

Household bednet ownership and use in Ghana: Implications for malaria control

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Abstract

The distribution of insecticide bednets has become a key malaria control strategy in endemic regions. The literature, however, points to a gap between availability and use. Using nationally representative household data from Ghana, this study investigates the factors that associate with household bednet ownership and use among minor children. The results indicate that more than half of Ghanaian households do not own any bednet; while among those who do, household crowding and other socio-demographic factors tend to impede their use. This notwithstanding, the analysis suggests that scaling up bednet distribution could facilitate increased use among vulnerable populations.

Keywords: *Ghana, bednet, malaria control, household.*

Résumé

La distribution de moustiquaires antipaludismes est devenue une stratégie pour l'élimination du paludisme dans les régions endémiques. Cependant, la documentation indique qu'il y a une disparité entre la disponibilité et l'utilisation de ces moustiquaires. À partir de données nationales représentatives des ménages ghanéens, cette étude examine les facteurs associés à la possession de moustiquaires antipaludismes et leur utilisation auprès de jeunes enfants. Les résultats indiquent que la moitié des ménages ghanéens ne possèdent pas de telles moustiquaires. Par ailleurs, parmi ceux qui en possèdent, l'utilisation est souvent entravée par le tassement dans les ménages et autres facteurs sociodémographiques. Et ce malgré le fait que l'analyse indique qu'une plus grande distribution de moustiquaires pourrait en faciliter l'utiliser chez les populations vulnérables.

Mots-clés : *Ghana, moustiquaire, élimination du paludisme, ménages.*

Introduction

Malaria continues to be the leading cause of death among children in sub-Saharan Africa, accounting for about 20 percent of childhood death (RBM 2010). In the face of this dire situation, experts, nonetheless, remain divided on whether emphasis should be placed on more daring policies aimed at a complete eradication or on a gradual control approach (Greenwood 2009). While contemporary advocates of malaria eradication, with the Bill & Melinda Gates Foundation at the vanguard, call for the development of a vaccine that could completely eradicate the disease; proponents of the control strategy believe that complete eradication may not be feasible particularly in high endemic countries in Africa. The latter school argues that due to a myriad of challenges such as the intensity of endemic transmission, weak health systems, the size and access to populations at risk, and high financial costs; the goal of eradication could be counterproductive (Roberts and Enserink 2007; Sabot et al. 2010; Snow and Marsh 2010; Tatem et al. 2010).

The advocates of malaria control point to the successes of programmes such as insecticide-treated bednets (ITNs), new artemisinin-based combination therapies (ACTs), and indoor insecticide spraying as indicative that eradication is already within reach (White 2008). This view has been corroborated by recent report from the Millennium Development Goal (MDG) summit in New York which indicates that the lives of about 1.14 million children in Africa could be saved if existing control efforts were maintained till 2015 (RBM 2010). It is therefore of little wonder that malaria control programmes have been given priority attention in high endemic areas including Ghana (Picard et al. 1993; Goodman et al. 2000; Meltzer et al. 2003; WHO 2003; RBM 2007). While indoor residual spraying, the use of coils and other mechanisms continue to play a major role in the prevention and control of malaria (Okrah et al. 2002), current policy in much of sub-Saharan Africa emphasizes the use of insecticide nets (WHO 2003).

The effectiveness of treated mosquito nets in reducing malaria-related morbidity and mortality is well documented in the literature. Large scale controlled trials of treated bednets in the region during the 1990s showed significant reductions in malaria-related deaths in young children (WHO 2003). In Kenya, Nevill and colleagues (1996) estimated that the use of treated nets contributed to a 33 percent reduction in mortality among children. A similar study in Ghana demonstrated a 17 percent reduction in childhood mortality as a result of insecticide net use (Binka et al. 1996). Indeed, Lengeler (2004) has argued that about half a million child deaths in sub-Saharan Africa could be avoided each year if bednets were widely used. Against this backdrop, the African Heads of State Summit (Abuja, Nigeria) in 2000 on Roll Back Malaria (RBM) set a goal of 60 per cent bednet coverage for children under-five years and pregnant women by 2005. Although this target was not achieved in most countries (Alilio et al. 2007), there persisted the political will which culminated in the 2006 revision of the bednet target to 80 per cent coverage by 2010. Attaining this target implied the provision of more than 160 million treated nets (WHO 2004) which necessitated calls on governments in the sub-region to encourage private sector participation (Simon et al. 2002; Alilio et al. 2007).

Research context

Recent efforts at promoting the use of treated mosquito nets in the fight against malaria in endemic countries have shifted emphasis from vulnerable populations to a much broader objective of universal household coverage (WHO 2007). In Ghana, for instance, the objective of the National Malaria Control Programme, *inter alia*, is to scale up the distribution of bednets such that 100 per cent of all households will own at least one treated mosquito net by 2015 (GHS 2011). Though this objective is noble, the literature however points to a significant gap between ownership and use of bednets due to certain personal, behavioural and contextual factors (see, e.g., Agyepong 1992; Aikins et al. 1993; Ahorlu et al. 1997; Okrah et al. 2002; Alaii et al. 2003; Korenromp et al. 2003; Pettifor et al. 2008). In a study of bednet use in the Luangwe District of Zambia, for example, Macintyre et al. (2011) were puzzled that about half of the freely distributed treated bednets, a component of a universal coverage programme, remained unused.

It is thus pertinent to understand the factors that account for this gap especially in the light of Ghana's official policy aimed at achieving a nationwide coverage of bednet. In Ethiopia, Deressa et al. (2008) observed that the use of bednets as a malaria preventive strategy was unpopular among the people living in the Adami Tulu District (a malaria endemic area) due to the peoples' limited knowledge about bednets or their inability to use them. In the Upper West Region of Ghana, the refusal of pregnant women and children under age five to use mosquito nets has been attributed to the structure and design of the nets which are mostly meant for mounted beds but unsuited for floor mats that are common in the area (Ghanaian Times 2008). Commenting on this particular case, a high ranking official of Ghana's Ministry of Health indicated that pregnant women and children in the district refuse to use the treated mosquito nets distributed free to them by the Regional Health Directorate, claiming that the nets are not airy (Ghanaian Times 2008). The use of mosquito nets has also been found to be a function of the season as well as the household power structure. Okrah et al. (2002) in an exploratory study in rural Burkina Faso observed that bednets were mainly used during the rainy season and that most of the existing nets were not used by children but by adults, particularly the household heads. In Uganda, Mugisha and Arinaitwe (2003) noted that most children use mosquito nets mainly because they happen to share a bed with their parents.

These challenges on the use of bednets are often compounded by local perceptions about the aetiology of malaria which often deviate considerably from the biomedical understanding of its causes. For example, Aikins et al. (1994) in their study at the Kassena-Nankana District of the Upper East Region of Ghana noted that only half of the local residents considered mosquitoes to be the cause of malaria. Similarly, in a study among a rural farming community in Southern Ghana, Agyepong (1992) observed that excessive heat from the sun was erroneously perceived as the dominant cause of malaria. Other reported local perceptions about the causes of malaria that depart from the biomedical understanding include: the cold weather that normally follows heavy rains, fruits, bad food, heat from burning charcoal, and heat from cooking or working near fire (Agyepong 1992; Okrah et al. 2002; Adongo et al. 2005). These misconceptions about the cause of malaria could gravely undermine the anti-mosquito measures on which

national malaria control policies and programmes are based (Adongo et al. 2005). We argue that the success of bednets as a control measure against malaria infection hinges heavily on the local knowledge about malaria and its aetiology as well as the personal and socio-economic context within which the bednet is provided for use. Even in areas where bednet use is high, the primary objective has been to limit the irritability caused by mosquitoes at night but not for malaria prevention (Louis et al. 1992; Klein et al. 1995; Van Bortel et al. 1996; Adongo et al. 2005), and that there is limited use particularly among children (Mugisha and Arinaitwe 2003; Wiseman et al. 2007). This is problematic considering the vulnerability of children to malaria infection and the fact that children are often the target of subsidized public programmes.

Prior studies on the use of bednets in Ghana are often from small scale controlled trials which usually involve the free distributions of bednets and follow-up visits to monitor their use. It is not clear, however, the extent to which these studies are affected by observational reactivity. That is, the fact that the beneficiaries of free bednets know they are being studied could motivate them to hang the bednets as a form of impression management in the eyes of the benefactors. The availability of a large nationally representative data such as the Demographic and Health Survey (DHS) which solicits information on a wide range of demographic and health outcomes could minimize the potential for social-desirability bias since the survey did not involve a free distribution of bednets, and was not primarily centered on malaria and its prevention. Furthermore, the use of the DHS affords the opportunity to investigate household bednet use on a national scale unlike the community-level data used by prior researchers (see, e.g., Binka et al. 1996; De La Cruz et al. 2006; Baume and Marin 2007). Another advantage of using a nationally representative survey is that it allows for cautious inferences to the broader population. Additionally, using the household as the unit of analysis is valuable since household level factors influence childhood cerebral malaria (Okoko and Yamuah 2006). Using the most recent DHS household data from Ghana, the study contributes to the literature on malaria control by estimating a two-stage parsimonious model that examines the ownership of household bednet and use among children. The objective of the study is to provide useful insights that could aid in the fine-tuning of strategies aimed at improving overall bednet use in Ghana.

Data, Measures, and Methods

Data for this study are drawn from the 2008 Ghana Demographic and Health Survey (GDHS) household data file (GSS et al. 2009). It is the fifth in a series of DHS conducted in Ghana by the Ghana Statistical Service (GSS) in collaboration with Macro International. Funded by the United States Agency for International Development (USAID), Demographic and Health Surveys are nationally representative cross-sectional surveys that focus on socio-demographic, reproductive health, and child health indicators that started in the 1980s. The 2008 GDHS is a stratified sample of about 12,000 households.

Among others, respondents (household heads) were asked whether they had a mosquito net (either treated or untreated) in their households. Among those who answered in the affirmative, a contingency question enquired whether a child

under the age of five in the household slept under the net during the night preceding the survey, to which the responses are rank-ordered as no child, some children and all children. Since the possession of a mosquito net in the household may not necessarily imply its use, although the latter is contingent upon the former, two statistical models were run in the analysis. The first involves binary logit models predicting the likelihood of a household possession of a mosquito net as a function of certain characteristics. In the second stage, for households that possess a bednet and where there is at least a child under age five, an ordinal generalized linear model (Williams 2009) was used to predict the likelihood of *no child (coded 1)*, *some children (coded 2)*, and *all children (coded 3)* using the bednets as a function of theoretically relevant variables. The choice of the ordinal generalized linear model (oglm) became necessary after a Brant (1990) test indicated that the proportional odds assumption underlying the ordered logit model was violated.

The standard logit and oglm models are built on the assumption of independence of observations, but as widely discussed in the literature (see, e.g., Gyimah 2007), the DHS uses a multistage cluster sampling approach with households nested within communities. A major methodological problem with cluster-correlated data is that households from the same community cluster are likely to share similar characteristics. Hence, statistical models that assume independence of observations will generally underestimate the standard errors leading to elevated Type I error (Williams 2000). Robust standard errors are therefore estimated for these models to allow for observations which are not independent within clusters.

The study incorporated a number of conceptually relevant household characteristics that associate with malaria prevalence in Ghana (see, e.g., Boadu and Trovato 2006). Lying between latitudes 5 and 11° N, Ghana can be broadly divided into two main ecological zones comprising the southern and the northern belts based on annual rainfall patterns. Since rainfall distributions are markedly high in the southern belt than the northern belt (Dickson and Benneh 1995), the availability of surface waters for larval development will, *ceteris paribus*, be greater in southern Ghana than it will be for northern Ghana. Also, given that the 2008 GDHS data collection months (September–November) coincided with the minor rainy season of southern Ghana (which starts in September and peaks in October), and at a time when northern Ghana was experiencing a dry season (Dickson and Benneh 1995), we expect that mosquito density and nuisance levels at the time of the survey will be greater in southern Ghana than it will be in northern Ghana. Other household variables that could potentially explain differentials in household bednet ownership and use controlled for in the study include current place of residence (urban versus rural), sex of household head, highest educational attainment of household head, age of household head, number of bednets in household, and the ratio of number of people to sleeping rooms in the household. Preliminary model diagnostics revealed the absence of non-linearity with the explanatory variables measured on the interval/ratio scale. Variables that showed strong collinearity were dropped from the analysis.

Results

The descriptive statistics are presented in Table 1. Out of the 11,777 households that were surveyed, slightly less than half (48 per cent) had a bednet available while 52 per cent did not own any bednet. Of the households that have bednets and where there is at least a child under age five (N=3020), a little over half (57.2 per cent) of the respondents indicated that all the children under five in the household slept under a bednet the night preceding the survey, while about a third (33.6 per cent) indicated that no child slept under a bednet, and the remaining 9.2 per cent had some children under five in the household using a bednet in the night before the survey. For such households, we found that there is an average of 1.7 bednets, with 3.4 people sharing one sleeping room.

The other summary statistics suggest that the majority of the households were sampled from southern Ghana, which closely mirrors the national population distribution. Similarly, more households were sampled from rural areas (56 per cent) compared to their urban counterparts (44 per cent). The mean age of

Table 1. Descriptive statistics of variables included in the study.

	Observations	%
Household bednet ownership		
Yes	5,652	47.99
No	6,125	52.01
Children under 5 slept under bednet last night*		
No child	1,015	33.61
Some children	278	9.21
All children	1,727	57.18
Ecological zone		
Northern belt	2,749	23.34
Southern belt	9,028	76.66
Place of residence		
Urban	5,175	43.94
Rural	6,602	56.06
Sex of household head		
Male	8,042	68.29
Female	3,735	31.71
Highest educational attainment of household head		
No education/preschool	3,682	31.26
Primary	1,514	12.86
Secondary and higher	6,552	55.63
Don't know/no response	29	0.25
	Mean	SD
Ratio of number of people to sleeping rooms*	3.42	1.51
Number of bednets in household*	1.73	0.89
Age of household head (years)	44	16.12
Total number of households surveyed	11,777	100

* Computations are based on households that own a bednet and where there is at least one child under age 5 (N=3020).

a household head is 44 years (standard deviation of 16.1), with a little over half having attained secondary or higher levels of education. Over two-thirds (68.3 per cent) of the households are male-headed, and this seems to reflect the patriarchal nature of the Ghanaian social structure (see, e.g., Gyimah et al. 2010).

Table 2 presents the results of the binary logit model predicting household ownership of mosquito nets. Without controlling for the possible effects of potential confounders, the unadjusted odds ratios indicate that households in northern Ghana, those with higher ratios of people to rooms, and where the head of the household has no education or primary level of education are significantly more likely to own mosquito nets. On the other hand, households in urban areas, those headed by females and those where the head is older are significantly less likely to own a mosquito net. After controlling for the effects of potential confounders, the adjusted odds ratios indicate that variables such as the ecological area of residence, place of residence, age of the household head, educational attainment of the household head, the ratio of people to sleeping rooms in the household are statistically significant factors in predicting a household's ownership of a bednet. The association between the sex of the household head and the household ownership of bednet is however found to be of marginal significance.

Households in northern Ghana are about twice more likely [adjusted odds ratio (AOR) = 1.99, 95 per cent confidence interval (CI): 1.80–2.21] to possess a bednet compared to those located in southern Ghana. This may seem puzzling considering that the ecological conditions favorable for malaria transmission are more pronounced in the forest and coastal regions of the southern belt than they are in the northern savannah zone. This finding could perhaps be partly attributed to the often large scale free distribution of bednets in the north during controlled studies. Due probably to its relatively deprived socioeconomic conditions, northern Ghana has become a base for intervention trials often involving a large scale free distribution of bednets (see, e.g., Binka et al. 1996; Gyapong et al. 1996; Binka and Adongo 1997; Grabowsky et al. 2005). For instance, Binka et al. (1996) reported the free distribution of 21,500 bednets to compounds in 48 clusters in the Kassena-Nankana District in the Upper East Region, while Grabowsky et al. (2005) mentioned that 14,600 bednets were freely distributed to households that had one or more under five child in the Lawra District in the Upper West Region during a controlled trial in December 2002, thereby increasing overall household bednet ownership from 4.4 percent to 94.4 percent in the District.

The results also show that compared to households in rural areas, those in urban areas are significantly less likely to own a bednet. This finding is consistent with observations by Agyepong and Manderson (1999) who argued that economic constraints in urban areas tend to make the ownership of mosquito bednets less of a priority among urban residents. We add that the low ownership among urban households could also be due to the availability of mosquito screening on doors and windows in most urban homes which could render the possession of bednets redundant. Further, it is also not uncommon to read about the subsidized and often free distribution of bednets to rural households by both governmental and non-governmental organizations and agencies involved in malaria control (see, e.g., Meltzer et al. 2003). These free distributions are often premised on the notion that rural poverty may be a hindrance to the acquisition of the bednets among

Table 2. Logistic regression models on household bednet ownership.

	Unadjusted			Adjusted		
	exp (b)	Sig.	95% CI	exp (b)	Sig.	95% CI
Ecological zone						
Northern belt	2.033	0.000	1.862–2.220	1.994	0.000	1.802–2.208
Southern belt (reference)						
Place of residence						
Urban	0.499	0.000	0.463–0.537	0.53	0.000	0.489–0.574
Rural (reference)						
Sex of household head						
Female	0.755	0.000	0.698–0.817	0.923	0.064	0.849–1.005
Male (reference)						
Highest educational attainment of household head						
No education	1.132	0.003	1.043–1.227	0.806	0.000	0.728–0.893
Primary	1.281	0.000	1.145–1.433	1.021	0.730	0.907–1.149
Secondary and higher (reference)						–
Ratio of number of people to rooms	1.248	0.000	1.215–1.282	1.252	0.000	1.218–1.286
Age of household head	0.989	0.000	0.986–0.991	0.990	0.000	0.987–0.992
Number of observations						11681
Log pseudolikelihood						–7613.7028

Table 3. Ordered generalized linear models on childhood bednet use.

	Unadjusted			Adjusted		
	exp (b)	Sig.	95% CI	exp (b)	Sig.	95% CI
Ecological zone						
Northern belt	1.122	0.128	0.968–1.300	0.939	0.518	0.777–1.135
Southern belt (reference)						
Place of residence						
Urban	0.593	0.000	0.509–0.690	0.598	0.000	0.507–0.705
Rural (reference)						
Sex of household head						
Female	0.831	0.028	0.704–0.981	0.808	0.020	0.676–0.966
Male (reference)						
Highest educational attainment of household head						
No education	1.026	0.749	0.879–1.197	1.099	0.340	0.905–1.333
Primary	1.046	0.673	0.848–1.290	0.997	0.981	0.801–1.242
Secondary and higher (reference)						
Ratio of number of people to rooms	0.961	0.080	0.919–1.005	0.582	0.000	0.503–0.668
Ratio of number of people to the squared number of rooms	1.010	0.583	0.975–1.045	1.543	0.000	1.384–1.721
Number of bednets in household	1.384	0.000	1.267–1.511	1.583	0.000	1.430–1.753
Age of household head	0.984	0.000	0.979–0.990	0.987	0.000	0.981–0.994
/cut1				-1.36	0.000	-1.72–1.00
/cut2				-0.95	0.000	-1.30–0.59
Number of observations				2980		
Log pseudolikelihood				-2591.933		

rural dwellers, a notion consistent with the mainstream antipoverty initiatives in much of sub-Saharan Africa which have traditionally targeted impoverished rural areas (Maxwell et al. 2000).

Also, the likelihood of a household owning a bednet increases with the ratio of people to sleeping rooms in the household. Households where the head has no formal education are significantly less likely to own a bednet compared to their counterparts with secondary or higher levels of educational attainment. The ownership of household bednet is also found to be negatively associated with age of household heads. As Agyepong and Manderson (1999) noted, older people by virtue of their experience in child care, might have devised their own peculiar means of giving their children protection from the mosquitoes, such as the application of some conservative methods like “blowing” mosquitoes away with a cloth. It is also likely that older folks may be discriminated against in the supply of bednets because their children are probably older.

As intimated earlier, the factors that predict household ownership of bednet may not necessarily determine their usage, particularly among children under five. Table 3 presents the results of the ordinal generalized linear model of bednet use by children in households during the night preceding the survey. There is evidence that the factors that significantly associate with the ownership of bednets do not necessarily determine their use by children. The unadjusted odds ratios indicate that urban residence and female-headed households associate with less likelihood of bednet use by all children in household. Also inversely related with childhood bednet use are the age of the household head and the ratio of people to rooms in the household. The only factor that associates positively with the use of bednets by all children in the household is the number of nets (AOR=1.38, 95% CI:1.27–1.51).

Turning to the adjusted odds ratios, it is interesting to observe that while the odds of all children sleeping under bednets are significantly reduced with an increase in the ratio of people to sleeping rooms; in instances where the number of sleeping rooms are doubled while holding the number of household members constant significantly increases the odds that all children under age five will sleep under a bednet. In other words, the odds of all children using bednet are increased by 54 per cent (95% CI:38%–72%) when the number of sleeping rooms are doubled in the household while holding the de jure number of residents constant. Thus, it is plausible that one major household circumstance that hinders the use of mosquito nets among children in Ghanaian households could be due to over crowding. This notwithstanding, having more bednets significantly increases the odds that all children in households will sleep under mosquito nets. The results indicate that each additional bednet in the household increases the odds that all children will use them by 58 per cent (CI:43%–75%).

Consistent with our expectation, households in urban areas, compared to their rural counterparts, are significantly less likely to have all children sleep under bednets. This is due probably to the architectural designs of the houses with mosquito screened windows and doors which could render the use of bednets quite redundant. Also significant is the finding that female-headed households are less likely to have all children sleep under bednets compared to their male-headed counterparts. This finding however stands contrary to an observation made by the UNICEF (2007) that whenever women are the primary decision-makers in households, they

tend to invest more in health promoting ventures especially with regard to their children. In this regard, it was expected that household bednet use by children will be higher for female-headed households than those headed by males. The use of bednets for childhood malaria control could perhaps yield greater dividends if the circumstances of households headed by females can be investigated, particularly with respect to household authority relations within the context of a patriarchal social set up as it pertains in Ghana.

The results further show that households headed by older people are less likely to have all children under age five to sleep under bednet. While this could be attributed to the reluctance of older people to adopt new technologies, it is also possible that these older household heads may be grandparents caring for grandchildren. In such a case, the greater likelihood of non-use of bednets among such children could be due to the lax authority on the part of grandparents in dealings with their grandchildren. Nukunya (2003:31) described this grandparent-grandchild relationship as the “merging of alternate generations” which is characterized by the absence of serious authority and disciplinary procedures on the part of grandparents. It is also interesting to observe that educational attainment of the household head, though not significantly related with bednet use by children, is fairly consistent with earlier findings. For instance, De La Cruz and colleagues (2006) found that higher education and hence greater knowledge, especially about malaria, does not necessarily translate into improved bednet use in Ghana. Similarly, Agyepong and Manderson (1999) observed that the knowledge of malaria’s aetiology is independent of educational attainment in Ghana.

Conclusion

With the growing recognition that the malaria menace is multifaceted in nature, several attempts have been made to investigate the socio-economic and behavioural factors that influence the prevention, management and control of malaria in endemic regions. To this end, studies abound that seek to model the socio-economic determinants of bednet use, especially by children in households. Prior research, however, often conflates the household ownership of bednets with their actual usage, often using the former as a proxy for the latter (see, e.g., Nuwaha 2001; Meltzer et al. 2003; Wiseman et al. 2007). As Wiseman and colleagues (2007) acknowledged, a household ownership of bednets may not necessarily imply their usage and as such, understanding the factors that determine the actual use of bednets may provide better fine tuning to public policy decisions about the universal distribution of free bednets as well as their targeting towards specific groups.

This study empirically examined the factors that determine a household ownership of bednets and their use among children under the age of five years. A comparison of the results from the binary logit and ordinal generalized linear models indicates that not all the factors that significantly predict the household ownership of bednets also account for their use by all children in the household. For instance, while households in northern Ghana were found to be significantly more likely to own bednets compared to their southern counterparts, no significant difference in their use by children was observed. Similarly, while the ratio of people to sleeping rooms in household was found to be positively associated with

the likelihood of bednet ownership, it was negatively related with the actual use by all children in the household. However, if the number of sleeping rooms were to be doubled while holding the number of *de jure* residents constant, this would significantly increase the odds that all children under age five in households will sleep under mosquito nets.

The results imply that inadequate number of rooms for sleeping coupled with the usually large household memberships (see, e.g., GSS 1995) have a deflating effect on the use of bednet in Ghanaian households. In spite of this structural challenge, it is interesting to observe that having more bednets in the household significantly increases the likelihood that all children will use them. This suggests that scaling up bednet distribution, with the goal of achieving universal coverage will facilitate increased use among vulnerable populations. Implicit in the policy of universal coverage is the recognition that although not all nets distributed freely would be used, the used ones could nonetheless have a ‘knock-down effect’ on mosquito density, thus leading ultimately to a community-level protective effect (Howard et al. 2000; Hawley et al. 2003; Macintyre et al. 2011). In order not to further widen the gap between bednet ownership and use, and to maximize the potential benefits of these mass distributions, it is imperative that household level factors that constrain the use of bednets are identified and incorporated into the overall scheme of malaria control programming.

Within the Ghanaian context, for instance, household level factors that could have important implications for improving bednet coverage and use include the observations that older household heads as well as households headed by females tend to be significantly less likely to own bednets and are also less likely to have all children to sleep under them. While younger household heads are more likely to embrace the use of bednets as they are generally more likely to heed health education messages and also have a higher inclination to be innovators or early adopters of preventive technologies (Nuwaha 2001), older people on the other hand could be more likely to espouse erroneous perceptions about the aetiology of malaria and its appropriate control strategies. As regards the gender differentials, the finding that households headed by males are significantly more likely to own and use bednets compared to their female counterparts could reflect the asymmetrical power distribution that tends to favour men within Ghanaian households (Dodoo and van Landewijk 1996). Okoko and Yamuah (2006) observed a similar phenomenon in The Gambia, where fathers and/or patriarchs were more likely to be the ones to decide when to seek hospital treatment for childhood cerebral malaria. Thus, in a typical patriarchal society as Ghana, certain cultural norms could possibly influence health seeking behaviour within households. This paper therefore recommends that information and educational programmes and activities about childhood prevention malaria, such as those aired on television and radio stations, should have older people and female household decision-makers as important target groups for intervention.

In closing, the study suggests that although scaling up the distribution of bednets will have the potential for facilitating increased use, the key may actually lie in unpacking how household level socio-demographic factors either ease or impede its use among vulnerable populations in order to maximize results. Future research utilizing a more in-depth qualitative data would enhance our understanding of the household level contextual challenges on bednet use.

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