



Review Article

Enhancing Malaria Prevention in Cameroon Through Community Participation: An in-Depth Review

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Abstract: Despite 66 percent reduction in mortality between 2000 and 2015, malaria remains a major global public health problem, affecting mostly Sub-Saharan Africa. Cameroon remains endemic to malaria, with about 41 percent suffering at least one episode of malaria, annual overall mortality of 30 to 35 percent and 67 percent childhood mortality. Cameroon government's subsidy on artemisinin combination therapy (ACT) for uncomplicated malaria, intermittent preventive treatment for pregnant women (IPTp), free distribution of insecticide treated bed nets (ITNs) to pregnant women and under-fives have been more of a top-down approach, with the affected communities mainly at the receiving end. Challenges of failed adherence to test results, drug and insecticide resistance, substandard and self-medication, low ITN ownership and utilisation have been identified, especially in the rural areas. This study reviews malaria prevention in Cameroon and proposes community based context-specific complementary interventions strategies that will promote community participation in prevention and mitigate the effects of poverty towards achievement of the sustainable development goals targets for malaria. The study involved an in-depth review of secondary data from electronic and non-electronic documents. Electronic search was done in Global Health, PubMed, governmental and non-governmental organisation websites, journals and google scholar. Non-electronic documents from the University of Leeds and World Health Organisation (WHO), Geneva libraries were also used. A conceptual framework on integrated community-based approach on intervention to prevent neglected tropical diseases and infectious diseases of poverty was adapted and used, while different intervention strategies were analysed. A total of 96 publications were eligible for inclusion. Analysis of the factors influencing malaria prevention in Cameroon, reveals that current measures alone are insufficient. Therefore, a combination of multiple delivery strategies using an integrated community-based approach is likely to be more effective in breaking the transmission cycle than single programme interventions. Concurrent implementation of community mobilisation through social groups and Village Development Committees, education on house screening, training of mothers and caregivers and health promotion through environmental management were recommended as the best and most feasible strategies to complement current interventions in Cameroon.

Keywords: Malaria, Prevention, Community, Participation

1. Introduction

Despite 66% reduction in mortality between 2000 and 2015, [1] malaria remains a major global public health problem, [2] with an estimated 214 million new cases and 438,000 deaths in 2015. Sub-Saharan Africa (SSA) dominates global figures, [3] accounting for 80% of cases and 78% of deaths, with the greatest toll on children under five years of age. [1]

Over 90% of Cameroon's population are at risk of malaria, [4] with about 6 to 8 mosquito bites per person per night. [5] About 41% of the population suffers at least one episode of malaria each year, [4] with the highest mortality among women and under-fives. [1] Cameroon's Ministry of Public Health reported that malaria causes 30 to 35% of overall mortality [6] and 67% of annual childhood mortality. [7]

Plasmodium falciparum malaria contributes the highest number of cases, [1] causing 45 - 50% of all hospital consultations, [3] about 48% of hospital admissions, 30% of total morbidity, and affects about 40% of the poor in Cameroon annually. [2] Of the most malaria-endemic countries, Cameroon is ranked third in Central Africa and eleventh in Africa, [8] with a prevalence of 71 and 29 per 1000 in high and low transmission areas respectively. [1] Cameroon featured among African countries with insufficiently consistent data to evaluate malaria trends, [9] indicating likelihood of an underestimate of prevalence.

Cameroon has characteristic typical African desert with both tropical and equatorial climates which favour breeding of mosquitoes. [10] Malaria accounts for 26% of work absences and 40% of household health expenses. [11] Due to gender inequalities, low education and socio-economic status resulting from patriarchal structures, more women are trapped in a cycle of poverty, thereby compounding their susceptibility to infections. [12, 13] More than 54.3% of Cameroonians live below poverty line and government finances only about 28% of healthcare, with very high out-of-pocket payment, thereby creating inequality and inequity in access. [14]

Cameroon's National Malaria Control Programme (NMCP) responded through vector control measures, a one-time free distribution of insecticide-treated bed nets (ITNs) to pregnant women and under-fives, promoted the use of long-lasting insecticide treated bed nets (LLINs), Intermittent Preventive Treatment (IPTp) for pregnant women, [6] and artemisinin combination therapies (ACTs) as first line treatment against uncomplicated malaria. [6] This caused a drop in prevalence and mortality but such drop was not homogenous, [2, 11] with most parts of the country still highly endemic to malaria. [5]

Despite setbacks with current interventions (more of a top-bottom approach), and the continuous high prevalence of malaria, the role of affected communities seems virtually ignored. This study had as aim to review malaria prevention in Cameroon, analyse existing gaps and propose interventions strategies that would promote community participation to complement current preventive measures towards achievement of the sustainable development goals (SDGs) targets for malaria.

2. Methodology

2.1. Conceptual Framework

This study involved an in-depth review of secondary data. A conceptual framework for Community-based intervention to prevent Malaria (Figure 1) adapted from [15] based on an integrated community-based approach to prevent neglected tropical diseases and infectious diseases of poverty was adapted to analyse factors that influence community participation in malaria prevention in Cameroon. It pulls community education, mobilisation and health promotion together, for community-based interventions to prevent malaria in low resource settings, [16] interactively with individual perception and behaviour, health care system and governance structures. [15]

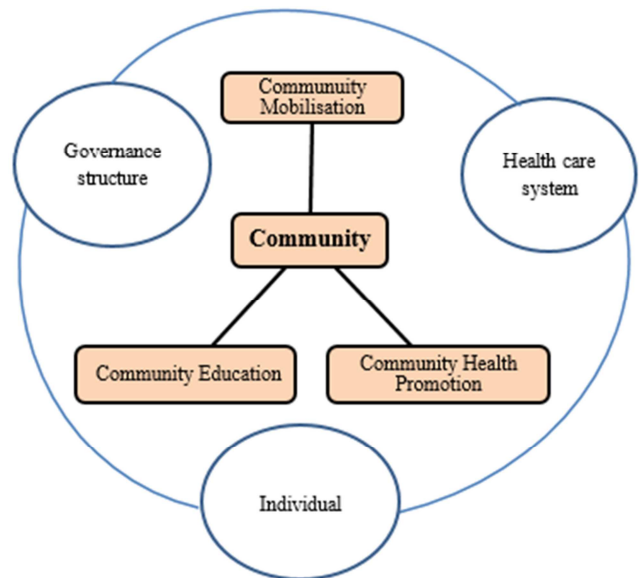


Figure 1. Conceptual Framework for Community-based intervention to prevent Malaria, Adapted from [15].

2.2. Factors Influencing the Prevalence of Malaria in Cameroon

a) Community Education on malaria prevention

Community health education is the spread of knowledge on prevention and control of diseases. [15] The ever-increasing shortage in health workers necessitates task-shifting to an alternate cadre of skilled and semi-skilled workers to provide services to the hard-to-reach groups. [17] This calls for education of target groups like school teachers, students and pupils, mothers, caregivers, and households to enhance community acceptability and promote behaviour change. [18]

b) Community Mobilisation on malaria prevention

Community mobilisation involves the formation of support groups, motivating and engaging whole communities to get involved in health interventions. [15] This promotes active participation [19] in changing their own norms to improve health, quite appropriate for community-based interventions

in multiple and low resource settings. [20] It is a community-specific facilitative process, sustainable and has been used in the developing world in expanding new ideas to promote behaviour change in different groups using different approaches. [21] Mobilisation of impoverished rural communities to participate in improving health reflects the underlying value for social justice, and promotes their contribution to decisions that affect them. [22]

c) Community Health Promotion to prevent malaria

It involves environmental modification and proper water, sanitation and hygiene (WASH) practices to control disease-causing agents such as mosquitoes and it is pivotal in breaking the infection cycle. [15] Community-based health promotion emphasises integrated and comprehensive primary prevention, through direct education and involvement of the general population in specific activities [20] such as environmental management and proper WASH. A synergistic implementation of these interventions is likely to improve knowledge, attitude and practice, and yield positive changes at the individual, household and community levels, with long term health benefits. [15]

d) Interacting Factors

Although individual behaviour, health care system and governance structure are not the main focus in this study, they are interconnected to and interact with community education, mobilisation and health promotion. Community health could be influenced by individual behaviour, perception [16] and willingness to change. [23] Health care systems address quality of service, access, equality, equity, capacity for better health care delivery and emergency preparedness. [16] Good governance structures and strong political commitment are pivotal in ensuring a well-functioning health system. [14]

2.3. Data Collection and Sources

Electronic searches were conducted in Global Health and PubMed databases which provided comprehensive international public health literature on tropical medicine, infectious diseases and vector control. Generic publications were accessed from Cameroon's Ministry of Public Health, NMCP, WHO, Cameroon Coalition Against Malaria (CCAM), Role Back Malaria, World Bank websites and google scholar while malaria journal provided subject-specific information. Relevant text-books and publications in the libraries of the University of Leeds and the WHO in Geneva provided additional information.

Appropriate keywords for a broad search strategy included "community participation*" OR "community involvement" OR "community engagement" OR "malaria*" OR Cameroon* OR Sub-Saharan Africa OR SSA. Hits from Ovid search engine were combined using the 'OR' and 'AND' functions to obtain the total number of articles (Table 1). The same procedure was used for each database and other sources and the results combined to give an overall total of 866 publications. Minor modification of the keywords were made for retrieval of information from websites.

Publications whose titles and abstracts address factors influencing community participation in malaria prevention were included, with priority given to peer-reviewed articles. To fit local contexts, literature was selected only from SSA. Only literature in both English and French (which the author understands), published after 2000 which address malaria targets within the Millennium Development Goals (MDGs) and into the SDGs were chosen. Publications which do not meet the above criteria were excluded.

Table 1. Summary of hits from databases and other sources.

Source	N°	Search term	Hits
Global health	1	Communit*	133338
	2	Involve* OR participat* OR act* OR service* OR engage*	932417
	3	Prevent* OR reduct* OR eradicat* OR eliminat* OR control* OR suppress* OR fight*	912563
	4	Malaria*	65463
	5	Cameroon* OR Sub-Saharan Africa* OR SSA*	16002
PubMed		1 AND 2 AND 3 AND 4 AND 5	111
	#1	Community	548728
	#2	Participation OR engagement OR involvement OR action OR service	1676110
	#3	Prevention OR eradication OR elimination OR reduction OR control OR suppress OR fight	4361345
	#4	Malaria	79094
Other sources	#5	Cameroon OR Sub-Saharan Africa OR SSA	176690
		#1 AND #2 AND #3 AND #4 AND #5	228
Total	527		866
Referenced			96

3. Results and Discussion

3.1. Selected Literature

A total of 866 publications identified were screened using the exclusion and inclusion criteria, and 96 were eligible for

inclusion and referenced as summarised in a Prisma Flow Diagram (Figure 2), adapted from. [24] Endnote X7 reference-management software was used to sort database literature for citation and referencing.

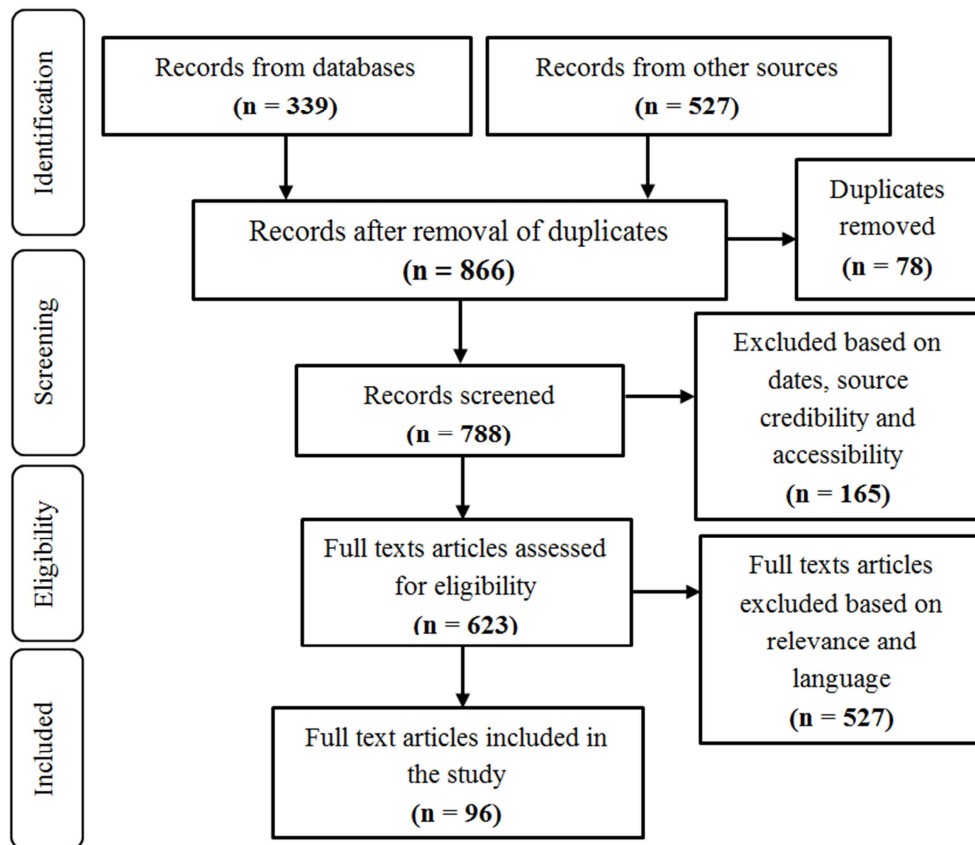


Figure 2. Prisma Flow Diagram, adapted from [24].

3.2. Weaknesses of the Current Malaria Prevention Measures in Cameroon

3.2.1. Case Management

Failed adherence to malaria test results had been reported in Cameroon, with about 45% of rapid diagnostic tests (RDT) in Cameroon poorly adhered to, and 70% of malaria negative febrile patients treated with ACT. [25] This promotes drug resistance [2] and reduces the proportion of patients receiving appropriate treatment, especially when stock is in short supply. [26]

Substandard, counterfeit and self-medication pose challenges to malaria interventions in Cameroon. [27, 28, 29] Poor legislation led to the influx of 32%, 10% and 13% of substandard and cheap chloroquine, quinine and sulphadoxine pyrimethamine respectively into Cameroon, [28] including ACT used as recommended first-line treatment of uncomplicated malaria. [30] These poor quality products encourage drug resistance, compromise disease treatment, cause disease progression and hinder the chances of proper treatment. [31] More than 60% of the population practice self-medication, [28, 29] with higher rates in the rural communities due to poverty and limited access to quality medicine. [32]

Drug resistance is equally a nightmare, and parasite resistance to drugs like chloroquine, sulphadoxine pyrimethamine and ACT [2] and its derivatives has rapidly spread and affected all the ten regions in Cameroon. [33, 34]

3.2.2. Vector Control

Despite the increase in ITN ownership from 33% in 2011 to 66% in 2013 for under-fives and pregnant women, malaria mortality paradoxically increased. [35] Resistance to insecticides such as permethrin and deltamethrin was reported, [36] and have limited the ability of current measures to effectively prevent malaria. [37]

Affordability remains a major impediment, with ITN cost noted as a major determinant of ownership and coverage, with 14.4% stating financial hardship as obstacle to ITN ownership. [4, 38] The free distribution of ITN (one per under-five child or pregnant woman) was a one-time activity and not sustained. [39] Many, especially the poor in rural communities could not afford to replace torn or expired ITNs, [23, 40] while others used them for fishing so as to provide food for their families. [41] These caused Cameroon to be ranked lowest of 29 African countries in ITN ownership and to feature among African countries with little or no progress in malaria prevention after ITN scale-up. [32, 42]

Despite the fact that 37% malaria infection occur in rural compared to 21% in urban areas, [43] access to ITN in the rural communities is very limited due to non-availability, [11, 44] creating inequity and inequality. There is therefore little information on social perception and malaria prevention situation in rural communities, [4] leading to low national ownership of 36%, with only 21% of under-fives sleeping under an ITN. [43]

Cultural unacceptability and limited knowledge have

contributed to low ownership and utilisation of ITNs. [40] Although all pregnant women in Ndop Health District in the North West knew malaria prevention measures, only 79.4% used them. [11] This was supported by 99% awareness in the Buea Health District in the South West Region where only 58% slept under ITNs, [39, 40] highly determined by individual knowledge and perception. [45]

Accessibility to vector control methods was a major problem particularly in the rural areas. Despite the administration of IPTp during antenatal visits, those especially in very remote rural areas who do not attend antenatal clinics were often left out of coverage. [6] The lack of purchasing power limits access to ITNs, [38] and equally push many to self-medicate on substandard and counterfeit medications when they cannot afford the more expensive and effective medications like ACT. [27, 28]

These weaknesses indicate that current measures are not enough to control malaria in Cameroon, [46] hence the need to promote community participation towards sustainable preventive measures.

3.3. Critical Analysis of Interventions Strategies to Prevent Malaria in Cameroon

With the weaknesses in vector control and case management, using self-help schemes by applying details to a multiplicity of simple participatory methods may be more successful and long-lasting. [47] Combining multiple integrated malaria prevention methods using community creativity, [48, 49] and enthusiasm about self-help indigenous projects have shown greater potential to break the transmission cycle than single programme interventions. [50] Therefore, performing community mobilisation, education and health promotion activities in collaboration with Community Health Workers (CHW), Community Health Officer (CHO) and Local District Health Service (LDHS) is likely to make rural communities initiators of malaria prevention programmes. [51] As shown in the Ladder of Community Participation (Figure 3), from [51] such communities graduate from recipients to owners.

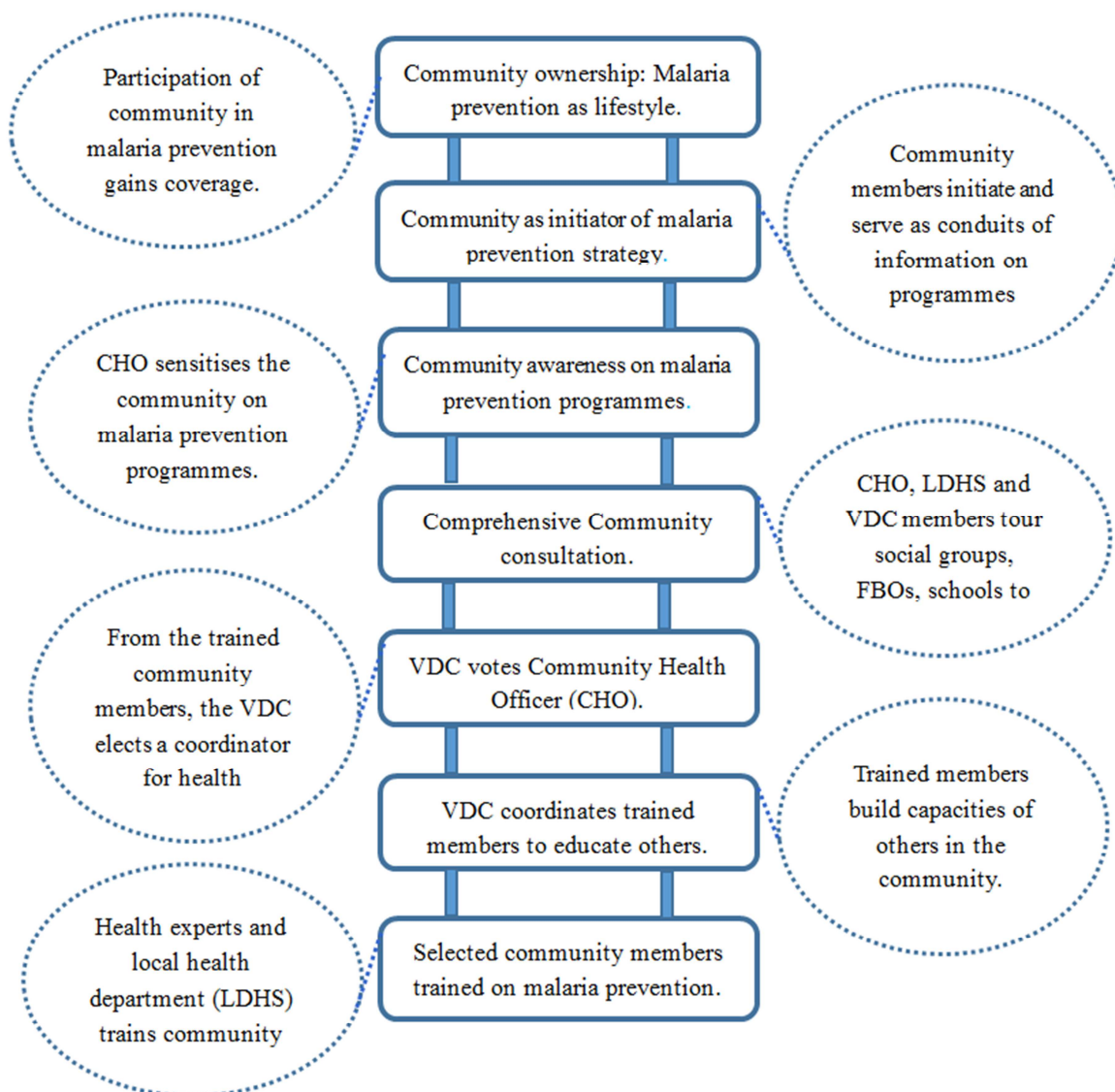


Figure 3. Ladder of Community Participation in malaria prevention, adapted from [51].

Despite being tested and proven as a potential complement to development efforts in Cameroon, [48] little use has been made of local creativity and community enthusiasm and participation in self-help indigenous projects. [50] There is therefore the need for a paradigm shift towards community level emphasis using an integrated approach to promote community participation to improve knowledge, attitude and practice in malaria prevention. [52] Also, considering that the greatest disease toll is in the impoverished rural communities, there is need for sustainable and cost-effective preventive approaches that might mitigate problems with accessibility, availability, affordability of preventive measures and reduce gender inequity.

To avoid false assumptions in selecting the best and interventions with greater prospects of successful implementation, technical effectiveness (how well an intervention interrupts the disease cycle), gender-cultural acceptability (the influence of gender and socio-cultural norms on the intervention), and financial feasibility (cost of an intervention in terms of “person-power”, money and materials) were used in the analysis. [53] Sustainability (ability to continue the intervention in the long term after withdrawal of donor support) and organisational feasibility (the ease or difficulty with which intervention can be implemented) also guided the analyses. [54]

3.3.1. Strategies to Address Community Education

Most intervention strategies in Cameroon are urban-focused, [4] meanwhile rural areas with limited knowledge carry the greatest disease burden. [11] A study reported that about 79.4% of pregnant women in Ndop Health District in the North West Region of Cameroon believe long-lasting insecticide treated bed nets (LLINs), 9.5% hygiene and sanitation, 6.3% insecticides and 4.8% believe drugs are malaria prevention methods. [4, 11] Also, 32.69% and 11.54% cited palm wine drinking and witchcraft respectively as causes of malaria in the North West Region, [33] while 40.3% of women knew correct malaria preventive methods compared to 20.2% men. [32] Malaria prevalence of 29.20% among females compared to 30.90% among males was found across all age groups in Mbakong Health Centre. [2] These could be attributed to knowledge from ante-natal clinics for women of reproductive age. [11]

About 82.5% of women used at least one preventive method while 12% combined ITNs, indoor residual spray (IRS), insecticides and sulphadoxine pyrimethamine. [38] Also, 99% regarded ITN as effective in malaria prevention, 47.0% possessed at least one ITN out of which 32% were potent while the rest were either torn or had never been retreated. [39] Despite the level of awareness, malaria prevalence remains relatively high in many parts of Cameroon, [11] corroborated by similar findings in Tanzania, indicating that knowledge is not matched with practice. [55] There is need for an integrated community education to correct wrong knowledge, clarify misinformation and wrong perception about malaria.

a) Encourage use of local insect repellents.

Due to high temperatures in Cameroon, many people dress so as to feel airy, thereby exposing themselves to mosquito bites. [56] This requires the use of repellents but modern types like diethyltoluamide are ineffective, unavailable and unaffordable particularly in the rural areas where they are most needed. This has caused many to resort to using local plant repellents. [57]

Mosquitoes do not bite 52% and 39% of those who use *Saccharum officinarum* and *Ocimum basilicum* (traditional plant repellents) respectively in Cameroon. [57] Similar studies have been reported in Kenya [56, 58] and soap-form (“Faso Soap”) repellents has also proven effective in Burkina Faso. [59]

Although, rural communities have the skills to prepare, it is considered laborious, [56] making it less organisationally feasible. It is also considered old-fashioned, stains dresses, has bad odour [57] and promotes gender inequity because the burden to prepare is often on the women, hence, unacceptable. Nevertheless, plant-derived repellents are cost-effective since plants are harvested at no cost, hence, financially feasible [57] but unsustainable because the plants are unlikely to be found nationwide.

b) Screening doors and windows and closing eaves of houses.

Screening was highly effective in reducing overall indoor mosquito density by 40% in Ethiopia, [60] 59% in Gambia [61] and a reduction in incidence of malaria and prevalence of anaemia. [62] Fitting nets or metal mesh on windows and a secondary door (automatically controlled by an elastic band or iron spring), could reduce mosquitoes entering houses. [63]

Less technology is required in screening, uses locally available materials, skills and labour, [64] hence, highly organisationally feasible. However, it might require purchase of nets if not freely distributed and may also require alteration or changes to existing buildings. [64] It has dual benefits of preventing entry of mosquitoes and other potentially harmful organisms while at same time keeps houses airy (when eaves are closed with mesh), hence, highly acceptable. [61] Also, screening has no gender inequity concerns because protection does not target individuals. [65] The possibility of using expired ITNs [64] and locally affordable and accessible materials like mud, palms and sticks, [60, 63] makes screening highly financially feasible and highly sustainable. [64]

c) Include malaria prevention in school curricula.

Malaria affects mostly children of school-going age, particularly under-fives, causing persistent cognitive defects. [66] Despite being recognized as key players in malaria control, little evidence exists on the involvement of school children in prevention activities. [67]

Teaching malaria lessons in primary schools effectively increased knowledge and made children in a Kenyan rural community change agents, [67] with significantly improved hygiene in school and home environments, hence, decreased malaria prevalence. However, it is less organisationally feasible because it will add workload, demand more teachers and face complex administrative procedures to update

curricula, [67] hence, likely unacceptable. Despite its long term benefit of improvement in school attendance and performance, it is not financially feasible because it demands additional expenditures on teachers and pupils. [66] However, it is highly sustainable because it cultivates behaviour change, with long term positive impacts. [67]

d) Training of mothers and caregivers

Mothers and caregivers spend most of their time with the under-fives who are most affected by malaria, hence, the need for them to gain skills in managing the disease, whose benefit will also reduce morbidity and mortality among women, especially those who are pregnant.

Rural community-based training of caregivers and mothers proved highly effective in significantly reducing under-five malaria morbidity and mortality [3, 32] and childhood mortality by 40% in Ethiopia. [68] Training increased pre to post-intervention knowledge among mothers on unclean environment as cause of malaria from about 50% to 64% ($p < 0.001$) in Nigeria. [69] Training a mother influences the entire household, and increases coverage. [69] Organisationally, it is highly feasible through partnership with district health services and community health workers (CHWs) and builds local capacity. [70]

It is highly acceptable when training is conducted in local languages (due to illiteracy like in rural areas), reduces gender-cultural barriers [69] and empowers the vulnerable. [71] Partnership with district health services makes it financially feasible through resource pooling as in Mali and Zambia. [70] Educating mothers and caregivers empowers them to share ideas and face future challenges, [69, 70] making it highly sustainable.

3.3.2. Strategies for Community Mobilisation

Cameroon's Ministry of Public Health used audio-visual and print media to mobilise and educate the public on ITNs in urban but not in the rural. [4] However, mass mobilisation and ITN ownership did not necessarily lead to a drop in malaria prevalence, [30] with Cameroon government raising concerns about lack of public collaboration in malaria prevention. [41] Despite the complexities of community mobilisation, it was very effective in disease prevention in the 1970s, [32] and should be contextualised to complement current efforts. Community mobilisation to fight diseases in rural communities of the North West Region of Cameroon had significant positive effects but has not been sustainably replicated, [21] and should therefore be promoted to valorise its potential role in malaria prevention.

a) Advocacy

Advocacy influences individuals and organisations across the board to increase awareness and commitment to interventions. [72] March of Dimes to eradicate poliomyelitis and Kenya NGO/Private Sector Alliance against Malaria (KeNAAM) have been effective in public health advocacy [73]. Advocacy through non-governmental organisations (NGOs) like CORE Group [74, 75] and CCAM benefits technical assistance [76] and is organisationally feasible. However, despite being effective in influencing decisions on

HIV treatment in South Africa, [75] media (print and audio-visual) advocacy have faced strict government control, low coverage and poor reading culture in Cameroon.

"Grassroots" or "bottom-up" advocacy breaks socio-cultural barriers, gender inequity, empowers communities and make everyone a protagonist in shaping their future in health, [72] hence, highly acceptable. However, it is financially less feasible because financial support is often not a guarantee. Gain of local, national and international support and policy influence can make it sustainable. [72]

b) Social groups

Social groups commonly called *njangis* have been a form of "traditional banking" in many parts of Africa, including Cameroon for years [21] but with limited involvement in healthcare due to lack of mobilisation. Mobilising *njangis* in rural communities promoted positive practices to fight diseases in Cameroon. [21] Training of women's groups by Plan International significantly reduced malaria in children in the East of Cameroon. [74] Due to its high effectiveness in promoting community health in Zimbabwe, it was replicated in post-conflict Sierra Leone and war-torn Northern Uganda. [77]

Social groups involve different segments of the community, with a pool of talents to identify and solve problems, [21, 51] hence, highly organisationally feasible. Mobilisation of community health clubs and *njangis* proved to be highly acceptable in promoting condom use, [20] and involves all members in group decision-making irrespective of gender. [77] Mobilising *njangis* as a socio-economic association of women, men and youths in Cameroon and other parts of Africa, [21] with individual financial contributions, is highly financially feasible. Social groups have a community development and social capital approach and strengthen individual and community's capacity to improve well-being, [21] hence highly sustainable.

c) Village Development Committees (VDC)

Despite their effectiveness to community development in Cameroon, VDCs' role has been mainly focused on roads, education and water projects, with little involvement in health due to lack of mobilisation. VDCs have potential to expand human capital development [78] and have proven to be highly effective in raising public awareness in prevention and control of endemic diseases. [79] They provide leadership to ensure proper coordination, [79] hence, have high organisational feasibility.

VDCs are local initiatives, built on relationship and trust, [51] promote social inclusion of disadvantaged groups, empower women, and reduce gender inequity, [78] hence, highly acceptable. Although VDCs have low human capital development, this capital is not an individual's but shared community resource. [78] Because they are built on trust to oversee project design, fund-raising, implementation and maintenance in a participatory manner, [79] they are highly financially feasible. Many VDC members also belong to other village-level institutions, creating a strong but underutilised social capital community-based network, [78] with potential development leaders and champions, [19] hence, highly sustainable.

d) Partnership

Partnership between rural communities and the public sector, non-governmental organisations (NGOs) and civil society organisations like faith-based organisations (FBOs) and community-based organisations enhances performance of health interventions. [74, 77, 80] Government partnership with FBOs was effective in providing care to 40% of HIV/AIDS patients in Lesotho and Zambia, [81] particularly among disadvantaged populations in low resource settings. [82] The Centre for Infectious Disease Control [83] found that partnership pools human resources and the involvement of competent experts ensures availability of people to drive the vision, [84] hence, organisationally feasible. However, it could face management challenges and conflicts of interest, with each organisation seeking to override the other. [80]

Some partners such as FBOs take services to the hard-to-reach people (in remote areas where they live, work and play), thereby, reducing barriers to access [85] hence, highly acceptable. FBOs gain respect and support of members and society at large, [85] making them acceptable. Although partnership pools resources together, [83] partners often prefer to invest more in their own programmes and contribute less to the pool, making it less financially feasible. However, it pools expertise, promotes knowledge exchange, builds capacity, nurtures and increases individual and organizations' motivation for growth, hence, sustainable. [83, 84]

3.3.3. Strategies for Community Health Promotion

Poor environmental hygiene accounted for 21.3% of malaria cases in many parts of Cameroon, [32] while hygiene and sanitation practices reduced malaria prevalence in Ndop Health District. [11] The CCAM, a national non-governmental organisation (NGO), expressed optimism of winning the fight against malaria if current measures are backed by health promotion practices. [86] Cameroon government recommended proper disposal of non-biodegradable plastic bags which block drainage systems leading to pools of water, thereby creating mosquito breeding sites. [41] Therefore, successful and sustainable prevention of malaria requires malaria-endemic populations to practice preventive measures like cleaning surroundings and draining standing water, [87] to reduce mosquito breeding sites. [32, 71]

a) Environmental Management

Environmental management, with individuals cleaning gutters to get rid of standing water, and clearing bushes, changes behaviour and leads to a healthier environment. [80]

Proper environmental management has been highly effective in preventing malaria in the tropics [88] and in reducing overall mortality by 50% within 3 – 5 years post-intervention in Zambia. [89] Environmental management through environmental cleanliness significantly increased malaria prevention from 40.4% to 54.5% ($p < 0.001$) in Nigeria. [69] Communicating environmental management through social gatherings in Tanzania improved knowledge on cleaning activities by 96% ($p < 0.001$). [90] Community human investment in the North West Region of Cameroon usually involved male and female working together, with less gender inequity, hence, highly acceptable. [32]

It is highly organisationally feasible because it follows a horizontal approach, [90] empowers local residents and strengthens local communities to deal with malaria locally. [91] The use of local skills and "person power" promoted ownership and reduced cost, making environmental management highly financially feasible. [90] Community participation in environmental management promoted individual behaviour change, [32] hence is highly sustainable in malaria prevention but 'grossly underused in most endemic areas. [49]

b) Water, Sanitation and Hygiene (WASH)

Despite being the most cost-effective means of preventing infectious diseases, [92] WASH practices dropped from 60% in 1990 to 47% in 2000 and attract less investment in SSA countries. [93] Improved WASH is highly effective in breaking the cycle of transmission and achieving sustained control, elimination, and possible eradication of malaria. WASH practices for child survival interventions in the 42 most affected countries averted 3% of child mortality. [94]

It uses local skills and labour, hence, organisationally feasible. WASH was found to be acceptable in Zimbabwe with 52% of members attending all 20 meetings. [77] It gives a sense of indigenous achievement, builds confidence and removes women from obscurity to become strong outspoken community leaders, hence, highly acceptable. [77]

With less than 1% of the Ministry of Health budget and less than 2% of household budgets, WASH was successfully implemented in Burkina Faso, [95] hence, highly financially feasible but might be costly locally. Participatory hygiene and sanitation transformation (PHAST) was widely acknowledged as a good and sustainable practice to tackle diseases in Southern Africa. [96] However, it is complex to implement, labour-intensive, and time-consuming.

4. Conclusion

Despite government efforts through free ITN distribution to pregnant women and under-fives, IPTp for pregnant women and ACT subsidy, malaria remains a major health burden in Cameroon. This is due to the weaknesses with case management (drug resistance, non-compliance to rapid diagnostic test (RDT) results, substandard and self-medications) and vector control (low ownership and utilisation of ITN and insecticide resistance). These are indicative of insufficiencies of current preventive measures resulting from focus on top-down approach and the neglect of the role of communities in malaria prevention.

From the discussions and analyses, community participation is imperative in complementing current interventions in Cameroon. Engaging VDCs and social groups, promoting the use of local insects repellent, house screening, training school pupils, mothers and caregivers on malaria prevention are likely to be more effective and sustainable. This also requires promoting knowledge and practice on environmental management and WASH and advocacy and partnership to gain support. Considering the poverty and poor access to health facilities in rural communities, knowledge and practice of malaria prevention are likely to make them

initiators and owners of prevention programmes.

The WHO recommended the combination of multiple delivery strategies to control malaria because no single intervention is sufficient to achieve the SDG targets for malaria. All the interventions analysed have proven successful to different levels in reducing malaria prevalence in different contexts. However, based on technical effectiveness, organisational feasibility, gender-cultural acceptability, financial feasibility and sustainability, the following have shown greater likelihood of successful implementation in the context of Cameroon.

1. House screening has dual benefits of preventing the entry of mosquitoes and other harmful organisms into houses.
2. Training mothers and caregivers empowers them and builds their capacities on malaria prevention and management, hence, an effective method in reducing mortality especially amongst under-fives, and particularly pregnant women.
3. Mobilising and engaging rural communities in an all-inclusive and facilitative manner to prevent malaria will encourage buy-in by the affected population.
4. Involving social groups such as *njangis*, community health clubs, women and youth meetings in malaria prevention will capture and engage different segments of the community in malaria prevention.
5. Engaging VDCs, identifying and training rural community leaders provides leadership for coordination, promotes ownership and participation in community-initiated malaria prevention interventions.
6. Community-based health promotion practice is the most appropriate method to prevent malaria in low resource settings.
7. Practicing environmental management through draining of standing water in gutters, mudbrick moulding sites and potholes, getting rid of empty containers and clearing bushes around houses sustainably empowers and strengthens rural communities to reduce mosquito breeding sites.

5. Limitations of the Study

Publications which are specific to community participation to prevent malaria in Cameroon and other SSA countries were very few, limiting an exhaustive study on the topic. Also, Cameroon's Ministry of Public Health website is not regularly updated, hence, possibility to have missed key and recent data. The reliability and credibility of information from grey literature might be questioned. Good articles in languages other than English and French were excluded. Using only data from 2000 limited the expanse of the review. Analysis using option appraisal is a subjective process and it is not necessarily the interventions with the best prospects that might succeed.

Abbreviations

ACT: Artemisinin Combination Therapy
CCAM: Cameroon Coalition against Malaria

FBOs: Faith-based Organisations

IPTp: Intermittent Preventive Treatment for pregnant women

ITN: Insecticide-Treated bed Nets

NMCP: National Malaria Control Programme

SDGs: Sustainable Development Goals

SSA: Sub-Saharan Africa

VDCs: Village Development Committees

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