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Socio-Economic Status and Malaria Prevalence among Infants: the Case of Uganda.

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Abstract
The rationale of this study is to explain the link between household welfare, the region in which an infant is situated, literacy level of a mother and malaria prevalence among infants in Uganda with a more recent nationally representative data set that is the 2006 Uganda Demographic and Health Survey in lieu of the findings by other researchers on this particular subject. This was done with the aid of logit model estimation. The findings indicate that the region where an infant situated is fundamental in explaining malaria prevalence among infants. Alongside region is the location of a child whether he or she is in the rural or urban setting, the findings indicate that malaria prevalence lower among urban infants as compared to their rural counterparts. In conclusion, it was observed that malaria prevalence is not a case of household socioeconomic conditions but rather it's a communal disease as exemplified by the significance of region and urban-rural location of an infant.

Key words: socioeconomic status; malaria prevalence; infants, Uganda

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1. Introduction

In Sub-Saharan Africa it is estimated that malaria leads to over one million deaths per year and for every 30 seconds an African child dies[23]. Furthermore, the resultant effect of malaria is that it enhances household poverty since its consequences fall heavily on the poor (Mathanga and Cameron, 2007). In an effort to reduce the Malaria burden by 50 per cent by 2015, the Government of Uganda (GoU) under the guidance of the World Health Organisation adopted the Roll Back Malaria (RBM) initiative in 1998. The RBM initiative calls for among others; ensuring that pregnant women and children under five years of age have access to the most suitable and affordable combination of personal and community protective measures and prompt, and effective treatment for malaria within 24 hours of onset of illness[24]. Alongside RBM is the Uganda National Malaria Strategic Plan and the Health Sector Strategic Plan II which largely promote improving case management of clinical malaria and malaria prevention using a combination of insecticide treated nets (ITN), indoor residual spraying (IRS) and environmental management (where feasible).

Note that inspite of the government's adoption of robust initiatives such as RBM the incidence of Malaria in Uganda is rather significant. Malaria accounts for up to 40 percent of out-patient visits, 25 percent of hospital admissions and 14 percent of hospital deaths furthermore, its burden is greatest among infants and pregnant women[25]. Worse still the 2004 National Service Delivery Survey (NSDS) reveals that of all the households that reported sickness 30 days before the survey, over 50 percent were attributed to malaria. Therefore given the dire incidence of Malaria, there is a need to understand mechanisms through which GoU can improve upon the functioning of existing policies and programs aimed at combating malaria. One of the steps in that direction is to understand the household socioeconomic conditions in light of malaria prevalence.

Understanding household socioeconomic conditions is fundamental in both effective health policy and program design and adoption. Note that several studies have been undertaken to enhance the understanding household socioeconomic conditions in light of malaria prevalence among these are Khan et al. (2006) and Filmer (2005). They noted that household poverty has no association with malaria prevalence but rather the concentration of poverty within a given community. Filmer (2005) further ascends that the effect of household poverty becomes insignificant in the event other factors such as maternal education are controlled for. In light of that, this study sought to explain the link between household wellbeing, the region in which a household is situated, literacy and malaria prevalence among infants in Uganda with a more recent nationally representative data set that is the 2006 Uganda Demographic and Health Survey.

In the recent past a few studies have been undertaken to understand infant malaria prevalence given household socio-economic status for instance, Mugisha and Arinaitwe, (2003) and Njama et al. (2003). The inadequacy with Njama et al. (2003) is the limitedness to which inference can be drawn based on the fact that the study group were residents of Kawempe Division (found in

[23] Kvinnofrum and the Roll Back Malaria Partnership Secretariate
[24] Demographic Household Survey (2006)
[25] http://rbm.who.int/wmr2005/profiles/uganda.pdf

Kampala City) who are not necessarily representative of Uganda. With regard to Mugisha and Arinatwe (2003), the study was limited to the utilisation of mosquito nets among under-fives with the aid of the 2000–2001 Uganda Demographic and Health Survey. In that respect, the fact that this study uses the 2006 Uganda Demographic and Health Survey[26] has the added advantage that it does not only have a comprehensive malaria module but also covered the entire country unlike Njama et al. (2003). Besides, the study explains the relationship between household socioeconomic status and malaria prevalence among infants in Uganda.

The remainder of this study is organized in five major sections as follows. Section two reviews the literature. Section three presents the methodology. Section four presents and discusses the results. Section five gives conclusion and recommendations.

2.0 Review of Literature

Note worthy that with regard to the use of bednets, Mwangi *et al.* (2003) using a cross section survey data collected from Kilifi District in Kenya, unearthed that children that slept under treated mosquito nets showed evidence of malaria protection as compared to those that did not. They further posit that, children who slept under untreated mosquito were not any different from children that did not sleep under mosquito nets. On the contrary, Koram et al. (1995) with the aid of a case-control approach in which over 350 Gambian children with malaria resident in a peri-urban area with seasonal transmission were studied observed that bednets were not significantly relevant in the protection against malaria. They actually found out that insecticide spray offered a significant cushion against malaria. Despite the findings by Koram et al. (1995), Clarke et al. (2001) rather emphasise the importance of children sleeping under treated mosquito nets. Using the cross section survey data from Gambia, they argue that untreated mosquito nets are a threat to a given community at large. That they cause persons not under mosquito nets to receive more bites hence increasing malaria prevalence.

With regard to literacy and malaria prevalence, Coldren et al. (2006) using survey data that captured a total of 1,141 respondents in Kenya argue that household literacy was positively correlated with an individual either having malaria parasites or not. McFadden et al. (2004) in studying malaria health behavior of rural populations with the aid of the 1999 Demographic and Health Survey for Guinea, West Africa indicate that formal education background enhanced preventive behavior irrespective of the household's economic status. They further argue that the effect of education is enhanced with increased household economic status in prevention against malaria. The effect of education is that it enhances household's ability to correctly identify, treat and prevent malaria (Dikea et al. 2006 and Njama et al. 2003).

In studying urban malaria with respect to primary caregivers' knowledge, attitudes, practices and predictors of malaria incidence in a cohort of Ugandan children of age 6 months to 5 years using data attained as part of a longitudinal randomized trial between July and August 2000 Njama et

[26] Uganda Bureau of Statistics, (2007).

al. (2003) argue that the child's age at enrolment had a profound effect in explaining the incidence of malaria and that the being highest in children aged 24–41 months at enrolment.

Empirical evidence above suggests various household factors explain the prevalence of malaria among infants in both Uganda and other tropical regions. The relevance of this study is that the dataset it utilises has a comprehensive malaria module besides being country representative. Furthermore, none of the studies holistically explain the association between household socioeconomic status and malaria prevalence among infants in Uganda.

3.0 Methods

3.1 Data

The study used 2006 Uganda Demographic and Health Survey (UDHS) which had a total of 11,034 respondents among which 8,531 were women of age 15-49 while 2,503 were men of age 15-54. The survey was the fourth of its kind with the added advantage that it covered the entire country unlike the previous three surveys. Besides, the survey was designed to allow separate estimates at the national level and for urban and rural areas of the country. It captured household information on among others infant, child, adult, and maternal mortality; maternal and child health; and family planning with the rationale of guiding health policy and program design and adoption, Uganda Bureau of Statistics (2007).

3.2 Description of variables

For purposes of this study, the variables used were extracted from responses by women about maternal and child health. These variables are thus as described below:

Malaria prevalence (fever). The most easily acceptable measure of malaria prevalence would be through the study group having had a confirmed laboratory malaria diagnosis. However as ascended by Worrall et al. (2005), between 20 percent and 40 percent of malaria cases are treated in the formal health facility implying that the study would run the risk of not capturing a good number of malaria cases. It is in that respect that the underlying assumption here is that fever is a proxy for malaria prevalence. Note that mothers were asked if their children under five years had a fever in the two weeks prior to the survey. Therefore, if the response was yes '1' was assigned otherwise '0' was assigned. For mothers whose response was 'do not know'; I ignored them hence the binary dependent variable fever.

Wealth Quintiles (welindex), note that the survey did not capture information on household income. However as a proxy for long term household standard of living, the household wealth index was attained from the household asset composition which inter alia included: consumer items such as a refrigerator, television, and car; dwelling characteristics such as floor material; type of drinking water source; and toilet facilities. Note that the asset scores attained were later standardised such that they followed a Normal Distribution. Furthermore, the household wealth index was disaggregated into household wealth quintiles. Important to note is that the wealth quintiles are not reflective of whether a household is poor or not but rather that a household in say the fifth wealth quintile has a better socio-economic status than all households in the other

wealth quintiles. Conversely, the household in the lowest wealth quintile has the worst socio-economic status as compared to the other household wealth quintiles[27].

Literacy (lit): The respondent's level of literacy was determined by the respondent's ability to read none, part, or all of a simple sentence. Note that interviewers made this assessment based on cards on which sentences were printed in all the major languages spoken in Uganda. Furthermore if a respondent attended at least secondary education, there were considered literate in other wards they were not subjected to reading the cards. Therefore, 0, 1, and 2 was assigned if a respondent could: not read, partly read and attended at least secondary education respectively.

Type of bednet(s) slept under last night. Three binary variables were constructed that is; ttedbed, unttedbed, and nottedbed. With regard to ttedbed, it captures infants that slept under a treated mosquito net such that a value '1' was assigned otherwise '0' was assigned. Note that '0' captures both infants that slept either under untreated bednets or no bednet at all. While unttedbed assigns the value '1' to infants who were reported to have slept under untreated bednets and '0' otherwise that is slept under either treated or no bednet at all. Finally is nottedbed, this assigns infants a value '1' if there slept under a bednet other '0' was assigned.

Urban rural dimension (urb_rur), this variable captures the location of the household and thus the infant. Such that if an infant is reported to be in the urban area then '1' is assigned otherwise '0' was assigned.

Region (reg), this is yet another location variable that defines where a household or the infant for that matter was situated. It is a binary variable where if an infant was reported to be situated in either, Central, Central2, Kampala, East Central, Western or South West then '1' was to then otherwise a '0' that if the infant was reported to be located in either Eastern, North, and or West Nile. The underlying assumption is that infants situated in the Central, Western and Southern regions are perceived to have better welfare as compared to infants from other regions (Appleton, 2003).

Age of an infant (ageinf). Here infants were grouped with a rank assigned. In this case, infants group between the age; 0 to 9 were ranked 0, 10 to 19, 20 to 29, 30 to 39, 40 to 49, and 50 to 59 with a corresponding ranking of 0, 1, 2, 3, 4, and 5 respectively.

3.3 Descriptive statistics

For purposes of this study, we had a total of 2511 infants between the age 0 months and 59 months old. 57.51 percent of them were reported not have had malaria while 42.49 percent of them were reported to have had malaria. Of the infants who were reported to have had malaria, 47.7 percent of them were from Eastern, Northern, and West Nile regions of Uganda. While 52.3 percent of the infants that were reported to have had malaria were from the Central, Southern, and Western regions of Uganda. On the contrary of infants that were not reported to have had

[27] For a complete exposition on how the wealth index and thus the wealth quintile was attained please see Uganda Bureau of Statistics (2007): 2006 Uganda Demographic Household and Health Survey.

malaria 61.63 percent of them were from Western, Central and Southern Uganda while the rest were from Northern, West Nile and Eastern Uganda.

Furthermore, taking care of the urban-rural dimension, 89.58 percent of infants were situated in rural areas while 10.42 per cent lived in the urban setting. With regard to malaria prevalence, 94.28 per cent and 5.72 per cent of infants were reported to have had malaria and at the same time lived in rural and urban areas respectively

With regard to the age of infants, 18.54, 18.39, 16.71, 17.02, 15.00, 14.44 per cent of them were in the age group 0 to 9, 10 to 19, 20 to 29, 30 to 39, 40 to 49 and 50 to 59 months respectively. With regard to malaria prevalence, infants in the age group 10 to 19 months rank highest with 28.84 per cent followed by those in the age group 20 to 29 months with 18.29 per cent. While 17.71, 16.71, 13.4, 9.65 percentage points were attributed to infants in the age groups 30 to 39, 0 to 9, 40 to 49, and 50 to 59 months respectively. Its thus evident that malaria prevalence is highest between ages 10 to 40 months respectively, this is agreement with findings by Njama, et. al., (2003).

Referring to the wealth quintile, out of a total of 1,067 infants that were reported to have had malaria, 27.74, 22.02, 19.68, 17.81, and 12.75 per cent were in the first, second, third, fourth and fifth quintile respectively. Where by the fifth quintile implied the highest standard of living while the lowest implied the worst standard of living. The lowest incidence of no malaria (16.69 per cent) was reported among infants of that belong in the fourth quintile. The highest incidence of infants to have had malaria was surprisingly in the worst quintile (22.23 per cent) followed by infants in the third quintile (21.33 per cent).

3.4 Model estimation.

With the aid of the logit model which employs the maximum likelihood estimation technique, this study estimates the link between malaria prevalence against the household socioeconomic conditions as defined above. The study used STATA version 9 to estimate the model.

4.0 Discussion and presentation of results

Overall, the study found out an association between wealth quintile, age of infant, region, and urban-rural location of an infant and the likelihood of an infant having malaria or not. These are thus discussed below largely based on the marginal effects in multivariate table of results

Multivariate table of results

Logit model	**1**		**2**	
Number of observations	2345	Marginal	2345	Marginal
LR chi	(8) 67.76	Effects of 1	(9) 76.17	Effects of 2
Prob > chi2	0.0000		0.0000	
Pseudo R2	0.0211		0.0237	
Log likelihood	-1572.438		-1568.23	
	Fever		**Fever**	
unttedbed	-0.0368	-0.009	0.0075	0.0019
	(0.833)	(-0.21)	(0.04)	(0.965)
nottedbed	-0.0571	-0.014	0.0266	0.0065
	(0.659)	(-0.44)	(0.841)	(-0.0572)
Lit	-0.0182	-0.0045	-0.0014	0.0003
	(0.716)	(0.716)	(-0.03)	(0.978)
welindex	-0.0730	-0.0179	-0.0200	-0.0049
	(-2.04)*	(-2.04)*	(-0.50)	(0.618)
Urb_rur	-0.8947	-0.201	-0.9209	-0.206
	(-5.27)**	(-6.05)**	(-5.42)	(-6.26)**
sexhh	-0.0610	-0.0150	-0.0658	-0.0162
	(-0.6)	(-0.6)	(-0.65)	(-0.65)
agehh	0.0002	0.0000	-0.00006	-0.00001
	(0.04)	(0.04)	(-0.02)	(-0.02)
ageinf	-0.0856	-0.021	-0.0866	-0.0212
	(-3.22)	(-3.22)	(-3.25)	(-3.25)**
Reg			-0.2982	-0.0732
			(-2.90)	(-2.90)*
constant	0.4063		0.3644	
	(1.8)		(1.61)	

Note.
Absolute value of z statistics in parentheses
*Significant at 5%; ** significant at 1%

Wealth quintile: The wealth quintile is a proxy of household welfare such that higher quintile levels are associated with better household standard of living. In this study (referring to logit model 1) controlling for other factors, the marginal effect of the household standard of living on the likelihood of an infant either having malaria or not is 1.8 per cent. This finding supports Koram et al. (1995) who too argue that Malaria was associated with children from households with poor wellbeing where quality housing and crowding were a proxy of household wellbeing. This perhaps implies that better household welfare enhances the likelihood of an infant in that particular household utilising malaria preventive facilities for instance bednets, anti-mosquito sprays to mention but a few, (Worrall et al. 2005).

Note that the relationship between household wellbeing and malaria prevalence should be treated with caution. This is because the introduction of region (logit model 2) as another control variable completely overshadows the impact of household welfare. This does not come as

surprise for other studies for instance; Filmer (2005) in the study about fever and its treatment among the more and less poor in Sub-Saharan Africa too found out that the effect of household poverty becomes insignificant in the event other factors such as maternal education are controlled for. In the same perspective, Al-Taiar et al. (2008) using a case-controlled research design to explain the effect of socioeconomic and environmental factors on non-severe malaria in children in Yemen too found out that the effect household wealth diminished in the multivariate analysis.

In this study, the effect of household welfare in explaining acquisition of malaria by infants particularly diminished with the introduction of the region variable. Region is 95 per cent significant with a marginal effect of 7.3. This finding implies that if an infant is relocated from the northern or eastern region of Uganda to the southern, central or even western region, the likelihood of that infant acquiring malaria reduces by 7.3 percent. This finding is in line with the descriptive statistics which indicated earlier that 61.63 percent of infants from Western, Central and Southern Uganda were reported not to have had malaria as compared to 38.37 percent of infants from the Northern, West Nile and Eastern Uganda were reported to have had malaria.

Note that, Filmer (2005) argues the concentration of poverty with in a community is likely to explain malaria prevalence to the effect that household welfare itself is insignificant. In Uganda using the head count poverty measure, 22.3 percent, 31.4 percent, 46.6 percent, 63.3 percent as a proportion of persons living in Central, Western, Eastern and Northern regions are regarded as poor (Okidi et al. 2005). Therefore, following Filmer (2005) it can thus be justified that significance of region in explaining malaria prevalence among infants in Uganda is to some extent explained by the existing regional poverty levels.

Another interesting finding is that of urban-rural dimension. The multivariate analysis shows that as one moves from rural to urban setting the likelihood of an infant having malaria reduces by 20.6 percent. This finding perhaps indicates that infants in urban households are more likely to have access to malaria preventive measures as compared to rural infants. In fact as noted in Uganda Bureau of Statistics (2007), rural households (71 percent) unlike urban households (39 percent) are less likely to own a mosquito net. Furthermore, as compared to rural infants while 49.4 percent of urban infants slept at least under a mosquito the night before the survey was undertaken only 18.2 per cent did in rural areas.

With regard to the age of infants under study, the multivariate analysis indicates that older infants are more susceptible to malaria than their younger counterparts with a likelihood of 2.13 per cent. The data shows that the effect is most amongst the age cohorts 10 to 19, 20 to 29, and 30 to 39. From the multivariate analysis, use of bednets, mothers literacy, and age of household head were profoundly insignificant

5.0 Conclusion and Policy Recommendations

The rationale of this study was to explain the link between household welfare, region in which an infant is situated, literacy level of a mother and malaria prevalence among infants using the 2006 Uganda Demographic and Health Survey in lieu of the findings by other researchers on this particular subject. The study concurred with findings by Khan et al. (2006) and Filmer (2005) that is it is community welfare rather than individual household welfare that explains malaria prevalence. In this study infants located in Northern and Eastern regions are more likely report malaria prevalence than their counterparts situated in the Central and Western regions. This in away emphasises the regional differences in poverty levels since Northern and Eastern regions are profoundly poorer than the Central and Western regions. Therefore infants in Northern and Eastern regions are more susceptible to malaria as compared to the better off Central and Western regions. Given that malaria is more associated with poorer regions of Uganda, therefore enabling equitable regional economic development is fundamental. Note that adverse economic conditions imply inadequacy of funds for malaria drugs and preventive initiatives. Therefore the success of initiatives such as RBM, Uganda National Malaria Strategic Plan and the Health Sector Strategic Plan II shall in away depend of how regional economic imbalances are addressed. In a nut shell the key findings in this study was that malaria among infants was more related to the location of an infant than to say the literacy level of a mother, the household wealth level, age of the household head, utilisation of bednets and sex of the household head. Thus malaria is more of a communal than a household specific disease hence community level malaria programs would have profound effects.

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