

Review of Determinants of Low Insecticide Treated Net Utilization and Interventions to Improve Utilization Among Under-Fives in Ghana: An In-depth Review

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Abstract: Malaria continues to be a public health challenge in Ghana, especially among children under five years. World Health Organization recommends 80% usage of insecticide treated nets as it is one of the most effectiveness means of preventing malaria. However, usage of insecticide treated nets is only 47% among this vulnerable group in Ghana, which is below the recommended rate. This in-depth review aims to explore factors contributing to low net utilization among under-fives in Ghana and analyze interventions that have improved utilization in countries of similar context and discuss their applicability in Ghana. This review was based on secondary data. Using a conceptual framework, factors leading to low net usage among under-fives and interventions that have proved to increase usage in other countries were obtained from databases such as Global Health, Medline, PubMed and Web of Science and websites of organisations such as Ministry of Health, Ghana Health Service, Ministry of Education and World Health Organization. A feasibility assessment tool was applied in analysing each intervention identified and appraised based on their feasibility in Ghana. Increasing age of a child, lack of mechanisms for monitoring net usage at home, large family size, negative perception and attitude towards its usage and lack of education on its correct usage emerged as factors contributing to low net usage among children under five in Ghana. Having analysed these factors, in addition to feasible interventions in addressing low usage, malaria stakeholders in Ghana need to evaluate these interventions to assess how appropriate and applicable they are in Ghana to increase net usage among under-fives.

Keywords: Malaria, Under-fives, Insecticide Treated Net, Utilization

1. Introduction

Malaria continues to be a public health challenge in Ghana even with efforts from both national and international organisations. It is one of the major causes of morbidity and mortality among children under five years of age. It also results in nutritional deficiencies, low weight, anaemia and

school absenteeism [1]. About 2% of children who recover from cerebral malaria (complication of malaria infection) suffer long-term disorders like epilepsy which negatively affects their educational achievements [2, 3].

Families of children affected with malaria spend productive hours and other resources in taking care of these children, which tends to put extra financial burden on the

family [4]. In Ghana, malaria contributes to a loss of almost 10.6% of Disability Adjusted Life Years (DALYs) lost, costing about 6% Ghana's Gross Domestic Product annually [5]. The World Health Organization (WHO) recommends correct and continuous usage of Long Lasting Insecticide-treated Net (LLIN) as it prevents human-mosquito contact thereby reducing the incidence of malaria among children under five and child mortality by 20% [1, 6, 7].

Although utilization of ITNs among under-fives in sub-Saharan Africa witnessed an upsurge from 2% in 2000 to 68% in 2015, there is still a wide gap as WHO recommends 80% [8]. Acknowledging the continuing impact of malaria on affected children, families and health systems across the continent, WHO developed the 2016-2030 global technical strategy for malaria control involving three main components, thus; control, elimination and research, with the goal of reducing global malaria burden by 90% by 2030 [8].

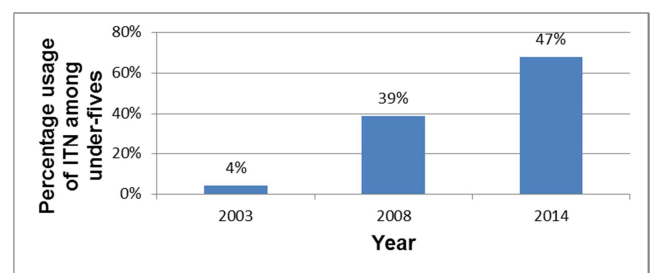
Globally, about 3.2 billion people are at risk of malaria infection. In 2015, about 214 million cases of malaria infection and estimated 438,000 deaths were reported. Out of these numbers, sub-Saharan Africa alone recorded 88% cases and 90% deaths. Although global malaria deaths among children under five decreased from 723,000 in 2000 to 306,000 in 2015, malaria was the fourth highest cause of deaths [9].

The entire Ghanaian population of 24.2 million (2010 census) is at risk of malaria infection with under-fives being the most vulnerable [10]. In Ghana, malaria accounted for about 38% of outpatient attendance and 27% of hospital admissions in various health facilities and 48.8% of under-five deaths in 2015, making it one of the major causes of morbidity and mortality [11].

Researchers and malaria stakeholders recommend a multiple approach towards malaria prevention, among which ITN utilization among under-fives is very crucial [12, 13]. There are limited studies on review of strategies to improve ITN usage among this vulnerable group [14] with no system in place to monitor household usage of ITN [15]. All these have contributed to low ITN usage. Ghana, in its attempt to reduce malaria infection has made efforts to ensure affordability, ownership and usage of ITN since the establishment of the Roll Back Malaria (RBM) initiative in 1999 [16]. In 2002, Government of Ghana relinquished taxes on importation of ITN and formulated its first ITN policy, which aimed to ensure that ITNs were freely distributed to pregnant women during their first antenatal attendance to improve household utilization among under-fives [17].

In 2013, the National Malaria Control Programme (NMCP), with funding from United States Agency for International Development (USAID) and United Nations Children Fund (UNICEF) held school-based free ITN distribution in nine regions in Ghana during which 1.2 million ITNs were freely distributed to primary school children [18]. Again, with funding from UNICEF, Department for International Development (DFID) and other donors, Ghana Health Service (GHS) freely distributed almost 12.5 million LLINs between December 2010 and

October 2012 in all ten regions of the country through universal mass distribution campaign [19]. These efforts have over the years contributed to a progressive increase in ITN utilization among under-fives (figure 1), which however remains below WHO recommended 80% usage rate for this age group. As utilization rate lags behind, despite efforts from both national and international organizations, this review aims to explore factors that have contributed to low ITN utilization among under-fives and identify measures to improve utilization, in order to reduce malaria burden among under-fives, by which Ghana will contribute its quota towards the new Global Malaria strategy for 2016-2030 [20]. This study will also be used to guide malaria stakeholders in developing effective and feasible interventions needed to increase utilization of ITN among under-fives in Ghana.



(Demographic Health Survey, 2014) [21]

Figure 1. Percentage trends in ITN usage among under-fives in Ghana.

2. Methodology

2.1. Conceptual Framework

The Socio-Ecological Model (SEM) [22] was adopted for this in-depth review based on secondary data. It includes five systems at the intrapersonal/individual, interpersonal, institutional/organisational, community and policy levels. This model cuts across multiple levels, which allows for analyses of numerous factors affecting ITN utilization. It also helps in identifying multiple-level approach of interventions most likely to sustain the efforts of malaria prevention efforts [13].

2.1.1. Intrapersonal/Individual Factors

Involves caregivers' personal characteristics including lack of skills on ITN hanging, low level of knowledge on malaria transmission, misconception and negative perception and attitude towards ITN usage that impacts negatively on its usage among under-fives [22, 23].

2.1.2. Interpersonal Factors

Involves social influence through friends, family, cultural beliefs and its impact on ITN utilization among under-fives [22, 23].

2.1.3. Institutional Factors

Involves factors such as price of ITN, attitude of some health workers, lack of constant supply of ITN and their influence on ITN demand and its impact on utilization [22, 24].

2.1.4. Community Factors

Involves the formal and informal systems, cultural norms, economic inequalities, limited access to health facilities and health products, such as ITN and its influence on usage among under-fives [22, 24].

2.1.5. Policy

Includes regulations and policies at the district and national levels, including policy on access to ITN by households with children under-five [22, 24].

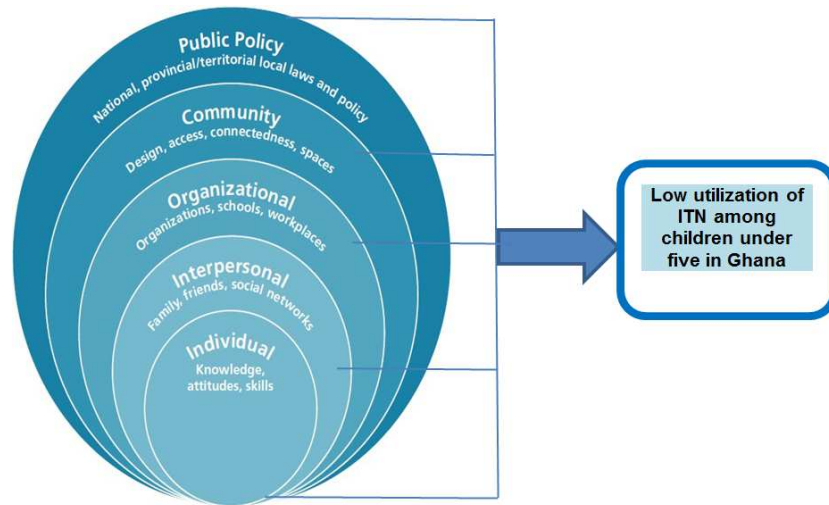


Figure 2. Socio-ecological model adopted from [22] (Kumar et al., 2012).

2.2. Feasibility Assessment Analytical Tool

This analytical tool developed by Walley and Wright (2010) was applied to each intervention identified and evaluated based on their feasibility in Ghanaian [25].

Table 1. Description of analytical tool.

CRITERIA	EXPLANATION
Technical effectiveness	The degree to which an intervention improves ITN utilization.
Organisational feasibility	The capacity of the health institution to provide staff, training and resources needed to implement the intervention.
Financial feasibility	Assesses the financial implications of the intervention as far as manpower, materials and other resources are concerned.
Gender, equity and cultural feasibility	Assesses the acceptance of community members of the intervention and the extent to which intervention equally reaches everyone within the vulnerable group.

[25].

2.3. Keywords/Search Strategy

Using selected key words from the topic of study, literature search was conducted using databases such as Global Health, Medline, PubMed and Web of Science. Keywords were also modified to access information on previous and current trends on ITN utilization among children under-five from the websites of MOH, GHS and MOE and international agencies such as UNICEF, UNAIDS and WHO.

2.4. Inclusion and Exclusion Criteria

Titles and abstracts were used in selecting full text articles addressing factors leading to low ITN utilization among under-fives and interventions to improve utilization. Articles with open access online were included in the final list. Peer-reviewed articles and those published by internationally recognised organizations including WHO, UNAIDS were selected. Articles with contents not relevant to developing countries and those not published in English were excluded.

Table 2. Results of keywords and number of hits from databases.

	Keyword	Global Health	Medline	PubMed	Web of Science
1	Utiliz*	68045	273476	572511	849529
2	Usage	18703	44912	68038	155517
3	Insecticide Treated Net*	860	769	867	2189
4	Infant	11465	513382	1117847	34748
5	Child*	284564	1085360	2294221	100586
6	Child* under five	1168	1032	11145	1469
7	Sub-Saharan Africa	9514	10762	169343	8433
8	Ghana	6326	4939	9288	4396

Combinations of keywords and number of hits

Search Number	Keyword	Global Health	Medline	PubMed	Web of Science
9	Utiliz* OR Usage	85542	314716	632151	994124
11	Child* OR infant OR Child* under five	348917	1280232	11889	1626835
12	Sub-Saharan Africa or Ghana	15392	15326	172453	40131
13	9 AND 3 AND 11 AND 12	9	9	49	25
Data Selection					
14	From search number 13	4	5	25	15
	Articles from databases				49
Other Sources					71
Total					120
Referenced					65

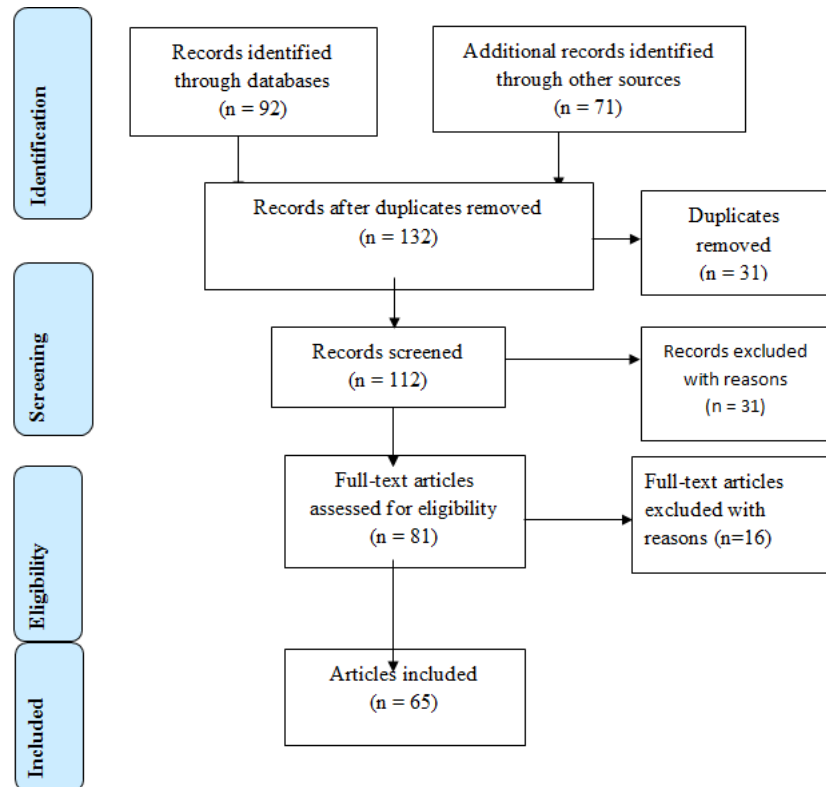


Figure 3. Prisma flow diagram adapted from (Moher, Liberati, Tetzlaff & Altman, 2009).

3. Results and Discussion

3.1. Intrapersonal/Individual Factors

3.1.1. Caregivers Level of Education

The higher the level of education of a woman, the more likely she is to be knowledgeable on accessibility and use of health services and health products, including ITN [27]. The proportion of females with no education is higher, especially among those aged twenty-five years and above, with females based in rural areas having a higher level of illiteracy (35%) than females in urban communities (18%) [21]. Usually, instructions on proper usage of ITNs are written in English. This, coupled with high illiteracy rate among females, hinders usage by children of such mothers as a result of lack of understanding of instructions on correct usage. Findings from a study in Ghana establish that out of 71% of households who do not use ITNs, 40% were mainly related to illiteracy among caregivers who were mostly women [28].

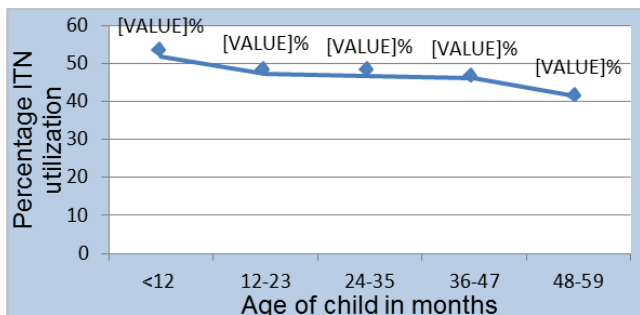
3.1.2. Caregiver's Perception and Attitude Towards ITN

Perceived susceptibility to an infection affects an individual's attitude towards a health behaviour [29]. Some individuals sleep under mosquito nets due to their perceived benefits of reducing the nuisance of mosquitoes and ensuring a good night sleep. This tends to undermine its benefit of preventing malaria, thereby limiting its usage during the dry seasons when mosquitoes are known to be less common [30, 31]. Due to hot temperatures in Ghana, some caregivers perceive the use of ITN as unpleasant, as it makes their children feel hot and uncomfortable [32].

3.1.3. Age of Child

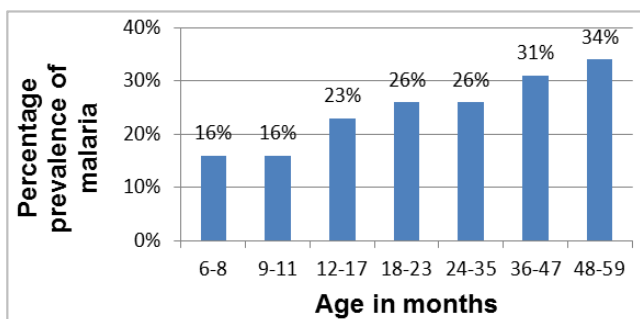
Usually, mothers tend to be protective of younger children. This results in them having priority when it comes to household ITN utilization. As children advance in age, there is a decreased probability of them sleeping under ITN (figure 4) as priority is given to a new born, leaving other children

under five years sleeping without ITN [33]. This results in increased malaria prevalence with increasing age of a child (figure 5) [34].



(Demographic Health Survey, 2014) [21].

Figure 4. Decreasing utilization of ITN with increasing age among children under five in Ghana.



(Multiple Indicator Cluster Survey, 2011) [34]

Figure 5. Increasing malaria prevalence with increasing age of child.

3.2. Interpersonal Factors

Influence of religion and spirituality: Religious/spiritual leaders tend to have greater influence on peoples' lives and are therefore held in high regard in the society. Due to this, some caregivers seek alternate forms of health information and protection against infections [35]. From experience, some caregivers turn to traditionalists for objects which are usually tied around the wrist of their children, and these objects are perceived to have powers to protect their children from being infected with certain childhood diseases including malaria. Resorting to such objects obviously hinders ITN usage despite its availability in such households [35].

3.3. Institutional/Organisational Factors

3.3.1. Supply of ITN

Although the NMCP made tremendous efforts towards ITN promotion which increased household ownership of ITN in Ghana from 4% in 2003 to 68% in 2014, there are still gaps in terms of frequent supply of ITN in health institutions, leading to limited access by caregivers [36]. Average household ownership of 68% is still below the 100% target of the NMCP [16]. This results in low ITN usage among under-fives.

3.3.2. Lack of Education on ITN Use

Although some households have ITNs, there is lack of on-going education on its proper usage. Those who acquire ITNs, from outlets other than health facilities are less likely to gain further information on its proper usage, which eventually results in low or improper usage [15]. Information Education Communication (IEC) and behaviour change communication tools, which enhance awareness on need for ITN usage is limited at the district and community levels. Inadequate health promoters, especially at the district level also undermines the efforts of ITN promotion and usage [14].

3.3.3. Monitoring Systems

The NMCP, in the attempt to control malaria has conducted free ITNs distribution through various approaches such as school-based ITN distribution, antenatal clinics and routine immunization services. However, there are no systems in place to monitor its usage in various households, which continues to imply negatively on its usage and on malaria outcomes among under-fives [15].

3.4. Community Factors

3.4.1. Distance to Healthcare Facilities

Travel time to healthcare facilities greatly influences acquisition and usage of ITNs. Free and subsidized ITNs are normally obtained from public immunization centres, where caregivers are given additional information on proper use [37]. Caregivers who live nearer to health facilities and keep to routine immunization appointments for their children are more likely to use ITNs. Longer distance to healthcare facilities therefore limits access and hinders ITN ownership and usage [38].

3.4.2. Family Size

Ghana has an average family size of five [39]. Large family size, coupled with low income, limits affordability of ITN and provision of beds for every child in the house, resulting in some children sleeping on the floor, which hinders hanging and usage of ITN [40]. In a study by Bashinyora (2010), more than half of respondents (59%) had a maximum of two beds in the house, and an average of five people per household. In this instance, only breastfeeding children slept on the bed with parents, implying that other children under five years would sleep on the floor, which hinders hanging and usage of ITN [41].

3.5 Policy on ITN

In 2002, Ghana formulated the first ITN policy, to ensure promotion of ITN use among pregnant women and under-fives through free ITN distribution in health facilities [17]. Despite this policy, some pregnant women still do not have access to ITN resulting, in low utilization among under-fives in households. This is partly due to lack of sustainable funding from government for ITN supply and misallocation of ITNs by health workers, whereby ITNs are sometimes given to ineligible clients, leading to shortage of nets [42].

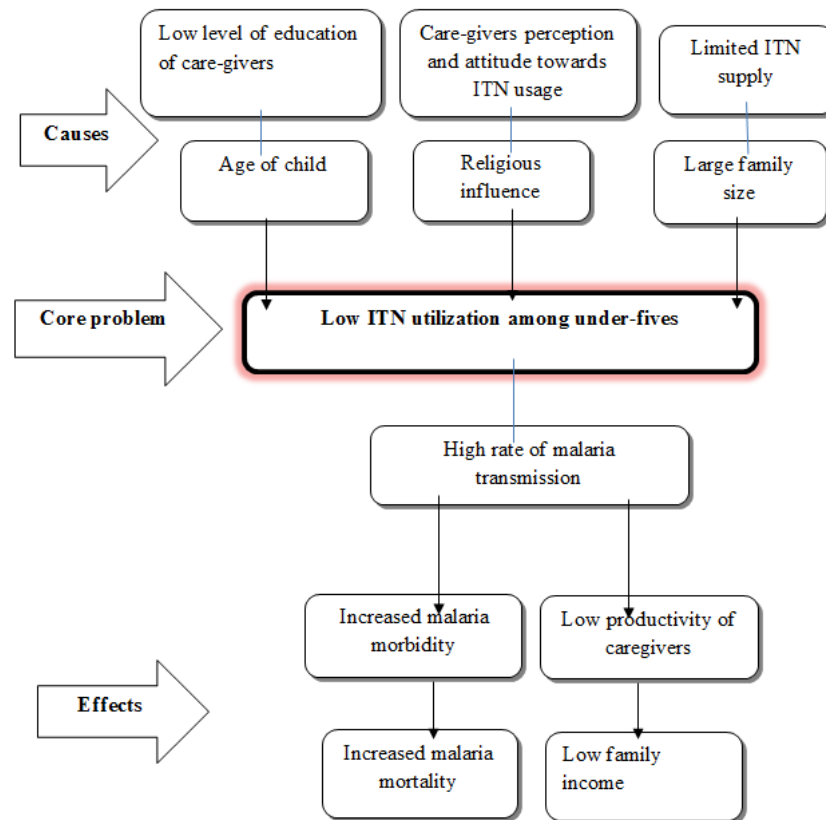


Figure 6. Summary of contributory factors and effects of low ITN utilization among children under five in Ghana.

4. Discussion of Interventions to Improve ITN Utilization Among Under-Fives

Upon discussions of factors contributing to low ITN utilization among under-fives in Ghana, there is the need to analyse interventions that have improved utilization in countries of similar context, with a focus on reasons for successful implementation of those interventions using the feasibility assessment analytical tool [25]. This will enable assessment of their feasibility in the Ghanaian context and the necessary measures needed to ensure successful implementation.

4.1. Mass Media Campaign

Mass media campaign is an effective way of passing across health-related messages as it reaches majority of people within a short period of time through various media channels including radio, posters, television (TV) and newspapers [43]. To successfully implement mass media campaign, the choice of media channel must be taken into consideration as some households may not have TV. Some caregivers, due to busy work schedules may not always have the time to watch TV, but radio could easily be carried along and listened to during normal daily activities [44].

Mass media campaign has been implemented successfully, which increased ITN use among under-fives in Cameroon

from 41.1% in 2011 to 65.4% in 2012 through the launch of “KO Palu” (Knock out Malaria) campaign where information on ITN use was aired through music and videos by popular celebrities through TV and radio programmes [43]. Although mass media campaign on ITN has proved to be effective, studies suggest that its effectiveness is enhanced if combined with interventions like home visits targeted towards ITN hanging and usage [45].

Effectiveness of mass media in Ghana will depend on clarity of message and choice of channel, ensuring that the general public get access to the right information. Also, the question of whether or not the audience will understand the messages and put it to practice cannot be over-looked. Use of audio-visual demonstrations on proper technique of ITN hanging, or role play showing a child who got sick due to non-use of ITN as well as involvement of influential people in the community such as community/religious leaders and celebrities would enhance acceptance on the need to use ITN [46].

Pertaining to organizational capacity, GHS is in partnership with mass media groups who are experts in health promotion activities through mass media and have successfully carried out similar interventions to promote healthy lifestyles, thus depicting the feasibility of mass media in promoting ITN use [47]. Currently, there are ongoing ITN-related-educational programmes on various mass media channels by the NMCP [34]. On-going occasional blackout in Ghana [48] may hinder effectiveness of mass media ITN campaign through TV and radio channels. Newspaper and

posters, although relatively cheaper than radio and TV programmes, may have minimal impact as few people purchase them daily [49]. Mass media through any means is relatively expensive [50].

Sustained partnership and support from mass media groups is essential in ensuring successful implementation of mass media ITN campaign in Ghana. Funds will be needed in purchasing airtime on TV and radios for such programmes. Evidence from the study in Cameroon [43] revealed successful mass media campaign through support of organisations like UNSAID and UNICEF. With the existence of partnership between NMCP and similar organisations in Ghana, financial support can be solicited to ensure successful implementation.

4.2. School-based Participatory Health Education

School-based participatory health education is an intervention that has the potential to raise awareness on ITN usage among children of school-going age and actively engage them as peer educators, who can serve as a medium to persuade their families on ITN use. This will in turn promote the health and general well-being of individual families and the community at large [51].

Several studies have shown the effectiveness of school-based participatory health education in promoting ITN usage. In Mali, malaria-prevention education sessions in schools resulted in a significant improvement in ITN use in the intervention group, with over 90% continuous usage in subsequent years [52]. This success rate was achieved because existing trained teachers were involved in organising malaria-prevention teaching sessions in the classroom to raise awareness on ITN usage among the school children, which positively influenced behaviour change in households within the community. A similar intervention in Kenya doubled ITN use among school children and their families three months after the intervention [53]. Training existing teachers other than health workers travelling to schools enhances effectiveness and reduces cost involved [54]. To ensure effectiveness, teachers can be trained to understand the need for ITN use in malaria prevention to gain their cooperation, as their involvement is critical to the success of this intervention [54].

Ghana Education Service (GES) has School Health Education Programme (SHEP) department responsible for health promotion activities in schools. The SHEP coordinators in schools ensure that teachers are well trained to implement health programmes [55], thus making it organizationally feasible in the Ghanaian context. Involving teachers from schools will be more acceptable to children than health workers whom they are not familiar with [54]. To enhance understanding, school children need to be addressed with the appropriate language, through role plays and small group discussions [55]. Using teachers from the schools will be less costly, as against health workers going to schools, thus making it financially achievable. However, funds will be needed to cater for the cost of training materials. Existence of partnership between MOH and GHS with NGOs like

Catholic Relief Services can be capitalized on for financial support needed to implement school-health education programs [55].

4.3. Free ITN Distribution (FID)

Cost of ITN and long distance to health facilities were identified as factors contributing to decreased ownership and usage of ITN among under-fives in households in Ghana [56, 57]. Free ITN distribution is therefore an effective way of increasing ITN coverage and usage [25], with community-based distribution method having the highest capacity to increase coverage of ITN distribution and reaching as many under-fives as possible compared to facility-based ITN distribution [58].

Community-based distribution will be a great way to get ITN to the door step of people in the community thereby, making it possible for those who cannot manage to pay for ITN and those who live far from health facilities to have access to ITN [58]. Through FID, ITN use among under-fives increased from 28.8% to 64% in Tanzania [59].

Existence of community volunteer networks, health workers and logistic and procurement and supply experts in GHS can ensure successful implementation of FID [59-61]. Freely distributed nets will be highly acceptable in the community. However, as to whether there will be adequate nets to cover every child in eligible households remains a challenge. Each household may need more than one ITN, which will cause a further rise in the financial implications on the government and the NMCP.

Although existing donor agencies like USAID, Global Fund and UNICEF can provide financial support, long-term sustainability will be of great concern, should donor support cease. NMCP will therefore need to advocate for continuous financial support from the government and other donors in addition to the existing donors.

4.4. House-to-House ITN Hang-up and Interpersonal Communication Campaign

This intervention involves house-to-house visits by community health workers and volunteers and has higher potential to increase knowledge and understanding on ITN usage and provides assistance in hanging unused ITNs in households [62, 63]. In Togo, levels of ITN use was found to be 14% higher among under-fives in households that received assistance and education on ITN hanging by community volunteers [62]. House-to-house education on ITN hanging and use significantly increased ITN use from 54% in 2008 to 81% in 2010 among under-fives in Zambia [64].

To ensure effectiveness of this intervention in Ghana, there should be community volunteer groups who are able to mobilize and engage community members to implement such an intervention as community participation is key. Community-based Health Planning and Services (CHPS) has increased in districts in Ghana over the past few years. This has increased the number of trained Community Health Officers (CHOs) who liaise with volunteers in health service

delivery [47]. Existence of this network makes this intervention feasible in Ghana [65].

Engaging CHOs and volunteers who live in the community will create a sense of responsibility, enhance effective communication and acceptability, as information on ITN can be passed on in a familiar language and at a time appropriate and acceptable to the people [65]. Considering the tiring and time-consuming nature of this intervention, community volunteers will need to be motivated by way of incentives to ensure that are fully engaged as they are key to the success of this intervention [62]. Educational materials and sample of ITN for demonstration need to be purchased, which can be obtained freely from CHPS clinics, thus making this intervention seemly feasible financially.

5. Conclusion

This in-depth review highlighted low utilization rate of ITN among under-fives in Ghana as against the recommended rate by WHO for this vulnerable group. Although efforts have been made by both national and international organizations towards promotion of ITN, its usage among under-fives is only 47%, which is far below the 80% rate recommended by WHO. Malaria therefore remains a public health challenge, especially among under-fives, and accounted for 38% of outpatient attendance, 27% of hospital admissions and 48.8% of deaths among under-five in Ghana in 2015 alone.

This was attributed low level of education among caregivers, negative perception on malaria transmission and attitude towards ITN use on the part of care givers of these infants. Institutional factors such as occasional infrequent supply of ITN, lack of continuous health education on proper ITN usage and lack of mechanisms for monitoring ITN usage have also negatively influenced ITN usage and malaria outcomes among under-fives. Upon discussion, interventions seemly feasible in the Ghanaian context included mass media campaign on ITN promotion, school-based participatory health education, house-to-house ITN hanging and interpersonal communication campaign and Free ITN Distribution. To ensure applicability and successful implementation of the interventions discussed, it is recommended that stakeholders at various levels in health care should assess how applicable they are in the Ghanaian context, giving consideration to the available resources in order to ensure successful implementation and to improve usage of ITN among under-fives in Ghana. Also, stakeholders should ensure proper monitoring and evaluation of recommended interventions to measure their long-term impact in order to inform decision-making. By so doing, Ghana will contribute its quota towards reducing the global malaria burden by at least 90% by 2030.

5.1. Implications of the Study

The study found access to ITN not to be the major concern as Ghana has witnessed a progressive increase in household ownership of ITN over the years. Nevertheless, it is critical to

enforce its usage in households. Lack of mechanisms for supervision and monitoring of ITN usage in various households negatively affected usage because ITN ownership alone does not always translate into usage. Health workers can only rely on report from care-givers which may not always be true. Malaria stakeholders should therefore strengthen the capacity of community support systems by engaging the youth in the community as volunteers who can be trained to do occasional household monitoring and assistance on ITN hanging to increase usage within the community.

The study also identified and discussed various interventions that have proved to be effective in increasing ITN utilization in regards to its technical effectiveness, organisational and financial feasibility and cultural acceptability as well as possible adaptability and replication in Ghana. This will serve as a guide to malaria stakeholders in designing effective health promotion programmes and allocating resources needed to implement these feasible interventions which will address low ITN utilization.

The Ministry of Education should implement policies that will scale up school health education in basic schools, specifically by organizing in-service training for SHEP coordinators in basic schools to impart knowledge on malaria prevention and ITN usage among school children who can also serve as a medium to pass on knowledge to their families and the community. Religious and opinion leaders by virtue of their positive influence within the society should also encourage the youth to be fully engaged in malaria-prevention activities within the community.

Nurses, midwives, community health nurses and health promoters should be trained to scale up malaria prevention programmes through health education in their various departments in the hospital.

The methodology, though suitable for this review, relied solely on secondary data and may therefore not be a true reflection of the current situation in regards to ITN usage as report bias might have influenced some of the data found during literature search. A primary study, possibly using a qualitative approach may be employed to acquire a much deeper level of understanding on reasons for non-usage of ITN among under-fives to allow for development of context specific interventions to enhance utilization.

5.2. Limitations of the Study

There were few publications that discussed interventions to improve ITN utilization among under-fives. Since the study solely relied on secondary data and not primary data, the reliability of some information from secondary data may be questioned. Some abstracts had very useful information but access to full text was limited.

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