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An overview of the literature on economic and financial factors influencing population access to vector control interventions: long lasting insecticidal nets, indoor residual spraying and supplementary interventions.

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1. Introduction

The Global Technical Strategy for malaria 2016-2030 includes malaria control and elimination targets for 2030 and interim milestones for 2020 and 2025. The nearest GTS milestone includes a reduction in malaria case incidence and mortality rates of at least 40% by 2020 compared to 2015 levels, the elimination of malaria in at least 10 countries and the prevention of re-establishment of the disease in countries that are malaria-free.

After 15 years of success in global malaria control, progress in reducing morbidity and mortality has stalled and the likelihood of reaching the 2020 milestones is small. In 2016, there were an estimated 216 million cases of malaria or 5 million more than in 2015 and around 445,000 deaths [1]. The African Region continues to bear an estimated 90% of all malaria cases and deaths worldwide. Fifteen countries – all but one in sub-Saharan Africa – carry 80% of the global malaria burden [1].

Universal access to WHO-recommended interventions is necessary to reach the GTS milestones, especially in counties with the highest malaria burden. A better understanding of these gaps and how they relate to malaria burden especially in high burden countries, the factors contributing to these gaps, populations affected and types of strategies that may be used to reduce these gaps are required to ensure progress towards UHC and the GTS 2020 milestone.

This report summarises the available evidence on the factors influencing coverage and use of vector control interventions, with a particular focus on economic and financial factors and strategies on the supply and demand of long lasting insecticidal nets (LLINs), indoor residual spraying (IRS) and supplementary interventions such as larval source management (LSM). Evidence pertaining to the non-financial or non-economic factors is outside the scope of this report. The next section describes the methods used to review the literature and is followed by a section presenting and discussing the results.

2. Methods

Scope of the review

The aim of this review is to identify the key economic and financial factors reported in the literature to influence population coverage and use of vector control interventions. It is not concerned with the absolute costs and cost effectiveness ratios associated with interventions, but rather the range of economic determinants that influence their availability and use. In this report, the focus is on LLINs, IRS and other supplementary interventions such as LSM.

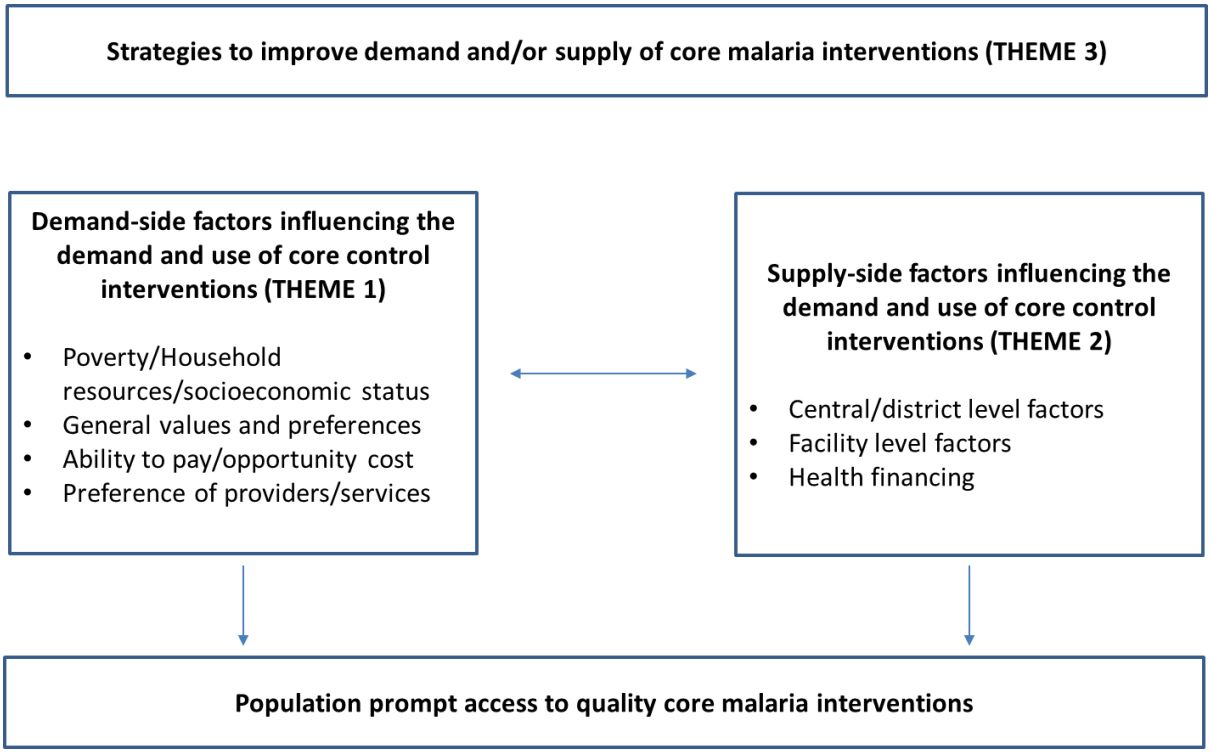
Conceptual framework

The review draws on a simplified conceptual framework of factors influencing the supply and demand of an intervention [2]. An intervention is defined as a technology and activities to support its optimal use [2]. In this report, the framework was adapted to focus on economic and financial factors hypothesised to influence the performance of the core malaria interventions under study (Figure 1).

On the demand side, demand and adequate use of interventions may be influenced by household resources, ability to pay, general values and preferences (Theme 1). On the supply side, the availability and quality of interventions may be influenced by economic and financial factors playing at central, district and facility levels and more broadly through global and national health financing policies and arrangements (Theme 2). The conceptual framework also considers the strategies that

may be implemented to improve the performance of interventions by addressing supply and/or demand side constraints (Theme 3). Other factors such as socio-cultural and gender dynamics; knowledge and information barriers; and health facility deterrents [3] [4] are outside the scope of this review and not included in this report.

Figure 1 Simplified conceptual framework



Search strategy

PubMed and EconLit dababases were used using key terms described in Appendix A and focusing on peer reviewed references written in English and published since 2010. Abstracts were read and when relevant to the review topic full texts were collected and read for relevance. In case of doubt on the relevance of the study, the reference was read by another researcher to confirm inclusion or exclusion. While Themes 1 and 2 present a relatively comprehensive overview of the literature, in Theme 3 we select a small number of studies to illustrate the range of impact evaluations conducted within our timeframe. We see the WHO technical consultation meeting to be held 12-15 February as providing an important opportunity to further identify and reflect on the availability of additional data.

3. Results

Overview

A total of 368 unique studies were identified during the searches and 59 were found to be relevant to the subject of this report. Of these relevant studies, 23 were relevant to Theme 1, 26 to Theme 2 and 10 to Theme 3. Across the three themes, the focus of the identified studies was on malaria endemic countries of the WHO African region. Outside Africa, studies concerned countries in the WHO South East Asia region (2 studies) and Western Pacific region (1 study). Seven studies had no specific country or regional focus. No relevant studies were identified in the WHO America and Eastern Mediterranean regions. The geographical spread of the reviewed studies is presented in Appendix B.

Theme 1: Economic and financial constraints on the demand and use of vector control

In this theme we explore the economic and financial factors that have influenced uptake of vector control interventions. While much has been written about the acceptability and appropriate use of nets overtime, and to a lesser extent IRS, here specific attention is paid to how economic and financial issues may have helped shaped their possession and/or utilization.

Our search criterion focused on evidence from 2010 onwards. This is important to note for two reasons. Firstly, it precedes the well documented debate about the optimal strategy for distributing nets to ensure their maximum health impact and sustainable use. The debate centred on whether nets should be given at full cost, subsidized, or free. Much attention was given to the extent subsidised or free nets should be targeted or universally distributed[5]. Secondly, since 2010, the market for vector control technologies has changed. The roll out of longer-lasting bed nets has meant that the majority of nets no longer need frequent retreatment which was a barrier (sometimes financial) to their use. Against the backdrop of a change we have reviewed the literature to assess what, if any, new demand-side economic and financial barriers or facilitators to vector control feature in the recent literature. As summarised below, much of the more recent literature echoes findings from socio-economic related studies published a decade earlier.

Socioeconomic status

In Burkina Faso, a study found some evidence on ownership by wealth quintile and geographic area, with urban households and those from the richest quintile more frequently owning a net [6]. In 2013, Njau et al claimed to have undertaken the first study to use nationally representative data to explore inequalities in bed net ownership and related consequences on childhood malaria infection rates using National malaria indicator survey (MIS) data from Angola, Tanzania and Uganda [7]. While targeted distribution of free bed nets improved overall bed net ownership, it did not overcome ownership inequalities as measured by household socioeconomic status. Use of bed nets was disproportionately lower among poorest children, except for Angola where bed net use was higher among poorest households when compared to children in wealthier households [7]. Hailu et al in their study on both LLINs and IRS in Ethiopia found coverage of LLIN was low and significant more likely to be owned by the rich households, whereas houses were sprayed equitably [8].

Financial barriers

Studies, most commonly towards the start of our review timeframe also spoke of the financial barriers to net ownership and use [9-11]. In Kenya and Mali, Hill et at 2015 explored the sources of

nets, the sale of free nets, issues of favouritism and stock-outs [9]. The study found that women in both countries obtained their ITNs from a variety of sources though predominantly from ANC visits or hospital, child health clinics and immunisation programmes, mainly (though not always) provided free-of-charge [9]. In Kenya, although most women said ITNs were given to them free at ANC, one woman complained she was charged [9]. In Mali, several women complained that they did not always receive their free ITN[9]. Other sources of nets in Kenya were campaigns or shops, and in Mali, the pharmacy or from parents for adolescent girls [9].

In a study conducted in the cities of Douala and Yaounde, Cameroon, Ndo and colleagues identified a range of problems experienced by families. These included difficulty in finding chemicals for retreatment of nets (47%), insufficient financial means to buy new bed nets to replace old ones (24.5%) or, to provide bed nets to everybody in the household (19.4%)[10]. Intra-household allocation of nets and the decision-making around net allocation was the focus of study in Uganda.. The study found that in households with too few nets those who were prioritised were selected on the basis of biologically vulnerability, rather than the most economically active family members [11]. In Cameroon, Oyekale found that reasons for not owning mosquito nets by all the households included: lack of financial means (25.17%), using something else (1.80%) and not having many mosquitoes in the vicinity (5.53%)[12].

When looking at predictors of indoor insecticides spray utilization in the prevention of malaria related mosquito bites in Ogun State, Nigeria Amoran et al. identified reasons for not using insecticides included being expensive (23.5% of the study respondents), un-availability (18.5%), inconvenience (9.5%) and fear of side effect (4.0%) [13].

User preferences and values

This idea of 'using something else' was also mentioned in a study in Kenya. Ernst et al pointed to the perception of treatment as a preferred alternative to nets in their combined site analysis [14]. Their findings indicated that not using an available bed net was associated with the attitudes that taking malaria drugs is easier than using a bed net[14]. Whilst in Mbachu and colleague's study in Nigeria found that rather than treatment and nets being framed as 'competitors', the free distribution of LLINs and ACTs increased household coverage of both malaria control interventions and bridged the equity gap in access to them among the most vulnerable groups[15]. The notion that purchased bed nets were better than freely distributed ones was reported by Ernst and distrust in free delivery of nets featured in another study from Kenya[16].

In Uganda, participants of focus group discussions and interviews were often reluctant to openly discuss reasons why free LLINs had not been retained such that reported reasons unlikely fully explained non-retention [17]. Respondents generally felt that the donated LLIN should have been retained by recipients and appeared to assume that the interviewer or leadership figures would disapprove of people having sold or given away their LLIN [17]. There was considerable variety and depth in the explanations for not retaining the LLIN. Theft and sale were reported occasionally, while physical damage to the net was the most commonly stated reason why people were no longer in its possession [17]. In this study, the average "useful life of a net" was reported to be determined not only by the condition of the net, but also by the availability of replacement nets, among other factors. Mosquito nets with a few holes that would be considered to be in good condition in settings where new nets are scarce may be readily replaced by households regularly receiving free campaign nets or wealthy enough to buy new ones in the market [17].

In Nigeria, receiving a net for free was considered an important determinant of use [12, 13]. Yet despite the distribution of LLINs, Adeneye et al claimed access to and use of LLINs continued to be minimal [18]. Willingness-to-pay data were collected using semi-structured questionnaire among

pregnant women attending antenatal clinics and mothers of under-five children in randomly-selected malaria holo-endemic communities in two areas of Ogun State. Results showed that only 23.6% of 495 respondents owned and were using LLINs. One of the main reasons for non-use of LLINs was unaffordability of LLIN cost. However, 84.2% of the 495 respondents were willing to pay at a hypothetical price of N800.00 (US$5.00). Their willingness to pay was significantly determined by education and occupation [18]. In an earlier study in Osun state Nigeria, Esimai & Aluko assessed the use of insecticide treated nets and the determinants of their use among caregivers of under five children in an urban local government area. About a third (32.8%) had ever used ITNs. The reasons given by the 67.2% who had never used ITN included "it was not readily available (13.0%) and expensive (13.7%)". Marital status, knowledge of ITN, attitude towards ITN, ownership of ITN and free ITN were factors that determined the current use of ITN by the care givers [19]. In a study in Uganda, women who always slept under an ITN during pregnancy were more likely to be influenced by an advertisement on the radio/poster than being given an ITN free of charge [20].

Gebresilassie & Mariam conducted a study in malaria-endemic areas of southern Ethiopia to assess the bednet possession of the community, determine the people's willingness-to-pay for ITNs, and identify what factors influenced it. Results revealed that around 86% of the respondents were willing to buy ITNs [21]. The community's WTP was significantly affected by gender, educational status, perceived benefit of ITN, previous source of bednet, and characteristics of bednet[21]. In Northern Ethiopia, Aleme et al suggested that promotions, the nets colour and shape, price and the place the net was available all had significant association with willingness to pay for ITNs. Specifically, as the average monthly income of respondents decreased, the WTP for ITNs had increased significantly (AOR-22.44, 95% CI =12–41.34), however no explanation was given as to why this might have been the case [22]. The WTP to pay for retreatment featured in two studies conducted in Ethiopia before 2010 but published during our study period. The first in Azendabo town suggested that nearly half of the respondents were not willing to pay for ITNs retreatment due to lack of their affordability[23]. The second in Gursum district in Eastern Ethiopia suggested WTP was determined by average monthly income and those households who live within a distance in 30 min to the health facility [24].

Brown et al surveyed 612 households in Gulu and Oyam districts of northern Uganda during a period of very high malaria transmission and following a pilot indoor residual spray (IRS) programme. A discrete choice experiment was conducted within the survey, in which respondents indicated their preferences for different IRS programmes relative to money compensation in a series of experimentally controlled, hypothetical choice sets. The data was used to estimate respondents' willingness to accept (WTA) some amount of money compensation in lieu of foregone malaria risk reductions. Significant heterogeneity was observed: four in five household heads had high valuations for IRS programmes while the remaining 20 % reported costly side effects of IRS. [25]. Statistically significant predictors of belonging to the high-value group include respondent gender, mean age of household members, participation in previous IRS, basic knowledge of mosquito reproduction, and the number of mosquito nets owned[25]. Proxies for household income and wealth are not found to be statistically significant predictors of WTA[25].

Theme 2: Economic and financial constraints on the supply of vector control

During this literature search, many studies talked about technical and operational challenges in the delivery of vector control, frequently advocating for more or sustained funding [26-30]. Call for more funding towards R&D and development of new tools also came up during the search [31]. Other retrieved studies reported evidence on effectiveness and/or costs of different vector control interventions or delivery strategies [28, 32-46]. One paper also discussed how funding for and/or expansion of vector control for malaria is an opportunity to other less funded vector borne diseases [47]. As described in more detailed below, fewer papers were found to report *how* financial resources or economic issues affected the supply of vector control interventions.

Financing

Availability of financial resources was reported, not surprisingly, as a key enabler for increasing coverage of vector control interventions and ultimately improving health outcomes and, conversely, the lack/absence/ decline/withdrawal of financial resources were reported to negatively affect both coverage and outcomes [48-61].

In 2010, Flaxman and colleagues examined the relationship between cumulative development assistance for health (DAH) targeted at malaria between 2000 and 2008 and the change in national – level ITN coverage over the same time period. They estimated that each US$1 per capita in malaria DAH was associated with a significant increase in ITN household coverage and ITN use in children under 5 coverage of 5.3 percentage points (3.7 to 6.9) and 4.6 percentage points (2.5 to 6.7), respectively[52].

In Papua New Guinea, Hetzel et al. indicate that thanks to the Global Fund financial support, the country was able to re-intensify its malaria control activities in 2008-2009 through a campaign that aimed at quickly achieving high levels of ownership and usage of nets[53]. They report that whilst the Global Fund supported catch-up campaign failed to reach the 80% ownership and usage targets for LLIN, it contributed to dramatically increase ownership from less than 10% in sentinel sites to just below 65% in the overall study sites [53]. LLIN usage was also found to increase from 5.5% to 55% [53]. Undersupply of nets was the primary contributor to low usage with under-supply determined by accessibility of villages and household size[53].

Jakubowski and colleagues reported in a before-after study that population coverage of ITN increased significantly by around 8% points and of IRS by around 6.5% points after PMI programme implementation [51]. Winskill et al. combined an established mathematical model of Plasmodium falciparum transmission dynamics with epidemiological, intervention, and PMI-financing data to estimate the contribution PMI has made to malaria control via funding for LLINs, IRS and artemisinin combination therapies (ACTs). They estimated that PMI has played a significant role in reducing malaria cases and deaths since its inception and that reduction in funding to PMI could lead to large increases in the number of malaria cases and deaths [60].

A systematic review of the literature reported that all resurgence events were attributed, at least partly, to weakening of malaria control programmes with resource constraints being the most commonly reported reasons[54]. In Malawi, Chanda and colleagues discussed the financial constraints on implementing IRS and vector control in the context of insecticide resistance and more expensive new tools. IRS operations were reported to be cut back from seven to one district in 2014 because of a decline in international funding combined with unpredictable and late disbursement of domestic funding [49]. In Zimbabwe, financial and logistical challenges were reported to be the

major obstacles to reach IRS coverage targets through delays in the supply of IRS, recruitment and training of sprayers [62]. In Uganda, integrated vector management was found to be poorly developed partly because of the lack of adequate funding available for malaria vector control methods [63].

More recently, in the context of new tools for insecticide resistance management, financial resources were reported as the most powerful reason for policy adoption, such that the Global Fund was reported to be perceived as one of the most influential actors during a study undertaken in Burkina Faso in 2014 [64]. Prices of next-generation LLINs were reported as a key factor in determining availability, with affordability relating to international donors willingness to finance it [64]. Global and national targets for universal health coverage translated into donors' willingness to get the highest LLIN coverage within a given budget envelop with insufficient attention to insecticide resistance and LLIN performance and cost-effectiveness [64]. Closely linked to this, *"the absence of global guidelines on where and when next generation LLINs should be deployed"* was reported as a critical barrier to donor funding and national adoption of new LLINs [64].

Central and district level factors

A 2017 report by Arne Klau of the World Trade Organisation described to which extent tariffs are still imposed on ITN/LLIN and calculate how tariffs reduce ITN/LLIN trade. The author found that in 2015, tariffs were levied by at least 16 African countries, although some countries may grant tariff concessions on imports of nets[65]. Whilst governments are reported to apply tariffs to protect specific industries or generate fiscal revenue, the contribution by anti-malaria commodities is found to be relatively small for most countries and as a share of total fiscal income it is reported as negligible[65]. The author estimated that the trade loss caused by tariffs amounted $7 million and nearly $5 million under a concessions scenario equivalent to suppressed imports of between 2.2 to 3 million ITNs between 2011-2015[65].

Facility level factors

A qualitative rapid assessment study identified the operational strengths and weaknesses of LLINs continuous distribution in Kenya, Malawi, Mali and Rwanda. The study used semi-structured individuals and group discussions at national, sub-national and facility level including malaria programmes, ANC and EPI programmes, government logistics units, and partner organizations, as well as policy and guideline document review [66]. The study revealed in all four countries challenges impeding the performance of LLIN continuous distribution all contributing to stocks-out at facility level and missed opportunities to increase coverage of targeted populations[66]. Key challenges included facilities' lack of involvement in the order and resupply process and the lack of structures in place to effectively and promptly respond to stock-outs at the facility level [66]. The study authors point out that facility-led re-supply of LLIN could create a consistent and uninterrupted supply of LLINs, which is reported as essential to make continuous distribution a truly routine service [66]. Whilst the costs of improving these supply systems may be substantial they need to be assessed in order to identify and implement cost-effective sustainable approaches for LLIN continuous distribution [66]. The authors argue that the financial concern of maintaining "buffer stocks" to resupply facilities when required would not require the purchase of additional LLINs but rather a consistent supply and storage of nets in country before they are needed [66]. They conclude that an integrated system to improve delivery could provide cost savings due to shared resources across programmes [66]. Another financially related constraint to LLIN continuous distribution included the lack of funding for training on LLIN distribution specifically in the context of limited financial resources and high staff turnover [66].

In Kenya, Chuma and colleagues reported affordability factors as constraints on ITN suppliers in their 2006-2007 study[16]. The cost of buying ITN from wholesalers or manufacturers was found to be prohibitive for retail shopkeepers and while they were willing to continue selling ITN, the cost of purchasing nets limited retailers capacity to stock them[16]. Public health workers also interviewed during this study were found to be concerned by the shortage of funds to sustain ITN programmes following the reduction of user fees and the uncertain sustainability of donor funding[16].

Theme 3: Strategies and their impact on demand and supply-side constraints

Subsidies

A Cochrane review conducted in 2013 identified 10 studies reporting on the effect of different strategies to increase people's ownership and use of ITN to prevent malaria[67]. The studies were found to take place in Africa and India. In five of the studies, people were either given insecticide-treated bednets free, or could buy them at a subsidized price or full market price. The review found that providing free ITN probably increases the number of people who own ITN compared to providing subsidized ITN or ITN offered at full market price, indicating that ITN demand is price elastic. Yet the provision of free ITN probably leads to little or no difference in the use of bednets compared to providing subsidized bednets or bednets offered at full market price, implying that people who purchase an ITN are not more likely to use them than those who received them for free. The review also found that providing incentives to encourage use of ITN probably leads to little or no difference in ownership or use of bednets compared to those who did not receive an incentive[67].

In Madagascar, a randomised control study was used to evaluate the effect of price on household demand for and use of ITNs in rural villages. At the village level, the price at which households could purchase a net was randomly varied. In the study sites, intervention categories included a range of prices equivalent to 100, 75, 50, 25% and no subsidy relative to the social marketing price of ITN. In each intervention category, households received a voucher to purchase an ITN from a dedicated local shop [68]. As reported by Polec et al. [67], this study found evidence that demand for ITN fell as price increased [68]. The study authors argue that partially subsidized nets limited ownership whilst distribution of free ITN or ITN at a small nominal price would maximise coverage in the study sites [68]. Finally, they did not find evidence that households were more likely to use a nets that they paid for [68], a similar finding to Polec and colleagues [69]

In Kenya, similar findings are reported by Cohen and Dupas in a field experiment in which they randomized the price at which prenatal clinics could sell ITNs to pregnant women. They found no evidence that cost-sharing reduced wastage amongst those who would not use ITNs [70]. Women who received free ITNs were not less likely to use them than those who paid subsidized prices. They also found no evidence that cost-sharing induced selection of women who needed the net more with those who paid higher prices being no sicker than the average prenatal client in the area in terms of measured anaemia[70]. Their results show that cost-sharing affect demand negatively with uptake 60% point lower when IPT prices increased from free to $0.60, equivalent to a decline of 10% point in the subsidy. In another experiment in Kenya, Dupas found that households that received a free or highly subsidised net did not lower their willingness to pay for another nets in future[71, 72]. Finally, Cohen and Dupas concluded that free distribution of ITNs could save many more lives than cost-sharing programs have achieved so far and likely at a lower cost per life saved [70].

In Tanzania, the Government had implemented the National Insecticide Treated Nets programme (NAT-NETS) to scale–up the distribution of insecticide-treated nets (ITNs) and from 2009 LLINs [73].

Under NAT-NETS, the Tanzania National Voucher Scheme (TNVS) was a key distribution mechanism between 2004 and 2014 with the aim to increase access of and use of ITN, then LLIN amongst pregnant women and young children [73]. The scheme provided a discount voucher to these two target groups during reproductive and child health facility visit. The voucher could then be exchanged for an ITN/LLIN at a participating retail outlet at a reduced price. The TNVS was a public private partnership led by the MOH and included multi and bi lateral development partners, NGO, academic institutions, mosquito net manufacturers, wholesalers and retailers [73]. Funding was provided by the Global Fund to Fight AIDS, Tuberculosis and Malaria (The Global Fund) from 2003 until 2011; the United States Agency for International development (USAID) through the President's Malaria Initiative from 2011 until 2014. The TNVS reached national coverage in 2006 and is reported as *"one of the largest and most enduring keep-up programmes targeting pregnant women and young children in any endemic country"*[73].

Using data collected in 2006, Gingrich and colleagues estimated the ITN demand equation and found without surprise that women from households with higher socio-economic status had a higher probability of buying an ITN[74]. They also found that a higher level subsidy reduced the probability that the voucher recipient bought an ITN, although the contrary would be expected with reduced price associated with increased demand. Free ITN were also reported to negatively affect ITN short term purchase decisions for voucher recipients [74]. However, estimating separate demand functions for poor and less poor women showed the marginal impact of price on purchase decisions of poor women to be higher (twice) that of less poor women [74]. Yet the impact of free ITNs on ITN demand did not differ significantly by socio-economic status. Finally, mother education and density of retailers accepting TNVS vouchers for nets were positively affected demand[74].

Between 2009 and 2012, fixed top-up vouchers for LLIN were introduced as part of the TNVS. This aimed to reduce the amount paid by pregnant women and mothers in the context of the switch from ITN to higher priced LLIN, to ensure equity in access amongst the voucher beneficiaries and to prevent price variation throughout the country [73]. Early 2013, the fixed top-up voucher was replaced by a hybrid voucher model with the aim of addressing the operational challenges faced by the fixed top up voucher and to encourage the development of a sustainable commercial market for LLIN [73]. However the hybrid model never really succeeded in creating a commercial market for LLINs and was later cancelled following withdrawal of donor funding, partly as a results of fraud suspicion at different levels of the distribution chain [73].

Nonetheless, the TNVS is reported to have significantly contributed to increase household ownership and use of LLINs, ensuring continuous protection of vulnerable populations before, after and during the 2009 and 2011 mass campaigns [73]. Its effectiveness is reported to be a function of several interdependent factors including: supply chain of vouchers through the public health system, the supply chain of the nets in the private commercial sector, the demand for nets from vouchers recipients; management and risk mitigation measures and the influence of global and donor objectives[73]. A separate study analyzing and recommending options for maintaining universal coverage with LLIN in Tanzania in 2011 reported that mass campaigns, even when combined with a continuation of the TNVS would produce large temporal fluctuations in coverage levels [75]. School-based voucher approaches combined with the at-the-time existing TNVS was reported as a "keep-up" strategy with the highest potential to reach most households and ensure continuous coverage [75, 76].

In Toamasina II District, Madagascar, an evaluation study of community based continuous distribution of LLIN was conducted. Nine months after the December 2012 mass campaign, a community-based distribution pilot ran for an additional 9 months. Households requested ITN coupons from community agents in their village and then exchanged the coupon for an ITN at a

distribution point. At the end of the pilot or 18 months after the 2012 mass campaign, household ownership of any ITN was 96.5%, population access to ITN was 81.5 and 61.5% of households owned at least 1 ITN for every 2 people. Without the ITNs provided through the community channel, all these indicators were found to be lower. Finally, ownership of community-distributed ITNs was higher among the poorest wealth quintiles and community acceptability of the scheme was reported to be high[77].

In urban Senegal, the effects of different marketing and distribution techniques on the purchase of LLIN were evaluated. Results show that receiving an offer to purchase an LLIN with a voucher valid for seven days increased purchases by 23 % points compared to an on-the-spot sale offer. In addition, providing information was found significantly correlated to the demand for LLIN for individuals who never attended school and had poor knowledge of malaria [78].

In Zambia's Eastern province, Fink and Masiye evaluated the effectiveness of scaling-up existing bednet distribution campaigns, using a randomised controlled trial with 516 farming households in Katete rural District. In the trial, selected farmers were assigned to bednet programmes that allowed them to obtain additional bednets for free or at subsidized prices through agricultural loan programmes. On average, 2.4 nets were distributed in the free distribution group and 0.9 in the net loan group[79].

4. Conclusion

This overview highlighted some of the peer-reviewed contributions on the economic and financial factors influencing access to vector control published over the last 8 years. It is apparent that, after having been a much written about topic at the beginning of the millennium, there has been a more limited amount of research published on the economic determinants of demand and supply for vector control more recently. Reasons may include the availability of some relevant evidence in the grey literature such as reports from institutions working on vector control related issues or a body of recent evidence on new tools and approaches not yet published. Another reason may be a switch in resource use considerations in vector control and malaria control interventions more generally, including prioritization and targeting of interventions for optimal resource allocation in the context of insecticide resistance, limited funding and potentially more costly and effective tools.

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Appendix A: Search strategy

Table of condensed search terms

Disease key word		Control intervention key words		Economic factor key words
Malaria	AND	Vector Control	AND	Access
		Treated Nets		Financ*
		LLINs		Cost*
		ITNs		Economic*
		Residual Spraying		Determinants
		IRS		Providers
		Larval*		Pay
				Incentive*
				Subsid*
				Supply
				Demand

Table of actual searches undertaken

No	Disease key word 1	Control intervention key word 1	Economic factor key word 1	Economic factor key word 1
1	Malaria	Vector Control	Access	
		Treated Nets		
		LLINs		
		ITNs		
		Residual Spraying		
		IRS		
		Larval*		
2	Malaria	Vector Control	Financ*	
		Treated Nets		
		LLINs		
		ITNs		
		Residual Spraying		
		IRS		
		Larval*		
3	Malaria	Vector Control	Access	Economic*
		Treated Nets		
		LLINs		
		ITNs		
		Residual Spraying		
		IRS		
		Larval*		
4	Malaria	Vector Control	Access	Financ*
		Treated Nets		
		LLINs		
		ITNs		
		Residual Spraying		
		IRS		
		Larval*		
5	Malaria	Vector Control	Access	Determinants
		Treated Nets		
		LLINs		
		ITNs		
		Residual Spraying		
		IRS		
		Larval*		
6	Malaria	Vector Control	Access	Providers
		Treated Nets		
		LLINs		
		ITNs		
		Residual Spraying		
		IRS		
		Larval*		
7	Malaria	Vector Control	Cost*	Pay
		Treated Nets		
		LLINs		
		ITNs		
		Residual Spraying		

		IRS		
		Larval*		
8	Malaria	Vector Control	Access	Incentive*
		Treated Nets		
		LLINs		
		ITNs		
		Residual Spraying		
		IRS		
		Larval*		
9	Malaria	Vector Control	Access	Subsid*
		Treated Nets		
		LLINs		
		ITNs		
		Residual Spraying		
		IRS		
		Larval*		
10	Malaria	Vector Control	Access	Demand
		Treated Nets		
		LLINs		
		ITNs		
		Residual Spraying		
		IRS		
		Larval*		
11	Malaria	Vector Control	Access	Supply
		Treated Nets		
		LLINs		
		ITNs		
		Residual Spraying		
		IRS		
		Larval*		

Appendix B Geographical spread of studies

	Number of studies		
	Theme 1	**Theme 2**	**Theme 3**
AFRICA (studies that focus on the whole region)		**2**	**1**
Algeria			
Angola	1		
Benin			
Botswana			
Burkina Faso	1	3	
Burundi			
Cabo Verde			
Cameroon	2		
Central African Republic			
Chad			
Comoros			
Congo			
Côte d'Ivoire			
Democratic Republic of the Congo			
Equatorial Guinea			
Eritrea			
Ethiopia	5		
Gabon			
Gambia			
Ghana			
Guinea			
Guinea-Bissau			
Kenya	3	2	1
Liberia			
Madagascar			1
Malawi		2	
Mali	1	1	
Mauritania			
Mayotte			
Mozambique			
Namibia			
Niger			
Nigeria	4		
Rwanda		1	
Sao Tome and Principe			
Senegal			1
Sierra Leone			
South Africa			
South Sudan			1
Swaziland			
Togo			
Uganda	5	3	
United Republic of Tanzania	1	2	4
Zambia			
Zimbabwe		1	
AMERICA			
Belize			
Bolivia			
Brazil			
Colombia			
Dominican Republic			
Ecuador			
El Salvador			
French Guyana			
Guatemala			
Guyana			
Haiti			

Honduras			
Mexico			
Nicaragua			
Panama			
Peru			
Suriname			
Venezuela			
EASTERN MEDITERRANEAN			
Afghanistan			
Djibouti			
Iran			
Pakistan			
Saudi Arabia			
Somalia			
Sudan			
Yemen			
EUROPE			
Tajikistan			
SOUTH EAST ASIA			
Bangladesh			
Bhutan		1	
Democratic People's Republic of Korea			
India			1
Indonesia			
Myanmar			
Nepal			
Thailand			
Timor-Leste			
WESTERN PACIFIC			
Cambodia			
China			
Lao People's Democratic Republic			
Malaysia			
Papua New Guinea		1	
Philippines			
Republic of Korea			
Solomon Islands			
Vanuatu			
Viet Nam			
NO SPECIFIC COUNTRY FOCUS/REVIEWS		7	