elimination.

Results- The available literature suggests that the sustainability of malaria control initiatives in Uganda and Zimbabwe may be unachievable. There seems to be a gap in all the reviewed literature concerning the assessment of the level of participation of the communities in which these strategies are being implemented. The communities are mere recipients of the control measures without adequate involvement. Hence, their sustainability is not being realized.

Conclusion- Zimbabwe and Uganda may continue to face challenges in the fight against malaria if they do not incorporate sustainability concepts into their malaria elimination efforts. Their continued overreliance on international aid and Non-Governmental Organizations will remain their major pitfall. [*Ethiop. J. Health Dev.* 2024; 38(1): 00-00]

Keywords- Sustainability; Malaria elimination; Malaria vector control; Indoor Residual Spraying; Long Lasting Insecticidal Nets.

Introduction

Malaria remains a challenge worldwide despite efforts being made towards its elimination. Several strategies and guidelines have been developed by the World Health Organization (WHO) towards this goal (1). These strategies and guidelines are available for countries to adopt in their malaria control policies. Each country prepares its policy depending on the availability of funding, resources, and suitability of strategies to their specific situations.

Vector control, environmental manipulation, and effective case management are some of the strategies being implemented towards malaria elimination globally. Most countries that have achieved malaria elimination, like China, have adopted the Integrated Vector Management (IVM) approach (1–3). However, indoor residual spraying (IRS) and long-lasting insecticidal nets (LLINs) remain the most important strategies in malaria vector control.

According to the World Health Organization World Malaria Report (4), global malaria cases in 2019 were 229 million. A total of 409,000 deaths were attributable to malaria. The African Region was the most affected, with 213 million cases and 409,000 deaths respectively. Uganda had 8 million cases and 4,545 deaths while Zimbabwe had 310,000 and 266, respectively (Table 1).

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Table 1: **Malaria Statistics (2015 to 2019)**[1]

Indicator/Variable		2015	2016	2017	2018	2019
CONFIRMED MALARIA CASES						
	Global	219m	227m	231m	228m	229m
	African Region*	199m	206m	212m	213m	213m
	Uganda	5m	12m	14m	12m	8m
	Zimbabwe	342 000	281 000	468 000	260 000	310 000
CONFIRMED MALARIA DEATHS						
	Global	446 000	427 000	416 000	405 000	409 000
	African Region**	411 000	389 000	383 000	380 000	386 000
	Uganda	5153	5991	4722	2611	4545
	Zimbabwe	462	235	534	192	266
VECTOR CONTROL COVERAGES (%)						
Indoor Residual Spraying						
	Africa Coverage	88	86	89	91	96
	Uganda Coverage	84	86	91	95	97
	Zimbabwe	78	83	88	94	96
Long-Lasting Insecticidal Nets						
	African Region	86	86	85	92	94
	Uganda Coverage	73	76	74	83	87
	Zimbabwe Coverage	77	80	73	88	94
MALARIA INCIDENCE RATE* **						
	Global	58.9	58.7	59.2	57.2	56.3
	African Region	228.3	223.6	226.2	218.4	214.1
	Uganda	253.5	283.1	294.9	262.7	262.7
	Zimbabwe	97.6	68.4	118.8	55.8	67.9

**Sub Saharan Africa shoulders 95% of global cases as of 2020 (WHO, 2020).*
***Sub Saharan Africa contributed 96% of the global deaths in 2020 (WHO, 2020).*
****Malaria incidence per 1000 at risk population.*

Uganda and Zimbabwe are landlocked countries in sub-Saharan Africa. Their climatic conditions are almost similar and favor the survival of the malaria vector as well as the spread of malaria. The economies of both countries are poor as both are still categorized as developing countries. Available facts show that Uganda had a Gross Domestic Product (GDP) of about $ 37.37 billion in 2020 ewhile Zimbabwe had a GDP of $ 16.77 billion.

Both countries rely heavily on Non-Governmental Organizations (NGOs) for assistance in their malaria elimination programs. In terms of malaria morbidity and mortality, Uganda had 15 million confirmed cases in 2020 ewhile Zimbabwe had 447,000 cases (5). According to the African rankings on malaria burden, Uganda was on number 3 while Zimbabwe was on number twenty-eight (5).

In Uganda, IRS was implemented in high malaria endemic districts ewhile in Zimbabwe, it was targeted for areas that were reporting five or more cases per 1,000 population. Uganda sprays almost twice annually (January and July) and annually in Zimbabwe (October). For LLINs, mass distributions in both countries are done after 3 years from the previous one, assuming that each net has a life span of 3 years. In Zimbabwe, LLINs are targeted for areas reporting two to four cases per 1,000 populations.

The review sought to assist the National Malaria Control Programs, especially those in the WHO African region and specifically those in Zimbabwe and Uganda, in evaluating their IRS and LLINs programming. Malaria programming post-2019 was affected by the COVID-19 pandemic, hence the review's five-year focus from 2015 to 2019. The review may inform policymakers on ways or approaches to sustain their IRS and LLINs programs.

This review may provide a baseline for future malaria elimination sustainability studies and was overly qualitative as it sought to evaluate malaria vector control interventions in the two countries. We wanted to find out if IRS and the use of LLINs could be sustainable by examining those requirements unique to different populations as well as exploring those contexts in which the programs were implemented to achieve malaria elimination.

The findings may, therefore, help influence or inform policy development or guide policy implementation. The review findings may promote the reduction in malaria cases as well as the eradication of the mosquito vector by promoting the improvement of IRS and LLINs programming in Zimbabwe and Uganda.

Objectives

Th systematic review aimed to determine the sustainability potential of IRS and LLINs in Uganda and Zimbabwe between 2015 and 2019 by answering the following study question:

To what extent did Zimbabwe and Uganda maintain IRS and LLINs as the pillars of malaria vector control in their malaria elimination attempts between 2015 and 2019?

Materials and Methods

A protocol for this systematic review was developed using the guidelines provided in the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015 checklist. The protocol was not registered or published but is available on a repository of the Open Science Framework (OSF) (doi:10.17605/OSF.IO/F7S8C). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement was used as a guideline for the performance of this systematic review.

Eligibility criteria

Studies were selected according to the criteria outlined below:

Timing: Peer-reviewed journal articles published between 2015 and 2022 only were reviewed.

Setting: Peer-reviewed journal articles only on malaria vector control in Zimbabwe and/or Uganda were included in the review.

Language: Only peer-reviewed journal articles published in English were reviewed. The detailed PICOS criteria used for the inclusion and exclusion of studies for the review are presented in Table 2.

Table 2: **PICOS criteria used to include/exclude studies during study selection.**

Parameter	Inclusion criteria	Exclusion criteria
Population/ Problem	Studies were undertaken only in Zimbabwe and/or Uganda on malaria vector control. There was no age restriction.	Studies not conducted in Zimbabwe or Uganda and studies not exclusively on malaria control.
Intervention	Studies were undertaken in Zimbabwe and/or Uganda on community-centred IRS and LLINs distribution as the major malaria vector control strategies.	Other non-malaria vector control strategies such as case management, intermittent prophylaxis treatment, etc
Comparators	Studies reporting on malaria incidence before and after IRS or LLINs roll out in Zimbabwe and/or Uganda between 2015 and 2019	Studies not within the range of 2015 to 2019

Parameter	Inclusion criteria	Exclusion criteria
Outcome	Changes in malaria incidence in Zimbabwe and/or Uganda after IRS/LLINs rollout between 2015 and 2019	Studies are not reporting on malaria incidence during the specified period.
Study design	There were no restrictions on study designs, provided the study was a journal and peer-reviewed publication.	Unpublished research studies (e.g., editorials, letters, and conference abstracts),

Information sources

We conducted electronic searches for eligible studies within each of the following three databases:

- Ebsco Host;
- Science Direct;
- Web of Science;

In addition, we searched the World Health Organization (WHO) website (https://www.who.int/publications/) only for supporting information. Authors' files were not searched, and neither did we scan reference lists. This was because we had adequate literature available on malaria hence literature saturation was not a challenge.

Search strategies

Literature search strategies were developed using text words related to malaria vector control in Zimbabwe and Uganda. The review included both qualitative and quantitative studies. The search was not limited to any particular study design, though it was limited by publication period (2015 to 2022), language (only English), and study setting (studies conducted only either in Zimbabwe or Uganda or both countries).

Ebsco Host, Science Direct, and Web of Science databases were searched. Specific search strategies for each database (Table 3) were developed with guidance and assistance from experienced researchers.

Table 3: Database search queries, filters, and records found.[2]

Database	Search query	Filters applied	Records found
Ebsco Host	*(malaria) AND (malaria AND Zimbabwe) AND (malaria AND Uganda) AND ((indoor AND residual AND spraying)) AND ((treated AND bed AND nets) AND (long AND lasting AND insecticidal AND nets) OR (treated AND mosquito AND nets))*	-Online full-text and peer-reviewed -Date range 01/2010 to 12/2020 -Language English	2563 records 15/03/23*
Science Direct	*malaria AND Zimbabwe AND Uganda AND indoor residual spraying AND treated bed nets AND long-lasting insecticidal nets OR treated mosquito nets*	-Refined by period 2010 to 2022 -Review articles and research articles	1976 records 22/03/23*
Web of Science	((((ALL=(malaria)) AND ALL= (malaria and Zimbabwe)) AND ALL= (malaria and Uganda)) OR ALL= (indoor residual spraying)) OR ALL= (treated bed nets or long-lasting insecticidal nets or treated mosquito nets)	-Publication years 2010 to 2022 -Document types – Article; Review article; Open access	3490 records 28/03/23*

*Last date search conducted

Selection process
Two reviewers worked independently during study selection to eliminate inclusion bias. Firstly, eligibility assessment was achieved using Endnote X9 software, Build 12062. All retrieved studies were collected into one Endnote library and all duplicates were deleted using the remove duplicating function, then exported into Excel. A title/abstract/full-text screening tool was then developed based on the inclusion and exclusion criteria.

The tool was published in Covidence 2.0, an online screening software (6). The screening tool was piloted first using studies included in the review to refine the tool. Title, abstracts, and full-text articles were exported from Endnote and uploaded into Covidence 2.0. Title, abstract, and full-text reviews were then done by the same reviewers using Covidence 2.0. Decisions with regard to inclusion or exclusion of studies were made by consensus. Disagreements between the reviewers were resolved through discussion.

Data collection process
The Cochrane Data Extraction Template (Data collection form for intervention reviews: RCTs and non-RCTs, Version 3, April 2014) (7) was adopted and used to develop an Excel data extraction tool. Working independently, the reviewers used the tool to extract data from each of the thirty-six included studies. Reviewers resolved their disagreements through discussion.

The data extraction tool was pilot-tested first, using five randomly selected articles from those included in the review. This was to ensure the capturing of relevant information as well as ensuring consistency of the extracted data, thus reducing data extraction errors while improving validity and reliability.

Risk of Bias Assessment
We assessed the risk of bias in the included studies using a modified Downs and Black checklist (8). The checklist was designed to model judgments according to the grading of recommendations, assessment, development, and evaluation (GRADE) criteria. Two review authors (NDG and CK) independently applied the tool to each of the 36 included studies and recorded supporting information and justifications for judgments of risk of bias for each domain (excellent, good, fair; poor).

Any discrepancies in judgments of risk of bias or justifications for judgments were resolved by discussion to reach a consensus between the two reviewers. Following the original guidance by Downs and Black (though with a slight variation), we derived an overall summary risk of bias judgment (excellent, good, fair, or poor) for each specific outcome, whereby the overall risk of bias for each study was determined by the highest risk of bias level in any of the domains that were assessed.

Synthesis methods
A combination of methods was used, including qualitative and textual narrative synthesis. Meta-analyses could not be undertaken due to the heterogeneity of interventions, settings, study designs, and outcome measures. We had planned to use harvest plots as the graphical method for displaying data where meta-analysis was not possible on the overall pattern of evidence from the review. However, we synthesized the evidence narratively.

Narrative synthesis was used as it enabled us to investigate similarities and differences between the heterogeneous studies included in the review, as well as exploration of relationships within the data, including an assessment of the strength of the evidence and findings on access to LLINs effectiveness of IRS, malaria morbidity and mortality in Zimbabwe and Uganda.

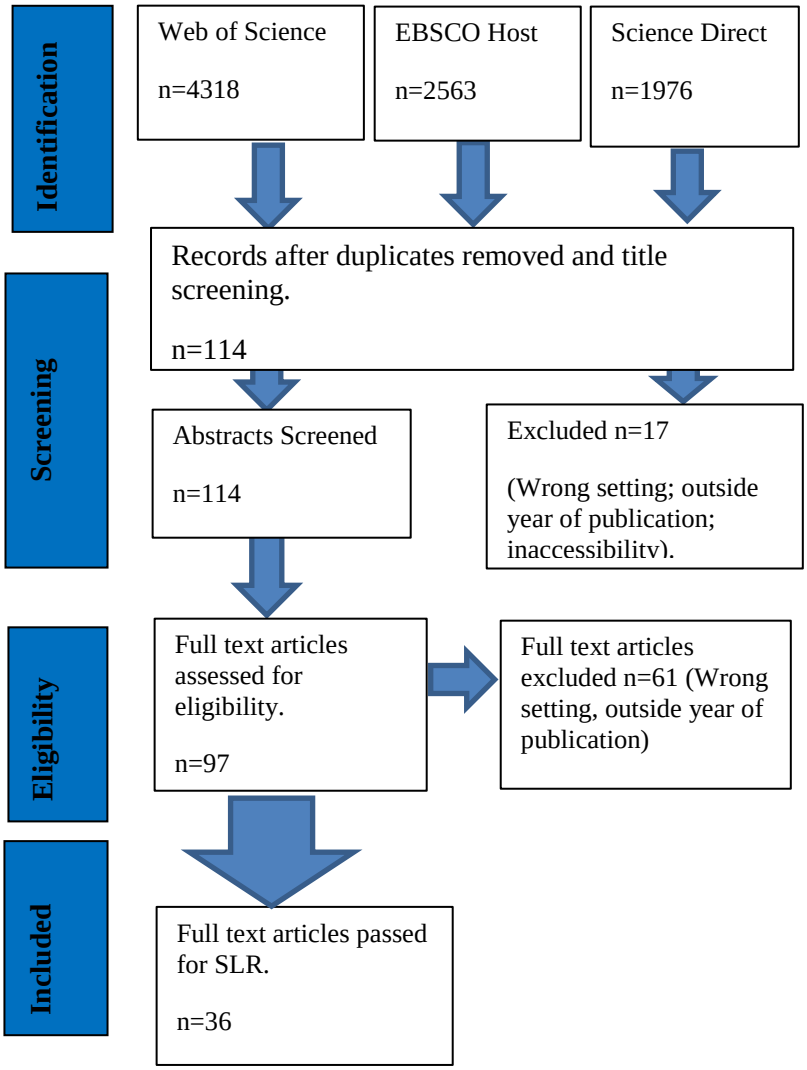
We pre-planned an adjusted model to include important study covariates related to the channels of LLINs distribution both in Zimbabwe and Uganda (mass vs. continued) ,whether the distribution involved trained personnel (yes vs no), and whether IRS was considered (yes vs no). These covariates were included a priori given that programs were tailored to varying communities or beneficiaries and might include more intervention components or be delivered by different professionals with varying experience.

Assessment of heterogeneity was not done since the included studies had varying methodologies. However, an attempt was made to use methodological quality to examine potential sources of heterogeneity. No sensitivity analysis was done.

Results
Study selection
A total of 8,857 records resulted from searching the three databases. The last search was conducted in March 2023. After the authors removed duplicates and carried out title screening, 114 articles passed for abstract screening/review. Seventeen articles were excluded during abstract screening. Thus, ninety-seven articles passed to the full-text screening stage. Sixty-one articles were excluded for various reasons.

The actual review thus included 36 articles. Two authors (NDG and CK) carried out the titles and abstracts screening as well as full-text reviews. The selection process was done following the PRISMA 2020 guidelines, as illustrated in Fig 1.

Figure 1: **Results of the search and selection process.**



Risk of bias in studies

We used a modified Downs and Black checklist to assess the risk of bias for each of the included studies. Three articles (8.3%) had a high risk of bias, 13 (36.1%) had a moderate risk and 20 (55.6%) had a low risk of bias. In terms of the overall risk of bias, twenty of the studies had a low risk of bias. There were some concerns about the risk of bias for thirteen of the studies (medium risk), with three studies being assessed as at high risk of bias (9–11).

The most common criterion that affected the studies was internal validity associated with confounding for experimental studies, which increased selection bias. Deviations from study protocols were another issue that affected two of the studies(12,13). Generally, all studies were judged to have a low risk of reporting/publication bias.

Results of individual studies

Averaged national IRS estimates of coverage for Uganda and Zimbabwe for the five-year review period (2015 to 2019) were 87% and 89%, respectively. Averaged LLIN ownership and coverages were 88% and 85%, respectively. Incident rates fluctuated instead of being maintained on a downward trend. Five insecticide classes were reported: (1) Pyrethroids (Permethrin); (2) Organochlorines (DDT); (3) Carbamates (Bendiocarb); (4) Organophosphates (Actellic) (5) Neonicotinoids (Sumishield). Comparisons were made (Table 4) for the major outcomes between official but unpublished data (as presented in Table 1) and the findings of the review.

Table 4: **Comparison between official (unpublished) data and study findings**

Item		Uganda		Zimbabwe	
		Official	Study findings	Official	Study findings
Number of IRS campaigns 2015 to 2019		7	7	5	5
Number of LLIN mass distributions 2015 to 2019		1	1	4	2
IRS coverage* 2015 to 2019		90.6%	87%	87.8%	89%
LLIN ownership estimates 2015 to 2019**		78.6%	88%	82.4%	85%
Types of insecticides used	**2015**	Bendiocarb		Permethrin	
	2016	Bendiocarb		Permethrin	
	2017	Actellic		Permethrin + DDT	
	2018	Actellic		Permethrin + DDT + Actellic	
	2019	Actellic and Sumishield		Permethrin + Actellic	

Ten articles out of the 36 reviewed articles evaluated pyrethroid resistance. Of the 15 studies from Zimbabwe, only six evaluated the issue of pyrethroid resistance while Uganda had only three out of 16 studies evaluated. Only two of the 36 reviewed articles (from Uganda) offered a better assessment of the extent of community involvement in the rollout of malaria strategies (14,15).

Two studies from Zimbabwe assessed the availability of international funding towards malaria elimination (16,17). None of the reviewed studies assessed the extent to which each country can fund malaria control initiatives in the absence of international funding. *Anopheles gambiae* sensu lato (s.l.) is the primary vector species in both countries, while *Anopheles funestus* s.l. is secondary.

From the assessment, the rate of research work in both countries increased from 2015, with studies on malaria being published every subsequent year. However, Zimbabwe has been publishing each year since 2015 ewhile Uganda started publishing yearly in 2018. A total of 18 articles assessed both IRS and LLINs (11 from Zimbabwe, seven from Uganda) ewhile eight articles from Uganda and two from Zimbabwe evaluated a number of strategies. Twenty-four articles assessed morbidity and mortality (11 from Zimbabwe, 13 from Uganda), while 12 articles did not (seven from Zimbabwe, five from Uganda).

Results of Syntheses

Twenty-four included studies assessed malaria morbidity and mortality. More than 80% of the articles reported on IRS campaigns and coverages for both countries between 2015 and 2019. About 54% of the reviewed articles reported on LLIN mass distributions and the corresponding LLIN ownership coverages between 2015 and 2019. Eight studies reported on enhanced electronic reporting during and after IRS and LLINs rollout.

Twenty-nine included studies were of good quality or rated as low risk of bias, five of fair quality or rated as medium risk of bias, and two were of poor quality or rated as high risk of bias. Studies with increased risk of bias had potential limitations related to internal validity, publication bias, blinding of outcomes assessors, whether confounders were assessed with reliable measures, and whether potential outcomes were pre-specified.

Based on the findings obtained, the review established that the sustainability potential for both countries was 87% (Table 4). Sustainability in this review's context was taken to imply the ability of IRS and LLINs to continue achieving a reduction in malaria cases for the 5 years from 2015 to 2019. Thus, the authors considered the effectiveness of the prevention methods presented to be the result of better implementation of these strategies, which in turn relates to the ability of the countries to sustain them.

Discussion

The need for achieving sustainability of preventive health services has led to a number of studies aimed at evaluating the effectiveness of one or more control strategies (18–22). A number of studies have observed that during controlled or hut trials, the strategies appear to offer good results in eliminating malaria from targeted communities (23–25). Malaria trends in Uganda and Zimbabwe were assessed to determine the possibility of sustaining malaria elimination attempts.

Pyrethroid resistance is one of the new challenges downplaying the efficacy and effectiveness of malaria vector control initiatives (21,26–28). Of the 36 reviewed articles, 6 articles assessed issues of pyrethroid resistance in Zimbabwe and Uganda. This showed that pyrethroid resistance monitoring and research are not being done effectively to influence changes in approaches to vector control.

The continued use of one chemical – accompanied by widespread and indiscriminate use – can select the vector for resistance. Zimbabwe and Uganda have poor policies and poor monitoring of pyrethroid resistance (29–31). Once the vector becomes widely resistant to pyrethroids, it then means that the malaria elimination targets and gains will not be sustained. It was noted that most researchers were not looking at the level and extent of community ownership of malaria vector control interventions, especially IRS and LLINs.

The argument is that the more the community adopts the interventions, the more they can be sustained. The community needs to identify and accept the control measures for success to be realized fully over time (32–34). Failure to involve the community fully has led to the misuse of LLINs, whereby the communities use nets for fishing and making fowl runs instead of sleeping under them.

Zimbabwe and Uganda were relying on international funding in the fight against malaria. One of the disadvantages of this is that funders can fund specific research. Funds are usually availed for specific research, i.e., NGOs come with their research agenda and fund those only; anything outside their specific scope is not considered. Another issue associated with relying on outside funding is that once the funder pulls out or stops funding, all the gains will also be lost unless the community is capacitated to take over to promote sustainability.

Zimbabwe and Uganda share the same malaria vector species – *Anopheles gambiae* sensu lato (s.l.) and *Anopheles funestus* s.l. These species are the most widely distributed in Africa (10,20,35). Studies of these vectors are important in understanding issues to do with vector resistance in different African settings. Six articles of the thirty-six reviewed had looked at vector resistance in Zimbabwe and Uganda. Only two articles (11,36) had studied vector resistance issues; the rest were just secondary reviews of other studies.

Our findings agree with those of (37) that African countries will continue to face challenges in the fight against diseases like malaria if they do not incorporate sustainability concepts within their public health efforts. Their continued reliance on international aid and NGOs remains a pitfall. Malaria burden remains an issue in Zimbabwe and Uganda despite the use of IRS and LLINs.

Appropriate policies need to be put in place if any gains are to be sustained. Most researchers evaluate the control strategies themselves, leaving behind an important aspect of community involvement. Most communities are not involved in the decisions that affect their lives; hence, in the absence of government agencies/workers/partners, they tend to forget about the strategies, thus reversing any gains that could have been made. In some cases, misuse of control strategies such as the use of LLINs in fishing may promote insecticide resistance, considering that the mosquito vector leaves eggs in water, and their larvae hatch and grow in water or along water bodies.

Implications for practice and policy

Findings from this review indicate that even though there are growing concerns of resistance, IRS and LLINs use remain relevant in the fight against malaria. However, the reviewers are of the opinion that governments should formulate guidelines that provide for alternate use of insecticides instead of just relying on a single insecticide in successive sprays. The review also noted that malaria incidence would fall just after LLINs mass distribution or IRS.

The continuous net distribution channels need to be assessed separately to determine their contribution towards malaria elimination in Zimbabwe and Uganda. Community involvement and local funding capabilities are other factors that need to be addressed if the sustainability of IRS and LLINs use is to be realized. The role of Environmental Health Technicians in community mobilization and sensitization needs to be re-emphasized. Enhanced electronic reporting needs to be strengthened as well.

Implications for Research

Findings from this review suggest that several studies were done to assess IRS and LLINs programming. However, the following issues need some considerations for further research: (1) Local funding capabilities (African countries should be able to fund malaria control programs rather than relying on donor funding); (2) Community involvement (target communities should be involved in planning stage through implementation to monitoring and evaluation stage); (3) Other channels of LLINs distribution, besides mass distribution, need to be assessed.

Study limitations

The systematic review was without a meta-analysis. This was so because the review was largely qualitative, and also, the studies included in the review were too heterogeneous. Secondly, no grey literature was included in the reviewed studies, which only zeroed in on published peer-reviewed literature, thus introducing some inclusion bias. Grey literature was only consulted during the literature review to have a balanced assessment of the subject.

Another limitation of the review is that a review protocol was prepared but not registered. Another limitation was the inclusion of articles with different study designs. This was a major challenge during bias assessment using the Downs and Black quality assessment tool. However, the quality assessment tool was designed in such a way that it could be used for both randomized and non-randomized studies.

Conclusion

The review sought to determine the sustainability of malaria elimination strategies in Uganda and Zimbabwe between 2015 and 2019. The review established that the use of IRS and LLINs in Zimbabwe and Uganda was largely sustainable (87%). Zimbabwe and Uganda will continue to face challenges in the fight against malaria if they do not incorporate sustainability concepts within their public health efforts. Their continued reliance on international aid and NGOs remains a pitfall. Appropriate policies also

need to be put in place and followed through if any gains are to be realized.

Most researchers evaluate the control strategies themselves, leaving behind an important aspect of community involvement. The misuse of control strategies, such as the use of LLINs in fishing, may promote insecticide resistance, considering that the mosquito vector's life cycle involves water bodies. As rightfully articulated in the global malaria report (4), new and better implementation approaches are required in order to realize the set 90% reduction in global malaria incidence by 2030.

Conflict of Interests

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Contribution of authors

NDG: Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Supervision; Validation; Visualization; Writing – original draft; Writing – review & editing.
TP: Conceptualization; Formal analysis; Funding acquisition; Project administration; Resources; Supervision; Validation; Writing – review & editing.
LM: Conceptualization; Funding acquisition; Resources; Supervision; Validation; Writing – review & editing.
KO: Funding acquisition; Resources; Supervision; Validation; Writing – review & editing.
DA: Funding acquisition; Resources; Supervision; Validation; Writing – review & editing.
CK: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Software; Validation; Visualization; Writing – review & editing.

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