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Willingness to pay for community-based ivermectin distribution: A study of three onchocerciasis-endemic communities in Nigeria

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Summary

OBJECTIVE To determine the willingness to pay (WTP) for local ivermectin distribution in a community financing framework.

METHOD Contingent valuation in three communities in Nigeria, using randomly selected household heads. WTP was elicited using a bidding game, and for collecting information on the households' socio-economic status, level of knowledge, priority ranking and perception of risk of contracting the disease, structured questionnaires were used. Ordinary least squares (OLS) multiple regression analysis was used to analyse factors associated with WTP.

RESULTS Between 92.1% and 93.3% of respondents were willing to pay amounts ranging from 5 Naira (US$ 0.06) to 100 Naira (US$ 1.25) (median: 20 Naira, US$ 0.25) in the three communities, more than three times the modelled unit direct cost of distributing ivermectin by the communities themselves. Occupation of the respondent, marital status, average monthly expenditure on health care, manifestations of onchocerciasis, the type of savings scheme embarked on by the respondent, age-group, level of education and type of property were statistically significant ($P < 0.05$) variables affecting WTP.

CONCLUSION This study shows that there is WTP for local ivermectin distribution in the three study communities, and that it should be assessed before instituting community-directed treatment with ivermectin.

keywords willingness to pay, community-based, ivermectin, onchocerciasis

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Introduction

Onchocerciasis or river blindness, a parasitic disease caused by the filarial worm *Onchocerca volvulus*, is endemic in large parts of West Africa, Central and southern America. Important foci of the disease can be found close to fast-flowing rivers where transmission is highest (Plaiser *et al*. 1990). This makes the disease a major obstacle to socio-economic development of fertile river basin areas, and justifies the broad attention for both the nature of transmission and the possibilities of its control (WHO 1987). Nigeria is the most endemic country in the world for the disease, with approximately 40 million people at risk of infection (Akpala *et al*. 1993a). It is a leading cause of blindness in Nigeria (Umeh *et al*. 1996) and a stigmatizing disease, as onchocercal skin lesions constitute an impediment to marriage and are a leading cause of divorce (Amazigo *et al*. 1994).

The Onchocerciasis Control Programme in West Africa (OCP), launched in 1974 and extended in 1986, covers the savannah areas of 11 West African countries (WHO 1997). The principal, and highly successful, control strategy of OCP has been vector control. Onchocerciasis is now under full control throughout the OCP area (WHO 1997): some 1.5 million people originally infected no longer have the disease; 125 000–200 000 people have been prevented from going blind; 30 million people are no longer at risk of infection and blindness; and 2.5 million hectares of land have been made available for settlement. Unfortunately, aerial larviciding was not considered technically feasible or cost-effective outside the OCP, and virtually no action used to be taken to control the disease in non-OCP countries, but this changed when

ivermectin was introduced in 1987 and made available by the manufacturers, Merck, Sharp and Dohme, free of charge and for 'as long as needed' (WHO 1997).

Nigeria is outside the OCP area and the method for disease control is through mass distribution of ivermectin (Mectizan®) through vertical distribution programmes undertaken by both the government-controlled National Onchocerciasis Control Programme (NOCP) and nongovernmental organizations. Though the drug is provided free of charge by the manufacturers, the cost of delivering it to final consumers equals the government budgetary allocation to health, which in 1989 was approximately US$ 58 million (NOCP 1993). This has resulted in less than 30% of affected communities being covered by mass distribution of ivermectin (NOCP 1994). Donor funds are limited because it is estimated that onchocerciasis needs at least yearly uninterrupted dosing with ivermectin for 10–15 years before the transmission cycle can be completely broken in a community, as the mean reproductive lifespan for *Onchocerca volvulus* is 9. 0–9.5 years with an upper limit of 15 years for 95% of infections (Remme *et al*. 1990). Most donor-funded efforts are on a five-year basis.

Financial sustainability is thus a major challenge facing ivermectin distribution in Nigeria. The bleak outlook for funding from outside the health sector has lent added urgency to the exploration of options for mobilizing additional resources within it. In essence, this means considering whether households should pay for services, and if so, what form payment should take (de Ferranti 1985). The World Health Organization (WHO) through the newly established African Programme for Onchocerciasis Control (APOC) has already started exploring this option. It is a given objective of APOC to promote community-led and community-funded ivermectin distribution, with the aim of completely transferring the distribution of ivermectin with its funding to the communities by the year 2008 (TDR 1996).

Most rural communities in Nigeria are medically underserved – given their limited resources, both federal and state governments cannot provide health facilities in every community (Ojanuga 1985). Such communities must provide their own health facilities to promote, protect, and maintain their health. According to Jancloes *et al*. (1985), it is difficult to prejudge a community's capacity to satisfy its basic needs, because no satisfactory method has been developed to predict the potential resources of a poor community. To improve their health conditions, all people, even poor, have some resources available. Akpala *et al*. (1993b) investigated community participation and financing of mass distibution of ivermectin in eastern Nigeria, where communities donated land, labour and nonmonetary capital for the success of the programme. Ransome-Kuti (1992) reported successful community involvement in family planning services and mass immunization. However, in order to have sustainable community schemes, it is important to determine the level of willingness of the communities to pay for such schemes.

O'Brien and Viramontes (1993) analysed whether WTP was a valid and reliable measure of health state preferences by surveying 102 persons with chronic lung disease and eliciting WTP by a simple bidding game. They reported that there was no opening bid bias, and that WTP methods will generate the most reliable data in minor diseases, where the respondent already has some familiarity with consumer purchase. Opening bid bias occurs when the respondent's WTP amount is influenced by a value introduced by the scenario (Mitchell & Carson 1989). Thus the bidding game and 'take-it-or-leave-it' elicitation techniques pose the most obvious threat of this kind since they directly confront the respondent with a proposed amount that he or she is asked to accept or reject. WTP is a concept increasingly used to inform policy decisions in the health sector (Russel *et al*. 1995), and it is of utmost importance to interpret results cautiously (Johannesson 1993), as revealed and stated WTP may vary. In addition to biases introduced by the wording of the questions, a major doubt is whether people can give meaningful answers to these questions (Russel *et al*. 1995). The ultimate test of validity is to compare hypothetical bids with actual payments, or to see whether WTP bids are systematically related to socio-economic variables, and if so, in what way (Russel *et al*. 1995).

Although ivermectin is a private good and gives private utility in consumption, the benefit is both private and social. Therefore a reasonable level of willingness to pay for ivermectin distribution in onchocerciasis-endemic communities is expected, and must be determined, even if households are presumed poor. The major focus of this study was to determine the levels of willingness to pay for local ivermectin distribution in three different communities of Nigeria, given that private payment for local ivermectin distribution is a potential option for eliminating onchocerclasis as a public health problem.

Subjects and methods

Study sites

Achi community in the Oji River Local Government Area (LGA) of Enugu State, is presumed predominantly onchocerciasis nonblinding forest-savannah mosaic zone of south-eastern Nigeria. The town has a projected population of approximately 45 000 and is located 5 km from the local government headquarters and 30 km from the state capital. Its onchocerciasis prevalence is 45% (Okonkwo *et al*. 1991). Achi is divided into 12 villages, some of which are not easily accessible by road. Each village is comprised of a number of

big or super family units (*ummuna*). Ivermectin has been mass-distributed since 1990: from 1990 to 1996 as a vertical programme, but from 1997 as an NGO-promoted CDTI scheme.

Nike community in Enugu-East LGA of Enugu State, and located in the same onchocerciasis zone as Achi, has a projected population of about 60 000. Part of it is within the LGA headquarters, while other parts are up to 20 km from the LOA headquarters. The state capital is about 7 km away. Nike is divided into four zones with at least five villages each. Onchocerciasis is hyperendemic. The inhabitants are predominantly farmers and civil servants. Mass distribution of ivermectin has been taking place since 1995 as an NGO-promoted CDTI scheme.

Toro community, about 110 kilometers from the state capital, in Toro LGA of Bauchi State, is situated in the predominantly onchocerciasis-blinding Sudan-savannah mosaic zone of northern Nigeria. Its projected population of 20 000 has an onchocerciasis endemicity level of about 40%. Toro is comprised of hamlets grouped in 5 villages. The peoples' most frequent occupations are farming and public service. Ivermectin has been mass-distributed in Toro since 1993.

Study design

The respondents were randomly selected household heads or representatives of households. 404 households were selected in Achi, 393 in Nike, and 214 in Toro. The sample was self-weighing and a multistaged technique was used. Villages were selected by balloting from sections of communities. Then simple random sampling was used to select households with the primary health care (PHC) house numbering system as the sampling frame. The household heads or their representatives (if the household head was not available) from the selected households were interviewed.

Study tool and contingent valuation procedure

We used an interviewer-administered structured questionnaire. Consent was obtained from the chief community leader and respondents had the option to decline. Native interviewers were trained and employed to reassure the respondents that the exercise was not for levy or tax purposes. Post-primary education was the minimal educational requirement for the interviewers to ensure they could satisfactorily conduct interviews and record responses. After training, we pilot-tested the questionnaires with 100 residents in a community near Achi and modified the wording of some questions and coding of responses accordingly.

A scenario explaining the effects of the disease and effectiveness of ivermectin against onchocerciasis was presented to the respondents (Appendix 1). It explained the rationale for looking for additional funds to distribute ivermectin, benefits of long-term community distribution of the drug; the relative safety of ivermectin compared to older filaricides and side-effects. Respondents were made to understand that ivermectin was free from the manufacturers, but that costs of local drug distribution will be incurred by the community for community-based and controlled dispension. The ivermectin collection system and modality of drug distribution were explained. This scenario was presented to the respondents before asking them to make their bids and state the maximum amount they were willing to pay per treated person in their households.

Since this health service was presented to the respondents with a hypothetical market, they were made to offer amounts based on the information provided by the interviewer. The bidding either went up or down depending on the initial response. 30 Naira (US$ 0.38) was used as the starting bid for all respondents in all three communities, and they were allowed only three bids, and the last bid represented their maximum WTP (Appendix 2). The range of amounts used in the bidding game was derived from cost-modelling for community-financing of local ivermectin distribution (Onwujekwe 1996). The cost modelling revealed that the unit total direct cost of distributing ivermectin using a community-based system ranged from 9 Naira (US$ 0.11) to 12 Naira (US$ 0.15) depending on the demographic characteristics of a community. These figures were increased and used in the bidding game so as to account for possible cost increases and uncertainties in the future. The questionnaire also contained questions exploring personal and socio-economic status of the households, together with their knowledge about and attitude to onchocerciasis and ivermectin.

Willingness to pay procedure

Data collected for the WTP determination were personal data of respondents and socioeconomic characteristics of the households. Information was gathered about priority ranking of onchocerciasis, perceived risk of contracting onchocerciasis, presence of onchocerciasis in the household, WTP for local ivermectin distribution, willingness to contribute to a communal fund for ivermectin distribution and WTP for other eligible household members.

Assessment of validity

According to Weaver *et al.* (1993), validity was assessed using multiple regression analysis of WTP and independent variables. However, the ultimate validity test will be in the future, when stated WTP bids are compared to actual payments.

Data analysis

Percentages, Ordinary-least squares multiple regression and χ^2 analysis were used, as well as quantitative and scored qualitative data. Three regression functions were specified and analysed separately. WTP was the sole dependent variable. The first regression equation had 'ability' variables as the independent variables, which were assumed to be the key ability-to-pay determinants of a household and included average monthly household expenditure on health care (EH), average monthly household expenditure on food (EF), type of property owned (OP), average monthly household income (YH) and type of savings scheme embarked on by the respondent (TS). The second regression equation had personal data of the respondents as independent variables, comprising main occupation, level of education, marital status and age group. These variables were selected as they were assumed to be the most important personal profile variables that could affect WTP, and would be amenable to analysis. The third function involved some knowledge and attitude variables which were perceived risk of onchocerciasis (RC), presence of onchocerciasis in the household (PC) and priority ranking of onchocerciasis (PR).

Results

Summary of personal data of respondents

Table 1 shows the personal data profile of respondents. The majority were males in all three communities; aged between 41 and 60 years in Achi and Nike, and 20–40 years in Toro. Most were married; 66.1% in Achi, 81.2% in Nike and 80.8% in Toro. The respondents in Toro had the highest educational level. While predominantly farmers were interviewed in Achi, in Nike and Toro most respondents worked for the government.

Table 1 Demographic characteristics of the respondents.

Variables	Study communities					
	Achi (n = 404)		Nike (n = 393)		Toro (n = 214)	
	n	%	n	%	n	%
Sex						
Males	263	65.1	342	87.0	196	91.6
Females	141	34.9	51	13.0	18	8.4
Age group						
< 20 years	9	2.2	10	2.5	8	3.7
20 to 40 years	103	25.5	143	36.5	138	64.5
41 to 60 years	233	57.7	172	43.7	45	21.0
> 60 years	59	14.6	68	17.3	23	10.8
Status in household						
Household head	301	74.5	322	81.9	179	83.6
Representative of household	103	25.5	71	18.1	35	16.4
Marital status						
Single	51	12.6	54	13.7	37	17.3
Married	267	66.1	319	81.2	173	80.8
Widowed	82	20.3	15	3.8	1	0.5
Divorced/separated	4	1.0	5	1.3	3	1.4
Level of education attained						
No formal education/did not complete primary education	188	46.5	182	46.3	37	17.3
Completed primary education	155	38.4	137	34.8	22	10.3
Completed secondary education	48	11.9	49	12.5	98	45.8
Completed tertiary education	13	3.2	25	6.4	57	26.6
Main occupation						
Unskilled laborer/unemployed/ student	16	3.9	18	4.5	27	12.8
Skilled laborer	23	5.7	2	0.5	22	10.3
Farmer	270	66.8	16	4.1	36	16.8
Government worker	28	6.9	204	51.9	90	42.1
Private company employee	6	1.5	110	28.0	4	1.9
Businessman/woman	52	12.9	5	1.3	33	15.2
Professional	9	2.3	38	9.7	2	0.9

Willingness to pay

Table 2 shows that the great majority of the households, willing to pay for both themselves and other eligible household members, interestingly were prepared to contribute to a communal fund instead of just paying for themselves alone. χ^2 analysis showed that there was no statistical difference ($P > 0.05$) between the preferences made in the three communities.

How much were households willing to pay and what factors influenced WTP?

WTP amounts ranged from 5 Naira (US$ 0.06) to 100 Naira (US$ 1.25). Table 3 shows the mean and median WTP amounts in the three communities. The median WTP was 20 Naira (US$ 0.25) in Achi, 25 Naira (US$ 0.28) in Nike and 30 Naira (US$ 0.38) in Toro. OLS-multiple regression analysis showed that WTP was statistically significantly related ($P < 0.05$) to different sets of variables in the three communities (Table 4). In Nike, the level of education and occupation of the respondent, his/her marital status, average monthly expenditure on health care and presence of manifestations of onchocerciasis were statistically significant ($P < 0.05$) variables affecting WTP. In Toro, these were perceived risk of contracting the disease, the type of savings scheme embarked on by the respondent, occupation and age-group. In Achi, the variables that were significant at $P < 0.05$ were type of property owned by the household, type of savings scheme, level of education and occupation.

Table 2 Respondents willing/not willing to pay for themselves, to contribute to a communal fund and to pay for other eligible members of the community

Category	Achi (n = 404)		Nike (n = 393)		Toro (n = 214)	
	n	%	n	%	n	%
To pay for themselves						
Willing	377	93.3	364	92.6	197	92.1
Not willing	27	6.7	29	6.4	17	7.9
To contribute to communal fund						
Willing	373	92.3	366	93.1	203	94.9
Not willing	31	7.7	27	6.9	11	5.1
To pay for other eligible members of the community						
Willing	372	92.0	355	90.3	199	93.0
Not willing	32	8.0	38	9.7	15	7.0

a, $\chi^2_2 = 0.254$, $p > 0.05$; b, $\chi^2_2 = 1.029$, $p > 0.05$; c, $\chi^2_2 = 1.505$, $p > 0.05$

Table 3 Mean and median of the stated WTP amount per eligible household member

	Achi	Nike	Toro
Mean WTP (N)	23.97 ($0.30)	22.78 ($0.28)	28.89 ($0.36)
Standard deviation	15.872	13.839	17.254
Median WTP (N)	20.00 ($0.25)	25.00 ($0.31)	30.00 ($0.38)

Discussion

Community-directed treatment with ivermectin (CDTI) is the new onchocerciasis control measure now being introduced not only in Nigeria, but in many other countries of Africa, under the guidance of the African Programme for Onchocerciasis Control (APOC). In CDTI, the communities are actively involved in planning, designing, financing and executing the ivermectin distribution system possibly through native community-based distributors (CBDs). The principal objective of APOC is to 'establish within a period of 12 years, effective and self-sustainable community-based ivermectin treatment throughout the remaining endemic areas in Africa (WHO 1996). Integral parts of a CDTI scheme are community-funding of local distribution costs that may arise, and community self-distribution through CBDs. Community-financing of local ivermectin distribution costs is vital to sustain CDTI schemes, and availability of local resources to maintain the system is one of the sustainability indicators of CDTI schemes (WHO 1996). Thus the government should work out a scheme in communities that lack the willingness to pay for it, which implies that ways of determining the direct costs of CDTI that communities will bear and the appropriate local financing mechanisms need to be investigated.

Ivermectin distribution in three communities (Achi, Nike and Toro) in Nigeria has helped to establish whether WTP for community ivermectin distribution existed and the extent to which financing mechanisms will satisfy local needs and also be equitable. Households were used as the unit for the study. The use of household heads or their representatives seemed to he appropriate, because in a related work, Gordon

Table 4 OLS multiple regression analysis results in the three communities.

Variables	Coefficient			Standard error			F-test		
	Achi	Nike	Toro	Achi	Nike	Toro	Achi	Nike	Toro
EH	0.967	1.921	1.609	0.624	0.537	1.070	2.385	12.786*	2.670
EF	2.069	1.095	−1.275	1.152	1.328	1.421	3.223	0.680	2.798
OP	6.280	−1.089	2.237	1.827	1.280	1.405	11.818*	0.714	2.533
YH	0.004	0.940	1.504	1.178	0.796	1.430	0.001	1.397	3.369
TS	3.953	1.131	2.672	0.698	0.629	0.965	32.081*	3.237	7.662*
Occupation	1.974	2.348	1.585	0.591	0.588	0.776	11.147*	15.498*	4.175*
Education	2.645	−1.816	0.428	1.089	0.829	1.181	5.899*	4.797	0.131
Marital status	−6.922	−3.271	−4.786	1.384	1.564	2.579	0.444	4.373	3.444
Age group	1.715	−0.605	−3.394	1.203	1.033	1.609	2.034	0.343	4.451
PC	−2.756	0.461	0.527	0.818	0.461	1.122	11.348	6.998*	1.212
PR	0.789	−0.618	−0.336	0.849	0.617	1.238	0.864	1.003	1.238
RC	−1.016	1.028	−1.359	1.351	0.556	0.993	0.566	3.420	6.993

*$P < 0.05$

et al. (1996) reported that participation in treatment was closely related to the attitude of the compound heads. Even representatives of the households should provide valid household WTPs bearing in mind the household's socio-economic profile.

Since the focus of the study were household heads, most of the respondents in the three communities were males. The high proportions of government workers in Toro and Nike could be linked to the fact that they are part of the local government headquarters. However, all occupational groups, especially the civil servants, were engaged in subsistence farming. The nonsignificant differences in the number of respondents willing to pay for themselves ($P > 0.05$), and to contribute to a communal fund ($P > 0.05$) in the three communities showed some uniformity of responses. This could be seen as trying to introduce equity and re-enforce the social contract in the scheme's implementation. However, some said that they would only pay smaller amounts than the stated WIP for both themselves and eligible household members, if they had to pay for all.

The WTP for local ivermectin distribution exists in these onchocerciasis-endemic communities. The willingness to pay-study was done through contingent valuation and the maximum amount the respondents were willing to pay was elicited by bidding. The median stated WTP should be adequate to cover the cost of local ivermectin distribution in a year. However, the stated median WTP bids in the communities were far greater than the modelled unit economic cost of distributing ivermectin to all eligible community members, which was between US$ 0.10 to US$ 0.15 from sensitivity analysis (Onwujekwe 1996). The median WTP should guide the community in setting annual payments for local ivermectin distribution. Thus, the WTP should be adequate to cover the costs of local ivermectin distribution in a year per person. The high amounts respondents were willing to pay may represent the benefits they feel. More recently, the benefits of health care programmes were measured using the WTP method (Golan & Shechter 1993). Such a study and ours provide information for decision-making and priority-setting in the health sector.

In the test of theoretical validity, Ordinary-least squares (OLS) multiple regression analysis of WTP vs. some key independent variables was done. The consistent statistically significant relationship between WTP and type of occupation of the respondents in the three communities was remarkable. Occupation in this instance could be viewed as a good proxy of income since the various occupations were grouped into higher progressive classes, and the higher the class, the more the income. The type of savings scheme was scored and the higher scores saved their money in banks, and this variable is another good proxy of income. The relationship between type of property owned and WTP is explained by the fact that the more wealth one has, the greater the WTP. In Achi, level of education was significantly linked to WTP because with increasing educational level there is assumed higher awareness about health care needs, resulting in the will to pay for personal and household protection.

People who were not willing to pay might have felt that it was the duty of the government to continue distributing the drug free of charge as before, especially since it is provided free of charge by the manufacturers. Others may have believed in spiritual healing only, while some respondents might have felt that the drug was dangerous because of their direct or indirect exposure to its adverse effects. Since a simple survey cannot tell the full story, other influential factors may be peoples' desire to participate in communal schemes, which is common in Nigeria. The perceived side-effects of ivermectin and the lack of perception of onchocerciasis as a priority problem may also influence the WTP bids.

Though there was positive community response to private payments for local ivermectin distribution in onchocerciasis-endemic communities, detailed analysis of factors affecting WTP must be undertaken before initiating private payments or community-financing. Unfortunately, these results are not generalizable since each community has unique characteristics. The WTP of any community where CDTI will be implemented should be established a *priori*, and any community-financing scheme for local ivermectin distribution must be preceded by mass health education and sensitization, and motivate the population to pay the small amount needed to ensure protection against onchocerciasis.

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Appendix 1

Scenario

A drug called ivermectin is very effective in controlling onchocerciasis. It must be taken at least once yearly for 10–14 years in order to completely clear the disease from your community. It has minor adverse effects which are mostly transient and easily controlled with paracetamol and piriton. These adverse events include mild headache, dizziness, swelling of the body (especially the face) and itching. However, they are not life-threatening and minor compared to those associated with the earlier drugs against onchocerciasis, such as DEC tablets.

Ivermectin is also provided free by the manufacturers. What is needed is the money to bring and distribute it to all eligible community members since only comprehensive community coverage with the drug will ensure that onchocerciasis is eliminated. The chairman of the onchocerciasis committee to be established by your community will collect ivermectin from the local government headquarters for onward distribution to eligible community members through community-based distributors to be selected from each village.

What is the maximum amount that you are willing to pay yearly per treated person in your household (**Please use the bidding card here**)?

Appendix 2

The bidding card iteration

1. Are you willing, to pay 30 Naira? If yes go to number 2; if no go to number 3.
2. Are you willing to pay 40 Naira? No matter what your answer go to number 4.
3. Are you willing to pay 20 Naira? No matter what your answer go to number 4.
4. What is the maximum amount you are willing to pay?