The implications of socially entrusted decision-making on estimates of willingness to pay (WTP): The case of insecticide treated nets (ITNs) in India

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Aim: *This paper explores which type of respondents considered themselves to be decision-makers concerning WTP for an ITN.* ***Methods:*** *1200 people from 80 villages in rural Surat, India were asked their maximum WTP for an ITN, using a bidding game with a final open-ended question. Respondents were also asked who would make the decision to buy an ITN. A two-part model (logit followed by linear regression, accounting for clustering) for those who were not sole decision makers and a linear model for sole decision makers' values was used to explore variation. To assess reliability a 25% follow-up survey compared stated and actual values.* ***Results:*** *Of the 932 people willing to buy an ITN, 55% were sole decision-makers and willing to pay Rs67.9, on average, (SD66.9-68.9) whereas non-sole decision makers were willing to pay Rs42.4 (41.7-43.0). Sole decision-makers' WTP values were associated with a narrower range of variables (e.g. income, household size (-ve), knowledge of market prices, level of mosquito nuisance, starting bid, total number of prevention methods used) compared with non-sole decision-makers whose stated WTP was also positively associated with education, caste, number of rooms, and use of coils. Both groups of decision makers were similarly reliable in their stated values, but83% of non decision-makers who said they would not buy an ITN did not.* ***Discussion and conclusions****: Our discussion debates three issues: How important the notion of decision-making responsibility is to the design, analysis and interpretation of WTP surveys? How is the validity of valuation related to an intervention and its implementation? And, how might future surveys account for our findings?*
Key words*: household decision-making, contingent valuation, demand, malaria*

1.0 Introduction

Willingness to pay (WTP) studies are used either to estimate the worth or benefit of a non-marketed good or service and therefore to evaluate the gains or losses of an intervention when market prices don't exist or when they don't fully capture benefits. Whynes et al (2005) consider WTP studies help three types of resource allocation decisions in the health sector: to guide pricing and revenue forecasts for a new health care intervention to be provided privately; to predict take-up given and level of subsidy required at different levels of charging for a good where a decision suggests merit in part public provision; through estimating consumer surplus, to help select which goods should be provided as part of a portfolio of health services when compared with cost of provision.

The closer goods or services are to pure public goods, the lower the chances that a free market will either provide services or provide them at an efficient level. Health care is also argued to be a merit good, where despite enforceable property rights, a desire for greater equity may justify government intervention. Therefore, a cost-benefit analysis may still be justified. However, occasionally purposes merge and a government may seek to decide whether to provide a currently non-marketed good but then decide whether to introduce some level of user charge. Insecticide-treated nets (ITN), which have proved to be a cost-effective method to prevent malaria over a more established method, indoor residual spraying (IRS) even in places with low malaria mortality such as India (Bhatia et al, 2003) are such a case.

ITNs are now recognised as an important part of the malaria control strategy in India, Anon (2005), although this was not the case when we undertook the study. However, in order to achieve the national investment targets set at the macro-level, households, at the micro-level, must use available health care services. In many low-income countries even the most cost-effective interventions are underutilized. Through our research on WTP we begin to explore the micro-level aspects of households and how they might or might not choose to invest in health.

Our early qualitative research explored how households were defined, how decisions were taken at the household level for the purchase of mosquito nets and who the respondent ought to be. These issues were explored in over 100 semi-structured interviews of key informants and 25 FGDs. The types of respondents included community leaders, anganwadi workers, long term participant observers, shop-keepers, private practitioners, pharmacists, mosquito net sellers, villagers from different castes.

Early findings indicated that there was not one approach to making purchase decisions. For example, in low caste and low-income families the main earner, who was most often a man, would decide. However, in higher income and higher caste families a woman may have access to more money and be able to take the decision – it was considered likely to be too small a cost to bother the main earner or head of household with. We also established that the main earner was not always the head of household as younger men may earn more that a retired father. We chose to focus our

survey questions on the main earners of households for two reasons: a potential purchase was an economic decision that required access to money; and, it was too complex and potentially embarrassing to establish who had decision-making responsibility in a household first and then administer the survey. However, we supplemented this by asking a question in the survey to establish whether the respondents considered themselves the decision-maker or not or whether they made joint decisions.

This paper explores which type of respondents considered themselves to be decision-makers concerning WTP for an ITN. It considers how responsibility affects both the values and reliability of statements about WTP, prior to reflecting on how cultural specificity in this context might influence the general methodology.

2.0 Methods

2.1 The data

We use two related data sets. The first data set was constructed from interviews with a random sample of 1200 households from 80 villages in the rural area of Surat district in Gujurat, India. Interviewers visited homes at least three times to gain an interview with the main earner before asking another adult (preferably the spouse or parent) to respond instead. Three quarters of the selected sample was participating in one of three arms of a community randomised trial comparing a control arm of active case detection and treatment (ACDT) with ACDT plus insecticide treated mosquito nets or ACDT plus insecticide residual spraying. A description of these interventions and their cost-effectiveness is given in Bhatia et al (2004). The fourth group of 20 villages was randomly selected from those villages outside the trial (OTA) with the same parasitic index as those selected for the trial that were <5 km from a trial village.

The interview comprised five sections: household socio-economic and demographic profile; use of preventive measures; treatment seeking behaviour; WTP; income and expenditure patterns. The design and development of the questionnaire is described and justified in Bhatia and Fox-Rushby (2002).

Respondents were first asked whether they were willing to buy an ITN at all. Those who were not willing to buy an ITN were then asked if they are willing to do so if the option of paying in instalments was available. Those who said 'yes' or 'don't know' to either of the two questions were asked further questions about positive WTP values - through a bidding game (designed as a double-bound dichotomous choice format with an open-ended question at the end). Those who said yes to the starting bid were provided with a higher bid and those who said no to the starting bid were provided with a lower bid. After the second bid, all respondents were asked about their maximum WTP. Three starting bids (50, 75, and 100 Rupees) were randomly allocated across households.

The second set of data refers to a follow-up study which involved a simulated market experiment. The 300 households in the OTA group were revisited within 2-4 weeks after the first interview in order to sell ITNs at a fixed price of Rs 75. The detailed methods and aggregated results are given in Bhatia and Fox-Rushby (2003).

2.2 Analysis

Open-ended CV data is characterised for having a particular distribution, with a significant fraction of the observations equal to zero and a continuous positive distribution for those who agree to pay something. We present a two-equation model that allows for the decision process to be modelled separately as a decision of whether or not to buy a ITN, and the amount WTP, once they have decided to buy.

Selection bias could exist due either to potential protest answers or to sole and non-sole decision makers varying in unobservable ways. In this case, separate equations for decision makers and non-decision makers would lead to inconsistent estimates of both set of parameters. Therefore Lee's, two-step selection model (Lee, 1983; Hjortsberg, C., 2003; Su et al 2006) was used to test and control it. The lambda generated from the first stage logit model and included in the second stage OLS regression for logWTP was assessed for statistical significance. In addition to this, the coefficients with and without the lambda term were compared, with statistically significantly different coefficients (Using the Hausman test) indicating existence of selection bias.

The selection of independent variables followed general-to-specific inclusion, where all the variables statistically significant in a bivariate analysis against the dependent variable were included into the base model, and those significant at 10% level were kept in the reduced model. As this survey used a cluster (by village) randomised design, cluster-robust standard errors were used.

The RESET test and Hosmer-Lemeshow test were used to assess the goodness of fit of the logistic models; while the validity of the OLS assumptions were tested using RESET test for the specification of the model, Breusch-Pagan/Cook-Weisberg test for heteroskedasticity (before the cluster option was included), and Shapiro-Francia test for normality. All analyses were undertaken using Stata version 9.

3.0 Results

3.1 Response rate and descriptive statistics The response rate was 100%. However, as 4 individuals answered 'don't know' to all WTP questions and. 7 provided contradictory answers, (stating a positive WTP for one net but answering that they would buy no nets at this price) they were dropped from the study. Therefore the usable sample size is 1189.

The characteristics of the sample are summarised in Table 1. Most respondents were males, had up to primary education, belonged to households with 5 people from the scheduled tribe and lived in kacha houses. Most were engaged in agriculture or labouring and, on average, tended to spend more than their monthly income of Rs30,500. This income was unevenly distributed, with 20% having 60% of the income. Most considered mosquitoes to be a major nuisance and most used smoke and sheets to protect themselves. 42% owned a mosquito net, although mostly due to the trial, and most wanted an additional 1.7 nets per household. On average 1.3 people in the household had had malaria in the last month, with an average expenditure of Rs37. Within this group, 89% of respondents were the main earners and 43% considered themselves to have sole decision-making responsibility for an ITN.

78.4% were willing to pay something for an ITN. Following the bidding game, respondents were asked to state their maximum WTP for an ITN and the mean value was 57.17Rs (SD=38.7). Table 2 shows that, of the 932 people willing to buy an ITN, 55% considered themselves sole decision-makers. However, nearly all the 'zero' values (99.6%) of the 257 not willing to buy an ITN did not considered themselves able to make a decision. The estimated population mean WTP (95%CI) for sole decision-makers was Rs67.9 (66.9-68.9) and those who were not able to make sole decisions was Rs42.4 (41.7-43.0).

3.2 Exploring variation in decision-making status and WTP values

Table 3 explores the difference in characteristics between those who did and did not consider themselves to have the capacity to make a sole decision to buy an ITN. The main differences were with respect to the intervention village; more people in the ITN and OTA groups felt unable to make sole decisions relative to those in the IRS and ACD trial arms; and the number of ITNs they already owned was statistically significantly higher among those who were not entrusted with sole decision responsibility.

Table 4 shows that individuals more likely to be able to make a sole decision were; the main earner (the estimated probability increases by 24%), more knowledgeable about methods for preventing mosquitoes, in agriculture or animal husbandry, or living in better quality housing. However, if ITNs were the most preferred mosquito preventive method for that individual, the probability that they will be the one who decide to buy one is 0.094 times lower. The income variable is not significant at 90% significance level, but was kept to achieve a good specification as its inclusion increased the goodness of fit.

In testing for sample selection bias, we found that the lambda terms were insignificant in all outcome models and that there were no statistically significantly differences in coefficients with and without the selection term. Therefore, we concluded that a two-part model will lead to consistent estimates. The sample is, therefore, divided into decision makers and non-decision makers, with an OLS regression conducted for the first group, since there is no concentration of zeros; and a two-part model for the

second group where the decision process is assumed to be made sequentially, i.e., the choice of buying a net is not influenced by the decision of how much to pay.

The factors that explain the decision to buy an ITN are presented in Table 5, where marginal effects are reported. One of the most influential categorical variables is "considering mosquitoes to be a major nuisance", with the probability of buying a net being 0.328 times higher compared with those who consider mosquitoes not to be a nuisance (holding all other variables constant). Those who belong to villages other than ITN villages have a higher probability of stating a positive WTP. The estimated marginal effect for sex of main earner indicates that males have a probability of buying an ITN 0.132 times higher than females. Also, if the respondent knows the market price of an ITN they will be more willing to buy an ITN. The income effect is positive, with those individuals in higher income quartiles having a higher estimated probability of buying a net than those in the lower quartile. On the other hand, belonging to a different caste rather than schedule tribe will reduce the estimated probability that an individual will buy the ITN, as well as living in a relatively high quality-type house. Moving to the continuous variables, the household size and the expenditure on treatment have a positive impact in the probability of buying a net. Each household member increases the probability of buying an ITN by 0.028, while the increase related with an extra 10 rupees spent on treatment is 0.02. Finally, for each net the household already owns, the probability of buying an extra one is 0.064 less.

The results of the linear regression of positive amount WTP for sole decision makers and non-sole decision makers are presented in Table 6. Both regressions passed the RESET test for good specification, the Breusch-pagan test for heteroskedasticity[1], but failed the normality test. However, the kurtosis and skewness statistics of the error were close to the normal values of 3 and 0 respectively, (4.64 and -0.24 for non-sole decision makers; and 4.83 and -0.05 for sole decision makers); and we could also appeal to the Central Limit Theorem to justify the sufficiency of sample size. The R-squared statistics are 0.2945 and 0.2147 for non-sole decision maker and sole decision maker linear models, respectively.

[1] computed before the cluster option was included (χ^2=0.36, p=0.5495 and χ^2=1.71, p=0.1907 for non-decision makers and decision makers, respectively),

In the reduced model, 11 variables were significant for those unable to make sole decisions (see Table 6). The coefficients can be interpreted as elasticities: an increase in a 10% of the annual income will increase the estimated amount an individual is WTP in 0.789%. Also, as expected, the starting point for the bidding game has a positive effect, with individuals facing a relative high bid value having a higher estimated WTP. The impact of having a high education[2], compared with having only primary or not education at all, is an increase by 18.86% on the amount that an individual will be WTP. The greatest impact is related with the variable "consider mosquito to be a nuisance", since WTP rises by a 26.9% and 36.2% when the individual considers that mosquitoes are a major or a minor nuisance, respectively. If the individual knows the price of the net in the market or prefer ITN as a preventive method from mosquitoes, the estimated impact in their WTP is 6.84% and 14.65% higher, respectively compared with the base case. The individuals belonging to any caste rather than schedule tribe have a lower WTP.

Among those who felt able to make a sole purchase decision, the number of variables that explain WTP is smaller; although all have the same sign as the non-sole decision maker sub-sample. The only variable that appears in this model and does not enter in the non-sole decision maker sub-sample, is the number of preventive methods from mosquitoes the household uses. Its impact on the amount the sole decision maker would be WTP is a positive 0.034% for 1% increases in the variable. Most of the variables have a similar impact as those in the non-sole decision maker sub-sample, although the impact of knowing the market price of the net (12.59%) almost doubles the one for non-sole decision makers, while the impact of the view of mosquitoes as a nuisance is much lower (22.01% and 23.22% for major and minor nuisance respectively).

Table 7 shows that mean WTP was statistically significantly higher for those who considered themselves able to make a sole decision than those who did not. If a sole

[2] Regarding the categorical variables, the interpretation of the coefficients is not straightforward. Discussion on the interpretation of the coefficients of dummy variables when the dependent variable is log-transformed is given in Halvorsen, R. and Palmquist, P., 1980 and Kennedy, P., 1981. The result developed in these papers is that if β is the coefficient of a dummy variable, and $Var(\beta)$ is the estimated variance of β, then the estimate of the percentage impact of the dummy variable on the variable being explained is given by: $100 *(\exp(\beta - Var(\beta)/2) - 1)$.

decision-maker had been present we are therefore likely to have had higher WTP values from those households. However, sole decision-makers are also likely to reflect the circumstances of their own households. We use the data of those willing to buy to predict what households with zero values and without a decision-maker present would have done. This results in an the mean WTP for the whole sample increasing from Rs54.6 [52.8 56.3] to Rs69.7 [68.9 70.5] and increase in the median by Rs4.3

Finally, we considered the validity of responses of the two groups by comparing stated with actual preferences. 300 individuals were interviewed in order to sell ITNs at a fixed price of Rs75. 54% of sole decision makers who said they would buy an ITN did, compared with 60% of non-sole decision makers. However, 83% of non decision-makers who said they would not buy an ITN did not. These results can be affected by the fact that the individuals stated they would buy an ITN but their WTP was lower than the price at which they were asked to buy it. We compare stated and actual preferences considering that the individual would buy if they stated a WTP of Rs 75 or higher. A similar percentage (69%-61%) of sole decision makers who stated a WTP higher (lower) than Rs75 did (not) buy an ITN and this did not differ significantly between sole and non-sole decision-makers (66%-63%).

4.0 Discussion

Our results have implications for three main issues: (a) the importance of the notion of decision making responsibility for the design, analysis and interpretation of WTP surveys; (b) the validity of valuation related to an intervention and its implementation; and (c) how future surveys might account for our findings. We discuss each below.

4.1 Decision-making responsibility and WTP surveys

Scrutiny of literature on WTP surveys suggests that little consideration has been given to who ought to be respondents in WTP surveys. A review of studies analysing WTP for prevention and treatment of malaria reveals that WTP surveys commonly ask questions to 'Head of household' or their spouse (e.g. Masiye and Rehnberg, 2005; Onwujekwe et al., 2004; Kilian et al., 2003; Whittington et al., 2003; Cropper et al., 2000); or 'patients'(Asafu-Adjaye and Dzator, 2003; Wiseman et al., 2005), assuming they will adequately reflect how purchase decisions would be made in real-life,

implicitly assuming elicited WTP will resemble closely the actual one. Some studies have asked all members of the households (Dgedge 2000) and others limited this toadults over 20 years-old (Sauerborn et al., 2005).

However, household decision making process is usually complex, particularly when households, as a group, choose a particular member or members to make purchase decisions- something we refer to as the member's "socially-entrusted decision making ability". In the context of our study, we found that not being able to play this role within the household is a key predictor of zero answers and this also affects significantly the estimation of mean and median WTP. Two more findings suggested its importance. Firstly, the variables associated with variation in positive values of WTP were different between decision makers and non-decision makers. Secondly, the ability to make sole decisions varies across households and in our sample, for ITNs, it was positively associated with being the main earner (probability increased by 24%); being more knowledgeable about methods for preventing mosquitoes; being in agriculture or animal husbandry; and being in better quality housing. These characteristics might be important to consider while deciding who ought to be the respondent in WTP surveys.

We also found that the more a person preferred an ITN compared with other malaria prevention methods, the less they were likely to be the sole decision-maker. In this case, in order to influence those who make sole decisions in the household, our survey would suggest that non-sole decision makers find out the price of an ordinary net and stress the importance of how many methods the household already uses to avoid the nuisance of mosquitoes in attempting to persuade the person able to make sole decisions in the household.

4.2 The validity of valuation

Whilst there was no statistically significant difference between positive values for WTP among those with and without sole decision-making capacity in whether ITNs were actually bought (around 66%), there was a much higher correlation between those who said they would not buy an ITN and did not (83%). Thus, even with 2-4 weeks time in which to discuss a purchase decision between the survey for stated and actual preference, most respondents without sole decision-making power who said

'no' to buying an ITN did not change their mind. It is of course, possible that no discussion within the household took place. However, we will need to explore further, at the individual level, the reasons for changing decisions.

4.3 How might future surveys account for our findings?

The influential NOAA panel of 1993 that set out guidance on how to construct WTP surveys pointed out that respondents needed to; find the task credible and incentive compatible; be reminded of "the number and extent of budgetary substitutes" and provide reasons for giving 'no answer' options. In addition, researchers were advised to conduct face-to-face interviews because "it is impossible to guarantee random selection (of adults) within household surveys or to confine answering to a single respondent".

These ideas have been mirrored in more recent guidance (Bateman et al, p99) which states that "for higher quality stated preference surveys, it will probably be desirable to employ random selection of an adult household member" …..(so that) "results can be reliably extrapolated to the general population" (p93). Further suggestions recognise the need to identify both people who are directly and indirectly affected by an intervention which may include those who pay for the good in question.

Contrast the recommendations from the environmental literature with practice in the health economics literature, where it has been observed (Bhatia, 2000) that respondents in WTP surveys in high-income countries have belonged to one of 3 groups: patients with a particular disease or condition; convenience samples e.g. students, teachers, nurses and the general population. In developing countries, where face to face interviews tend to be undertake, most respondents have been heads of households or users of health facilities and, whilst a tricky issue, the definition of head of household has rarely been discussed. A more recent review (Sach et al, 2007) of 40 WTP for pharmaceutical interventions showed that respondents selected were most often 'users' (68%) followed by a convenience population (20%), the general population (7.5%) and a mix of the above (5%).

Notice that the way that decisions might be made within a household is not explicitly considered and patterns of responsibility, by implication, not deemed to vary across

contexts. We therefore have two questions to ponder. First, is decision-making really this simple? Given our findings, the answer would be a "No", suggesting that ignoring this would have a significant impact on WTP surveys and cultural context is likely to be highly influential. That is, understanding first how households entrust decision-making ability to its members is a key to deciding who should be the respondents in WTP surveys. This also has implications for how one might estimate WTP values accounting for the complexity created by this additional variable.

Secondly, if decision-making is not simple, does it matter? Let's consider the response with respect to a study that seeks to estimate expected demand (for pricing or estimating subsidies). Here, there seems to be a strong case for eliciting values from a decision-maker given the behavioural imperative emanating from a decision to provide a new good. Another type of study would be one that wants to elicit consumer surplus for a purely public good, where there may be the strongest argument to adopt random sampling of a general population. However, it is possible that even here the conception of value may be, in practice, still tied to decision capacity and jointedness of decision making (possibly in addition to ability to access the household's financial resources and relative bargaining power within a household). Even if a person has some command over money they may not be entrusted socially with a decision to buy the good or service in question. Much more work therefore needs to be done to establish whether this is the case, because it potentially makes so much difference to the estimation of consumer surplus and estimated demand. Importantly, it is possible that the degree of concern will vary with the degree of private property rights, other characteristics of the good as well as approaches to household decision-making.

In the light of above discussions, we recommend several measures that are likely to improve estimation of WTP in future studies. First, qualitative research in advance of surveys might be useful to establish a credible vehicle for decision-making. Such a study might consider all people in household able to make purchase decisions for type of good/service valued. This approach mirrors other calls to increase the credibility of other aspects of stated preference surveys e.g. the market and payment vehicles. Second, future surveys could consider adding a screening question as to who is the decision maker relevant to the product being valued in order to select samples within households. Third, it might be worthwhile to consider emulating decision-making

processes in the household rather than insisting on random samples of individuals. Giving respondents more time might allow consultation but, if decisions are not made jointly in a household, then giving more time will still not get over the issue – unless individuals can be entrusted with conveying the views of the decision-maker. Fourth, as long as being able to earn explains one's WTP values, it may be a good idea to check what share of income in the household is brought in by the respondent and consider this variable both in the design and analysis phases of a WTP survey.

Future endeavours could also add in questions about who is considered head of household, main earner, who makes decisions for the goods valued as additional questions in order to allow analysis to attempt to control for such factors, in the event that a survey design is not able to cope with such complexity. A further consideration would be to acknowledge the possibility of finding out whether respondents are likely to know what decision the household decision-maker would make. Since our results may not transfer to other goods or countries, it is important to ensure that future research considers this decision making ability with respect to market entry and pricing.

Finally, we consider what additional analyses could be done to improve our current understanding using the same samples. The possible next steps could be: (a) consider, in the econometric estimation, a few interaction terms (e.g. is there an additional interaction between, say, caste and main earner); (b) develop an explanatory model for validity of stated preferences compared with actual behaviour, that explores further the issue of decision making ability; and (c) explore jointedness in decision making. With respect to point c, in this study we considered those who have sole responsibility for buying an ITN as the decision maker, neglecting those who might have a 'say' in the decision making process. In addition, jointedness also imply exploring econometric models that could estimate one's decision making ability and WTP jointly, assuming that households "choose" which member(s) make the decision on their behalf and it may be likely that this choice is associated with the WTP via unobservable. Therefore, endogenous choice modelling could be something to explore.

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Table 1: Characteristics of sample from hypothetical WTP survey

		Mean (SE)\ % responses
General characteristics	*Household size*	5.1 (2.2)
	Sex respondent (Male)	86.80%
		13.20%
	Sole decision maker for buying ITN? (Yes)	43.06%
	Zone Coastal	27.25%
	Irrigate	41.30%
	Foothill	31.46%
	Intervention village TMN	25.06%
	IRS	25.06%
	ACDT	24.81%
	Outside trial arm	25.06%
	Main earner (Yes)	88.98%
		11.02%
	Education No education or primary	80.57%
	Further education	19.43%
	Occupation Agriculture	22.71%
	Animal	6.14%
	Labour	44.83%
	Service	18.00%
	Business	6.90%
	Others	1.43%
	Caste Schedule caste	2.04%
	Schedule tribe	74.94%
	Other background	16.23%
	Other caste	5.89%
	Type of house Kaccha	65.69%
	Semi pucca	18.00%
	Pucca	16.32%
	Number of buffaloes/cows/bullocks	1.63 (2.3)
Price and income	Total income	30516.44 (?)
	Total expenditure	31180.37 (?)
	Starting bid Rs 100	33.14%
	Rs 75	33.47%
	Rs 50	33.39%
Preventive measures	Consider mosquitoes as nuisance? Major	76.20%
	Minor	21.28%
	No	2.52%
	TMN as first or second most preferred method? (Yes)	77.63%
	Use net? (Yes)	38.77%
	Use smoke? (Yes)	82.09%
	Use sheet? (Yes)	77.63%
	Use fan? (Yes)	35.66%
	Know cost of net in market? (Yes)	42.22%
	Own a net? (Yes)	41.63%
	Number of nets owned	1.03 (1.5)
	Number of net wanted	1.78 (1.5)
	Wealth index (ownership of combination of 6 items)	-1.27e-08 (0.8)
Treatment Seeking behaviour	Number of members suffering form malaria last year	1.28 (1.4)
	Expenditure on treatment	37.27 (182.9)

Table 2: Number of people who considered themselves able and not able to make sole decisions to buy an ITN

	Able to make sole decision	Not able to make sole decision	Total
Willing to buy	511	421	932
Not willing to buy	1	256	257
Total	512	677	1189

Table 3: Tests for statistically significant differences for household variables between those who were sole decision makers and those who were not.

Variable	Sole decision maker (n=512)	Not sole decision maker (n=677)	Statistical test* and p value
Consider mosquitoes to be a nuisance? Major nuisance Minor nuisance No nuisance	 407 (79.49%) 94 (18.36%) 11 (2.15%)	 499 (73.71%) 159 (23.49%) 19 (2.81%)	χ^2=2.02, (df=2) p = 0.3634
Income Quartiles Lower Second Third Upper	 123 (24.02%) 131 (25.59%) 128 (25.00%) 130 (25.39%)	 102 (29.84%) 150 (22.16%) 163 (24.08%) 162 (23.93%)	χ^2=1.55, (df=3) p= 0.6702
Caste Schedule caste Schedule tribe Other backward caste Other caste	 16 (3.13%) 381 (74.41%) 89 (17.38%) 26 (5.08%)	 19 (2.81%) 510 (75.33%) 104 (15.36%) 44 (6.50%)	χ^2=0.30, (df=3) p= 0.9597
Prefer TMN as a preventive measure? No Yes	 128 (25.00%) 384 (75.00%)	 138 (20.38%) 539 (79.62%)	χ^2= 1.39, (df=2) p = 0.2372
Intervention village Treated Mosquito Nets In-house spray village Active case detection Outside trial area	 92 (17.97%) 156 (30.47%) 155 (30.27%) 109 (21.29%)	 206 (30.43) 142 (20.97%) 140 (20.68%) 189 (27.92%)	χ^2= 44.4 (df=3) p < 0.001
Expenditure on malaria treatment	36.95 (181.1)	37.50 (184.5)	t = 0.0408 p= 0.9675
Household size	5.02 (2.06)	5.15 (2.29)	t = 0.8453 p = 0.3992
Number of nets household own	0.78 (1.37)	1.22 (1.60)	t = 1.6688 p = 0.0971

Table 4. Marginal effects from logit model of probability of being able to make the sole decision to buy an ITN

		Marginal effects
Main earner (yes)		0.241 (0.05)***
Occupation:	Agricultural and animal husbandry	Base
	Labour work	-0.053 (0.04)
	Service	-0.034 (0.05)
	Business	-0.026 (0.06)
	Other	-0.162 (0.08)**
House type:	Kaccha	Base
	Semi-Pucca	0.086 (0.04)**
	Pucca	0.001 (0.05)
Is preferred method a mosquito net?		-0.094 (0.04)**
Total number of mosquito prevention methods respondent knows about		0.050 (0.02)***
Total annual income (in quartiles):	Lower (0-10000)	Base
	Second (10001-16000)	0.074 (0.05)
	Third (16001-30000)	0.045 (0.05)
	Upper (30000+)	-0.010 (0.06)

Table 5. Logit model for the probability of buying an ITN

Intervention Village	Treated mosquito nets	Base
	In house spray village	0.271 (0.07)***
	Active case detection	0.234 (0.08)***
	Outside trial arm	0.276 (0.08)***
Sex main earner (male)		0.132 (0.08)*
Household size (log in outcome model)		0.028 (0.01)**
Caste	Schedule caste	-0.317 (0.19)*
	Schedule tribe	Base
	Other backward caste	-0.273 (0.08)***
	Other caste	-0.345 (0.11)***
House type	Kaccha	Base
	Semi Pucca	-0.184 (0.05)***
	Pucca	-0.073 (0.08)
Mosquitoesconsidered to be a……..	Major nuisance	0.328 (0.13)***
	Minor nuisance	0.255 (0.09)***
	No nuisance	Base
Does the respondent know the cost of a 6*4 net in the market (yes)?		0.101 (0.05)**
Is preferred method a mosquito net?		0.095 (0.06)
Total expenditure incurred on treatment (log in outcome model)		0.002 (0.0004)***
How many nets do you own? (log in outcome model)		-0.064 (0.02)***
Total annual income (quartiles in selection model/ log in outcome model)	Lower (0-10000)	Base
	Second (10001-16000)	0.108 (0.05)**
	Third (16001-30000)	0.121 (0.06)**
	Upper (30000+)	0.222 (0.06)***
Starting bid (log)		NA
Lambda		NA
_cons		NA
N		677
Goodness of fit (Hosmer-Lemeshow)		χ^2=8.17, (df=8), p=0.4171
RESET test		χ^2=1.41, (df=1), p = 0.2359

Table 6: Linear regression on positive WTP for sole and non-sole decision makers (base and reduced models)

	Not sole decision makers		Sole decision makers	
	Base model	Reduced model	Base model	Reduced model
Zone				
Coastal	Base			
Plain irrigated	-0.089 (0.07)			
Foothill	-0.085 (0.08)		NA	
Intervention Village				
Treated mosquito nets	Base		Base	
In house spray village	0.044 (0.07)		0.065 (0.06)	
Active case detection	0.028 (0.07)		0.082 (0.06)	
Outside trial arm	-0.014 (0.07)		0.031 (0.07)	
Household size (log)	-0.102 (0.05)*	-0.106 (0.05)**	-0.092 (0.04)**	-0.094 (0.04)**
Sex main earner (male)	0.058 (0.05)		NA	
Education				
No education or primary education	Base	Base	Base	
Further education	0.144 (0.05)**	0.174 (0.05)***	-0.004 (0.04)	
Occupation of respondent				
Agricultural and animal husbandry	Base		Base	
Labour work	-0.062 (0.05)		0.002 (0.04)	
Service	0.003 (0.06)		-0.002 (0.05)	
Business	0.030 (0.07)		-0.043 (0.07)	
Other	0.057 (0.07)		0.132 (0.08)	
Caste				
Schedule caste	-0.137 (0.08)	-0.081 (0.08)	0.111 (0.08)	
Schedule tribe	Base	Base	Base	
Other backward caste	-0.245 (0.08)***	-0.129 (0.06)**	-0.084 (0.06)	
Other caste	-0.287 (0.13)**	-0.201 (0.10)*	0.017 (0.09)	
House type				
Kaccha	Base		Base	
Semi Pucca	-0.052 (0.05)		0.065 (0.07)	
Pucca	-0.095 (0.11)		0.023 (0.05)	
Number of rooms (log)	0.102 (0.05)*	0.099 (0.04)**	0.016 (0.03)	
Landownership (log)	0.009 (0.006)		-0.003 (0.004)	
Cow (log)	0.007 (0.004)	0.114 (0.005)**	0.007 (0.005)	
Do you consider mosquitoes to be a nuisance?				
Major nuisance	0.181 (0.12)	0.245 (0.12)**	0.169 (0.09)*	0.203 (0.09)**
Minor nuisance	0.233 (0.14)*	0.316 (0.12)**	0.185 (0.09)**	0.212 (0.08)**
No nuisance	Base	Base	Base	
Does the respondent know the cost of a 6*4 net in the market (yes)?	0.051 (0.04)	0.067 (0.04)*	0.130 (0.04)***	0.119 (0.03)***
Is preferred method a mosquito net?	0.120 (0.05)**	0.138 (0.05)***	NA	
Total number of mosquito prevention methods respondent knows about (log)	NA		-0.065 (0.06)	
How many nets do you own? (log)	0.016 (0.01)		0.003 (0.008)	
Does the household use a net (yes)?	-0.096 (0.10)		NA	
Does the household use smoke (yes)?	-0.094 (0.07)		NA	
Does the household use coil (yes)?	0.193 (0.09)**	0.145 (0.08)*	0.107 (0.10)	
Does the household use odomos (yes)?	0.229 (0.18)		NA	
Does the household use fan (yes)?	-0.021 (0.06)		-0.073 (0.06)	
Does the household use mat?	NA		0.118 (0.19)	
Total number of mosquito prevention method the household use (log)	-0.002 (0.08)		0.052 (0.03)**	0.034 (0.02)*
Number of family member suffering from malaria last year (log)	-0.002 (0.005)		-0.006 (0.004)	
Wealth index	0.026 (0.03)		0.048 (0.04)	
Total annual income (log)	0.042 (0.03)	0.0789 (0.03)***	0.091 (0.03)***	0.098 (0.02)***
Starting bid (log)	0.420 (0.06)***	0.402 (0.06)***	0.392 (0.05)***	0.386 (0.05)***
_cons	2.171 (0.46)***	1.481 (0.39)***	1.660 (0.39)***	1.464 (0.32)***
N	421	421	511	511
RESET test		F=1.61, (df=3), p=0.1876		F= 0.43, (df=3) p=0.7306

Table 7: Mean and median WTP (in rupees, 1997 values)

	Mean WTP	[95% Conf. Interval]	Median WTP	N
Sole decision makers	67.9	[66.9 68.9]	66.4	512
Non-sole decision makers	44.6	[41.7 43.03]	41.8	677
All sample	54.6	[52.8 56.3]	63.7	1189

Table 8. Stated willingness to buy versus actual preferences.

Willing to buy	**Sole decision maker**	**Not sole decision maker**
Purchased	*59 (54%)*	*88 (60%)*
No purchased	50 (46%)	59 (40%)
Not Willing to buy		
Purchased	NA	7 (17%)
No purchased	NA	*35 (83%)*

Table 9. Stated WTP versus actual preferences

Willing to pay >=75	**Sole decision maker**	**Not sole decision maker**
Purchased	*38 (69%)*	*58 (66%)*
No purchased	17 (31%)	30 (34%)
Willing to pay <75		
Purchased	21 (39%)	37 (37%)
No purchased	33 (61%)	64 (63%)

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