EX POST AND *EX ANTE* WILLINGNESS TO PAY (WTP) FOR THE ICT MALARIA *Pf/Pv* TEST KIT IN MYANMAR

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Abstract. Willingness to pay (WTP) for the ICT Malaria *Pf/Pv* test kit was assessed by the contingent valuation method using a bidding game approach in two villages in Myanmar. Kankone (KK) village has a rural health center (RHC) and Yae-Aye-Sann (YAS) is serviced by community health worker (CHW). The objectives were to assess WTP for the ICT Malaria *Pf/Pv* test kit and to determine factors affecting the WTP. In both villages WTP was assessed in two different conditions, *ex post* and *ex ante*. The *ex post* WTP was assessed at an RHC in the KK village and at the residence of a CHW in the YAS village on patients immediately following diagnosis of malaria. The *ex ante* WTP was assessed by household interviews in both villages on people with a prior history of malaria. Ordinary least squares (OLS) multiple regression analysis was used to analyze factors affecting WTP. The WTP was higher in *ex post* conditions than *ex ante* in both villages. WTP was significantly positively associated with the average monthly income of the respondents and severity of illness in both *ex post* and *ex ante* conditions ($p < 0.001$). Distance between the residence of the respondents and the health center was significantly positively associated ($p < 0.05$) in the *ex ante* condition in a household survey of YAS village. Traveling time to RHC had a negative relationship with WTP ($p < 0.05$) in the *ex post* condition in the RHC survey in KK village.

INTRODUCTION

Malaria is a major public health problem in Myanmar. About 61% of the total population reside in risk areas. Malaria accounts for 7% of outpatients and 20% of inpatients admitted to hospitals (Ministry of Health, Myanmar, 1996). Routinely, confirmatory diagnosis of malaria is based on the results of microscopy. Not all health facilities in rural settings in Myanmar are equipped for the microscopy. Where it is used, microscopic diagnosis in rural areas of Myanmar often requires a long waiting time to get results from the nearest township or a district hospital equipped with laboratory facilities. To ensure rapid diagnosis of malaria followed by prompt and specific treatment, a simple, rapid, sensitive diagnostic test is urgently needed.

In this context, the ICT Malaria *Pf/Pv* test kit may be considered in Myanmar because of its simplicity of procedure, rapidity of the result and accuracy of diagnosis (Cho-Min-Naing *et al*, in preparation). A key question to be answered is what financial considerations would be applicable to introduction of the ICT Malaria *Pf/Pv* test kits in Myanmar.

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Since malaria is a top priority disease of national concern, diagnosis and treatment of malaria in public health facilities is provided free of charge in Myanmar. As a part of national health sector reform aimed at long term financial sustainability, alternative health care financing mechanisms have been established in some parts of Myanmar since 1992 (Ministry of Health, Myanmar, 1996). Among various schemes of health care financing, user charges for diagnostic tests have been included in order to contain costs of public health services. In conjunction with this general user charge scheme, user charges for the ICT Malaria *Pf/Pv* test kit need to be considered for a wider introduction.

Although the ICT Malaria *Pf/Pv* test kit provides immediate benefit to individual patients, it may also produce a public health benefit by facilitating more rapid and specific treatment and thereby contributing to the lowering of transmission. Keeping this possibility in mind, the National Malaria Control Project (NMCP) is considering an appropriate level of a subsidy of the kit may be necessary to establish a wider distribution of the ICT Malaria *Pf/Pv* test kit in the public sector.

In Myanmar, a national health insurance scheme is not yet established. Thus, the NMCP has to de-

cide how to price the new diagnostic test kit in relation to patients' willingness to pay (WTP). WTP is defined as the maximum amount of money that may be contributed by an individual to equalize a utility change (Klose, 1999). People's WTP is important because consumer responses to prices will influence utilization of services and revenues collected. Giuffrida and Torgerson (1997) pointed out that the consumption of health care is generally sensitive to price.

There are various approaches to determine WTP for particular goods or services. Direct measurement of WTP for particular goods or services can be assessed by asking people directly how much they would be willing to pay for specific health care services or products. For direct measurement of WTP for the intended product or service, there has been increased interest in the contingent valuation method (CVM) for health care technologies, particularly in the bidding game approach. An advantage of this approach in determining WTP is that it requires only yes/no responses to each bid and thus it may reflect a more realistic market situation than obtained from open-ended questions (O'Brien and Viramontes,1994).

The objectives of this study were (i) to assess the extent of WTP for the ICT Malaria *Pf/Pv* test kit, and (ii) to determine factors influencing WTP for the ICT Malaria *Pf/Pv* test kit in the Taikkyi region of Myanmar. A secondary aim of this study was to assess the validity of using the CVM as a measure of WTP for the ICT Malaria *Pf/Pv* test kit. The consumer's attitude can influence monetary valuation with respect to different conditions, *ex post* and *ex ante*. In essence, *ex post* condition focuses on currently symptomatic persons while *ex ante* condition focuses on currently non-symptomatic persons who are at future risk.

We are not aware of any WTP study of the ICT Malaria *Pf/Pv* test kit. Although there are many studies of WTP for other health care technologies, studies capturing both *ex post* and *ex ante* viewpoints are very limited. To date, the most widely used perspective in health care contingent valuation studies has been the *ex post* user-based approach (O'Brien and Gafni, 1996).

MATERIALS AND METHODS

Study sites

This study was carried out in the villages of Kankone (KK) and Yae-Aye-Sann (YAS) in the Taikkyi region, about 80 km northwest from Yangon, the capital of Myanmar. The Taikkyi region is situated in the foothills of Bago yoma, a forest area of Myanmar. Two principal situations exist in the rural setting of Myanmar for health care service: services rendered in a formal health center, usually a rural health center (RHC) and services rendered without any formal health center through a community health worker (CHW) from the village. To capture these real life services, we sampled two different villages, one with an RHC and the other with a CHW.

The size of the population in KK village has been estimated at 34,350 in 6,026 households. The population of YAS village is 863 in 130 households. Both villages are classified as meso-endemic areas. The KK village has a RHC headed rendered by basic health staff headed by a health assistant, while YAS village is equipped only with volunteer services rendered by the CHW.

Study design

A cross sectional study implementing the CVM with a bidding game approach was conducted in two different conditions with a total of four different settings of respondents. The *ex post* condition encompasses (i) those attending the RHC in KK village and (ii) those attending the residence of the CHW in YAS village. These two settings reflect responses at the point of the consumption of the diagnostic technology. The *ex ante* condition encompassed (i) household representatives of KK village who had had malaria within the last six months and (ii) householders of YAS village who had had malaria within the same period. In essence, WTP *ex post* assumes knowledge and exposure to the ICT Malaria *Pf/Pv* test kit while *ex ante* assumes that knowledge was imparted both formally and by direct observation but there was no exposure to the test kit.

Research instruments

In this study, the CVM for direct measurement of WTP using a bidding game has been applied. Informed consent was obtained from the local authorities and the participants. The participants had the option of declining. Local interviewers were trained for this study so as to insure that the respondents felt free in giving their answers. A pretest was conducted with 50 residents in the Chin-Kone village situated in the same locality to gauge the clarity of questions (Golan and Shechter, 1993). The words used and coding of responses were modified

accordingly.

The effects of rapid on-site diagnostic testing followed by specific and prompt treatment of malaria were explained to the respondents. The explanation included the consequences of existing presumptive treatment resultant with less chance of a cure rate coupled with more chance to relapse. The merits of accurate and correct diagnosis with specific treatment with a better chance of a cure were also explained. The rationale for cost sharing for the rapid on-site diagnostic test kit was given as enabling them to access it at their village. They were given to understand that the ICT Malaria *Pf/Pv* test kit had relatively high unit cost. It was clarified that WTP means their own personal willingness and ability to pay out of pocket. Since the health service was presented to the respondents as part of a hypothetical market, they were encouraged to offer amounts based on information provided by the interviewer. The bidding either went up or down depending on the initial response. Kyats (Ks) 50 (equivalent to the cost of 5 eggs at the time of study) was used as the starting bid for all respondents in all four study settings. The starting amount used in the bidding game was derived from interviews conducted in parallel to obtain cost information for malaria diagnosis and treatment in the Taikkyi region of Myanmar (Cho-Min-Naing *et al*, in preparation). It is important not to frustrate or bore respondents with a lengthy bidding game. Therefore they were allowed only three bids (Fig 1). The last bid, Ks 150 (equivalent to 15 eggs), represented their maximum WTP (the verbatim question is available from the author on request).

Sample population

Kankone village: 750 fever patients (perceived malaria) attending the RHC of KK village were interviewed using an interviewer-administered structured questionnaire for general information and the CVM with a pretested bidding game approach. 350 households having members who have experienced a malaria episode within the last six months were selected and enumerated. A household roster was developed and used for a planned interview session as above.

Yae-Aye-Sann village: 250 fever patients (perceived malaria) seeking treatment from the CHW in YAS village were interviewed using the standardized questionnaire including general information and a bidding game approach as above. 130 households possessing members having a malaria episode as above was selected and enumerated. Then the same procedure was applied to interview.

The respondents were also asked to rate their perceived severity of illness (malaria). In a household survey, the respondent selected was not necessary the head of the family, but any household member between age 18 and 60 years who had experienced episodes of malaria within the last six months.

Reliability assessments

Reliability of instruments was examined by test-retest procedure using intra-class correlation so as to check the consistency of answers. 30 sub-samples in each setting were interviewed by the same interviewer with identical question format at an interval of three weeks.

Data analysis

The survey results were analyzed using ordinary least square (OLS): the dependent variable was WTP and the key explanatory variables. There were ability variables such as average monthly income and main occupation of the respondents; personal variables such as level of education (years of schooling in this study), family position, age, sex, marital status; biomedical variables such as perceived severity of illness; accessibility variables such as distance between the nearest health center and the residence of the respondent. These variables were selected on the basis of their association with WTP and that they would be amenable to analysis. Data analysis was carried out using SPSS 9.0 for Windows. Qualitative data were handled by dummy variables to transform into numerical data (Dawson-Saunders and Trapp, 1990; Gujarati,1995). A stepwise procedure was applied, which terminated with the selection of a best-fitting model when no additional variable could be added to or deleted from the last model fitted. Values for variance inflationary factor (VIF) were checked for evidence of co-linearity among the set of explanatory variables (Levine *et al*, 1999). The test-retest reliability for instruments was reported by the intra-class correlation coefficient.

RESULTS

The profile of the respondents

Table 1 gives a brief profile of respondents. Among the respondents of all four study settings, the majority were male. The mean age in *ex ante* condition in both villages is older than that of *ex post* condition. Among the respondents, mean individual monthly (gross) income was highest in re-

Table 1
The selected characteristics of the respondents.

Characteristics	KK (*ex post*) (n= 750)	YAS (*ex post*) (n= 250)	KK (*ex ante*)[c] (n = 350)	YAS (*ex ante*)[c] (n =130)
Gender				
male n (%)	668 (88.9)	222 (88.8)	249 (67.7)	86 (66.2)
female n (%)	82 (10.9)	28 (11.2)	101 (27.4)	44 (33.8)
Age				
mean (SD)	37.9 (11.4)	37.7 (11.4)	40.3 (13.1)	40.5 (13.0)
Monthly income[a] mean (SD)	1,224 (430.6)	1,229 (426.7)	1,334 (589.9)	1,354 (579.7)
Level of education[b] mean (SD)	6.5 (3.0)	6.5 (3.0)	6.7 (2.5)	6.8 (2.6)
Severity				
mild n (%)	331 (44.1)	113 (45.2)	167 (47.7)	62 (47.7)
moderate n (%)	410 (54.7)	135 (54.0)	150 (42.9)	57 (43.8)
severe n (%)	9 (1.2)	2 (0.8)	33 (9.4)	11 (8.5)
Distance in km mean (SD)	4.98 (2.96)	5.08 (2.96)	8.42 (6.14)	5.3 (1.54)
Traveling time Mean (SD)	54.7 (7.5)	31.1 (132.5)	-	-
Waiting time Mean (SD)	30.9 (13.2)	28.3 (10.3)	-	-
Total time (travel+waiting) Mean (SD)	85.5 (15.1)	59.4 (15.5)	-	-

SD = Standard deviation: Km= kilometer
[a](1 egg = Ks 10.0 at the time of survey)
[b]Years of schooling
[c]Perceived severity of the last episode
KK = Kankone village
YAS = Yae-Aye-Sann village
Time is expressed in minutes

Table 2
Multiple regression analysis results of four study settings (stepwise method).

Variables	Coefficient				Standard error			
	KK (*ex post*)	YAS (*ex post*)	KK (*ex ante*)	YAS (*ex ante*)	KK (*ex post*)	YAS (*ex post*)	KK (*ex ante*)	YAS (*ex ante*)
Intercept	21.289	-2.695	42.4	11.449	10.88	-0.281	4.75	1.08
Income	0.0518[a]	0.051[a]	0.018[a]	0.029[a]	0.003	0.006	0.003	5.982
Perceived severity of illness	17.944[a]	14.6[b]	NS	NS	2.539	4.661	NS	NS
Time travel	-0.556[b]	NS	NS	NS	0.174	NS	NS	NS
Distance	NS	NS	NS	3.99[b]	NS	NS	NS	1.84

Adjusted R^2 : KK (*ex post*)= 0.34, YAS (*ex post*) = 0.29, KK (*ex ante*) = 0.08, YAS (*ex ante*) = 0.27
F- statistic: KK (*ex post*) = 131.04[a] , YAS (*ex post*) = 52.114[a], KK (*ex ante*) = 29.995[a], YAS (*ex ante*) = 25.389[a]

[a]p <0.001
[b]p <0.05
NS = Not shown (The stepwise regression shows only significant variables)

Table 3
Test-retest reliability (three weeks interval) of the research instrument for a sub-sample of respondents in all four settings.

Setting	Mean WTP (first interview)	Mean WTP (second interview)	Intra-class correlation[c] (95%CI)
KK *ex post* (n=30)	Kyats 80.5	Kyats 81.7	0.78 (0.53-0.89)
YAS *ex post* (n=30)	Kyats 81.2	Kyats 76.6	0.9 (0.8-0.95)
KK *ex ante* (n=30)	Kyats 66.5	Kyats 65.9	0.7 (0.62-0.91)
YAS *ex ante* (n=30)	Kyats 74.1	Kyats 70.3	0.86 (0.71-0.93)

(1 egg = Kyats 10.00 at the time of survey)
CI = Confidence interval
[a]p < 0.001

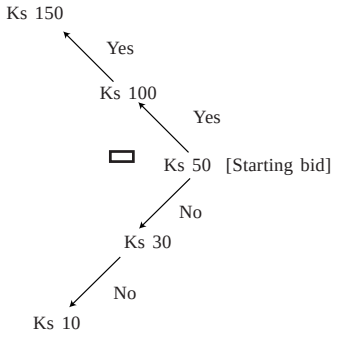

Fig 1–Bidding game algorithm for Kyats 50 Starting.

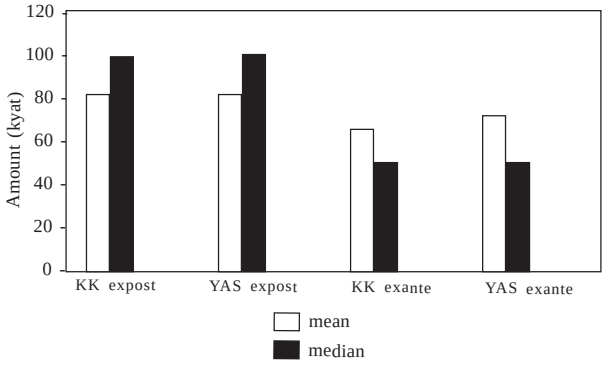

Fig 2–Mean and median willingness to pay for the ICT Malaria *Pf/Pv* test kit.

spondents of the household survey in YAS village and lowest in the RHC survey in KK village. The WTP values vary from Ks 10 to Ks 150 in all settings in accordance with the established bids. Notably, the mean WTP and median WTP in *ex post* (*ie*, at the time of symptoms so also at the time of consumption of the ICT Malaria *Pf/Pv* test kit) were obviously greater than that for the *ex ante* (*ie* non symptomatic but potential users for next episodes of malaria) in both villages (Fig 2).

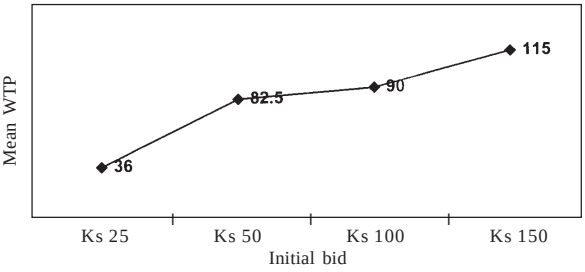

Fig 3– Relationship between mean willingness to pay (WTP) for the ICT Malaria *Pf/Pv* test kit and initial bid.

Regression output

Table 2 presents significant regression outputs of the model following a stepwise procedure. There was no significant relationship between age and WTP in both conditions, *ex post* and *ex ante*. To our surprise, there was a negative relationship between WTP and educational level in both settings of *ex ante* condition, but it was not significant at the conventional 5% level.

Ability to pay is a major consideration in consumption according to welfare economic theory. Therefore we hypothesized that WTP would have a positive relationship with individual monthly income. As expected, the estimated coefficient was significantly positive in all four study settings. It has been assumed that improved access to care is an important indicator for health policy (Mathiyazhagan, 1998). Distance to health facility is used as a proxy for physical accessibility: the longer the distance to access the necessary health care services, the more WTP exists for it to be available at their locality. Thus, we hypothesized that there would be a posi-

tive coefficient. This expectation was only observed in the *ex ante* condition in the YAS household survey. Both settings of *ex post* and *ex ante* conditions of KK households showed an inverse relationship between distance and WTP, though this was not statistically significant (data not shown).

We expected that severity of illness could be used as a proxy for consumption of health care services. We hypothesized that severity of illness would have a positive relationship with WTP. As expected, perceived severity of malaria in the *ex post* condition as well as perceived severity of malaria in the last episode in the *ex ante* condition played a role in WTP with respect to an expected positive sign. However, statistical significance at the 5% level was observed only in the *ex post* condition but not in the *ex ante* condition. The overall explanatory power of the regression measured as adjusted R^2 was highest at 34% for WTP *ex post* at RHC in KK village and lowest at 8% for a WTP *ex ante* in household surveys in KK village. Before completing analysis, we inspect the residuals further, checking for constant variance and normality. Values for VIF showed no evidence of co-linearity among the set of explanatory variables (VIF < 5.0 in all four settings). The models fit well: it was a significant overall *F*-statistics. Intra-class correlations between the first and second responses were good for all four settings (Table 3). It was best in the WTP *ex ante* in the survey at the residence of CHW in YAS.

Investigating the anchoring bias

To investigate a possible starting point or "anchoring bias", sub-samples were created and started with an initial bid of an amount other than Ks 50. Taking into consideration our time and resources, we assessed it only in one setting, *ie* the RHC in KK village. The finding suggests a possible threat to the initial bid according to its mean value (Fig 3). The higher the amount of the initial bid, the higher the mean value of WTP exists.

DISCUSSION

Amount of willingness to pay

The currently symptomatic person has more willingness to pay for the diagnostic technology. In microeconomic theory, demand-determining variables included tastes of the commodity consumed, among others (Pindyck and Rubinfeld, 1998). In this case, we considered that the respondents provided the answer in accordance with their current taste of the diagnostic kit, assuming that they have perfect knowledge of it.

Income

The more income an individual has, the greater the WTP, which is consistent with welfare economic theory. Furthermore, the marginal utility of income for health will vary according to the risk preferences of the person involved. Drummond *et al* (1997) stated that WTP depends, upon the risk preferences of the respondents, *inter alia*. A risk aversion with respect to income is a standard assumption in economics (Johannesson, 1996). If the respondents are characterized by risk aversion, utility increases with the person's income, but at a decreasing rate (Mansfield, 1997). Though our study did not encompass assessment of the respondent's attitude toward risk, future research should do so. There are two important assumptions on which of our analysis has been based: (i) individuals are the best judges of their welfare; (ii) distribution of income among the respondents is equal on average, *ceteris paribus*. If the second assumption is violated such that the distribution of income not being equal, the WTP values broken down by income groups and preferences and using weights to illustrate the importance of distribution issues (Donaldson, 1999) should be included in future study.

Severity of illness

Preferences for medical therapies are expected to show variation as a function of individual health status (Ramsey *et al*, 1997). A positive relationship between the severity of malaria and WTP was indeed evident. Since people tend to avert risk, the more they suffer, the more they want to pay for a cure.

Distance

The longer the distance of access to a formal health care facility, the greater the WTP existed for it to be accessible at their locality was recognized in a WTP *ex ante* for the proposed diagnostic kit in the YAS village household respondents. This suggests that physical accessibility is a determinant for the consumption of this health care technology.

Time factor

A significant inverse relationship between WTP and traveling time was observed in *ex post* condition in the KK RHC. This illustrated that the shorter the traveling time to access formal health care, the more WTP exits for it. This fact may be implicitly

explained that within a consumer's budget line the fewer expenses incurred for traveling to access the health service, the more utility exits for other things.

Issues concerning methodology

Since the implications of this study are intended for application more widely in Myanmar, potential threat to external validity was a concern. All four sample settings being located in the Taikkyi region offered a convenient way of obtaining a good cross sectional data, but at the cost of potential loss of a certain external validity. However, enhancement of external validity was tried using two different settings, *ex post* and *ex ante*, in two different types of service, RHC and the residence of CHW, rather than only one setting. We focused both on the *ex post* and *ex ante*. The latter persons are not currently symptomatic and are currently non-users of the diagnostic technology. But they would be willing to pay some amount now so that the diagnostic services (with a guarantee of better chance for a cure) will be available whenever they need them in future. This position is linked with option value as source of utility, securing future access to a rapid-onsite diagnostic service (O'Brien and Gafni, 1996). However, the findings in this study should be generalized with great caution until future research has replicated them satisfactorily.

Though reliability of the instrument was shown, it may be partly due to the short time interval (Sorum, 1999) between the two consecutive interviews: the longer the time interval, the less consistency of answers would be expected. Implied value cues such as "anchoring" were probed, showing that patients' preferences are so unstable and affected by the mere fact that they were initially asked (Stalhammer, 1996). While the best solution is still developing, we are convinced that unstable preferences may be present in the real market situation as well.

Conclusion

The promising result from this study pointed out that people's WTP for the rapid on-site diagnostic test kit for malaria was less than the market price (Ks 500 per kit or equivalent to 50 eggs) of the test kit. The highest median value was Ks 100 (equivalent to 10 eggs). For a wider distribution of ICT Malaria *Pf/Pv* test kit in the public sector in Myanmar, aiming for on-site diagnosis followed by a rapid, specific and correct treatment of malaria, it should not be possible without consideration of a subsidy amount in the context of national health care financing schemes. If the NMCP intends to introduce the ICT Malaria *Pf/Pv* with a free charge service, the partnership of an international donor agency such as WHO, UNDP, UNICEF may be considerably important. We are aware of that this single study may not be a guarantee for generalization, but it provides decision variables for health planners.

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