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Inequities in Valuation of Benefits, Choice of Drugs, and Mode of Payment for Malaria Treatment Services Provided by Community Health Workers in Nigeria

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Abstract. This study determined inequities of using community health workers (CHWs) for timely and appropriate treatment of malaria in terms of: 1) valuation of benefits; 2) actual purchase of drugs; and 3) payment modality in southeast Nigeria. Socioeconomic status (SES) influenced the valuation of benefits. Also, the poorest households consumed more of the cheaper drug and less of the more expensive drug ($P < 0.05$). The least poor households mostly paid in full, whereas the poorest households paid mostly through installments ($P < 0.05$). The use of CHWs improved overall geographic but not socioeconomic equity to the drugs. Hence, interventions for timely and appropriate treatment of malaria should be accompanied by drug delivery and payment strategies that would ensure SES equity in consumption of appropriate malaria treatment services.

INTRODUCTION

Interventions for providing prompt access to effective treatment of malaria nearer the homes are being advocated and implemented in sub-Saharan African countries such as Nigeria as a means of improving access to treatment of the disease for the general population. This is one reason that the African Heads of State meeting in Abuja, Nigeria, adopted effective treatment of malaria nearer the home as one of the strategies for malaria control in Africa.[1] It is believed that such approaches would improve the level of access and consumption of appropriate anti-malarials by all socioeconomic groups where formal health care services are non-existent or have collapsed. Prompt access means having treatment available as near to the home as possible so that it is given within 24 hours of onset of symptoms.[2] Interventions for improving prompt and appropriate access to malaria treatment services need to be implemented and sustained particularly in rural communities, where there is paucity of health care providers, leading to high levels of self-diagnosis and inappropriate drug use.[3,4]

Home management is the intervention that is mostly advocated for providing easily accessible appropriate treatment of malaria,[1,2] and one strategy for achieving the purpose is through community health workers (CHWs). In Nigeria, home management is a stipulated intervention for improving timely and appropriate treatment of malaria,[5] and there are currently ongoing efforts to determine the different models including CHWs and means of scaling-up home management in the country. The umbrella term "community health worker" encompasses a variety of health assistants who are selected, trained, and work in the communities in which they often live.[6] They are most often ethnically, socioeconomically, and experientially indigenous to the community where they work. This familiarity provides CHWs with a unique understanding of the culture and strength of the community they serve and increases trust.

Minimally trained CHWs have increasingly been introduced in many countries to increase the availability of trained health workers in mostly rural communities where their availability has been scarce.[7] The CHWs compared with regular household members are better able to recognize the symptoms of malaria, prescribe/dispense appropriate medication, ensure compliance to treatment, and provide a reliable referral point when treatment fails and for complicated malaria cases.[8] The use of CHWs to provide treatment of variety of health problems within the patients' village is a common approach in Latin America,[9,10] Asia, and sub-Saharan Africa for the control of malaria and implementation of other health interventions,[7,11–14] They also operate in Nigeria, mostly as village health workers, traditional birth attendants, community-directed distributors of ivermectin, and general volunteer CHWs.[11,15] Despite this evidence of the benefits of improving access to treatment using CHWs, some experts remain cautious about this approach, because of concerns that allowing CHWs to distribute anti-malarials will increase the misuse of drugs and accelerate the development of anti-malarial resistance.[10]

There is paucity of knowledge in using a home management strategy, especially through the use of CHWs for the treatment of malaria, about how different socioeconomic groups would value the services and hence be willing to pay for such services, as well as purchase the appropriate anti-malarials when readily available. Also, knowledge about the pro-poor payment strategies that should be implemented for improving equity to access to such interventions is unknown. It is possible that different modes of payment and availability of cheap drugs could increase the easy access of treatment to different socioeconomic groups and ensure that the use of CHWs strategy is equitable. Hence, CHWs may not be equitable if the poorest groups purchase the cheapest (and possibly least effective) drugs because of their severe budgetary constraints. It is important that the equity implications of such interventions for bringing malaria treatment nearer the homes are studied to ensure that they are equitable.

This paper provides information on the valuation of benefits of CHWs and equity implications of the CHW strategy based on user fees, because interventions for improving

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timely and appropriate treatment of malaria such as use of CHWs could improve geographic equity but not necessarily socioeconomic equity, especially if the services are based on user fees and the poor cannot pay for drugs and other services.[16] Stated willingness to pay (WTP) for CHWs as a means of valuing their benefits was determined using the contingent valuation method (CVM), which involves respondents evaluating, in monetary terms, goods, or services with benefits that may not be directly measurable.[17,18] In addition, this paper reports the influences of socioeconomic status (SES) on the choice of drugs that people actually purchased for the treatment of malaria and with payment strategies that were used to pay for CHW services. This information is useful to policy makers and program managers to aid in developing and implementing pro-poor interventions for bringing appropriate malaria treatment nearer to the people, especially now that many African countries such as Nigeria have are changing to artemisinin-based combination therapy as first-line treatment of malaria.

MATERIALS AND METHODS

Study area. The study sites were two malaria holoendemic villages in Achi community, Enugu State, Southeast Nigeria, namely Adu and Ahani. The town has a population of ~40,000 people living in 12 scattered villages. Achi is a rural town with a paucity of properly functioning and inequitably distributed public health care facilities. There is a small general hospital and two comatose health centers in the town. Three private clinics that mostly function irregularly during the weekend when the owners visit the town and two maternity homes complement the public providers. There are two patent medicine dealers in the study villages, and drug hawkers occasionally visit the area on the major market days, usually once every 4 days. The patent medicine dealers and drug hawkers usually provide unregulated low-quality services using drugs of questionable origin and quality. The health care facilities and providers are not easily accessible to most people because they are mostly clustered around the major road that runs through the town, whereas the interior of the villages are bereft of health care providers. A number of traditional medicine practitioners exist in the Achi. The major malaria vector in Achi is *Anopheles Gambiense*, whereas *Plasmodium falciparum* causes > 90% of all malaria cases.[19]

Study design. The study was conducted in three phases: a first survey was used to collect baseline data; the implementation of the CHW strategy; and a second survey to evaluate the intervention at the end of the second phase. The study lasted for 14 months.

First survey: valuation of benefits. A pre-tested questionnaire was used to determine the willingness to receive and to pay for treatment provided by CHWs from an adequate random sample of 300 households from each of the two villages. The sample was calculated using the EPI info software, based on a power of 80% and a confidence level of 95%. Household lists were first compiled in the two villages and used as the sampling frame. The respondents were the heads of households or their representatives (where the head was absent). The respondents' WTP for malaria treatment services that were rendered by the CHWs was determined using the bidding game contingent valuation question format, which to an extent mimics how people bargain for goods and services in Nigeria.[20] In eliciting WTP, a scenario that explained how the CHW strategy would work, its pros and cons, the fact that people will have to pay for services, and the modes of payment were explained to the respondents before the bidding game was used to elicit their maximum WTP per episode of malaria for the services of the CHWs. The maximum elicited WTP was a continuous monetary value.

Implementation, supervision, and monitoring of the intervention. There were a total of seven CHWs: four in Ahani and three in Adu. The CHWs who were nominated by community leaders were trained to treat only uncomplicated cases of fever and to refer all other cases to the health centers or general hospital. The general population of the villages were fully mobilized through announcements by town criers, in churches, in village assemblies, and through word of mouth by the CHWs about the nature of the intervention and urging them to patronize the CHWs. The CHWs did not operate from any health care facility but treated the people in either their homes or at the patients' homes if so requested or the patient was too ill to visit the CHWs.

Two anti-malarials were used in the project, chloroquine and sulfadoxine-pyrimethamine (SP), which were the first-line drugs for the treatment of malaria in Nigeria at the time of the study. After making a diagnosis of malaria, the CHWs explained to the consumers that they stocked SP and chloroquine and told them the costs and the payment mechanisms. However, as the project progressed, the villagers got to generally know the drugs that the CHWs stocked and the payment mechanisms. The CHWs informed patients about the effectiveness of the available drugs (which was similar in the study area), their side effects, and duration of treatment. The CHWs prescribed any of the drugs based on their assessment of the patients, especially their SES and severity of the illness, but the patients had the choice of choosing either drug and the payment mechanism. The CHWs were paid fixed commissions on each drug sale.

The consumers were allowed to pay either full cash-and-carry (complete payment at point of purchase) or to pay by a maximum of two installments. A full-dose treatment of adult malaria with chloroquine cost 50 Naira or US$0.40 per adult malarial treatment, whereas a full-dose treatment of an adult with SP cost 130 Naira or US$1.04 per adult malarial treatment. The cost of treating childhood malaria depended on age of the patient and varied from 20 Naira or US$0.16 to 40 Naira or US$0.32 for chloroquine and from 50 Naira to 100 Naira for SP.

Second survey: determining actual drug purchases and payment mechanisms. Data were collected from a total of 469 households that were treated for malaria by the CHWs. The actual number of people that were treated by CHWs during this period was > 469, but because some of the patients were from the same households, there was no need to duplicate the data that were collected. The CHW administered questionnaires to all their patients for the collection of information of household socioeconomic characteristics, the anti-malarial they took, and how they paid for treatment. The questionnaire that was used to collect the data was different from the forms that were used by the CHWs to collect routine data from their patients.

Data analysis. Tabulations, equity analysis, testing of means, and non-parametric tests were the major data analytic procedures. Ordinary-least squares (OLS) regression analysis was used to determine the factors that explain stated levels of WTP. A general-to-specific modeling approach was used to arrive at the best reduced models. The independent variables with the smallest *t*-statistic, and whose removal did not adversely affect the other coefficients or the prediction of the models, were removed sequentially. Generalized residuals were used to check for heteroscedasticity and normality in the models. The Ramsey RESET test was used to check for functional mis-specification. The RESET test is a *t*-statistic, and the critical value is 1.96 at the 5% level. The data from the two villages were combined in analyzing the data about actual purchase of drugs and payment strategies that were used to pay to increase the statistically power.

An SES index was used to examine whether there were systematic differences in choice of anti-malarial drugs and payment strategies by socioeconomic groups in the use of community-based malaria treatment services. Principal component analysis[21,22] was used to generate an asset-based household SES index. The variables that were used to generate the index were household ownership of a bicycle, television set, motorcycle, and motorcar, as well as per capita weekly food value. The SES index was used to divide the households into quartiles (least poor, poor, very poor, and poorest), which were used to determine the equity implications of some of the key variables. χ^2 analysis for trend was used to determine the statistical significance of the differentiation of the dependent variables into SES quartiles. Hence, χ^2 tests were used to test for the statistical significance of the differences of drugs consumed and payment strategies between the SES quartiles. Equity ratios were computed to show the level of inequity that exists in the dependent variables.[22] An equity ratio of 1 signifies perfect equity. However, if the ratio is more than one, the variable of interest occurs more among the poorest than the least poor group.

RESULTS

Stated preferences and WTP: first survey. *Socioeconomic and demographic characteristics of the respondents.* Table 1 presents the descriptive characteristics of the respondents and their households. Most of the respondents were the household heads and did not have any formal education, except in Ahani, where they were mostly representatives of the households and had some formal education. Households' composition showed that adults were the majority of residents. Not many households owned a motorcycle or motorcar.

Willingness to receive treatment and to pay for services from CHWs. The majority of the respondents stated that they were willing to receive treatment from CHWs when they were available (Table 2). The majority of the respondents also stated that they would be willing to allow children and pregnant women in their households to receive treatment of malaria from the CHWs. Although most of the respondents were also willing to pay to receive treatment from the CHWs, not many of them were willing to pay 500 Naira, which was the starting bid used in the bidding game. The mean and median WTP amounts were highest in Adu.

Socioeconomic differences in stated willingness to receive and to pay for services. In Ahani, the respondents from the least poor quartile compared with the poorest quartile were more willing to receive treatment from the CHWs (Table 3). A similar pattern was also noted for treating childhood malaria. However, in cases of pregnant women, the pattern was only noted in Ahani. In the case of WTP, the least poor were most likely to be WTP the first bid amount in the villages. However, there was marked socioeconomic differentials in stated WTP amounts in the villages, which increased as the socioeconomic status quartile increased.

Tests of validity of the elicited WTP estimates using OLS showed that, as SES class increased, WTP for CHWs also increased. Increasing number of household residents was negatively associated with WTP in Ahani, but the converse was true in Adu (Table 4). As age increased, WTP decreased.

Actual preferences: second survey. The respondents were evenly distributed across SES quartiles. Most of the respondents demanded for and used SP and paid fully for the drugs at the point of treatment. Within each quartile, a greater proportion of people used SP and made full payments (Table 5). There was a statistically significant relationship between SES and the drugs used. The poorer the household, the greater the

TABLE 1

Respondents'/household socioeconomic and demographic characteristics

	Adu (N = 299)		Ahani (N = 298)	
	n	Percent	n	Percent
Household head	205	(68.6)	147	49.3
Female	124	(41.5)	109	36.6
Age: mean (SD)	57.54	(58.0)	50.523	(14.77)
Had formal education	143	(47.8)	201	67.4
Years of formal education: mean (SD)	3.05	(4.30)	4.16	(4.26)
Ever married	262	(87.6)	269	90.3
No of household residents: mean (SD)	5.18	(3.59)	3.85	(2.01)
Occupational group				
Unemployed/housewives	19	(6.4)	9	3.0
Farmers	199	(66.6)	210	70.5
Petty traders/skilled labor	50	(16.7)	211	14.1
Regular wage earners	29	(9.7)	29	9.7
Professional and big business	2	(0.7)	8	2.7
Household owns a radio	261	87.3	234	78.5
Household owns a bicycle	165	55.2	162	54.4
Household owns a motorcycle	55	18.4	163	18.8
Household owns a motorcar	30	10.0	14	4.7
Weekly food value: mean (SD)	1,598.82	(1,308.99)	1,148.70	(1,163.01)

TABLE 2
Willingness to receive treatment and to pay for services from community health workers

	Adu (N = 299)		Ahani (N = 298)	
	n	Percent	n	Percent
Willing to receive treatment (respondents)	286	(95.7)	276	(92.6)
Willing to receive treatment (children)	284	(95.0)	278	(93.3)
Willing to receive treatment (pregnant women)	271	(90.6)	257	(85.9)
Number willing to pay	289	(96.7)	261	(87.6)
Whether willing to pay starting bid amount	176	(58.9)	87	(29.2)
WTP amount per episode of malaria				
Mean (SD)	454.65	(216.56)	332.37	(238.48)
Median	500		450	
95% confidence interval	430.0, 479.3		305.2, 359.6	

WTP, willingness to pay.

use of the cheaper drug, chloroquine, whereas the least poor households had the greatest use of the more expensive drug, SP ($P < 0.05$). The equity ratios confirmed that use of SP was more among the better-off households and *vice versa* for chloroquine.

Full payment for the services was the more common payment strategy used by consumers to pay for both SP and chloroquine (Table 5). However, there were statistically significant socioeconomic differentials with respect to payment strategies. The least poor households mostly paid fully at the point of use of treatment, whereas the poorest households paid more through installments ($P < 0.05$). No default in payments of the installments was recorded in the project. The equity ratios confirmed that the use of full cash-and-carry user fee payment strategy was more among the better-off households and *vice versa* for installments. The χ^2 analyses of the relationships between payment strategies and the type of drugs consumed were all statistically significant ($P < 0.05$)

TABLE 3
Socioeconomic differentials in willingness to receive and to pay for treatment from CHW

	Adu	Ahani
Willing to receive treatment (self)		
Q1 (%): poorest	69 (24.1%)	62 (22.4%)
Q2 (%): very poor	73 (25.5%)	73 (26.5%)
Q3 (%): poor	72 (25.2%)	73 (26.5%)
Q4 (%): least poor	72 (25.2%)	68 (24.6%)
χ^2 (P value)	3.39 (0.33)	17.24 (0.001)
IQR (Q1:Q4 ratio)	0.96	0.91
Willing to receive treatment (children)		
Q1 (%): poorest	68 (23.5%)	62 (22.3%)
Q2 (%): very poor	73 (25.3%)	74 (26.6%)
Q3 (%): poor	74 (25.6%)	73 (26.3%)
Q4 (%): least poor	74 (25.6%)	69 (24.8%)
χ^2 (P value)	4.08 (0.25)	20.31 (0.0001)
IQR (Q1:Q4 ratio)	0.92	0.90
Willing to receive treatment (pregnant women)		
Q1 (%): poorest	65 (24.0%)	54 (21.1%)
Q2 (%): very poor	69 (25.5%)	69 (27.0%)
Q3 (%): poor	68 (25.0%)	66 (25.7%)
Q4 (%): least poor	69 (25.5)	67 (26.2%)
χ^2 (P value)	2.12 (0.55)	16.20 (0.001)
IQR (Q1:Q4 ratio)	0.94	0.81
Willing to pay starting bid amount		
Q1 (%): poorest	35 (19.9%)	10 (11.5%)
Q2 (%): very poor	43 (24.4%)	11 (12.6%)
Q3 (%): poor	43 (24.4%)	29 (33.3%)
Q4 (%): least poor	55 (31.3%)	37 (42.5%)
χ^2 (P value)	12.05 (0.007)	35.74 (0.0001)
IQR (Q1:Q4 ratio)	0.64	0.27
Willingness to pay amount		
Q1 (SD): poorest	369.87 (245.66)	247.20 (314.98)
Q2 (SD): very poor	446.05 (207.65)	315.67 (170.35)
Q3 (SD): poor	484.73 (185.78)	360.89 (213.17)
Q4 (SD): least poor	519.32 (197.06)	407.09 (204.30)
χ^2 (P value)	22.95 (0.0001)	31.8 (0.0001)
IQR (Q1:Q4 ratio)	0.71	0.61

IQR, interquartile ratio.

DISCUSSION

The study shows that most of the respondents across the villages stated that they were willing to pay to receive malaria treatment services from the CHWs. All SES groups gave positive valuations to benefits of using CHWs, although the WTP amounts across the communities showed that the rich valued the CHWs' services more than the poor. However, the amounts that the poorest and poorer respondents could deplete a higher proportion of their income than that of better-off respondents. The inequity in WTP should be borne in mind by policy makers so that they do not implement programs that will exclude the poor and favor the rich.

The use of CHWs improved overall geographic access to treatment but did not improve socioeconomic access to high-quality drugs. This was because, although the CHWs were generally accessible to all the SES groups, because they were

TABLE 4
Reduced OLS multiple regression models of WTP in the two villages

	Adu [coefficient (SE)]	Ahani [coefficient (robust SE)]
Status in the household	–40.39 (30.43)	–
Number of household residents	6.82 (3.42)†	–12.54 (6.24)†
Sex	47.90 (28.64)*	–
Age	–1.58 (.80)†	–1.59 (.95)*
Education	–	–
Marital status	–	–
Had malaria in past month	–40.90 (23.88)	–
Used community health workers	144.14 (143.03)	–128.33 (40.19)‡
Socioeconomic status	50.62 (9.73)‡	48.62 (11.70)‡
Constant	536.13 (53.25)‡	465.76 (58.17)‡
F statistic	8.23‡	14.29‡
Adjusted R^2	0.15	0.10
Cook-Weisberg test for heteroskedasticity	1.18	0.15
Ramsey RESET test	3.88	2.7†

Levels of significance: *, $p < 0.10$; †, $p < 0.05$; ‡, $p < 0.001$.

Table 5
Socioeconomic differentials in actual choice of drug and payment strategy

	SP (N = 338)	Chloroquine (N = 111)	Full payment (N = 366)	Installment (N = 58)
Q1 (%): poorest	79 (23.4)	35 (31.5)	87 (23.8)	21 (36.2)
Q2 (%): very poor	78 (23.1)	30 (27.0)	82 (22.4)	16 (27.6)
Q3 (%): poor	87 (25.7)	26 (23.4)	96 (26.2)	15 (25.9)
Q4 (%): least poor	94 (27.8)	20 (18.0)	101 (27.6)	6 (10.3)
χ^2 (p value)	6.10 (0.013)	5.90 (0.015)	6.67 (0.01)	9.13 (0.003)
IQR (Q1:Q4 ratio)	0.84	1.75	0.86	3.5

SP, sulfadoxine-pyrimethamine.

near the people, there were inequities in types of drugs used and payment strategies. Most people demanded for and used the more expensive SP, and most people also made full payment. The reason for the preference of SP over chloroquine could be multi-factorial. The single day treatment with SP compared with several days for chloroquine could have contributed to the greater consumption of SP. It is a general belief (sometimes unjustified) in Nigeria that expensive goods are of better quality than less expensive ones, and because SP is more expensive than chloroquine, the perceived quality of SP ultimately determined its greater choice over chloroquine. The importance of peoples' perception of quality was shown when it was found that the ill and poor people bypassed free or subsidized services in facilities they perceived to be offering low-quality services; the main reasons for the choice of anti-malarial were experience from personal use and quality of the medicine.[23,24]

SES was correlated with the drugs used as a result of the differential cost of the drugs. Preference for the cheaper drug by poorer households is indicative of a household facing a cash constraint, as implied by the statistically significant relationship between the choice and the payment strategy. The inequity in treatment is in conformity with the findings, where leftover drugs were used to treat more episodes in the poor compared with the less poor community.[25] Similarly, in Tanzania, it was found that children in the poorest SES groups were less likely to receive anti-malarials compared with children in the wealthiest SES group.[26]

There were also statistically significant relationships between SES and the payment strategies, where the least poor households paid fully at the point of consumption of treatment, whereas the poorest households paid more by installments. The mostly preferred cash-and-carry payment strategy is the most common method of payment in primary health care in Nigeria.[22] Also from an overview of health projects in sub-Saharan Africa, there seems to be a clear preference for direct payment schemes, especially with curative care as the focus because they are seen to be fairly simple to administer and efficient from the providers' point of view.[27]

The study limitations were both logistical and methodological. A limitation was that, because of the short time frame and resource constraints, it was not possible to conduct a detailed post-intervention survey of randomly selected households to provide a fuller picture of the relationship between access to different drugs and services provided by CHWs with SES. Also, the study was not designed to understand significant differences in practices between CHWs that would have provided greater understanding of the factors underlying practices and support generalizability, because it was more interested in whether the use of CHWs as a whole would be valued by the consume and equitably used. Also, it could be argued that the use of CHWs to collect data from their clients in the second survey could have biased the information because the CHWs were the service providers instead of being interviewers that are not involved in service delivery. However, this is similar to what happens in usual practice, where doctors and other health care providers collect SES and other data of their clients, and such data are routinely used for decision-making.

In addition, the fact that SES consideration was one of the variables that determined CHWs drug provision behavior could have biased the results, questioning the relationship between SES and choice of drug. However, the fact that the CHWs first informed the consumers about the available drugs, especially the price, and also allowed the consumers to make the final decision about the drug to be prescribed and consumed would have limited the possible bias that prior considerations of SES could have introduced. Finally, it would be naïve to make SES comparisons between the two villages because of the relative nature of the SES index, and each village has a different index.

The CHW strategy could be made more equitable through the use of installment payments, which could also ensure that the poorest households are better able to consume the more expensive drug, SP, if they so wish. The finding of a high equity ratio in payment by installment implies that the payment mechanism could be used as a pro-poor strategy for CHWs and for many community-based health care programs. It is known that cash and carry payment mechanism through out-of-pocket payments is regressive and hence inequitable, because the poor may not be able to immediately pay the full cost of high-quality services, as found in our study. The greater use of installment payments by the poorest households is logical because the poorest households have greater budgetary constraints and hence decided to spread the payments over two or three times.

In summary, this study showed that, apart from a general program design to improve geographical equity to provide prompt access to malaria treatment, such interventions for bringing malaria treatment nearer the homes such as CHW strategy should also address issues regarding socioeconomic equity in drug use and payment strategies. Pro-poor payment strategies should be actively promoted so that the poorest will be able to consume the most appropriate drugs, especially in view that the generally expensive artemisinin-based combination therapy (ACT) is being introduced in Nigeria and in many sub-Saharan African countries as first-line drugs. Evidence shows that the poorer the people, the lower their willingness to pay for ACT.[28,29] An alternative approach could be to alter the cost of drugs to be paid by care seekers through subsidizing drug prizes.[3] The evidence for inequities should inform programs aimed at reducing overall burden of malaria, so that they include strategic components aimed specifically at improving socioeconomic, geographic, sex, and other forms of equity. This is also information that should inform the equitable deployment and use of ACT as the first-line drug for the treatment of malaria in sub-Saharan African countries such as Nigeria.

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