An exploratory study to estimate cost-effectiveness threshold value for life saving treatments in western Iran

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Abstract

Background: Cost-effectiveness analysis provides a crucial means for evidence-informed decision-making on resource allocation. This study aims to elicit individuals' willingness to pay (WTP) for one additional quality-adjusted life-year (QALY) gained from life-saving treatment and associated factors in Kermanshah city, western Iran.

Methods: We conducted a cross-sectional study on a total of 847 adults aged 18 years and above to elicit their WTP for one additional QALY gained by oneself and a family member using a hypothetical life-saving treatment. We used a multistage sampling technique to select the samples, and the Iranian version of EQ-5D-3L, and visual analogue scale (VAS) measures was used to obtain the participants' health utility value. The Tobit regression model was used to identify the factors affecting WTP per QALY values.

Results: The mean WTP value and standard deviation (SD) was US\$ 862 (3224) for the respondents and US\$ 1355 (3993) for the family members. The mean utility values using EQ-5D-3L and VAS methods were 0.779 and 0.800, respectively. The WTP for the additional QALY gained by the individual participants using the EQ-5D-3L and VAS methods were respectively US\$ 1202 and US\$ 1101, while the estimated value of the family members was US\$ 1355 (SD= 3993). The Tobit regression models indicated that monthly income, education level, sex, and birthplace were statistically significantly associated ($p < 0.05$) with both the WTP for the extra QALY values using the EQ-5D-3L and the VAS methods. Besides, education level and monthly income showed statistically significant relationships with the WTP for the additional QALY gained by the family members ($p < 0.05$).

Conclusion: Our findings indicated that the participants' WTP value of the additional QALY gained from the hypothetical life-saving treatment was in the rage of 0.20 to 0.24 of Iran's gross domestic product (GDP) per capita, which is far lower than the World Health Organization (WHO) recommended CE threshold value of one. This wide gap reflects the challenges the health system is facing and requires further research for defining the most appropriate CE threshold at the local level.

Keywords: Cost-effectiveness, life-saving treatment, willingness to pay, quality-adjusted life year, Iran

Background

The scarcity of healthcare resources and the increasing clients' treatment demands challenge the decisions on resource allocation including financial reimbursements, especially in the health systems of the resource-constrained countries (1, 2). The cost-effectiveness analysis which compares the costs and health gains from two or more alternative interventions in terms of the incremental cost-effectiveness ratio (ICER), is widely used to handle such challenging decisions (3-5). The quality-adjusted life years (QALY), which includes both the quality and quantity of life, is one of the commonly used health outcome indicators, and the cost per QALY is a ratio of the additional cost per QALY gained (6, 7). Hence, the CE analysis is a useful means to make a rational decision whether an intervention is worthwhile to fund or reimburse, and the central aspect of a decision on reimbursement for treatment is estimating or establishing the threshold value of the CE (8, 9). An intervention is considered cost-effective if the ICER value lies below the threshold, and vice versa (5, 10). Despite a commonly used approach, there is no single standard to estimate the CE threshold (11). The World Health Organization (WHO) considers that if the cost to QALY gained ratio is less than one, or a value of one to three times the per capita GDP as a cost-effective intervention, and higher value is unacceptable (12, 13).

A recent study that estimated the CE threshold using the opportunity cost indicated the WHO recommended threshold value is considerably high for the low-middle income countries (LMICs) (8). Because of the limitation of the WHO recommended estimation, others applied the willingness to pay method for a preferred attribute to estimate the CE threshold value (5, 14-16). However, its application in the healthcare systems is not well documented. Despite all methodological issues related to the use of the CE threshold value approaches, there is a consensus that the different thresholds should be well defined and used for different situations such as the quality of life-improving or life-threatening conditions. Evidence indicated higher willingness to pay (WTP) values for life-saving interventions than for the quality of life-improving ones (17). Others also reported different QALY value for different health status, and those with worse health status had a higher value than those with better health status (14).

In Iran's health system, there seems to be a consensus in using a local CE threshold to maximize health and efficiency. The establishment of the health technology analysis office at the Ministry of Health and Medical Education (MoHME) of Iran in 2007, the provision of training in the fields of health economics, health technology assessment, and Pharmacoeconomics in medical

universities, the application of pharmacoeconomic evaluation guidelines to include new drugs in the national drug list of the Food and Drug Administration of Iran, and the conduct of studies on economic evaluations concerning medical equipment and treatment are some of the national-level efforts showing the application of the CE threshold (18-20).

Despite the absence of clear criteria for the CE thresholds to aid the decision on health resource allocation, the decision-makers in Iran are implicitly applying the WHO recommendation of choosing the cost-effective intervention (s). Even how the decisions are made on the health insurance organizations' benefits using the WHO criteria was not clear. A study in Tehran, the capital of Iran, reported an average WTP per QALY of the participants that varied from US\$ 1032 to US\$ 2666. These values accounted for 0.22 to 0.56 GDP per capita of Iran in 2014 (2). However, to the best of our knowledge, little information is available on the monetary value of life-saving treatments and its influencing factors in Iran. This study aims to estimate the participants' WTP for one additional QALY gained from life-saving treatment and associated factors in western Iran. Eliciting the monetary value of the QALY as the threshold in CE analysis can provide useful information for evidence-informed decisions in resource allocation in Iran, and perhaps in other similar contexts.

Methods and materials

Setting

Kermanshah city, the capital of Kermanshah province, is located in western Iran. Based on the 2016 population census of Iran, the Kermanshah city had a total population of about two million people. The socio-economic status of the people is low, and the city's contribution to the national gross domestic product (GDP) is only about 1.7% to 2%.

Study design, study period, and sample size

A cross-sectional study was conducted on a total sample of 1000 adults aged 18 years and above, from the general population of Kermanshah city, to elicit their WTP for one additional QALY gained from hypothetical life-saving treatment in September to December 2019. The Mitchell and Carson formula (21) was used to determine the appropriate sample size.

$$n = \left[\frac{Z_{1-\frac{\alpha}{2}} V}{\Delta} \right]^2$$

Where at the $\alpha=10\%$, using V=2.5 and $\Delta= 0.1$ as a difference between true WTP and estimated WTP, a sample size of 786 was calculated. To increase generalizability of the study findings and 20% attrition rate, the final sample was 943 calculated. A multistage sampling technique was used to select the samples. We firstly divided the Kermanshah city into five western, eastern, central, northern, and southern geographic areas. Then, in each area, an equal sample (approximately n=190) was invited to participate in the study using a convenience sampling technique. Due to missing data, 96 observations were excluded which resulted in a final sample of 847 for statistical analysis.

Data collection and variables

We used a self-administrated questionnaire to elicit the participants' WTP for one additional QALY gained by oneself and a family member using a hypothetical life-saving treatment (4). The self-administered questionnaire obtained the participants' data on current health state, WTP for one additional QALY gained from life-saving treatment, and sociodemographic characteristics. Before the final data collection, five health economists checked the questionnaire for its content validity, a revision was made based on their opinions, and pilot tested on 30 participants to ensure the understandability of the questions and the hypothetical scenarios.

We used the Iranian version of the EQ-5D-3L, and the visual analog scale (VAS) measures to obtain the respondents' health utility values (4). The EQ-5D-3L consisted of mobility, self-care, usual activities, pain/discomfort, and anxiety/depression dimensions. Each of these dimensions had three-level responses consisting of no problem, some problems, and extreme problems. Then, we asked the participants to use one of these responses to each dimension to indicate their current health state(22, 23). Further, we allowed the respondents to indicate their current health state on a 100-unit thermometer analogous scale that shows from the dead to the perfect health state to obtain the VAS valuation(4, 24).

As in a previous study (4), we used two hypothetical life-threatening conditions for the individual participant and for a family member to estimate their maximum WTP value for one additional QALY gained. The assumption used in the first scenario was as follows: "Suppose you had a life-threatening disease for one year. There is a treatment for your disease condition. If you do not take any treatment now, you will die today. If you get treated, you will be back to your current health state and live only for one more year". The second scenario was similar to the

first one but asked the respondent to imagine that the condition is to one of his/her family members (a different perspective).

We elicited the maximum WTP value for one more QALY gained for a family member using the contingent valuation method (CVM). The CVM is one of the most commonly employed methods for eliciting the WTP of individuals for one additional QALY gained from an intervention. For example, a systematic review of studies reported that 92.85% of the studies applied the CVM, and only one study used a discrete choice experiment method to estimate the WTP of participants (17). Further, we used the payment card (PC) method, one of the CVM methods, accompanied by a follow-up of open-ended questions to identify the participants' WTP. The PC applies a visual scale consisting of a range of the potential bid values presented to respondents to indicate their best WTP value (25). Our study composed 15 bid values ranging from the lowest of US$ 78 to the highest US$ 19,380 and presented the scenario to those that showed a positive WTP. We included the values below US$ 78 and above US$ 19380 on the PC scale to avoid limiting the participants' chance of responding.

The follow-up questions elicited the respondents' exact WTP values. We used values ranging from zero to more than US$ 19380 from a pilot study conducted in 2019. The PC with closed-ended questions was preferred to study because it covers a wide range of bids, and helps avoid respondents' fatigue and confusion in the valuations. These limitations are likely to appear when using other CVM methods such as the dichotomous choice, bidding game formats, and the multiple bounded discrete choice methods, where the respondents tended to bargain to show the WTP values. The value of US$ 1 at the time of the study was equal to 128986 Iranian Rials (IRRs) (9). The sociodemographic related variables included in the analysis were age, sex, marital status, individual monthly income, education status, health insurance coverage, birthplace, and having a chronic disease.

Data analysis

We calculated the participants' utility scores for the current health state using the EQ-5D-3L and used VAS valuation data to measure and calculate the additional QALY gained. We scaled the VAS valuation data from the best to the worst imaginable health state and rescaled the scores from 100 to 0 accordingly. We used the following formula to rescale the respondent level values:

$$VAS_{\text{curretn health state}-\text{rescaled}} = \frac{VAS_{\text{raw}} - Death_{\text{raw}}}{'11111'_{\text{raw}} - Death_{\text{raw}}}$$

Where VAS$_{\text{current health state-rescaled}}$ and VAS$_{\text{raw}}$ indicates the scores of rescaled current health state and current health state, respectively. Death$_{\text{raw}}$ and '11111'$_{\text{raw}}$ are the scores of death and perfect health state, respectively.

In this study, we defined the additional QALY gained by each respondent as the difference between the utility measure obtained from the EQ5D or VAS for the current health state and death state (U=0.000). Additionally, we calculated the WTP for one additional QALY gained by each respondent from the utility measures of both the EQ-5D-3L and VAS methods as follows:

$$\text{WTP for one additional QALY gained} = \frac{\text{WTP value}}{U_{\text{current health state}} - U_{\text{death}}}$$

Where U$_{\text{death}}$ is the utility from death state and is equal to 0.000 and U$_{\text{curretn health state}}$ is the utility from the current health state. WTP for additional QALY gained is the amount of the WTP per an additional QALY gained by oneself or a family member.

We used the Mann-Whitney and chi-squares tests to explore the association between the continuous and categorical explanatory variables and the WTP for the life-saving treatment of the respondents, respectively. Data on the WTP for the additional QALY gained from the life-saving treatment using the EQ-5D-3L and VAS methods were positively skewed. Similar to previous studies (26-29), our study applied the Tobit regression model to explore the relationship between the WTP for the additional QALY gained and the explanatory variables and to handle the limitation that might arise when using the other models. We also estimated the marginal effect of the β^* and β^{**}, where β^* is the explained marginal effects for the probability of being uncensored and β^{**} is the explained marginal effects for the expected WTP value conditional on being uncensored: E (WTP | WTP>0). The age, gender, educational level, health insurance coverage, marital status, birthplace, chronic disease status, having a chronic disease status of a family member, death of a family member in the past year, and monthly household income were the dependent variables. All the analyses were performed using the Stata statistical software package version 14.2, and we considered the findings statistically significant at the p-value of less than 0.05.

Results

A total sample of 847 adults aged 18 years and above in Kermanshah city, responded at a rate of 89.8%, were included in the study. The mean age of the participants was 33.6 years, with a

standard deviation (±SD) of 12.1 years, and male and female participants accounted for 45.4% and 54.6%, respectively (Table 2). One-hundred and forty-eight of the respondents (17.5%) had a monthly income of less than US$ 78, 158 (18.6%) had a monthly household income of more than US$ 310 (US$ 1 = IRR 128986). Nearly 19% of the respondents reported having chronic diseases, and another 15.2% had a history of the death of a family member in the last year. Approximately two-thirds (65%) of the respondents were willing to pay for life-saving treatment for themselves. The univariate analysis indicated that gender, education status, health insurance coverage, birthplace, and monthly income were statistically significantly associated with the WTP for life-saving treatment.

<<< Place Table 1>>>

The pattern of WTP responses

The findings showed a higher mean WTP value for a family (US$ 1355±SD3993) than for the individual participant (US$ 862±SD 3224). Nearly 65% of the individuals had a positive response to the payment (WTP>0) for their own, and the rate increased to more than 90% if a family member would face the risk of death (Figure 1). Additionally, 53% of the participants would have the WTP value of zero if they would encounter a life-threatening condition, and another 28% would have the WTP value of zero if a family member were faced a life-threatening situation. In the mid-range of the bid values, the tendency towards paying for the family members was higher, but in the upper bid values, the participants showed similar behavior.

<<< Place Figure1>>>

Despite a higher tendency to pay for a family member to save a life, there was not a significant difference in the WTP pattern. Using the open-ended follow-up questions, 75% of the respondents had the WTP value of less than US$ 155 for themselves, and 59% had the same WTP value for their family members. Only 2% of the participants had the WTP value of as high as US$19381.

<<< Place figure 2>>>

WTP and WTP for additional QALY gained

The mean WTP values for the life-saving treatment ranged from US$ 0 to 19381 per year for oneself and US$ 0 to 38763 for family members. There was a slight difference between the mean utility value using the EQ-5D-3L method and the VAS method (0.779 vs. 0.800). The WTP for one additional QALY using the EQ-5D-3L and VAS methods were US$ 1202 and US$1101, respectively (Table 2).

<<< Place Table 2>>>

Factors affecting WTP per QALY values

The Tobit regression models indicated that education level, gender, birthplace, and monthly income were statistically significantly associated (p<0.05) with the WTP for the additional QALY gained using both the EQ-5D-3L and the VAS methods (Table 3). Further, education level and monthly income showed statistically significant relationships with the WTP for the additional QALY gained by the family members (p<0.05). The results of the marginal effects of the factors influencing the WTP revealed that females had a 9.3% and 8.2% higher probability on the WTP for the additional QALY gained from the life-saving treatment using both the EQ-5D-3L and VAS methods, respectively than their male counterparts (Table 4). The WTP of females for the additional QALY gained was about US$ 515 and US$ 388 more than the WTP of males using the EQ-5D-3L and the VAS methods, respectively .

The findings of the marginal effect analysis using the data from the EQ-5D-3L method, for example, revealed that the participants with moderate-income (US$ 156-310) and those with high income (more than US$ 310) had 11.3% and 17.5% respectively higher probability of the WTP for the additional QALY gained from the life-saving treatment than the participants with low income (less than US$ 78). Moreover, the participants with moderate-income and high-income had a US$ 641 and US$ 1044 higher WTP for the additional QALY gained from the life-saving treatment, respectively, than those with low income.

<<< Place Table 3>>>

<<< Place Table 4>>>

Discussion

Our findings indicated the participants' WTP values of US$ 1100 using the VAS method and US$ 1200 using the EQ-5D-3L method for one extra QALY gained from the hypothetical life-saving treatment for their current health state. These values accounted for 0.20 to 0.24 of Iran's

GDP per capita in 2019 (US$ 5506) and are far lower than the WHO suggested CE threshold value of one GDP per capita. The amount that the participants were WTP for the additional QALY gained from the life-saving treatment for a family member was about US$ 1355, which is about 0.27 of the GDP per capita. Our findings are slightly lower than the estimated WTP per QALY gained values that ranged between 0.22 and 0.56 of the GDP per capita, and the WTP per one additional QALY of 0.57 of the GDP per capita studies in Iran (2, 30). However, others from Thailand reported the WTP for one additional QALY gained using life-saving interventions was 1.42 times the GDP per capita in the year 2014 (4). The strong positive relationship between the WTP for the extra QALY gained, and the socioeconomic status of the participants might explain the difference.

The lower WTP for the additional QALY gained from the hypothetical life-saving treatment observed in our study can be explained by Iran's GDP per capita declining trend in the last few years. For example, the GDP per capita decreased from US$ 7818 in 2011 to US$ 5506 in 2019 (31). Additionally, the GDP per capita of Iran during the current study (US$ 5506) was markedly lower than the GDP per capita (US$ 7500) of Thailand in the year 2014. Thus, increasing the GDP per capita can contribute to the increase in the CE thresholds (8).

The findings in our study highlighted that the WHO CE threshold may be unrealistic for use by health policymakers to make a rational decision on choosing cost-effective interventions in low- and middle-income countries (LMICs) like Iran, where the resources are limited. Others also reflected a similar concern and concluded that the WHO CE threshold for choosing a cost-effective treatment is substantially high for the LMICs (8). Another possible reason for the differences in the CE threshold between ours and others might reflect differences in concepts and methods for eliciting the WTP for the additional QALY gained. For example, our study depended on the WHO's recommended CE threshold, which uses income (4), while others determined the CE threshold using the opportunity costs (8) and preference (32). The use of different scenarios such as life-saving treatments, life-prolonging treatment, and a difference in study population such as the use of the general population and a study on a specific disease can lead to differences in the WTP for the additional QALY gained. A study in the general population of Korea reported that the WTP for an additional QALY from a cure treatment was more than twice (KRW 35 million vs. 15 million) that of the non-cure one (33). As well, the use

of open-ended questions can be another reason for the difference in the WTP for the extra QALY values.

The VAS and EQ-5D-3L methods used in our study provided almost the same QALY values. Similarly, a study in Thailand reported closely related mean values of the additional QALY gained (0.872 vs. 0.853) using the VAS and the EQ-5D-3L methods (4). The statistically significant difference in the WTP for the additional QALY for oneself and a family member observed in our study might be due to the cultural influence on the family role in the context of Iran. The monthly income, education level, and sex in our study showed statistically significant associations with the WTP for the extra QALY gained. Others also reported that income was positively associated with the WTP for the additional QALY gained (4, 5, 30, 34) (34). Lastly, higher income and education level led to higher WTP and WTP for the extra QALY gained (33).

Strengths and limitations of the study

This study explored the WTP for the additional QALY gained from hypothetical life-saving treatment and provided input for evidence-informed decisions on the context of Iran. However, there are limitations, and the findings require cautious interpretations. First, this study analyzed data from a sample obtained from a general population of a specific geographic area, Kermanshah city, using a convenience sampling technique. Hence, the observed CE threshold values cannot be generalizable to the entire Iran. Second, the elicited WTP values for the additional QALY gained using the hypothetical life-saving intervention might have been influenced by other conditions. Third, our study assumed a family member as a healthy individual with a utility value of one. Thus, the QALY valuation for a family member might not reflect its reality. Finally, the family member was not specified during the study period while there could be a wide variation in the family members ranging from a child to an elderly. Thus, future studies need to consider those factors.

Conclusions

The findings revealed that the values of the WTP for the additional QALY gained using hypothetical life-saving treatment varied from 0.20 to 0.24 of Iran's GDP per capita. These values are far lower than the WHO recommended CE threshold of one GDP per capita. Besides, the findings uncovered the existence of a strong relationship between the monthly income and the WTP per capita values. Future studies aiming to elicit the WTP for the additional QALY

gained need to consider different scenarios of life-saving interventions to address some of the observed limitations.

Abbreviation

CE: cost-effectiveness

GDP: gross domestic product

LMICs: low- and middle-income countries

OLS: Ordinary Least Square

QALY: quality-adjusted life year

VAS: visual analog scale

WTP: willingness to pay

Declaration

Ethical approval and consent to participate

The ethics committee of the Deputy of Research, Kermanshah University of Medical Sciences, reviewed and approved the study protocol (IR.KUMS.REC.1398.349). The data were collected anonymously after obtaining informed verbal consent from each participant, and the respondents were explained about their rights of not participating and withdrawing from the study at any point during the data collection process. The data were used only for this research objective.

Consent for publication

Not applicable.

Availability of data and materials

The data used for the analysis in this study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

SR, BKM, PM, DMR, and NM contributed to the conception and design of the study. SR, BKM and NM performed the data analysis. AW, SR, and NM drafted the manuscript. AW critically revised the manuscript for its intellectual content. All authors read and approved the final manuscript.

Acknowledgements

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Table 1 Frequency distribution, Mann-Whitney and chi-square analysis of willingness to pay for life-saving treatment

Variable	Willing to pay (n=551)	Not willing to pay (n=296)	N(%) or mean (±SD)	p value
Age, in year	32.9	34.7	33.6 (12.1)	0.130
Sex				
Male	233 (42.3%)	152 (51.3%)	385 (45.4%)	
Female	318 (57.7%)	144 (48.6%)	462 (54.6%)	0.012**
Marital status				
Married	121 (40.9%)	235 (42.6%)	356 (42.0%)	
Single	162 (54.7)	294 (53.4%)	456 (53.8%)	
Others	13 (4.4)	22 (4.0%)	35 (4.2%)	0.867
Education status				
Illiterate	26 (4.7%)	21 (7.1%)	47 (5.5%)	
Primary and secondary school	133 (24.1%)	87 (29.4%)	220 (26.0%)	
Academic degree	392 (71.2%)	188 (63.5%)	580 (68.5%)	0.060*
Health insurance coverage				
Yes	438 (79.5%)	205 (69.3%)	643 (75.9%)	
No	113 (20.5%)	91 (30.7%)	204 (24.1%)	0.001***
Birth place				
Urban	458 (83.1%)	218 (73.6%)	679 (79.8%)	
Rural	93 (16.9%)	78 (26.4%)	171 (20.2%)	0.001***
Monthly income US$				
Less than US$ 78	263 (47.7%)	158 (53.4%)	421 (49.7%)	
US$ 78 – 155	125 (22.7%)	72 (24.3%)	197 (23.3%0	
US$ 156-310	113 (20.5%)	52 (17.6%)	165 (19.5%)	
More than US$ 310	50 (9.1%)	14 (4.7%)	64 (7.6%)	0.008***
Own chronic (long-term) disease				
Yes	101 (18.3%)	58 (19.6%)	159 (18.8%)	
No	450 (81.7%)	238 (80.4%)	688 (81.2%)	0.653
Family member with cancer				
Yes	118 (21.4%)	68 (23.0%)	186 (22.0%)	
No	433 (78.6%)	228 (77.0%)	661 (78.0%)	0.602
Family member died from cancer in last year				
Yes	82 (14.9%)	47 (15.9%)	129 (15.2%)	
No	469 (85.1%)	249 (84.1%)	718 (84.8%)	0.700

Note: SD is the standard deviation; *p<0.1; ** p<0.05; *** p<0.01
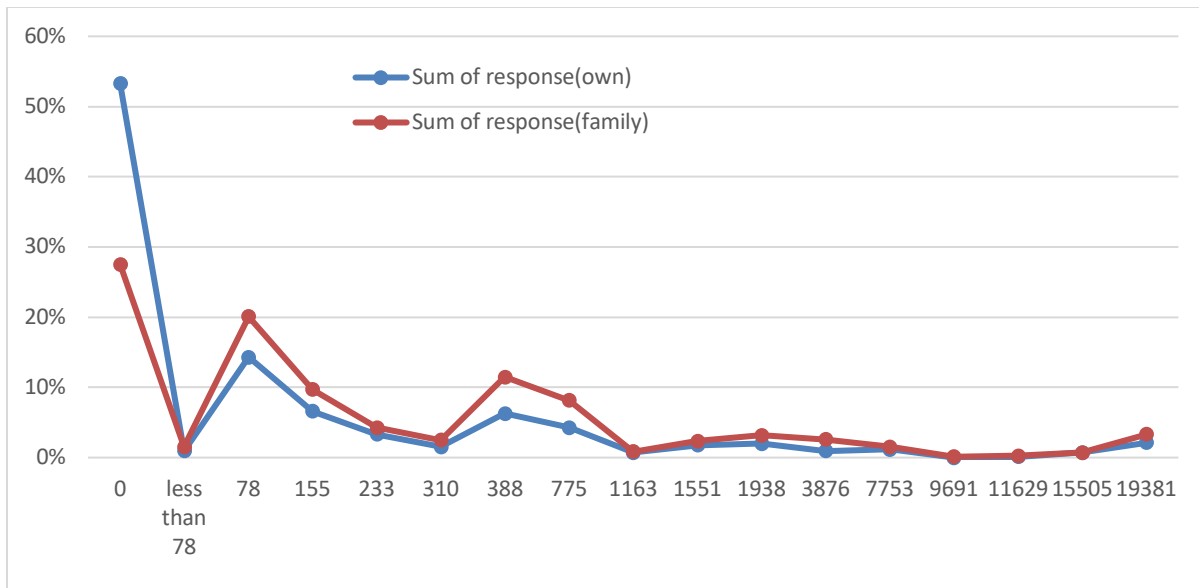
Figure 1 The rate of responses on each bid value for oneself and for a family member

Note: The less than US$ 78, includes all WTP responses which respondents had positive WTP but indicated less than US$ 78.

Figure 2 The stated WTP amount distribution of oneself and a family member

Note: The less than US$ 78, includes all WTP responses which respondents had positive WTP but indicated less than US$ 78.
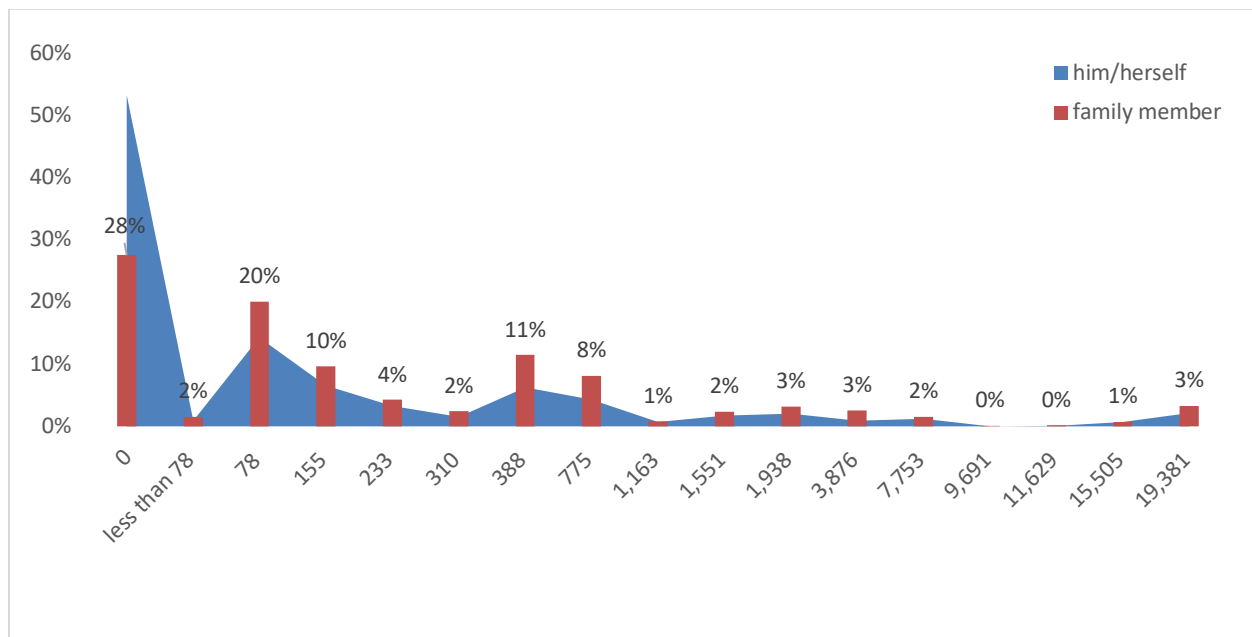
Table 2 Additional QALYs, WTP values and WTP per QALY values

WTP	Average±SD N=847	Minimum to Maximum
For oneself		
WTP per year ($US)	862± 3224	0 to 19381
Utility value using EQ-5D-3L	0.779 ± 0.168	0.10 to 0.89
Utility value using VAS	0.800 ± 0.204	0.11 to 1
WTP ($US) per QALY using EQ-5D-3L	1202 ± 4991	0 to 63819
WTP ($US) per QALY using VAS	1101 ± 4143	0 to 42640
For a family member		
WTP per year ($US)	1355±3993	0 to 38763
WTP per QALY	1355±3993	0 to 38763

Table 3 Results of the Tobit regression analysis of the factors affecting on WTP per QALY values

Explanatory variables	Model A β Coefficient	Model B β Coefficient	Model C β Coefficient
Age, year	-45.0	-39.4	-1.3
Sex (ref. male)			
Female	1510.5*	1126.4*	477.7*
Marital status (ref. single)			
Married	335.4	226.5	572.4
Others	1717.6	479.8	1307.1
Education status (ref. academic degree)			
Illiterate	3351.5*	2162.5*	659.3
Primary and secondary school	-260.8	-497.9	-812.9*
Health insurance coverage (ref. No)			
Yes	842.9	992.6	-16.1
Birth place (ref. rural)			
Urban	1398.4*	985.1*	488.2
Monthly income US$ (ref. less than 78)			
US$ 78 – 155	1060.5	506.4	338.9
US$ 156-310	1849.9*	1064.3*	771.7*
More than US$ 310	2864.8*	2094.6*	1388.0*
Having chronic disease (ref. no)			
Yes	71.9	418.1	37.1
Family member with cancer (ref.no)			
Yes	670.5	348.3	399.8
Family member died from cancer (ref.no)			
Yes	563.0	505.8	595.7
LR chi2 (14)	46.9	38.0	31.0
Prob>chi2	<0.001	<0.001	0.005
Left-censored observations	296	296	80
Uncensored observations	551	551	767
Log likelihood	-5785.2	-5691.8	-7543.4

Note: Model A: Dependent variable is WTP per QALY using EQ-5D-3L; Model B: Dependent variable is WTP per QALY using VAS; Model C: Dependent variable is WTP per QALY for family member; * significance at $p < 0.05$.

Table 4 Marginal effects of factors affecting on WTP per QALY values

Explanatory variables	Model A		Model B		Model C	
	Pr	**E**	**Pr**	**E**	**Pr**	**E**
Age, year	-0.003	-15.5	0.003	-13.7	-0.000	-0.5
Sex (ref. male)						
Female	0.093*	515.1*	0.082*	388.3*	0.043	202.4
Marital status (ref. single)						
Married	0.021	114.6	0.016	78.5	0.052	242.8
Others	0.106	626.9	0.035	168.7	0.116	583.7
Education status (ref. academic degree)						
Illiterate	0.204*	1334.9*	0.158*	848.5*	0.058	299.8
Primary and secondary school	-0.016	-87.2	-0.036	-167.8	-0.071*	-333.9*
Health insurance coverage (ref. No)						
Yes	0.051	289.4	0.073	344.4	-0.001	-6.85
Birth place (ref. rural)						
Urban	0.085*	460.7*	0.072*	330.1*	0.044	203.2
Monthly income US$ (ref. less than 78)						
US$ 78 – 155	0.064	354.1	0.037	171.1	0.031	140.7
US$ 156-310	0.113*	641.9*	0.078*	371.5*	0.070*	330.4*
More than US$ 310	0.175*	1044.6*	0.153*	775.9*	0.123*	620.4*
Having chronic disease (ref. no)						
Yes	0.004	24.7	0.030	145.1	-0.003	15.8
Family member with cancer (ref.no)						
Yes	0.041	230.2	0.026	120.8	0.036	169.9
Family member died from cancer (ref.no)						
Yes	0.034	193.3	0.037	175.5	0.054	253.2

Note: Model A: Dependent variable is WTP per QALY using EQ-5D-3L; Model B: Dependent variable is WTP per QALY using VAS; Model C: Dependent variable is WTP per QALY for family member; Pr shows the marginal effects for the probability of being uncensored and E indicates the marginal effects for the expected WTP per QALY value conditional on being uncensored: E (WTP per QALY | WTP per QALY>0); * significance at $p < 0.05$.
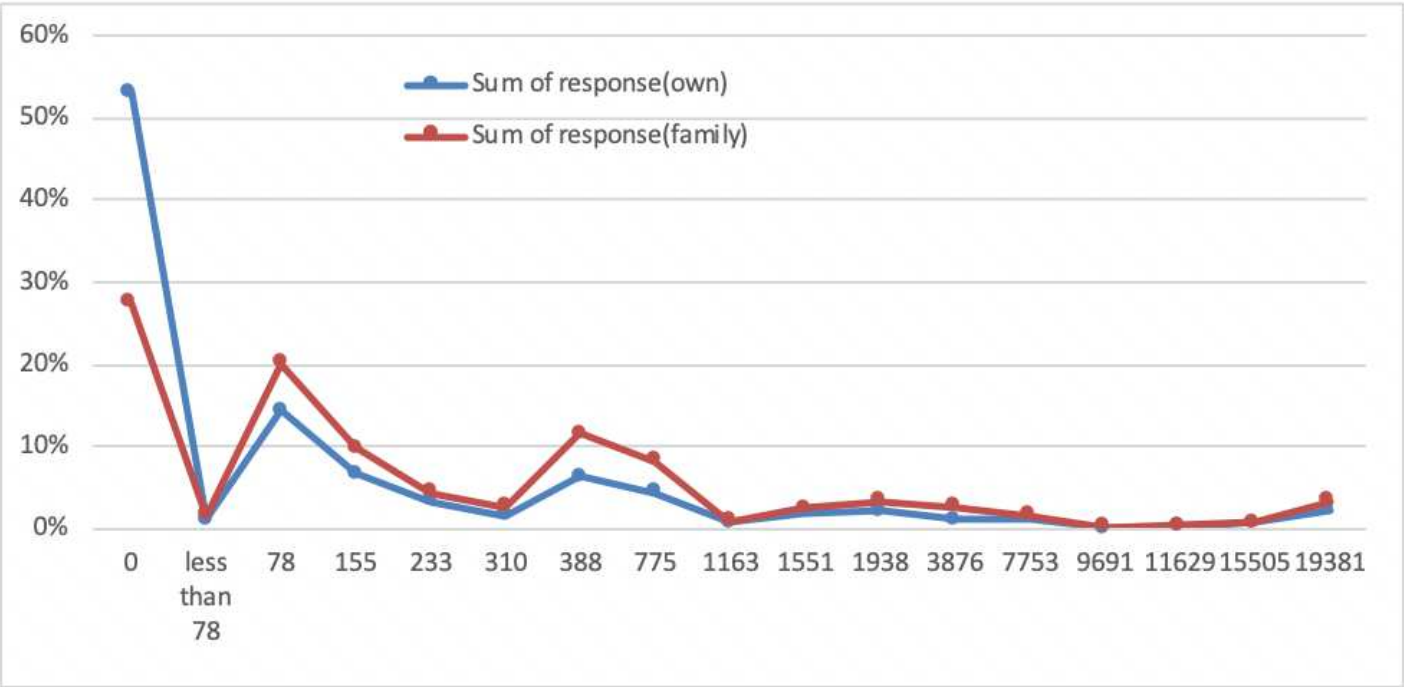
Figures

Figure 1

The rate of responses on each bid value for oneself and for a family member Note: The less than US$ 78, includes all WTP responses which respondents had positive WTP but indicated less than US$ 78.
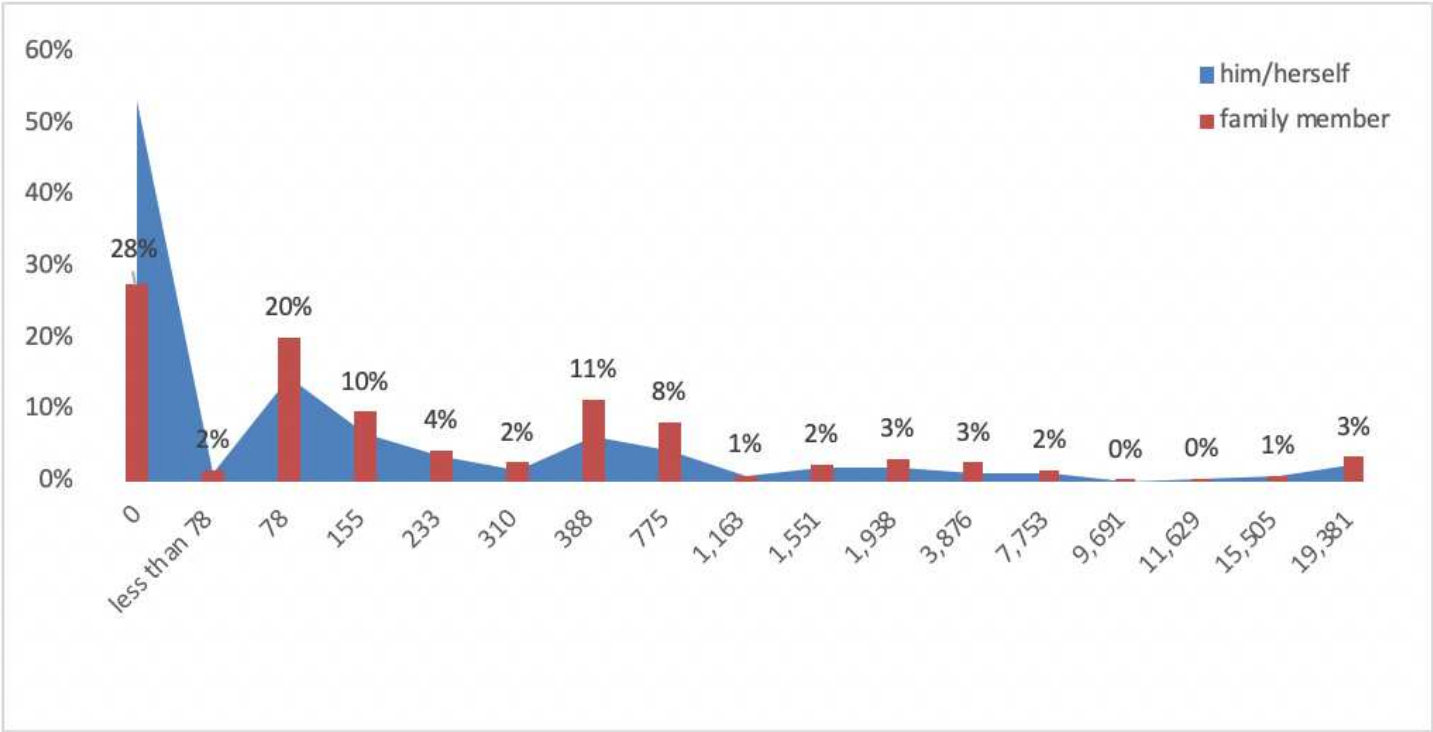
Figure 2

The stated WTP amount distribution of oneself and a family member Note: The less than US$ 78, includes all WTP responses which respondents had positive WTP but indicated less than US$ 78.