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Inequalities in purchase of mosquito nets and willingness to pay for insecticide-treated nets in Nigeria: Challenges for malaria control interventions

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Abstract

Objective: To explore the equity implications of insecticide-treated nets (ITN) distribution programmes that are based on user charges.

Methods: A questionnaire was used to collect information on previous purchase of untreated nets and hypothetical willingness to pay (WTP) for ITNs from a random sample of householders. A second survey was conducted one month later to collect information on actual purchases of ITNs. An economic status index was used for characterizing inequity.

Major findings: The lower economic status quintiles were less likely to have previously purchased untreated nets and also had a lower hypothetical and actual WTP for ITNs.

Conclusion: ITN distribution programmes need to take account of the diversity in WTP for ITNs if they are to ensure equity in access to the nets. This could form part of the overall poverty reduction strategy.

Introduction

Malaria is the leading cause of mortality and morbidity in Nigeria [1], resulting in the decreased productive capacities of households and increased poverty[2]. An increasing global prioritisation of malaria control has led to the establishment of two global initiatives to assist resource-constrained countries to control malaria and other endemic diseases: the World Health Organization's (WHO) Roll Back Malaria partnership and the Global Fund for AIDS, TB and Malaria (Global Fund). In parallel with these developments, there has been increased concern among the global public health community about identifying appropriate means of improving the health of the poor and reducing health inequalities[3].

Insecticide-treated mosquito nets (ITNs) have been shown to be an effective and cost-effective means for the control of malaria, especially among children under 5 year s [4-6]. The Abuja Declaration on Roll Back Malaria by African Heads of State in April 2001 committed national governments and their development partners to the goal of increasing coverage with ITNs to 60% of target groups by 2006[7].

There continues to be debate about the specific mechanisms through which the target for increasing coverage, set in Abuja[7], will be achieved. On the one hand, the WHO Strategic Framework for Scaling-Up ITNs[8] advocates a pluralistic approach, in which emphasis is placed on developing commercial distribution systems, with subsidies targeted at those who are unable to afford nets at commercial prices. On the other hand, some argue that poverty is so widespread among those rural populations most at risk of malaria that other mechanisms, such as free distribution, need to be explored[9,10]. While these positions are not mutually exclusive, and it should be possible to deliver targeted subsidies while pursuing commercial sector options, there continues to be vigorous debate about how best to finance and distribute ITNs on a large scale[11]. This debate is further fuelled by the lack of empirical evidence about both the nature of demand for ITNs, and the costs of alternative distribution mechanisms.

In Nigeria, the same debate is echoed about appropriate means of delivering this key public health tool. The Nigerian National Malaria Control Strategy emphasizes sale of ITNs on a user-fee basis [1]. However, the Federal Government recently announced free distribution of ITNs to pregnant women and children. This latter pronouncement has not been followed up either with policy documentation or by the identification of sources of funding. There have been other inconsistencies in ITN policy in Nigeria. For example, customs duty on imported nets was reduced from 40% to 5% in early 2002. Later that year, it was raised again to 70%, though it was reduced once more in May 2003.

Although there are a number of initiatives to promote ITN sales, involving both sales through public health facilities and a number of social marketing initiatives, coverage remains low, with around 10–12% of households owning at least one untreated net in Nigeria[12], and negligible coverage of treated nets. There are a number of possible explanations for this low coverage. Firstly, it may be due to affordability problems as household economic status has been related to net ownership in a number of studies [13-15]. As a result of prolonged economic crisis, poverty levels in Nigeria have continued to climb, with the majority of the poor located in rural areas where about 48% of the population is reported to be living in extreme poverty[16]. Secondly, people may not value the nets enough to buy them. And thirdly, it is possible that either nets are not physically available, or that people do not know where they can buy one.

There is a need for further understanding of the equity implications of charging for ITNs. We use the term 'equity' to mean equal access for equal needs irrespective of income and other socio-demographic characteristics [17,18]. Without equity in access to ITNs, this powerful public health tool will have a limited impact. This definition of equity implies that socioeconomic differences in need should also be considered. While there is little evidence of a relationship between soc io-economic status and malaria incidence, there is mounting evidence that poor households are more vulnerable to the consequences of malaria infection, such as severe or complicated malaria, or risk of mortality [19-21].

The aim of this paper is to provide new evidence about the characteristics of the demand for ITNs, in order to inform policy makers and programme managers about the potential equity effects of selling ITNs. These are examined by investigating patterns of net ownership and purchase in the population; by determining the values that individuals attach to ITNs through eliciting their maximum willingness-to-pay, using the contingent valuation method; and by using these values to estimate how responsive demand is to price and income. The contingent valuation method is widely used in health and environmental economics to explore individuals' preferences for goods and services for which markets do not exist or are subject to severe market failures. In this case, because treated mosquito nets were not available in the communities being studied, it was not possible to use actual market behaviour to study these preferences; hypothetical questions were required.

Methods

The study was conducted in Achi autonomous community, which is located 5 kilometres from Oji-River town, the local government headquarters, and 45 kilometres from the state capital, Enugu. Untreated mosquito nets are not sold in Achi, but they are sold in nearby urban centres of Enugu and Onitsha, which are 60 and 80 minutes away by bus, respectively. This project was the first contact of the villagers with ITNs.

Two cross-sectional surveys were conducted one month apart using pre-tested interviewer-administered questionnaires, which were applied to randomly selected household heads or their representatives (if the household head was not available). The first survey was used to determine past purchases of untreated nets and the hypothetical (stated) WTP for ITNs, and the second survey, accompanied by the sale of ITNs, was used to determine actual WTP for ITNs. The surveys also elicited information on factors likely to explain past purchases of untreated nets and WTP for ITNs. In addition, information was collected about the presence of malaria in the household in the month prior to the interview.

A mini-census was conducted in the villages to produce the household list that served as the sampling frame. A systematic random sample of 300 households was selected from each village by including every 2nd household. In the first survey, the sample size was calculated based on the formula for a population survey. The considerations for sample size calculation were: the total of 2,000 households for the three villages, 95% confidence level, power of 80% and 76% true positives (positive predictive validity) using results from a previous study[22]. The calculated sample size per village was 246 households per village but the sample was increased to 300 households per village to allow for refusals and non-response.

In the second survey, the same respondents were offered the ITNs for sale and were re-interviewed. The price at which an ITN was offered for sale was 350 Naira ($3.18)(US$1 = 110 Naira), paid either in two fortnightly instalments or as full and immediate payment. The results from the first survey showed that less than 5% of respondents were willing to buy ITNs at the price of 450 Naira set by the government. To increase the number of respondents likely to buy ITNs (and, therefore, the sample size), it was decided to sell each ITN at 350 Naira as a 100 Naira subsidy was the highest the project could afford. The ITN-sellers and the respondents were unaware of the subsidy.

Inequalities in ownership and WTP for ITNs were examined by household economic status [14,23,24], proxied using an asset-based index. Discussions with community members helped identify a list of assets to differentiate households by economic status. These included a radio, bicycle, grinding machine, motorcycle and motorcar. As respondents are usually reluctant to provide information on household income[25,26] the weekly cost of food consumed by the household was used as a proxy for income. This was calculated as the monetized value of home produced and consumed food plus expenditure on purchased food. Principal components analysis was used to create a continuous economic status (ES) index[27], using information on householder's asset holdings of radio, bicycle, motorcycle, grinding machine and motorcar, together with the cost of food.

The first principal component, which explained 33% of the variability in the 6 variables, was used to derive weights for the ES index. The highest weight was given to ownership of a radio (0.49), followed by car (0.43), motorcycle (0.42), grinding machine (0.42), bicycle (0.40) and food cost (0.26). Households were divided into quintiles on the basis of the value of the ES index.

The relationship between economic status and need (in terms of actual and perceived vulnerability to malaria) was assessed by comparing responses to questions about perceived risk, household malaria incidence, and expenditure on malaria treatment and prevention across the ES quintiles. To examine inequalities in ITN-related variables, the proportions of households that owned an untreated net, mean willingness to pay for ITNs, and actual purchases of ITNs were compared across quintiles. In both cases, the Chi-squared test for trend was used to determine whether the quintiles were statistically different.

The ratio of each dependent variable in the lowest ES to the highest ES quintile was computed as a summary measure of inequity. Multiple regression analyses were undertaken to investigate the other correlates of net ownership or purchase, and to determine whether the relationship with ES was robust to the inclusion of potential confounders. The continuous ES score was included as an independent variable and was hypothesized to be positively related to the dependent variables. Logistic regression analysis was used to explain variation in ownership of nets and purchase of ITNs, and ordinary-least squares (OLS) to examine variation in the continuous variable 'stated WTP' for ITNs.

Price elasticity of demand was computed using the data from the first survey. This used a "pseudo-demand" curve which relates the cumulative proportion willing to pay at different price levels, controlling for other factors. It is 'pseudo' because the market was hypothetical, and WTP was established for one ITN only rather than increasing numbers of ITNs per household. Because the lowest value of WTP is zero (censoring from below), a tobit regression was used to arrive at an unbiased estimate of the price elasticity of demand for each of the 5 ES quintiles, and to allow elasticity to vary with price a semi-log functional form was used. Elasticities are evaluated at the mean WTP, the 25th percentile, and at the actual selling price.

Data from the first survey were also used to calculate the income elasticity of demand, which is used to determine whether ITNs are a normal or a luxury good. Percent change in income from one quintile to the next was calculated using the mid-point of the food cost for each ES quintile (the change from Q1 to Q2 is not calculated due to the zero mid-point of income in Q1). The income elasticities are evaluated at the same prices as price elasticity.

Results

In the first survey, 798 (88.6%) of the questionnaires were usable for analysis (Table 1). In the second survey, many of the respondents were not available to be re-interviewed and the total number of usable questionnaires for the analysis was 453. In both surveys, most of the respondents were middle-aged, married and had formal education. Females comprised more than 50% of the

Table 1: Household vulnerability to malaria, by economic status (ES) group

	No of respondents perceiving risk of malaria (%)	No of malaria episodes in previous month		Expenditure in previous month to prevent malaria (Naira)		Expenditure in previous month to treat malaria (Naira)	
		Per household	Per capita	Per household	Per capita	Per household	Per capita
Q1 (Most poor)	38 (27.3)	0.41	0.18	31.6	12.3	106.6	43.1
Q2 (Very poor)	18 (12.9)	0.55	0.15	32.4	7.5	290.2	85.6
Q3 (Poor)	25 (18.1)	0.59	0.16	47.7	13.7	359.0	98.9
Q4 (Less poor)	28 (20.1)	1.01	0.20	52.3	12.8	444.3	126.8
Q5 (Least poor)	30 (21.6)	1.03	0.17	127.5	20.5	674.6	120.3
Chi2	8.4**	53.6***	12.5	40.4***	35.7	57.7***	39.5
Q1:Q5 ratio	1.37	0.40	1.1	0.25	0.6	0.16	0.4

Significance of parameters *<0.10, **<0.05, ***<0.01

respondents in both surveys. There was an average of one attack of malaria per household during the month prior to the survey and the average monthly expenditure to treat an episode of malaria was more than 250 Naira in both surveys. The cost of food to each household was about 1,000 Naira in the week prior to the interview in the first survey and about 900 Naira in the second survey. Most households possessed radios and bicycles, while a few also had motorcycles and motorcars. The distributions of the economic status (ES) quintiles show that the cases were evenly distributed in the five groups in both surveys.

Although the relationship between perceived risk and ES is not statistically significant, individuals in the poorest ES quintile were the most likely to perceive themselves as being at risk of malaria (Table 1). Actual household incidence of malaria appears to increase with ES, with the highest incidence among the least poor ($p < 0.001$), however this relationship is not as clear when measured per capita. Higher ES groups spend more to prevent and treat malaria.

The levels of ownership of untreated nets and purchase of ITNs, together with data on stated WTP across the ES quintiles are presented in Table 2. A total of 5.8% and 14.9% of the poorest quintiles owned untreated nets and purchased ITNs respectively. In contrast, 35.8% and 21.1% of the top quintile owned untreated nets and purchased ITNs respectively. While 13.3% of the poorest quintile were hypothetically willing to pay for ITNs, with a mean WTP amount of 105 Naira, 23.4% of the top quintile were willing to pay, with mean WTP more than double that of the poorest quintile (230 Naira). The gap between the top and bottom quintiles is smallest for purchase of ITNs and was highest in the case of ownership of untreated nets. Chi-square analysis for trend showed that the quintiles in the four dependent variables were statistically significantly different.

Table 2: Coverage with untreated nets and ITNs, plus WTP for ITNs, by ES group

ES quintiles	No of people whose household owned an untreated net		Average stated WTP for ITNs (Naira)	No of people willing to hypothetically pay for an ITN		No of people that purchased ITNs @ 350 Naira	
	n	(%)		n	(%)	n	(%)
Q1 (Most poor)	7	(5.8%)	104.8	81	(13.3)	17	(14.9%)
Q2 (Very poor)	18	(15%)	171.4	112	(18.4)	20	(17.5%)
Q3 (Poor)	20	(16.7%)	189.0	139	(22.9)	27	(22.5%)
Q4 (Less poor)	32	(26.7%)	216.1	134	(22.0)	26	(22.8%)
Q5 (Least poor)	43	(35.8%)	230.3	142	(23.4)	24	(21.1%)
Total	120	(100%)	Not applicable	608	(100)	114	(100%)
Chi2 for trend	42.48***		74.03***	97.40***		19.43***	
Most poor-Least poor ratio	0.16		0.46	0.57		0.71	

Significance of parameters * <0.10, **<0.05, ***<0.01 Note: 608 out of 798 were hypothetically willing to pay.

Table 3: Multiple regression analyses to determine the factors that explain the three dependent variables

	Logistic analysis	Ordinary least squares	Logistic analyses
Variables	Ownership of untreated Nets Coefficient (SE)	Stated WTP for ITNS Coefficient (SE)	Purchase of ITNs @ 350 Naira Coefficient (SE)
ES weight	.29 (.10)***	16.12 (4.64)***	.20 (.11)*
Status in the household	-.17 (.35)	29.38 (13.57)**	.36 (.40)
No. of household residents	.05 (.05)	5.72 (2.40)**	-.01 (.05)
Sex	.02 (.33)	35.69 (13.36)**	-.41 (.33)
Age	.01 (.01)	.14 (.40)	.02 (.01)**
Education	.10(.02)***	5.70(1.25)***	.47 (.33)
Marital status	.64 (.43)	-51.90 (15.68)***	-.02 (.38)
Incidence of malaria	.17 (.27)	-20.19 (12.64)	
Actual incidence of malaria	.07 (.11)	26.80 (5.68)***	.31 (.15)**
Occupational group 2: Farmers	-.39 (.62)	-15.06 (33.02)	-.52 (.65)
Occupational group 3: Skilled labourers/trading/pensioners	.18 (.61)	-2.67 (33.04)	-.19(.68)
Occupational group 4: Formally employed	.11 (.66)	-8.35 (36.10)	-.18 (.79)
Occupational group 5: Professionals/mid & big business	-1.00(.87)	47.71 (39.66)	-.13 (.84)
Stated WTP for ITNs	NA	NA	.01 (.001)***
Sales distance	NA	NA	-.04 (.01)***
Constant	-3.67 (.82)***	132.35(40.08)***	-3.40 (.95)***
No of observations	788	788	449
Chi2 (F statistic)	80.80***	17.10***	94.89***
Adjusted R-square	NA	0.21	NA
Correct predictions	85.15%	NA	80.18%

Significance of parameters *<0.10, **<0.05, ***<0.01 NA = Not applicable

In regression analysis using the first survey data, it was found that untreated net ownership and stated WTP for ITNs were significantly related to ES, with the expected sign ($p < 0.01$) and controlling for other socio-economic factors (Table 3). The ES score was also positively related to the purchase of ITNs in the second survey data ($p < 0.10$). The two logistic regression models correctly predicted more than 75% of the observations, while the OLS analysis explained about 22% of the variation in stated WTP for ITNs. All the regression analyses were statistically significant.

Table 3 also shows that recent incidence of malaria in a household was positively associated with stated WTP for ITNs and actual purchase of ITNs. The level of stated WTP was positively associated with actual purchases of ITNs, while living further away from the sales points for the nets was negatively and significantly associated with actual purchases of ITNs. Other important findings were that presence of formal education was positively associated with ownership of untreated nets and stated WTP for ITNs and interviewing a male, head of a household and respondents from household with many residents were associated with higher stated WTP for ITNs.

While the estimated price elasticity of demand is not significantly different across income groups, it does appear that the poorest are most sensitive to price (Table 4). Evaluated at the actual selling price of N350, a 10% decrease in price would lead to a 30% increase in demand in the lowest ES quintile, compared with a 20% increase in demand in the highest group. At lower prices (e.g. the mean stated WTP), demand is inelastic with a 10% decrease in price leading to only a 9% increase in demand among the lowest ES quintile and a 6% increase in the highest group.

In all but two cases, the income elasticity of demand indicates that ITNs are a "normal" good, with demand increasing as income increases, but less than proportionately (Table 4). At the actual selling price of N350, the income elasticities are more difficult to interpret, with the results suggesting that ITNs are a luxury good (demand increases more than proportionately with income) for the income range indicated by the change from Q3 to Q4; and an inferior good (demand decreases as income increases) for the highest income range.

Table 4: Price and income elasticity of demand, by ES group

Price elasticity of demand				
	Estimated coefficient (95% CI)	Price elasticity of demand, evaluated at:		
		Mean WTP (N101.7)	25th Percentile (N200)	Actual selling price (N350)
Q1	-0.009 (-0.01, -0.006)	-0.92	-1.8	-3.15
Q2	-0.007 (-0.008, -0.006)	-0.71	-1.4	-2.45
Q3	-0.008 (-0.009, -0.007)	-0.81	-1.6	-2.8
Q4	-0.006 (-0.007, -0.006)	-0.61	-1.2	-2.1
Q5	-0.006 (-0.007, -0.005)	-0.61	-1.2	-2.1
Income elasticity of demand				
	YED (102)	YED (200)	YED (350)	
Q2 to Q3	0.26	0.05	0.16	
Q3 to Q4	0.31	0.52	1.16	
Q4 to Q5	0.05	0.02	-0.13	

Note: Income elasticity of demand = YED

Discussion

The poorest socio-economic groups were less likely to own an untreated net, to purchase an ITN, and stated a lower willingness to pay for an ITN. Studies in Kenya, Tanzania and Uganda have also found that poverty was an impediment to the purchase of mosquito nets (untreated and ITNs)[9,13-15]. In some contexts, however, charging for nets has still been associated with high levels of uptake among the poorest quintile (up to 50%), though this has occurred in areas with aggressive social marketing of the nets[28,29].

In this study, a recent malaria episode in a household was also associated with increased WTP and purchases of ITNs. Hence, the decision to either pay for an ITN and/or acquire an untreated net was propelled by need and enhanced by better economic status. The fact that the poorest households perceived themselves to be at greatest risk of malaria suggests a coincidence of economic and biological vulnerability. While higher ES households report higher fever incidence, this relationship may be confounded by household size. However, it is not uncommon to find that better-off people report worse health. This may be due to their greater access to medical care, leading to a higher degree of clinical confirmation. Other studies have found a similar relationship when data pertain to recent occurrence of transitory ill-health[30].

The effect of pricing decisions on likely uptake of ITNs can be informed by estimates of how responsive demand is to price. To date, the price elasticity of demand has only been estimated using hypothetical WTP[31]. It was estimated that at the market price of around Naira 350 (US$3.33), demand is highly responsive to price, and that a 10% price reduction would lead to a 20–30% increase in demand. Although the results are not statistically significant, they also suggest that lower ES quintiles are more price-sensitive than those in higher groups. There is an urgent need to confirm these results using price elasticity estimates that relate to actual market behaviour, rather than stated WTP.

One potential limitation of the findings relates to the validity of the ES index. While the asset index approach has been validated in other contexts using data sets, which include both assets and income or expenditure, such data are not available from this study. More work is required to fully validate the variables that were included in the index. However, some confidence in the results can be drawn from the fact that the relationship between net ownership and ES is largely consistent with what would be predicted from economic theory, providing that nets and ITNs are a normal good.

It is difficult to claim fully as, at the actual selling price of N350, ITNs were an inferior good for the highest ES quintile. This could be because this group has other options available to them for mosquito control (e.g. screening on windows, electric fans or air conditioning). However, in rural areas such as the study area, the highest

ES group is not especially well-off in absolute terms. Hence, these findings could raise questions about the construction of the ES index or degree of mis-reporting of food expenditure rather than reflect actual differences in the economic nature of ITNs for this group. It may also be important in the future to triangulate the findings from the quantitative ES indices with qualitative studies such as interviews with key informants.

The association between WTP and socio-economic status, and the greater price sensitivity of the lowest ES groups, give cause for concern about relying on a strategy of selling nets if the Abuja targets are to be achieved and could be used to argue that strategies to protect the very poor from the user fees need to be considered. An increase in demand could be achieved through universal or targeted subsidies, with target groups defined either in terms of economic vulnerability (the poor) or biological vulnerability (e.g. pregnant women and children under 5 years). Applying a universal subsidy in the Nigerian context would be prohibitively costly (even if the target group was restricted to pregnant women, a subsidy of $4 per net for 6.3 million nets per year would cost $25.2 million/year). Alternatively, vouchers, distribution of free nets through public sector health facilities and payment for ITNs by the rich for the poor all offer some potential [32-34].

However, to date only pilot studies with no experience of expanding to the scale required to achieve the Abuja targets, have been undertaken. In addition to this it is important to consider the relative costs and effects of alternative demand-side approaches such as advertising or information campaigns, which would be expected to shift demand outwards and lead to increased demand. The costs and effects of intensive promotion efforts are currently being explored through a UK Department for International Development-funded social marketing project in four Nigerian states. Further experimentation is required for the costs and benefits of alternative demand-side interventions to be assessed. An alternative to demand-side interventions would be to investigate the degree to which prices can be lowered from the supply side. One potentially important measure is the removal of taxes and tariffs on nets.

In the long term, it is important to recognize that health and poverty are closely linked. Reducing malaria will help to contribute to the economic well-being of communities; and poverty-reduction will be an essential input into improving health. National malaria control strategies and their global partners need to recognize these links, and identify mechanisms for ensuring that the poorest have access to essential health interventions.

Authors' contributions

All authors contributed to the study conception and design: OO co-ordinated field work and supervised field data collection; all the authors participated in data analysis. OO wrote the first draft of the article with KH; OO, KH and JF-R critically revised the first draft for content and contributed to the final draft.

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References

1. Federal Ministry of Health: *National Strategic Plan for Roll Back Malaria Abuja: Federal Ministry of Health, Nigeria*; 2001.
2. Chima RI: **The economic burden of malaria, labour quality and productivity in sub-Saharan Africa: A complete Life Cycle Approach.** *The Bullion, Journal of Central Bank of Nigeria* 1998, **22:**.
3. Gwatkin DR: **Health inequalities and the health of the poor: What do we know? What can we do?** *Bull World Health Organ* 2000, **78:**3-17.
4. Armstrong Schellenberg JRM, Abdulla S, Minja H, Nathan R, Mukasa O, Marchant T, Mponda H, Kikumbih N, Lyimo E, Manchester T, Tanner M, Lengeler C: **KINET: a social marketing programme of treated nets and net retreatment for malaria control in Tanzania, with evaluation of child health and long-term survival.** *Trans R Soc Trop Med Hyg* 1999, **93:**225-231.
5. Lengeler C: *Insecticide-treated bednets and curtains for malaria control (Cochrane Review) Oxford: Update Software*; 2000.
6. Goodman CA, Mnzava AEP, Dlamini SS, Sharp BL, Mthembu DJ, Gumede JK: **Comparison of the cost and cost-effectiveness of insecticide – treated bednets and residual house-spraying in KwaZulu-Natal, South Africa.** *Trop Med Int Health* 2001, **6:**280-295.
7. WHO: *African summit on Roll Back Malaria, Abuja, Nigeria, WHO/CDS/RBM/2000.17. Geneva: WHO* 2000.
8. WHO: **Scaling up insecticide-treated netting programmes in Africa: A strategic framework for coordinated national activity.** *Geneva: WHO/CDS/RBM/2002.43* 2002.
9. Guyatt HL, Ochola SA, RW S: **Too poor to pay: charging for insecticide-treated bednets in highland Kenya.** *Trop Med Int Health* 2002, **7:**846-850.
10. Curtis CF, Maxwell CA, Lemnge M, Kilama WL, Steketee RW, Hawley WA, Bergevin Y, Campbell CC, Sachs J, Teklehaimanot A, Ochola SA, Guyatt HL, RW. S: **Scaling-up coverage with insecticide-treated nets against malaria in Africa: who should pay?** *Lancet Infect Dis* 2003, **3:**304-307.
11. Hanson K, Kikumbih N, Armstrong Schellenberg JAS, Mponda H, Nathan R, Lake S, Mills A, Tanner M, Lengeler C: **Cost-effectiveness of social marketing of insecticide-treated nets for malaria control in the United Republic of Tanzania.** *Bull World Health Organ* 2003, **81:**269-276.
12. Vyas S, Hanson K, Lines J: **Assessing the impact of ITN scaling-up activities: Consumer marketing surveys in Nigeria.** In: *The Third MIM Pan-African Malaria Conference; Arusha, Tanzania* 2002.
13. Hanson K, Jones C: *Social Marketing of Insecticide Treated Mosquito Nets, Tanzania: End of Project Social and Economic Analysis London: Malaria Consortium, London School of Hygiene and Tropical Medicine*; 2000.
14. Nuwaha F: **Factors influencing the use of bed nets in Mbarara municipality of Uganda.** *Am J Trop Med Hyg* 2001, **65:**877-882.
15. Kikumbih N: *Economic analysis of social marketing and commercial sector insecticide treated net delivery models in rural communities of Tanzania PhD Thesis, University of London*; 2002.
16. Federal Office of Statistics: *Poverty Profile in Nigeria: 1980 – 1996. Abuja: Federal Office of Statistics;* 2001.
17. Whitehead M: **The concepts and principles of equity and health.** *Int J Health Serv* 1992, **22:**429-445.

18. Mooney G: **What does equity in health mean.** *World Health Stat Q* 1987, **40:**296-303.
19. Filmer D: **The incidence and treatment of fever and household wealth in sub-Saharan Africa.** In: *Malaria and Human Affairs* in press.
20. Worrall E, Basu S, Hanson K: **The relationship between socioeconomic status and malaria: a review of the literature.** In: *Background paper prepared for meeting on "Ensuring that malaria interventions reach the poor" London School of Hygiene & Tropical Medicine*; 2002.
21. Abdulla S, Schellenberg JA, Nathan R, Mukasa O, Marchant T, Smith T, Tanner M, Lengeler C: **Impact on malaria morbidity of a programme supplying insecticide-treated nets in children aged under 2 years in Tanzania: community cross sectional study.** *BMJ* 2001, **322:**270-273.
22. Onwujekwe OE, Chima R, Shu E, Nwagbo D, Okonkwo P: **Hypothetical and actual willingness to pay for Insecticide-treated nets: A study in five Nigerian communities.** *Trop Med Int Health* 2001, **6:**545-553.
23. Wagstaff A: **Socioeconomic inequalities in child mortality: comparisons across nine developing countries.** *Bull World Health Organ* 2000, **78:**19-29.
24. Makinen M, Waters H, Rauch M, Almagambetova N, Bitran R, Gilson L, McIntyre D, Pannarunothai S, Prieto AL, Ubilla G, Ram S: **Inequalities in health care use and expenditures: an empirical data from eight developing countries in transition.** *Bull World Health Organ* 2000, **78:**55-65.
25. Whittington D, Smith K, Okoroafor A, Liu JL, McPhail A: **Giving respondents time to think in contingent valuation studies.** *J Environ Econ Manage* 1992, **22:**205-225.
26. Onwujekwe O, Shu E, Okonkwo P: **Can community leaders' preferences be used to proxy those of the community as a whole?** *J Health Serv Res Policy* 1999, **4:**133-138.
27. Filmer D, Pritchett L: **Estimating wealth effects without expenditure data – or tears: an application to educational enrollements in states of India.** *Demography* 2001, **38:**115-132.
28. Hanson K, Worrall E: **Report on the analysis of SMITN2 End-of-project survey.** In: *Book Report on the analysis of SMITN2 End-of-project survey London: Malaria Consortium, London School of Hygiene and Tropical Medicine*; 2002.
29. Abdulla S, Kikumbih N, Masanja H, Mshinda H, Nathan R, de Savigny D, Armstrong Schellenberg JRM, Victora CG: **Mosquito nets, poverty and equity in rural southern Tanzania.** 2001 [http://www.mimcom.org.uk/ifakara/poverty.pdf]. accessed 17 April 2002
30. Baker J, van der Gaag J: **Equity in health care and health care financing: evidence from five developing countries.** In: *Equity in the finance and delivery of health care: an international perspective* Edited by: *van Doorslaer E, Wagstaff A, Rutten F. Oxford: Oxford University Press*; 1993.
31. Simon JL, Larson BA, Zusman A, Rosen S: **How will the reduction of tariffs and taxes on insecticide-treated bednets affect household purchases?** *Bull World Health Organ* 2002, **80:**892-899.
32. Mushi AK, Armstrong Schellenberg JRM, Mponda H, Lengeler C: **Targeted subsidy for malaria control with treated nets using a discount voucher system in southern Tanzania.** *Health Policy Plan* 2003, **18:**163-171.
33. Guyatt HL, Gotink MH, Ochola SA, Snow RW: **Free bednets to pregnant women through antenatal clinics in Kenya: a cheap, simple and equitable approach to delivery.** *Trop Med Int Health* 2002, **7:**409-420.
34. Onwujekwe OE, Chima RI, Shu E, Nwagbo DFE, Akpala C, Okonkwo P: **Altruistic willingness to pay in community-based sales of insecticide-treated nets exists in Nigeria.** *Soc Sci Med* 2002, **54:**519-527.