

Role of Gender-Sensitive Interventions in Enhancing Malaria Prevention in Uganda: Insights from the 'Zooming-In' Approach

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Abstract

This study evaluates the impact of gender-sensitive interventions on malaria prevention in Uganda, focusing on male involvement in household health decisions. Implemented in Hoima, Masaka, and Rwenzori, the 'Zooming-In' approach utilized interpersonal communication and follow-up visits to engage men in malaria prevention activities. The study employed a quasi-experimental design, selecting intervention and control groups based on malaria burden, geographic distribution, and socio-economic factors. Households were randomly assigned within these groups to minimize selection bias. A total of 2,400 households were included, equally divided between intervention and control groups. Data collection involved household surveys, key informant interviews, and focus group discussions. Quantitative analysis applied descriptive statistics and logistic regression, while qualitative data underwent thematic analysis. Findings show significant improvements in malaria prevention behaviors in intervention areas, including higher ITN usage (81.8% vs. 76.5%, $p = 0.028$, OR = 1.27, 95% CI: 1.08-1.49), increased early treatment-seeking within 24 hours of fever onset (81.6% vs. 64.4%, $p < 0.001$, OR = 2.32, 95% CI: 1.89-2.84), and greater IPTp uptake (78% vs. 58%, $p = 0.022$, OR = 1.94, 95% CI: 1.61-2.34). The intervention also reduced malaria test positivity rates by 9%. However, sustaining male engagement remains a challenge, particularly in communities with entrenched gender norms. The study highlights the need for culturally tailored strategies and the integration of gender-sensitive approaches into malaria prevention programs. Future research should explore cost-effective scaling strategies, such as digital follow-ups and leveraging community health worker networks.

Keywords: Early Treatment-Seeking, Gender-Sensitive Interventions, ITN Usage, Malaria Prevention, Male Involvement, Uganda.

Introduction

Malaria remains a major public health concern in Uganda, with high morbidity and mortality rates, particularly among pregnant women and children under five years of age [1]. Despite intensive interventions—such as insecticide-treated nets (ITNs), indoor residual spraying (IRS), and intermittent preventive treatment in pregnancy (IPTp)—malaria-related deaths persist [2]. Beyond biological susceptibility, social determinants like gender

norms, power dynamics, and household decision-making significantly shape access to prevention and treatment services [3].

Gender-sensitive interventions recognise that men and women experience healthcare differently due to cultural roles, economic disparities, and access to resources [4, 5]. In Uganda's patriarchal society, men often control financial resources and household decisions, influencing whether women and children receive timely malaria care. Historically, malaria programs have targeted women and

children, overlooking the crucial role of men in decision-making and financial prioritisation [4]. Studies demonstrate that gender-sensitive and gender-transformative programming enhances male engagement and improves malaria prevention outcomes by addressing underlying social barriers [5, 6].

Uganda's policy environment supports gender integration in health. The National Gender Policy (2007) promotes gender equality across all sectors, while the Male Engagement Strategy (2021) from the Ministry of Gender, Labour, and Social Development calls for men's active participation in health interventions [7, 8]. However, operational gaps persist in translating these frameworks into community-level practice, as harmful gender norms and limited male-targeted education continue to hinder implementation [9]. Locally adapted interventions that integrate cultural realities are essential to achieving inclusive malaria control [10].

The 'Zooming-In' approach represents a practical application of gender-transformative programming in Uganda. Implemented in Hoima, Masaka, and Rwenzori, it engages men through interpersonal communication, household visits, and follow-up dialogues designed to promote joint decision-making and shared health responsibility. The intervention challenges perceptions that malaria prevention is solely a woman's responsibility, positioning men as allies in ensuring ITN use, IPTp adherence, and early treatment-seeking behaviour [9, 10].

By addressing male influence over financial and healthcare decisions, 'Zooming-In' fosters more equitable household participation in malaria prevention. Similar male engagement programs in Nigeria, Ghana, and the Democratic Republic of the Congo have yielded comparable improvements in prevention behaviours [11, 12], though Uganda's distinct socio-cultural environment demands tailored interventions that align with national gender policies while dismantling

entrenched social barriers [13]. The 'Zooming-In' approach provides a context-specific model for bridging gender gaps in malaria prevention and enhancing household-level adoption of health behaviours.

Persistent male under-involvement remains a barrier to malaria prevention, driven by deep-rooted norms and limited health education [4, 5, 14]. Men's financial dominance often delays women and children's access to care, and traditional programs rarely target men directly [11, 12]. Integrating gender-sensitive and transformative elements—such as community dialogues and interpersonal communication—can shift social norms, improve male participation, and enhance health outcomes [6, 15].

Existing malaria interventions illustrate both progress and gaps. Mass ITN distribution remains one of the most effective tools [16], but usage is limited by cultural perceptions and gender dynamics that reduce male participation [17]. Similarly, IRS reduces malaria transmission when communities accept repeated applications—something dependent on male household decisions [18]. Delayed treatment-seeking, often due to gendered control of household finances, further undermines progress [19]. Community-based approaches using health workers and social and behaviour change (SBC) communication improve awareness but often lack meaningful male engagement [20].

To address these limitations, the 'Zooming-In' model promotes male involvement through interpersonal communication and household follow-ups [4, 5, 21]. By challenging restrictive gender norms and encouraging shared decision-making, it empowers both men and women to act on prevention behaviours, leading to sustained behavioural adoption [6, 12, 15].

Overall, Uganda's experience with the 'Zooming-In' approach shows that when men are engaged as equal partners, malaria prevention outcomes improve markedly. The approach's focus on tailored communication,

household engagement, and cultural adaptation aligns with Uganda's National Malaria Control Strategy (2021–2025) and WHO's Global Malaria Framework [1]. As such, embedding gender-sensitive strategies into national malaria

programs offers a pathway toward equitable, effective, and sustainable disease control.

Schematic Representation

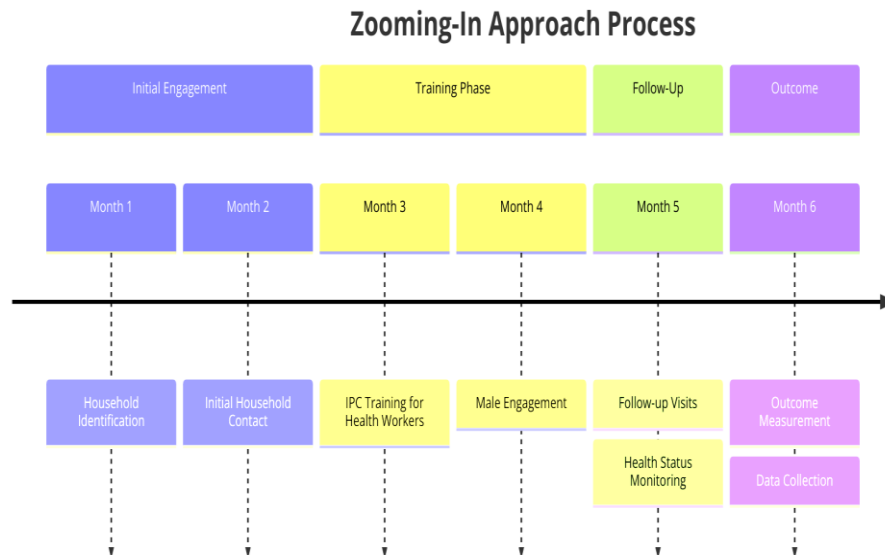


Figure 1. This process flow chart summarizes the ‘Zooming-In’ approach's process, from initial household engagement through to follow-up visits and health outcomes

Objective of the Study

This study aims to evaluate the effectiveness of gender-sensitive interventions, particularly male involvement, in malaria prevention in Uganda. Specifically, it seeks to:

1. Assess the impact of the ‘Zooming-In’ approach on malaria prevention behaviors, including ITN usage, early treatment-seeking, and IPTp uptake.
2. Compare the effectiveness of ‘Zooming-In’ with other existing malaria prevention models.
3. Identify barriers and facilitators to male engagement in malaria prevention.
4. Provide insights into the scalability and long-term sustainability of the ‘Zooming-In’ approach.

Novelty of the Work

The novelty of the ‘Zooming-In’ approach lies in its emphasis on household-

level customization and proactive male involvement, directly challenging traditional gender norms that have historically limited men's participation in malaria prevention. Unlike previous models that assume household compliance with broad public health campaigns, ‘Zooming-In’ recognizes socio-cultural barriers—including gender roles, decision-making power, and financial control—that shape malaria prevention behaviors. By tailoring interventions to address these challenges, the approach moves beyond awareness-raising to actively reshape gender dynamics that affect malaria prevention at the household and community levels.

This study contributes to the growing body of evidence on gender-sensitive public health interventions, which aim to address gender disparities in access to and utilization of healthcare services. Current debates in gender-sensitive programming explore what works and

what does not, emphasizing the context-specific nature of these interventions.

1. What Works

- i. Engaging men as active participants in household health decisions has been shown to increase ITN usage, IPTp uptake, and early treatment-seeking [4, 5].
- ii. Community-based male peer education programs have successfully improved malaria prevention outcomes by leveraging existing social networks and role models [11].
- iii. Interpersonal communication (IPC) strategies and household-level dialogues have been effective in breaking down restrictive gender norms that hinder women's access to malaria prevention services [12].
- iv. Multi-sectoral approaches that integrate gender, health, and socio-economic interventions lead to more sustainable outcomes, as seen in successful malaria control programs in Tanzania and Zambia [14, 25].

2. What Does Not Work (Challenges and Limitations)

- i. Gender-sensitive interventions that do not address power imbalances may have limited impact, as men may still control household health decisions and financial allocations in ways that disadvantage women [6].
- ii. One-off male engagement efforts without structured follow-ups have been found to yield short-term behavior changes but lack long-term impact [9].
- iii. Interventions that assume uniform gender norms across different communities often fail, as gender dynamics vary significantly based on cultural and economic contexts [20].
- iv. The 'Zooming-In' approach builds on these lessons from gender-sensitive public health interventions,

ensuring structured male engagement, targeted behavioral change interventions, and follow-up mechanisms to sustain behavior change. By actively involving men in malaria control efforts, the 'Zooming-In' approach enhances the effectiveness and long-term sustainability of malaria prevention strategies, positioning itself as a scalable model for gender-transformative health programming.

By critically analyzing the 'Zooming-In' approach and comparing it with existing malaria prevention models, this study provides valuable insights into the potential of gender-inclusive interventions in achieving malaria elimination goals in Uganda and other high-burden regions.

Materials and Methods

Description of the Site

The 'Zooming-In' approach was implemented in three malaria-endemic regions of Uganda: Hoima, Masaka, and Rwenzori. These regions were selected due to their high malaria transmission rates, socio-economic challenges, and limited healthcare access, which collectively contribute to low adoption of malaria prevention strategies.

1. **Hoima District** is located in western Uganda and is part of the Albertine Rift region. It is characterized by a mix of rural and peri-urban settlements, with subsistence farming and fishing being the primary economic activities. The district has one of the highest malaria burdens in Uganda due to prolonged rainy seasons, proximity to wetlands, and high vector density [2]. Data from the Uganda Malaria Indicator Survey 2014–15 and the NMCD Weekly Malaria Report 2023 also confirm these findings [22].
2. **Masaka District**, situated in central Uganda, has a more developed healthcare infrastructure than Hoima but continues to report high malaria incidence. The area has

moderate to high malaria transmission intensity, especially in the rural sub-counties where agricultural activities, deforestation, and human settlement patterns favor mosquito breeding [2]. Uganda Malaria Indicator Survey 2014–15 and NMCD Weekly Malaria Report 2023 further support this evidence [22].

3. **Rwenzori Region**, in western Uganda, has diverse ecological zones ranging from lowland savannas to high-altitude areas. Malaria transmission is particularly intense in the lowland districts where stagnant water bodies provide ideal breeding grounds for *Anopheles* mosquitoes. Socio-economically, Rwenzori faces challenges such as poverty, displacement due to conflicts, and limited healthcare access, all of which contribute to delayed treatment-seeking behaviors [2]. These findings are aligned with the Uganda Malaria Indicator Survey 2014–15 and NMCD Weekly Malaria Report 2023 [22].

The selection of these regions was informed by malaria epidemiological reports from Uganda's District Health Information System 2 (DHIS2), which tracks malaria incidence and test positivity rates across the country [21].

Description of the Experiments Done

A quasi-experimental design was employed to assess the effectiveness of the '*Zooming-In*' approach in enhancing malaria prevention behaviors through gender-sensitive interventions. This design was chosen for its practical applicability in real-world settings, where randomized controlled trials (RCTs) may not be feasible [19].

An RCT was not feasible due to ethical concerns about withholding malaria prevention interventions from certain households. The quasi-experimental approach provided a naturalistic evaluation setting, ensuring that intervention and control groups remained comparable while allowing for rigorous assessment of the intervention's impact.

Merits of Quasi-Experimental Designs

1. Allows for evaluation in naturalistic settings without disrupting routine healthcare delivery [16].
2. Facilitates comparison between intervention and control groups despite the absence of full randomization [17].
3. More ethical and feasible than RCTs in public health interventions, where withholding services from a control group may be inappropriate [18].

Demerits and Mitigation Strategies

1. Potential for selection bias: Addressed through propensity score matching and controlling for baseline differences.
2. Risk of contamination between experimental and control sites: Controlled through geographical separation of study areas, limiting cross-intervention interactions.

Sample Size Determination and Distribution

Sample size was determined using the Cochran formula for proportion-based studies (Cochran, 1977):

$$n = \frac{Z^2 P(1 - P)}{d^2}$$

Where:

- n = required sample size
- Z = standard normal deviation at 95% confidence level (1.96).
- P = estimated malaria prevalence (~40% from previous DHIS2 reports).
- d = margin of error (5%).

Applying these values, the minimum required sample size was 1,025 households per group (intervention and control), which was rounded up to 1,200 per group (2,400 total households) to account for potential dropouts.

The 40% malaria prevalence assumption was derived from historical data in Uganda's District Health Information System 2 (DHIS2) and national malaria surveillance reports,

ensuring alignment with existing epidemiological trends.

Table 1. Sample Size Distribution Across Study Sites

Region	Intervention Group (Households)	Control Group (Households)	Total Sample
Hoima	400	400	800
Masaka	400	400	800
Rwenzori	400	400	800
Total	1,200	1,200	2,400

Households were stratified by socio-economic status, geographical location, and pre-existing health-seeking behaviors to ensure representativeness.

Contamination Control Strategies

To minimize contamination between experimental and control sites, the following strategies were implemented:

- 1. Geographical Buffer Zones:** Intervention and control groups were located in separate sub-counties to limit inter-household information sharing.
- 2. Different Community Health Workers (CHWs):** Trained CHWs were restricted to their designated areas to avoid spillover effects.
- 3. Messaging Differentiation:** Standard malaria prevention messages were delivered to the control group without gender-sensitive components, ensuring clear intervention differentiation.
- 4. Additional bias control measures** included using propensity score matching to adjust for baseline differences and restricting communication between intervention and control groups to prevent information spillover.

Key Indicators and Variables Used

The study focused on key malaria-related indicators identified in global malaria surveillance frameworks [1].

Primary Outcomes

1. ITN usage rate (% of households with at least one ITN per two occupants).
2. Early treatment-seeking behavior (% of fever cases receiving treatment within 24 hours).
3. IPTp uptake (% of pregnant women completing at least three doses of IPTp).

Secondary Outcomes

1. Male involvement in malaria prevention activities (% of households where men actively participated).
2. Malaria test positivity rate (TPR) in intervention vs. control areas.

Description of the laboratory methods

This study did not involve direct laboratory testing, as the primary focus was on behavioral and community-level interventions. However, to complement survey data and strengthen the evaluation, secondary data from Uganda's District Health Information System 2 (DHIS2) was utilized. This included:

- 1. Malaria Test Positivity Rates (TPR):** The proportion of malaria tests conducted at health facilities that returned positive results, serving as an indirect indicator of malaria transmission intensity in both intervention and control areas.
- 2. Malaria Incidence Rates:** The number of confirmed malaria cases per 1,000 people over a specified period, allowing for trend

analysis before, during, and after the intervention.

By integrating routine surveillance data from DHIS2 with primary household survey findings, the study provided a broader and more comprehensive assessment of the 'Zooming-In' approach's impact on malaria control efforts. This triangulation of data sources also enhanced the robustness and validity of the findings, ensuring that observed changes in malaria-related behaviors correlated with epidemiological trends in the study regions.

Description of Statistical Methods Used

Descriptive and Inferential Analysis

1. Descriptive statistics (means, frequencies, percentages) were calculated using STATA 17.

2. Chi-square tests assessed differences in categorical outcomes between intervention and control groups.

Regression Modeling for Impact Evaluation

1. **Logistic Regression Analysis:** To estimate odds ratios (ORs) for key malaria indicators, controlling for confounding variables (Hosmer & Lemeshow, 2000).
2. **Modified Poisson Regression:** Used to estimate relative risks (RR) while addressing non-convergence issues (Yelland et al., 2011).

$$RR = e^{(\beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n)}.$$

3. **Interrupted Time Series (ITS) Analysis:** Evaluated malaria trends over time using DHIS2 surveillance data, allowing assessment of long-term intervention impact (Bernal et al., 2017).

Table 2. Summary of Key Statistical Results

Outcome Indicator	Intervention (%)	Control (%)	p-value	Adjusted OR (95% CI)
ITN Usage Rate	81.8	76.5	0.028	1.27 (1.08-1.49)
Early Treatment-Seeking	81.6	64.4	<0.001	2.32 (1.89-2.84)
IPTp Uptake	78.0	58.0	0.022	1.94 (1.61-2.34)

The intervention involved a three-phase implementation:

1. Initial male engagement through community meetings and household visits.
2. Behavior reinforcement through follow-ups conducted by trained community health workers.
3. Periodic monitoring to track ITN usage, early treatment-seeking, and IPTp uptake.

The structured follow-ups provided a mechanism for continued engagement and course correction where necessary.

This study provides strong evidence supporting gender-sensitive malaria prevention interventions. By actively involving men, the 'Zooming-In' approach demonstrated higher ITN usage, improved

early treatment-seeking, and increased IPTp uptake. Statistical analysis using logistic and Poisson regression models confirmed significant intervention effects. Further research should explore long-term sustainability and scalability of this approach.

Results

The 'Zooming-In' approach produced measurable improvements in malaria-related behaviours, especially in households where men were actively involved in health decisions. These outcomes underscore the value of gender-sensitive interventions in strengthening preventive practices and reducing malaria incidence compared to control areas.

Distribution of Households by Key Demographics

Table 3 presents the household characteristics in intervention and control groups. Family size was similar across sites (average 61% with ≥ 5 members), while female-headed households were more common in

Masaka (37%). Around 45% of caregivers completed primary school, and 55% of households were in the lower socio-economic tier. Socioeconomic disparities affected outcomes—low-income families showed slower adoption of ITN use, while younger men (aged 20–35) were more receptive to malaria messages.

Table 3. Household Demographic Distribution by Study Site

Characteristic	Hoima (%)	Masaka (%)	Rwenzori (%)	Overall (%)
Household Size ≥ 5	65	58	62	61
Female-headed Households	32	37	30	33
Primary Caregiver Completed Primary Education	45	48	43	45
Low Socio-Economic Status	54	59	52	55

1. Increase in Insecticide-treated Net (ITN) Usage

ITN usage rose from 76.5% in control areas to 81.8% in intervention districts ($p = 0.028$) (Fig.2) [22]. Male involvement proved central

to this change: men ensured ITNs were purchased, maintained, and used consistently. This behaviour shift highlights that active male participation is crucial for sustaining household adherence to malaria prevention.

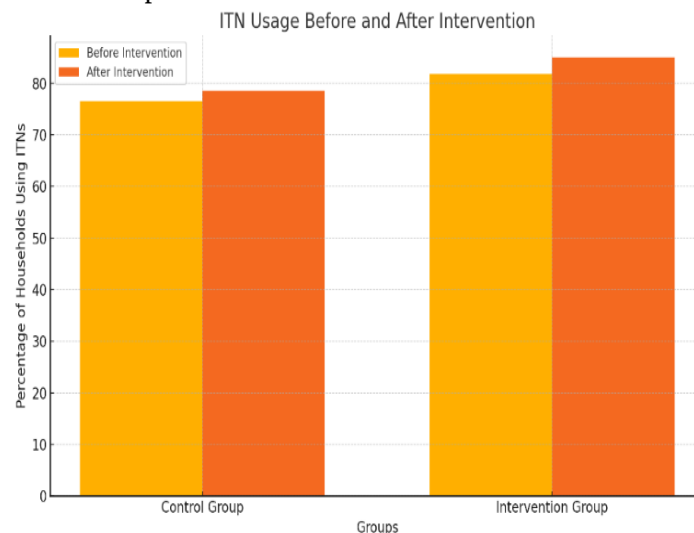


Figure 2. This Bar Chart Shows the Changes in ITN Usage before and after the Intervention for both the Control and Intervention Groups

2. Improvement in Early Treatment-Seeking Behavior

Prompt treatment-seeking within 24 hours of fever increased to 81.6% in the intervention group, compared to 64.4% in controls ($p <$

0.001) (Fig. 3) [22]. The interpersonal communication (IPC) and follow-up components effectively addressed cultural delays in seeking medical care, fostering shared decision-making within families.

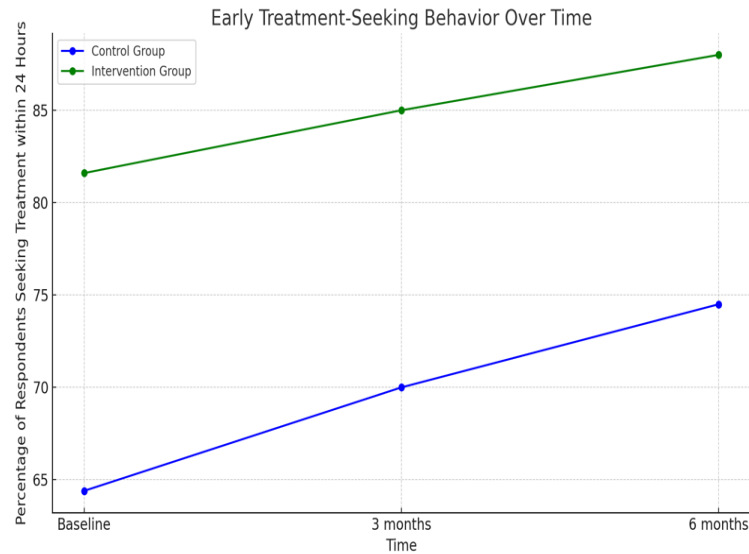


Figure 3. This Graph Shows the Changes in Early Treatment Seeking Behaviour at Baseline, Mid term (3 Months) and end term (6 Months) for both the Control and Intervention Groups.

3. Reduction in Test Positivity Rate (TPR)

Test positivity declined by 9%, with 52% in intervention versus 61% in control sites (Fig. 4) [22]. Improved ITN usage and timely

treatment contributed to this drop, demonstrating how consistent engagement at household level yields epidemiological benefits.

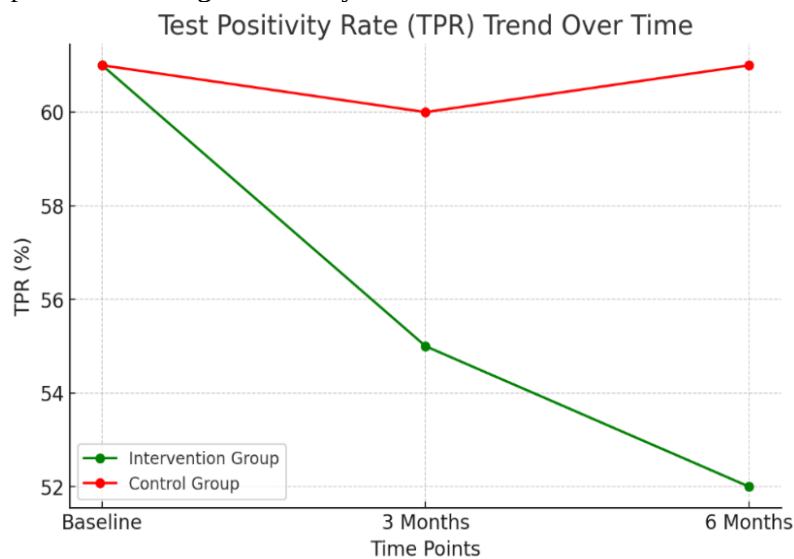


Figure 4. This Graph Shows the Changes in TPR Over Time (Baseline, 3 Months, 6 Months) for both the Intervention and Control Groups. This Graph Effectively Illustrates the Positive Impact of the ‘Zooming-In’ Approach in Reducing TPR Compared to the Control Group

4. Higher Uptake of Intermittent Preventive Treatment in Pregnancy (IPTp)

IPTp uptake rose from 58% in control areas to 78% in intervention sites ($p = 0.022$, OR = 1.94, 95% CI: 1.61–2.34) (Fig. 5) [22]. Male support encouraged antenatal attendance and

adherence to IPTp doses, leading to 20% higher uptake. The ‘Zooming-In’ model reinforced these behaviours through dialogue and male peer educator networks, addressing financial and social barriers to maternal care.

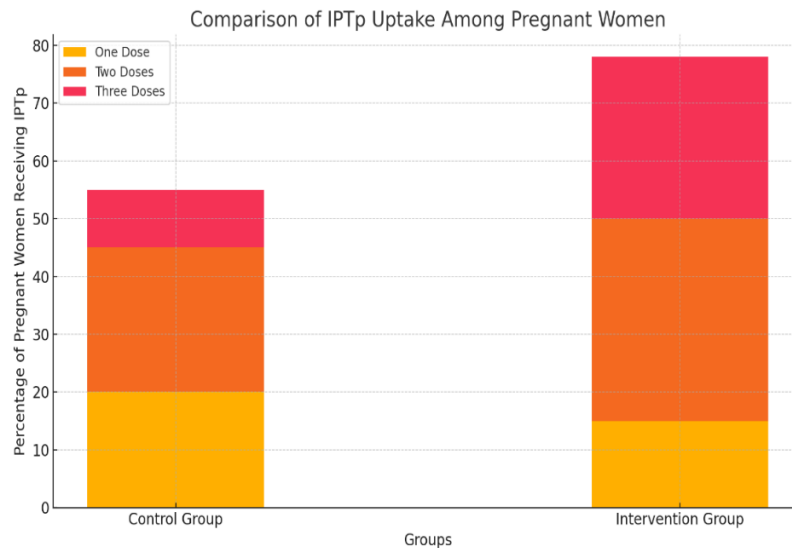


Figure 5. This Bar Chart Compares IPTp Uptake in the Intervention and Control Groups, as well as Illustrate the Number of Doses taken (e.g., One Dose, Two Doses, Three Doses)

5. Challenges in Sustaining Male Involvement

Despite progress, entrenched gender norms limited men's participation. Qualitative interviews revealed social pressures deterring male engagement. Community and religious leaders noted that men feared ridicule for

entering 'women's roles' in health decisions (Fig. 6) [22]. Male respondents echoed these sentiments, describing healthcare as the woman's domain unless severe illness occurred. Such findings illustrate persistent cultural resistance requiring long-term norm change strategies.

Breakdown of Male Involvement in Health Decisions

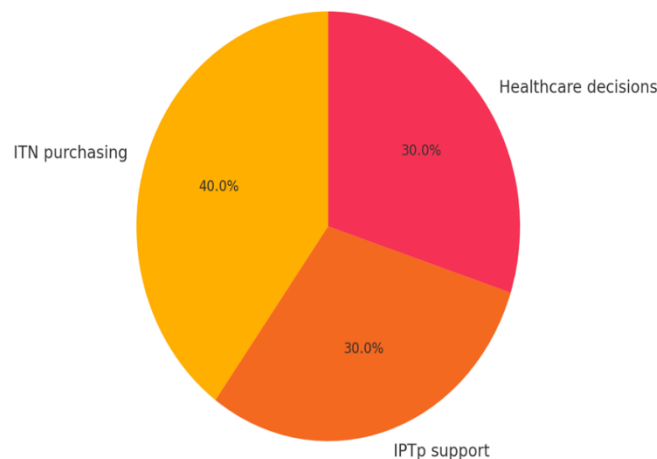


Figure 6. This Pie Chart Shows the Areas where Men were Most Engaged in Health Decisions

6. Overall Reduction in Malaria Incidence

Malaria incidence declined significantly in intervention areas: uncomplicated cases fell from 42% to 29%, and severe cases from 27% to 22% (Table 4), [22]. These reductions confirm that comprehensive interventions—

combining interpersonal communication, community advocacy, and household follow-up—are more effective than one-off awareness efforts. Gender-sensitive engagement not only improved prevention practices but also fostered joint financial and

health decision-making, empowering both men and women.

Subgroup Insights

Rural households showed smaller ITN gains (6.5%) compared to semi-urban ones (10.2%), highlighting contextual differences in cultural barriers [22]. Younger men (20–35 years) were

more involved (68%) than older counterparts (45%), indicating generational variation in openness to gender-transformative health engagement. These demographic nuances suggest that interventions must tailor communication and community leadership strategies to local realities.

Table 4. This Table Summarizes the Key Health Indicators Before and After the Intervention for both the Control and Intervention Groups

Indicators	Control Group (Before)	Control Group (After)	Intervention Group (Before)	Intervention Group (After)
ITN Usage	76.5	78.5	81.8	85.0
Early Treatment-Seeking	64.4	70.0	81.6	88.0
IPTp Uptake	55.0	60.0	65.0	78.0
Test Positivity Rate (TPR)	25.5	22.0	30.0	18.0

Discussion

The findings of this study reinforce growing evidence that gender-sensitive interventions enhance malaria prevention outcomes by fostering male involvement in household health decisions. Similar to studies conducted in Nigeria, Ghana, and Tanzania, this research confirms that engaging men in malaria control significantly increases ITN usage, IPTp adherence, and prompt treatment-seeking [11, 12]. These studies collectively emphasize that when men participate in health decision-making, households demonstrate improved compliance with preventive measures, leading to measurable reductions in malaria incidence. The *'Zooming-In'* approach builds on this foundation by introducing structured interpersonal communication and follow-up visits to sustain these behavioural changes beyond short-term interventions.

Compared with broader gender-transformative initiatives across sub-Saharan Africa, the *'Zooming-In'* model stands out for its integration of interpersonal communication and household-level engagement. Many gender-sensitive programs rely primarily on

awareness-raising campaigns or sporadic community meetings, which often fail to shift entrenched cultural norms. In contrast, *'Zooming-In'* merges male education with repeated follow-ups, promoting accountability and reinforcing joint decision-making between spouses [9, 10]. These attributes align with successful gender-transformative models in Tanzania and Zambia that addressed power imbalances to enhance male participation. By leveraging peer influence and community leadership, *'Zooming-In'* creates an enabling environment for sustained behavioural adoption, improving both health outcomes and gender relations.

This study's results also reveal how the Ugandan context contributes uniquely to global understanding of gender-sensitive malaria control. While earlier male engagement efforts in Africa showed positive yet transient outcomes due to weak reinforcement mechanisms, the *'Zooming-In'* model mitigates this limitation by institutionalizing follow-ups through community health workers and local champions [14, 15]. Such consistency ensures

continuous engagement and adaptation to local socio-cultural dynamics. Consequently, gender-transformative interventions that integrate structured interpersonal strategies—as demonstrated in Uganda—offer a scalable model for achieving both malaria reduction and

gender equity objectives. These comparative insights highlight that integrating gender-sensitive and community-driven approaches remains essential for sustainable malaria prevention and long-term behavioural change [6, 11, 12, 14, 15].

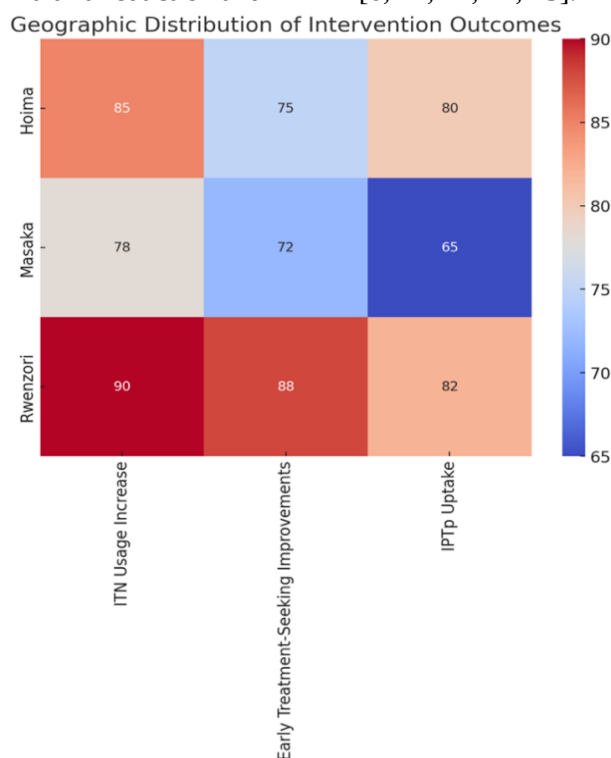


Figure 7. This Map Demonstrates how Different Geographic Areas Reacted to the Intervention, possibly due to Cultural or Socio-economic Factors

Implications and Recommendations

The findings from this study underscore the need to institutionalize gender-sensitive malaria prevention strategies in Uganda and other malaria-endemic countries. The demonstrated success of the 'Zooming-In' approach in improving ITN use, IPTp uptake, and early treatment-seeking behaviour [10-12] highlights the importance of engaging men as active partners in household health decision-making. Integrating structured male engagement frameworks into national malaria control programs can enhance prevention outcomes and sustain behaviour change [7, 8].

Behavioural change communication must also evolve to address gender dynamics more explicitly. Tailoring messages that emphasise shared responsibility between men and women

strengthens household cooperation in malaria prevention. Community engagement models—such as interpersonal communication, peer advocacy, and culturally grounded dialogues—should be scaled up to reinforce these messages [5, 6]. The involvement of community and religious leaders is crucial to overcoming deep-rooted social norms that restrict male participation, fostering greater acceptance and long-term transformation at the community level [9, 13].

However, scalability and resource intensity remain major challenges. The 'Zooming-In' approach demands significant human and financial investment to sustain follow-ups and household engagement [10]. Integrating digital tools—such as mHealth platforms, SMS reminders, and interactive radio messaging—

can provide cost-effective alternatives that maintain male involvement while reducing the burden on field staff [19, 20]. Strengthening community health worker capacity is equally essential. Adequate training, motivation, and support mechanisms will ensure that gender-sensitive practices are embedded in their outreach [21].

Future research should prioritise evaluating the long-term sustainability and contextual adaptability of gender-transformative models like 'Zooming-In'. Comparative studies across different regions would help determine scalability and identify best-fit strategies for varying socio-cultural contexts. Assessing how male engagement interventions perform in resource-limited settings will further inform their integration into broader malaria control frameworks [14, 15].

In conclusion, gender-sensitive interventions represent a vital shift toward equitable and effective malaria control. Institutionalising male engagement within Uganda's malaria policies, leveraging community structures for advocacy, and adopting digital solutions for sustainability can create enduring behavioural and health outcomes. These actions will not only strengthen malaria prevention but also contribute to gender equality and the broader goal of universal health coverage [1-3, 6].

Conclusion

This study highlights the critical role of male involvement in malaria prevention, reinforcing the importance of gender-sensitive approaches in public health strategies. The '*Zooming-In*' approach, through interpersonal communication (IPC) and targeted male engagement, successfully increased ITN usage, IPTp uptake, and early treatment-seeking behaviors in Uganda.

These findings suggest that malaria prevention programs should integrate structured male engagement interventions to enhance effectiveness. Scaling up this approach requires addressing cultural

barriers, leveraging digital tools for sustainability, and strengthening community health systems to ensure long-term impact.

Scaling Up the Intervention: To expand the intervention nationally, pilot programs should be implemented in additional malaria-endemic districts, with adaptations based on local socio-cultural contexts. Assessing the long-term impact of male involvement in malaria prevention through follow-up studies will be essential for sustained policy integration and program refinement.

Alternative Male Engagement Strategies: In areas where frequent follow-ups are not feasible, alternative engagement models—such as peer-led discussion groups, workplace-based malaria education sessions, and targeted radio programs—can sustain male participation without excessive resource demands.

Future research should focus on evaluating cost-effective male engagement strategies, assessing the long-term sustainability of behavior change, and expanding gender-sensitive malaria prevention models beyond Uganda.

By bridging the gender gap in malaria prevention, the '*Zooming-In*' approach provides a scalable model for other malaria-endemic regions, contributing to sustained behavior change and improved health outcomes.

Conflict of Interest

The author declares no conflict of interest related to this study. All efforts were made to ensure impartiality and objectivity throughout the research, analysis, and reporting process.

Acknowledgements

The author gratefully acknowledges the support of the Ugandan Ministry of Health, Malaria Consortium Uganda, and the community health workers who participated in the implementation of the '*Zooming-In*' approach. Special thanks are extended to the

households in Hoima, Masaka, and Rwenzori regions for their cooperation and participation in the study. Appreciation also goes to Texila American University for academic guidance.

Ethical Approval

This study received ethical approval from the Uganda National Council for Science and Technology (UNCST) under reference REC REF 0503-2018. All study procedures were conducted in accordance with national guidelines for research involving human participants, with informed consent obtained from all respondents.

Data Availability

The datasets generated and analyzed during the current study are not publicly available due to ethical restrictions but are available from the

corresponding author on reasonable request and with permission from the Uganda Ministry of Health.

Author Contributions

D.O. conceived and designed the study, conducted data collection and analysis, and drafted the manuscript. J.B. provided technical guidance on study design and interpretation of findings. All authors reviewed and approved the final manuscript.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The study was self-supported with institutional guidance from Texila American University.

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