

Mothers' Demand for Preventive Healthcare for Children Aged Under-Five Years: The Case of Utilization of Insecticide-Treated Bednets in Ghana

Edward Nketiah-Amponsah

Department of Economics, University of Ghana, P. O. Box LG57, Legon, Accra, Ghana

Tel: 233-21-501-485 E-mail: enamponsah@daad-alumni.de, eddyil@yahoo.com

Abstract

Child health outcomes remain one of the most important barometers for measuring the overall social and economic well-being of a country. Malaria is endemic in sub-Saharan Africa, being the major cause of under-five mortality in Ghana. An effective strategy to combat the widespread malaria morbidity among children aged under-five is the utilization of preventive healthcare via Insecticide Treated Bednets (ITNs). This paper examines the socio-economic factors influencing the adoption and usage of ITNs by mothers and/or care-givers for children aged under-five years. Logistic regression is employed for the empirical estimation. The study finds that low-income households, age of the child, area of residence, distance to the nearest health facility and distance to food market inter alia significantly predict mother's adoption and utilization of ITNs among children aged-under five. It is also worth-noting that women who had experienced childhood mortality in the last five years preceding the survey were 37 percentage points more likely to have their surviving children sleep under ITN. In addition, mothers who profess the Catholic faith were 2.4 times more likely to have their children sleep under ITN compared to their counterparts who are traditionalist. The paper contributes to the general debate on preventive healthcare.

Keywords: Preventive healthcare, Malaria, Insecticide Treated Bednet, Children under-five years, Logistic-regression

1. Introduction and Related Literature

Malaria remains the major cause of morbidity and mortality in sub-Saharan Africa. It is the leading cause of deaths in children aged under-five years (Snow, et al. 2005). In all, malaria threatens the lives and livelihoods of 3.2 billion people worldwide and causes over one million deaths annually (WHO, 2005). In Ghana, the disease accounts for 44% of ambulatory care, 13% of all hospital deaths and 22% of mortality among children less than five years of age (WHO, 2005; Steketee et al. 2003). Aside the suffering imposed by malaria, there is a cost dimension to morbidity. In societies with high dependency ratios such as Ghana, the disease in addition to creating out-of-pocket expenditures for patients and their families also undermine income generation, and as a result retard future economic welfare (Gertler and Gruber, 2002). Early diagnosis, prompt and appropriate treatment is crucial for malaria control but prevention remains the best approach.

The use of ITNs to protect children from malaria parasite transmission is one of the main strategies recommended by the Roll Back Malaria (RBM) partnership (Note 1). A major objective of the (RBM) campaign is to have 80% of pregnant women and children aged under-five sleep under ITNs by 2010 (WHO, 2005). In the year 2000, the African summit on RBM considered the removal of taxes and tariffs on ITNs as one of the important arsenals for fighting malaria. However, as of year 2007, more than half, 24 of the 39 Abuja signatories continue to impose taxes and tariffs on this life-saving tool. Taxes and tariffs considerably increase the price of ITN, reduce affordability, and discourage the commercial sector from importing ITNs (Alilio et al. 2007). The government of Ghana through its Ministry of Health has been at the forefront of malaria control and actively involved in the global effort against malaria under the RBM initiative. The commitment of the government of Ghana in the fight against the menace could be seen in the tax waiver on the importation of nets since 2000. This is to help render the price of ITNs affordable across income groups. A study by Simons et al. (2002) has shown that a reform of the tariff and tax policies on insecticides could significantly influence bednet use.

The demand for preventive health care via ITN's utilization is widely researched in sub-Saharan Africa and other malaria prone areas. One reason for this is the increasing patronage of inappropriate health providers conditional on morbidity with its related health risk and the ensuing cost; granted care is sought from appropriate providers. The Ghana Statistical Service reports that approximately 60% of persons who reported ill or were injured had consulted a health practitioner (GSS, 2008). This marks an increase of 16 percentage points from the level of 44% recorded in 2003, but still remains low and raises concern about the general healthcare seeking behaviour of the populace. Uzochukwu and Onwujekwe (2004) point out that self diagnosis of malaria by respondents was the commonest while drug stores or buying over-the-counter drugs was the first point of visit in South-East Nigeria (see also Owusu-Agyei et al. 2007, Chibwana et al. 2009). It is also evident that mothers usually go through different treatment regimes before consulting health facilities and thus causing obvious lag in appropriate health seeking (Malik et al. 2006, Chibwana et. al, 2009).

The demand for healthcare, whether preventive or curative, derives from a more fundamental demand for good health (Heller, 1982). It is a case of derived demand in that it is not demanded for its own sake but to ensure or maintain good health. Preventive services, are therefore, consumed in the expectation that the cost of prevention is significantly lower than the expected cost of illness. Kenkel (1994) studied the demand for adult preventive medical care and concluded that annual use of two preventive services decrease with age. The author also found that demand for preventive care is sensitive to insurance coverage and educational attainment. Tian (2010) examined the demand for preventive care services and its relationship with inpatient services and found that the utilization of preventive care services reduce the probability of the utilization of inpatient services. Thus demand for preventive healthcare reduces potential curative expenditures. Policy makers and researchers concur that relatively inexpensive and welfare-improving technologies such as utilization of ITNs are very effective at protecting particularly pregnant women and children from malaria. Nevertheless, the purchase and use of bednets remain low in many malaria-prone areas (Webster et al. 2005).

Studies examining ITN's efficacy suggest a significant reduction in malaria episodes. If used universally, ITNs could prevent approximately 7% of the global under-five mortality (Jones, et al. 2003). The UNICEF corroborates that under-five mortality rates could be reduced by about 25-30% if all young children in malaria endemic areas were protected by treated bednets at night (Note 2). In addition, a large clinical trial in Kenya affirms the effectiveness of bednets in curbing malaria infection. The results show a significant reduction in clinical malaria and moderate-severe anaemia by 60% in children under-five years (Alaii et al. 2003; Hawley et al. 2003). Abdella et al. (2009) using clinical trials confirmed that inconsistent use of mosquito nets coupled with other social and technical factors influence the efficacy of mosquito nets. In particular, the authors found that mosquito net possession and appropriate utilization of mosquito net were not associated with clinical malaria. However, given pragmatic deficiencies like poor ITN distribution and re-treatment services, ITNs were not significantly associated with clinical malaria in children aged under-five.

The demand for preventive healthcare is influenced by a host of socio-economic factors which are likely to influence the demand for any commodity such as income and market prices alongside current attributes-health status and the frequency of illness among others. Noor et al. (2009) employed recent national household survey data for 18 malaria endemic countries to study the utilization of ITNs by age and sex and concluded that in malaria endemic Africa, school-aged children are the least protected with ITNs but represent the reservoir of infections. In Mozambique, Chase et al. (2009) show that after controlling for other covariates, there is no discernible empirical evidence that poor households are less likely to own bednets. Conversely, the results indicate that education and market knowledge are associated with high willingness to pay for bednets while use of alternative preventive measures such as Indoor Residual Spraying (IRS) are found to decrease demand for bednet use. In Congo, Pettifor et al. (2008) found women with secondary education or better 2.8 times more likely to have used a bednet compared to women with less education.

Custodio et al. (2009) investigated the nutritional and socio-economic factors associated with plasmodium falciparum infection in children from Equatorial Guinea. Among the findings were that only 55% of the children who had suffered malaria were treated outside their homes. In particular, age, longer distance to health facilities, utilization of bednet and maternal anti-malaria medication among others were associated with parasitemia. In Nigeria, Oresanya et al. (2008) examined the predictors for treated net ownership and utilization among children aged under-five. Many socio-economic variables including education, distance to health facility, wealth, income and region of residence proved significant in predicting bednet utilization. On the contrary, Goesch et al. (2008) reported a strong inverse relationship between socio-economic factors such as presence of running water, flush toilet in residence and highest income score on one hand and on the other hand, bednet use. The authors attribute the inverse relationship to the 'insect nuisance hypotheses' in which bednet might be used to avoid excessive noise created by the insects but not necessarily for preventing mosquito bites. Hence, richer households are less prone to the insect and nuisance relative to poor households who often do not have nets in their windows as a first step of prevention. Other studies have shown that poor households may have lower or simply insufficient willingness to pay for bednets (Ozochukwu, et al. 2004). Even households that are willing to pay may not be able to do so if they lack the cash at hand and do not have access to credit. In Kenya, Noor et al. (2006) reported that homestead travel time to nearest market centres and mother's education were significantly associated with use of retail sector nets by children aged less than five years. However, the authors did not account for the effect of confounding variables such as religious denomination on bednet usage. The literature also show ample evidence that gender, occupation, place of residence, relationship with household head and other socio-demographic factors significantly contribute to sleeping under a mosquito net (Wiseman, 2007; Ng'ang'a et al. 2009).

Other findings emanating from the literature indicate that individuals who understand the connection between mosquitoes and malaria may also attribute the disease to other beliefs and attitudinal factors, making it difficult to convince them to adopt bednets as a control measure (Agyepong and Manderson 1999, Hill et al. 2003 and Adongo et al. 2005). For instance, warm weather and perceived absence of mosquito bites are cited as some of the reasons for not using bednets (Browne, et al. 2001). Owusu-Agyei et al. (2007) assessed malaria control in

the Kassena-Nankana District of Ghana using the RBM tools. The authors concluded that there was a significant increase in the utilization of ITNs among children aged under-five and pregnant women between the period 2000 and 2003. However, the authors did not empirically examine the socio-economic factors influencing the utilization of ITNs.

The main objective of this paper is to examine the socio-economic factors influencing the adoption and utilization of ITNs among a cross section of children aged under-five years. While quantitative analysis of this phenomenon in Ghana and elsewhere is widely addressed by some health researchers, this paper makes a number of specific contributions to the existing literature. Distance to the nearest health facility which denotes the ease or otherwise with which care could be sought conditional on malaria episode, is omitted in a number of studies reviewed. In the same direction, community characteristics including distance to the nearest market, which indicates market accessibility, in case of purchase from the private market is often not controlled for in multivariate analysis. Also, religious denominational variables are introduced to capture belief system which is missing in a number of studies. In addition, interactions among some of the variables were explored to verify probable pathways for policy interventions. In general, the study contributes to the general debate on malaria prevention in sub-Saharan Africa.

2. Methods

2.1 Data

This study uses data from a survey conducted in three Districts (Lawra, Ejisu-Juabeng and Dangme West) in Ghana between October 2007 and January 2008. The choice of the three Districts was informed by poverty and under-five mortality trends as well as the need to capture the ecological zones of Ghana. A cross-section of 531 women aged 15-49 who had experienced a live birth over the period 2002-2007 were recruited into the study (Note 3). The 531 women had between them 773 live births of which 94 (12.2%) had died at the time of the survey. This paper is based on the 679 surviving children at the time of the survey. The women were randomly selected and interviewed using validated, structured and pre-tested questionnaires (Note 4). The responses were elicited in a face-to-face interview in the residence of the respondents. For households with more than one woman in the specified category, the first willing woman was interviewed.

Due to the absence of a complete list of households in each District and due to the specificity of the subjects under study; women and children, a three stage stratified random sampling technique was employed where the first stage was the District, the second locality/village and the household being the third stage. To capture the differential impact of demographic, household and community characteristics, the population was divided into sub-population or strata and random sampling was applied to the sub-populations/strata based on the different sizes of the population. The use of this technique ensured that different sub-populations are adequately represented in the sample. To ensure data accuracy and quality, the enumerators who were largely graduate students with enormous experience in household surveys were retrained and the questionnaires thoroughly discussed prior to the field survey. The interviews/questionnaires were double-entered in order to guarantee accuracy with the entries. Also, to verify whether the children sleep under ITN or not, the interviewers often asked if the mothers/care givers could visibly display the bednets. While, some of the nets were openly and willingly displayed, self-reported usage was considered adequate because of ethical considerations.

2.2 Ethical Considerations

Participation in the survey was voluntary and informed consent was obtained from all household heads and women interviewees. Ethical approval was granted by the Ghana Ethical Review Committee of the Ghana Health Research. Approval was also sought from the District Directorate of Health Service and the traditional rulers in the communities visited.

2.3 Estimation

The model for the study is premised on the random utility model. Logit is one of the important models commonly used to solve discrete-choice problems (Greene, 2003). The rationale of the random utility model is that a consumer faces a choice between two alternatives; in this case to utilize ITN or not. Thus we seek to identify the factors influencing a decision with a dichotomous outcome. Each alternative chosen has an associated utility index describing the attractiveness of the alternative to the consumer. Although the utilities are unobservable, consumers reveal their preferences by choosing the alternative with the highest utility index. The decision to utilize ITN or not can be specified as a function of observed individual characteristics such as income, age and educational level plus other factors influencing the demand for ITNs. Algebraically, the individual or household decision process can be expressed as follows;

$$U_{i1} = \alpha_i M_{i1} + \varpi_i X_i + \mu_{i1} \quad (1)$$

$$U_{i2} = \alpha_i M_{i2} + \varpi_i X_i + \mu_{i2} \quad (2)$$

Where α_i and ϖ_i are vectors of coefficients corresponding to the variables in the vector representing the attributes of ITN (M_i) and socio-economic factors (X_i) respectively, while μ_{i1} and μ_{i2} are additive error

terms. A mother or care-giver adopts preventive care (ITN) if $U_{i2} > U_{i1}$ or continues with the status quo (without ITN) if $U_{i2} < U_{i1}$ and indifferent if $U_{i2} = U_{i1}$. Designating the adoption and utilization of ITN by $y_i = 1$ and $y_i = 0$, otherwise; the adoption probability can be written as follows;

$$P_i = (y_i = 1) = P(U_{i2} > U_{i1}) = P(\mu_{i1} - \mu_{i2}) > [(\alpha_{i1} - \alpha_{i2})M_i + (\omega_{i1} - \omega_{i2})X_i] = P(\varepsilon_i) < (\beta_i x_i) = F(\beta_i x_i) \quad (3)$$

Where x_i incorporates both M_i and X_i per equation (3). $P(\cdot)$ is a probability function; and F is a distribution function for $\varepsilon_i = (\mu_{i1} - \mu_{i2})$. The exact distribution of F depends on the distribution of the random term ε_i . It is assumed that if F follows a logistic distribution then F is a cumulative logistic function.

To determine the probability that the i th child sleeps under ITN, the standard formulation of the logit model is as follows;

$$\ln[P_x/(1 - P_x)] = \sum \beta_i x_i, \quad (4)$$

where P_x = the probability that an event (a mother or care giver adopts ITN for the child) occurs for N observed set of variables, x_i and β_i the coefficient to be estimated. x_i is the vector of the socio-economic variables influencing the demand for bednet. For the logit model, the dependent variable becomes the natural logarithm of the odds when a positive choice is made.

3. Results and Discussion

Table 1 presents the descriptive statistics of the variables used in the estimation. Regarding the usage of ITNs, approximately 68% of the children had access to ITN. This figure seems relatively high given that just about 15% of children had slept under ITN according to the 2003 Ghana Demographic and Health Survey (GDHS) report. The huge difference could be partly explained by the time lag between the GDHS and the current study coupled with the fact that the GDHS was nationally representative while the current study looks at only 3 Districts (Nketiah-Amponsah, 2010). In addition, the GDHS captured only children who slept under ITN the previous night before the survey while the current study considered two weeks prior to the survey. ITN's usage is highest in the Lawra District, though this district has the lowest mean income (see Table 4). This might be somehow attributable to the activities of health related NGOs which embark on malaria prevention campaigns in addition to public healthcare programmes. Also, due to the high level of poverty in the Northern regions of Ghana, households might find it difficult to undertake curative healthcare expenditures and therefore adopt bednet to avoid devastating health expenditures. Although there is an upsurge in the utilization of Insecticide Treated Bednets at least for the three Districts studied, it is still behind the Roll Back Malaria Campaign (RBM) which aims to have 80% of pregnant women and children under-five years sleep under ITNs by 2010.

<Table 1>

Spatially, approximately 66% of the respondents live in rural areas while the remaining live in urban and peri-urban areas. The mean years of schooling of the mothers in the sample is approximately 6 years, which is required to complete primary education in Ghana while the mean age is 27 years. Concerning marital status, 75% of the women were married while the remaining 25% were divorced or never married. In terms of gender, 48% of the children are boys while girls constitute 52%. There were approximately two children under-age five per household. The mean age of the children in the sample is 24 months. In the case of household power distribution, 25% of the households were headed by women. Access to running water remains problematic with only 15% of households having piped water in their residence, while the remaining households rely predominantly on public outdoor tap and boreholes. In the area of household income, the bottom 20% of the households (lowest income quintile) had an income range of \$152-\$872 per annum while the top 20% (highest income quintile) had a range of \$1920-\$8432 per annum. The mean distance to the nearest health facility is 5 kilometres while that of food market is 4 kilometres. Within the households, it takes approximately 1.4 kilometres on average to access any means of public transport. In the area of religion, about 28% of the mothers are practicing Catholics while 48% belong to other Christian faiths. Moslems constituted 12% of the mothers sampled.

Prior to the empirical model estimation, a Pearson correlation matrix on the independent variables was estimated to verify if there is any significant collinearity between the independent variables (Note 5). The results indicate that multicollinearity is very mild. None of the correlation coefficients exceeds 0.5, dampening the fear that two or more variables might be measuring the same thing. The model does quite well, explaining 16% of the variation in the utilization of ITNs among children aged under-five years. For a discrete choice model, a Pseudo R^2 of 16 suggests a good fit. In addition, the Log-Likelihood ratio test, and the Link-test (see Table 3) for model specification all attest to the fact that the model is well fitted (Note 6).

<Table 2>

<Table 3>

From our results, rural residents are less likely to sleep under ITNs but the result is not robust enough ($p=0.14$). In a previous study, Agyepong et al. (1999) in contrast found that rural residents in the Greater Accra region of Ghana used more bednets relative to their urban counterparts. The age of the child and birth parity are inversely and significantly associated with bednet use. Accordingly, as the children advance in age, the probability of sleeping under ITN falls. This result is counterintuitive to the fight against malaria in that until the child reaches age 5 and beyond, they are still susceptible to the menace. This situation could precipitate continuous malaria infection (Chase et al. (2009). There, is therefore, the need to ensure continuous usage until the child reaches the terminal age of 60 months, given that morbidity and mortality risk still persist. In the case of birth parity, the result shows that women attach more importance in terms of preventive healthcare for their first and perhaps second child but are less cautious with succeeding children ($p<0.01$). The gender of the child has no discernible effect on ITN utilization ($p=0.19$). The number of times the child is vaccinated with respect to the WHO recommended 9 vaccines for children aged under-five is highly associated with bednet usage. Vaccination increases the probability of utilizing ITNs by 3 percentage points. This suggests that childhood vaccination is a complementary preventive healthcare. This might be explained by the additional health education offered at child welfare clinics or other health facilities where vaccines are administered. Hence, mothers who adhere to childhood vaccination schedules are more likely to seek complementary preventive healthcare services including usage of bednets.

Strikingly, women who had experienced childhood mortality in the last five years preceding the survey were more cautious with their current surviving children and thus adopt ITN for their children. For the fear of losing subsequent children, such women adopt ITN to forestall malaria episodes. Women with such experience are 38 percentage points more likely to have their children sleep under ITN. Maternal education had the right signage but insignificant. This is in contrast with robust findings from other studies such as Pettifor et al. (2008) and Chase et al. (2009) but in congruence with some findings in the literature including Eisele et al. (2009) who found maternal education to be an inconsistent determinant of bednet use in their study on ITN use and maternal education across 15 African countries. Curiously, female headed households, maternal age and marital status had no significant effect on bednet use.

It is an incontestable fact that *ceteris paribus*, the price of bednet is an important argument in the demand for same. However, the price of bednet is excluded for justifiable reasons. First, in empirical analysis prices are unobserved for children who are not sleeping under ITNs (Wiseman et al., 2007). Aside information asymmetry on the price variable for those not using ITNs, there is often limited variation in price in highly regulated public health schemes. Similar argument has been used to exclude the price variable in modelling participation or adoption decisions such as in health insurance schemes (Blumberg and Nichols, 2002; Kirigia et al. 2005). Lastly, the difficulty in identifying those who were subsidized and to what extent, makes the price variable misleading, thus it neither represents willingness to pay nor marginal utility of bednet.

Another notable finding is the negative association between households in the higher income bracket and ITN usage. Rather, children from lower income households are 2.5 times more likely to sleep under ITN relative to their counterparts from the highest income bracket. The relationship is not surprising in that lower income households might not be able to afford devastating curative health expenditures following childhood malaria and thus prevention remains an important option. This finding is in contrast with Wiseman et al. (2007) but in agreement with Goesch et al. (2008) and Chase et al. (2009) to the effect that wealth has no significant impact on the utilization of ITNs. The results also give credence to the 'noise hypothesis' granted that some households employ ITN not necessarily for avoiding malaria infection but to prevent the nuisance created by the insect. The author is inclined to agree with the insect-nuisance hypothesis which argues that richer households do not necessarily keep bednets to fight malaria but rather to reduce the insect nuisance. Moreover, there is no evidence that households with piped water; another indicator of household well-being influences bednet usage. While this variable has a negative sign, it is woefully insignificant. However, Goesch et al. (2008) found a significant inverse relationship between presence of running water and bednet usage. Stunningly, however, an interaction between households with piped water in residence and those in the 4th income quintile proved significant. Such households are 3.6 times more likely to have their children sleep under ITN compared to others. This suggests that an interaction between some wealth indicators promotes ITN usage.

Community characteristics such as distance to the nearest health facility and distance to food market were found to be significant determinants of bednet use. Particularly, distance to the nearest health facility is negatively associated with bednet use. This variable is used as a proxy for the opportunity cost of obtaining a bednet. Since maternal and child health clinics offer such services, longer distances might hinder the demand and utilization of ITN. Conversely, what seems like a caveat is the positive relationship between distance to food market and ITN usage. Moreover, distance to public transport which approximates access to services including healthcare is inversely related to the utilization of ITNs but the effect is less robust ($p=0.13$).

Four dummies were introduced to account for religious affiliation and the outcome is startling. Religion proved to be a significant covariate of ITN's usage. For children whose mothers practice Catholicism, the probability of sleeping under ITN is 2.4 times higher than those whose mothers are traditionalist. Also, mothers who profess

other Christian faiths other than Catholicism are 14 percentage points more likely to utilize ITNs compared to those who practice traditional religion. In terms of District of residence, children residing in Dangme and Lawra Districts are more likely to sleep under ITNs as compared to their counterparts in the Ejisu-Juabeng District (the reference category). These two Districts are significant predictors for the utilization of ITNs but the effect is more pronounced in the Lawra District, where the marginal effect is 26 percentage points as compared to Dangme with 11 percentage points. The Dangme and Lawra Districts are relatively poor suggesting that poorer households or better still Districts are more cautious with preventive healthcare as they might not be able to adequately cater for the cost of treatment during illness.

4. Conclusion

The study demonstrates that a number of socio-economic and religious factors or beliefs influence the adoption of Permethrin Treated Bednets for children aged under-five years. It is important to note that reduction in curative care expenditures could release funds for more nutritious meals, the effect of which is to improve anthropometric indicators of the children. Consequently, the use of ITN as a preventive measure not only prevents malaria but could also help improve other health indicators. A community characteristic such as distance to the nearest health facility is an important factor influencing the utilization of ITNs; longer distances to health facilities are a disincentive to bednet usage. This is against the setting that ITNs are normally sourced at health facilities including child welfare clinics and other vaccination centres. In such facilities, ITNs are usually subsidized and mothers or care-givers gain additional knowledge on its proper utilization. Therefore, the bridging of health access through the establishment of Community Health and Planning Service (CHIP) zones throughout the country should be expedited to promote appropriate and timely health seeking among the populace. Another finding worth-reiterating is the influence of religion on bednet use. Catholic mothers and women of other Christian faiths have a higher propensity to adopt bednets for their children compared to those who are traditionalist. Hence, health education that defies religious beliefs should be encouraged in order not to undermine the global effort at fighting the menace.

Additionally, mothers or care givers who adhere to routine immunization schedules for their children are likely to gain other preventive health knowledge and as a result have a higher propensity to use ITNs. The study supports the view that neither wealth nor other wealth indicators such as piped-water in residence is associated with bednet usage. Rather, households from the lowest income bracket have a higher propensity to use ITNs. Similarly, maternal education did not prove to be a robust determinant.

At the continental level, African governments have to show enough commitment by implementing the tax waiver on ITNs and other tenets enshrined in the Abuja summit if the RBM targets on the continent are to be met. Even though, Ghana has implemented a tax-waiver on bednets, the full impact on malaria prevention will be felt if countervailing attitudes and beliefs are discarded. Lastly, one of the fundamental weaknesses of this study is that the responses on the usage of bednet are self-reported. While attempts were made to ascertain ownership and usage, it could not be enforced in all the interviews due to ethical considerations. It is however, envisaged that, the responses reflect the reality and by no means invalidate the study outcome.

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Endnotes

1. Other alternative but less effective preventive care against malaria in sub-Saharan Africa includes keeping tidy environment, good sanitation, use of mosquito repellants and drug prophylaxis for pregnant women.

2. http://www.unicef.org/health/index_interventions.html (Accessed on 19th November, 2008).

3. The sample size was calculated with recourse to Cochran's estimated proportion approach (1977). This is because the total population of women who had given birth over the past five years in the three districts was unknown. However, we are guided by the 2003 Ghana Demographic Health Survey (GDHS).

4. The data had been collected to investigate under-five morbidity, mortality and treatment seeking options.

5. Results not reported

6. Since –hatsq has no predictive power; we reject the null hypothesis that the link test is significant. Accordingly, the logit function as the link function is the correct choice or the relationship between the logit outcome variable and the independent variables.

Table 1. Descriptive Statistics of the Variables used in the Estimation

Variables	Observations	Mean	Standard Deviation
Rural Residence	679	0.6583	0.4746
Child's age in Months	679	25.9542	17.5218
Gender of Child (Boy=1)	679	0.4816	0.5000
Birth Order (Parity)	679	2.7555	1.8052
Number of children aged under 5 yrs old	679	1.5258	0.6208
Total No. of childhood vaccinations Received	679	7.6834	1.9841
1st Income Quintile	679	0.1900	0.3926
2nd Income Quintile	679	0.1973	0.3983
3rd Income Quintile	679	0.2077	0.4059
4th Income Quintile	679	0.2062	0.4049
5th Income Quintile(Ref.)	679	0.1988	0.3994
Mother had experienced U5MR in the last 5yrs	679	0.0383	0.1124
Piped water in residence	679	0.1502	0.3576
Piped water in residence*4th Income Quintile	679	0.0442	0.2057
Mother's age	679	26.6436	6.5425
Mother's years of schooling	679	6.3814	4.8676
Marital status of mother (Married =1)	679	0.7496	0.4335
Household headship (Female =1)	679	0.2459	0.4310
Distance to the nearest health facility (Km)	679	4.7319	5.5469
Distance to food market (Km)	679	3.9092	6.0098
Distance to public transport (Km)	679	1.3785	3.1949
Mother is a Catholic	679	0.2813	0.4500
Mother is a Moslem	679	0.1208	0.3261
Mother is other Christian	679	0.4890	0.5002
Traditional religion (ref)	679	0.1193	0.3244
District is Lawra	679	0.4654	0.4992
District is Dangme-West	679	0.1885	0.3914
District is Ejisu-Juabeng (Ref.)	679	0.3461	0.4761

Table 2. Estimation Results for Utilization of ITN for Children aged Under-five Years

Variables	Coefficient(Robust error)	std.	Marginal Effect	Odds Ratio
Rural residence	-0.3709(0.2515)		-0.0643	0.6901
Child's age in months	-0.0319(0.0068)***		-0.0057	0.9686
Gender of child (Boy=1)	-0.2488(0.1913)		-0.0446	0.7798
Birth order (Parity)	-0.1685(0.0762)***		-0.0302	0.8449
Number of children aged under 5 yrs old	0.6081(0.1710)***		0.1089	1.8370
Total No. of childhood vaccinations received	0.1573 (0.0622)***		0.0282	1.1704
1st Income Quintile	0.7074(0.3742)**		0.1119	2.0287
2nd Income Quintile	-0.0182(0.3104)		-0.0033	0.9820
3rd Income Quintile	-0.2164 (0.2980)		-0.0400	0.8054
4th Income Quintile	-0.1998(0.3239)		-0.0369	0.8189
5th Income Quintile (Ref.)	-		-	-
Experienced U5-mortality in the last 5yrs	2.0824(0.9247)**		0.3728	8.0237
Piped water in residence	-0.0853(0.3468)		-0.0155	0.9182
Piped water in residence*4th Income Quintile	1.2697 (0.6577)**		0.1608	3.5599
Mother's Age	0.0278(0.0218)		0.0050	1.0282
Mother's years of schooling	0.0011(0.0257)		0.0002	1.0011
Marital status of mother (Married =1)	-0.1061(0.2648)		-0.0187	0.8994
Household headship (Female =1)	-0.0018(0.2711)		-0.0003	0.9982
Distance to the nearest health facility (Km)	-0.0438(0.0214)**		-0.0078	0.9571
Distance to food market (Km)	0.0543(0.0274)**		0.0097	1.0558
Distance to public transport (Km)	-0.0313 (0.0207)		-0.0056	0.9692
Mother is a Catholic	0.8896 (0.3752)***		0.1428	2.4343
Mother is a Moslem	-0.0429(0.4019)		-0.0078	0.9580
Mother is other Christian	0.9167(0.3192)***		0.1628	2.5009
Traditional religion (ref)	-		-	-
District is Lawra	1.4432(0.2983)***		0.2502	4.2340
District is Dangme-West	0.6530 (0.2875)**		0.1042	1.9213
District is Ejisu-Juabeng (Ref.)	-		-	-
Constant	-1.5754(0.9283)*		-	-

Significant at the 1% level ($p \leq 0.01$); **Significant at the 5% level ($p \leq 0.05$); *Significant at the 10% level ($p < 0.10$).

Number of obs. = 679

Wald χ^2 (25) = 105.97*** Prob > χ^2 = 0.0000

Log pseudolikelihood = -340.75

Pseudo R² = 0.16

Table 3. Results for Link Test for Model Specification

Variable	coefficient	Standard Error	95% CI
hat	0.8556569***	0.1710	0.5204-1.1910
hatsq	0.0866898	0.0855	0.5204-0.2542
Constant	-0.010847	0.1205	-0.2471-0.2254

Number of obs = 679

Log likelihood = -340.21

LR chi2(2) =128.34

Prob > χ^2 =0.0000

Pseudo R² = 0.16

Table 4. Did Child Sleep under ITN (by District)?

District	Per-Capita Income	Yes (%)	No (%)	Total
Lawra	\$260.4	256(81.3)	59(18.7)	315
Ejisu-Juabeng	\$294.3	138(58.7)	98(41.3)	236
Dangme West	\$396.3	81(63.3)	47(36.7)	128
Total		475	204	679

Table 5. Did Child Sleep Under ITN (by Income Quintile)?

Income Quintile	Yes (%)	No (%)	Total
1 (\$152-\$872)	102 (76.7)	31(23.3)	133
2(\$872-\$1222)	96(70.6)	40(29.4)	136
3(\$1222-\$1509)	100(68.0)	47(32.0)	147
4(\$1509-\$1920)	90(68.1)	42(31.9)	132
5 (\$1920-\$8432)	87 (66.4)	44(33.6)	131
Total	475	204	679