ScienceDirect

Contents lists available at sciencedirect.com
Journal homepage: www.elsevier.com/locate/jval

Preference-Based Assessments

Estimating the Willingness-to-Pay per Quality-Adjusted Life-Year to Aid Health Technology Assessment in India

Yashika Chugh, PhD, Gaurav Jyani, PhD, Sitanshu Sekhar Kar, MD, Binod Kumar Patro, MD, Mayur Trivedi, PhD, Sandra Albert, PhD, Swati Raman, PhD, Kavitha Rajsekar, PhD, Shankar Prinja, MD, on behalf of the India cost-effectiveness threshold (CET) estimation study group

ABSTRACT

Objectives: The study aimed to estimate the willingness to pay (WTP) for a quality-adjusted life-year (QALY) to help determine the threshold for cost-effectiveness in India. We also assessed the factors affecting WTP/QALY.

Methods: We used a multistage stratified random sampling strategy to select 5460 respondents across 6 Indian states. Participants were interviewed to gather household socioeconomic and demographic data, followed by assessments of health gains using time trade-off and WTP. Respondents were presented with 12 hypothetical health states to gauge health gains and their WTP to restore health. These values were combined to determine WTP per QALY using an aggregated approach. The health gains were discounted at 3%. Weighted estimates based on state, residence, gender, age, and education were computed. A mixed-effect regression model explored the relationship between socio-demographic variables and WTP/QALY.

Results: Based on 21 640 observations, we found that mean weighted WTP/QALY was estimated to be INR 2 12 307 (US$ 2535). Based on the different health states, the WTP/QALY ranged from INR 1 70 414 (US$ 2034) to INR 2 58 985 (US$ 3092). Age, gender, family size, education, marital status, occupation, presence of health insurance, consumption expenditure, and number of earning members in the household significantly impacted WTP per QALY.

Conclusions: To our knowledge, our study reports the first-ever estimate of WTP/QALY for the Indian population. The WTP/QALY ranges from 1 to 1.52 times the gross domestic product per capita. This could be considered as the cost-effectiveness threshold for health technology assessment in India.

Keywords: contingent valuation, cost-effectiveness threshold, health technology assessment, priority setting, willingness to pay.

VALUE HEALTH. 2026; 29(3):457–466

Highlights

- India's Health Technology Assessment (HTA) agency currently relies on the WHO-recommended threshold of one time the gross domestic product per capita to interpret cost-effectiveness, though its suitability for India remains uncertain. Generating local evidence is therefore essential, with considerations including affordability, fairness, ethical concerns, and others.
- This study provides the first empirical estimate of a willingness-to-pay (WTP)–based cost-effectiveness threshold (CET) for India, derived from 21 840 observations across six states. To examine how WTP varies with disease severity, respondents were randomly presented with 12 health states ranging from mild to severe.
- This study offers a valid estimate of the CET for HTA in India, which is vital for guiding policymakers in making effective resource allocation decisions.

Introduction

India has taken significant strides in instituting evidence-based policy making with the establishment of the Health Technology Assessment in India (HTAIn).[1-3] This initiative aims to provide credible evidence to support policy decisions. Accordingly, a key responsibility of HTAIn is to generate evidence on the cost-effectiveness of health interventions, aiding in resource allocation decisions for various user departments. These user departments include budget-holding and decision-making entities, such as the Ministry of Health and Family Welfare, state health departments, payer agencies, such as the National Health Authority, other social health insurance schemes, and regulatory bodies, such as the National Pharmaceutical Pricing Authority. More recently, HTAIn has expanded its scope to accept submissions from the private sector innovators and industry partners as well.

For evaluating cost-effectiveness, the incremental cost per quality-adjusted life-year (QALY) gained or the incremental cost-effectiveness ratio (ICER), is compared with a benchmark known as the cost-effectiveness threshold (CET). The WHO's gross domestic product (GDP)-based criteria (ie, 1-3 times the GDP per capita) were earlier recommended for CET interpretation in India's HTA guidelines.[4] However, uncertainty surrounds the estimation of this CET used to assess interventions under evaluation. Previous research has suggested that health opportunity costs for low-and-middle-income countries (LMICs) tend to be below the lower bound suggested by WHO of 1 × GDP per capita.[5] Moreover, recent WHO guidance emphasizes that these criteria are not strict decision rules but rather serve as guidance, suggesting a need to generate local evidence for determining the CET, as well as to consider affordability, fairness, and local context in addition to cost-effectiveness.[6]

There are 2 broad approaches to the valuation of CET measuring the societal monetary valuation of health gains, or assess the opportunity cost of current healthcare spending.[7,8] In the United Kingdom, ongoing debates question whether the £20 000 to £30 000 per QALY threshold used by the National Institute for Health and Care Excellence (NICE) remains appropriate, with criticisms highlighting its weak empirical basis and limited transparency.[9,10] Similarly, in the United States, where no formal CET exists, the Institute for Clinical and Economic Review applies informal benchmarks of \$100 000 to \$150 000 per QALY, although these have been criticized as arbitrary and inconsistently applied.[11-13]

For India, previous efforts have focused on estimating the health opportunity cost.[14-17] However, there are 2 limitations of this approach. First, these previous evaluations did not factor in the private health expenditure, which comprises nearly 52% of the total health expenditure in India,[18] leading to an underestimation of the estimated CET.[16,19] However, incorporating private healthcare spending poses several challenges in India because of the fragmented nature of the private sector. Moreover, a lack of centralized data systems further hinders access to reliable private sector expenditure and health outcome data. Second, current healthcare spending has been claimed to be inadequate, given the reported unmet need for healthcare.[20] In view of this contextual state in the journey toward Universal Health Coverage,[21] which India is in currently, it may not be fully appropriate to use the health opportunity cost of current spending to make decisions on choosing newer interventions to fund for, or choose strategies to expand the population coverage.

In view of this, the HTAIn commissioned this study with the primary goal of estimating the demand-side willingness to pay (WTP) per QALY gained in India—by directly eliciting societal preferences.[22] Additionally, the study aims to identify socio-demographic and socioeconomic factors affecting the WTP per QALY in India.

Methods

Sampling Approach

The study was conducted across 6 Indian states: Haryana, Uttar Pradesh, Gujarat, Meghalaya, Tamil Nadu, and Odisha; selected based on their income levels, health status, and geographical locations (Table 1). A sample of 5410 was estimated using a confidence interval statistic set at a 95% confidence level, a coefficient of variation fixed at 2, a design effect of 1.5, and aiming for a maximum fractional error in the mean of approximately 7%.[26] Additionally, accounting for a 15% nonresponse rate and incomplete interviews, a total of 902 interviews were conducted in each state.

A multistage stratified random sampling technique was used to select these respondents. The selection was made at 5 different levels, ie, the states, districts, primary sampling units (PSUs), households, and the individuals to be interviewed The details on the sampling process have been published elsewhere.[22]

Recording the Data

The interviews used a customized tool, developed specifically for this study, to ensure standardized WTP elicitation. This study aimed to determine individual WTP per QALY through face-to-face interviews using the computer-assisted personal interviewing technique. The interview structure encompassed 3 sections: health gain assessment, corresponding WTP determination, and a background questionnaire capturing socioeconomic and demographic details. The interview process involved (1) elicitation of self-reported health using EuroQol 5-Dimension 5-Level (EQ-5D-5L) and EuroQol Visual Analog Scale (EQ-VAS); (2) information regarding age, gender, and experience with severe illness; (3) guidance for conducting TTO valuation, exemplified with an illustration; (4) evaluating the utility of the respondent's current health using TTO; (5) assessing the utility of 4 hypothetical health conditions for each individual using TTO; (6) determining the corresponding WTP for treating the same hypothetical health conditions through card sorting; and (7) recording information on socio-demographic and socioeconomic characteristics of respondents. The EQ-5D-5L is a validated tool that captures health-related quality of life across 5 domains: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each domain has 5 levels of severity, and responses can be converted into a utility score using a country-specific value set.[27] The EQ-VAS allows individuals to rate their overall health on a scale from 0 (worst imaginable health) to 100 (best imaginable health), providing a simple, direct measure of self-perceived health.[27]

Each TTO involved presenting the participants with 2 distinct lives: life A, representing optimal health, and life B, representing their current health. We then gauged the difference between these lives in terms of the number of years individuals were willing to sacrifice to achieve optimal health.[28]

After evaluating the utility of the respondent's current health, they were presented with life A as their current state and life B in a predetermined hypothetical health condition. The utility of this predefined condition was assessed using the TTO experiment. To represent life B, we selected 6 health conditions, each with 2 severity levels, chosen for their ease of imagination by respondents, their ability to demonstrate health gains across various severity levels, and to ease differentiation by participants. These conditions encompassed allergy (mild and severe), joint pain (backache and multiple joint pains), blindness (night blindness and bilateral blindness), paralysis (monoplegia and paraplegia), depression (major depressive disorder and psychotic depression), and respiratory/lung disease (chronic obstructive pulmonary disease and advanced-stage lung cancer). The selection of health conditions was based on multiple considerations. First, a literature review identified conditions used by other countries for WTP elicitation in similar contexts. This was supplemented by the authors' judgment on how well the population would comprehend the conditions. Stakeholder consultations with the HTAIn Technical Appraisal Committee, which included clinicians, public health specialists, social scientists, ethicists, health economists, and program managers, also informed the choices. Lastly, the descriptions were revised based on feedback from the pilot study. Vignettes (see Appendix 1 in Supplemental Materials) describing these health states were developed for interviewer use in aiding respondents' comprehension. Four health conditions were randomly selected and presented to the respondents. A detailed account of the process used to estimate utility values is published elsewhere.[22]

The subsequent part of the interview involved evaluating the WTP for the previously assessed QALY gains, for which we used contingent valuation.[29] In our study, we utilized a card sorting method in which respondents were presented with random payment cards. They sorted these cards into categories: definite payment, definite nonpayment, and uncertainty regarding payment. Cards marked uncertain were reevaluated to categorize them as definite payments or nonpayment. The maximum value respondents were certain to pay and the minimum they were

Table 1. Country-level estimates on the indicators of income, health, and education (2020-2021) for the sampled states.

S. No.	Study sites	Per capita state domestic product (in INR)[23]	Infant mortality rate[24]	Literacy rate[25]
1	Uttar Pradesh	₹ 61 666	38	73
2	Meghalaya	₹ 84 638	29	75.5
3	Odisha	₹ 1 01 501	36	77.3
4	India	₹ 1 45 679	28	77.7
5	Tamil Nadu	₹ 2 12 174	13	82.9
6	Gujarat	₹ 2 12 821	23	82.4
7	Haryana	₹ 2 35 707	28	80.4

unwilling to pay were summarized. Respondents then stated their maximum WTP within this range through an open-ended response. The amounts on these cards were based on actual treatment costs for hypothetical health conditions and data from pilot test interviews. However, if respondents were willing to pay less than the minimum card price or more than the maximum price, their WTP amount was determined through open-ended questions. Reasons for refusal to pay were recorded if respondents indicated unwillingness to pay for treatment.

Additionally, the participants were interviewed regarding their demographic information, socioeconomic status, medical history, and other pertinent factors.

Quality Control

For standardized data collection, a standardized training and pilot testing process was followed. Initially, trainers underwent training and then conducted contingent valuation interviews with acquaintances for pilot testing. After 3 rounds of 10 interviews each, the trainers were certified for subsequent site-based trainings. Field staff were recruited locally to address linguistic diversity, with uniform training sessions led by common trainers and supported by local coinvestigators. This ensured consistent interpretation of health conditions and WTP across sites. To maintain uniformity across sites, stringent quality control (QC) measures were adopted, focusing on protocol compliance and interviewer effects. To assess interviewer effects, we examined TTO and WTP responses' distribution and the presence of response clustering. Second, interviews were marked as noncompliant if the assessment of current health utility took less than 120 seconds, if all 4 TTO tasks were completed in under 240 seconds, or if the card sorting tasks took less than 180 seconds in total. Each interviewer underwent 3 pilot rounds until protocol compliance was achieved, with investigators providing remote support and feedback. Persistent issues led to removal, whereas compliant interviewers proceeded to data collection under ongoing QC monitoring. The detailed QC process has been published elsewhere.[22]

Data Analysis

All interview data were compiled in Microsoft Excel and analyzed using IBM SPSS Statistics, version 21. To determine the WTP per QALY, responses from health gain and WTP assessments were combined. The interviews provided utility scores for each health state as rated by respondents. Converting this into health gain involved deducting the utility score from the respondent's valuation of their current health, measured before the valuation of the hypothetical health states. In rare cases (<5%) in which the respondents indicated that the hypothetical health state was better than their current health, despite it being a clearly impaired condition, we excluded those individuals from the final analysis. This was done to preserve the validity of the utility estimates and ensure that responses reflected an accurate trade-off assessment based on the intended health decrement.

To ascertain health gain in terms of QALYs, this value was multiplied by the respondent's remaining years of life, calculated by subtracting their age from their life expectancy. Age and gender-specific life expectancy estimates for India were derived from recent life tables.[30] From the study interviews, we acquired health gains (QALYs gained) and their corresponding WTP for each of the 21 640 observations. Furthermore, the health gains were discounted at a rate of 3% using the following formula:

$$Discounted\ QALYs = u * \sum_{t=1}^{L} \frac{1}{(1+r)^t} \tag{1}$$

In which, for each person, we have

- u = QALY gain per year (same each year)
- L = remaining life years
- r = discount rate (3% or 0.03)

Finally, these QALY gain and WTP estimates were combined to establish an average WTP/QALY using an aggregated approach.[31]

The WTP/QALY value was calculated with the following formula:

$$WTP\ per\ QALY = \frac{\sum_{i=1}^{21,640} WTP_i}{\sum_{i=1}^{21,640} Health\ gain_i} \tag{2}$$

Adjusting for Sample Characteristics

In our sample, to correct for any discrepancies between the sample and the population, sampling weights were calculated. The sampling weights were computed for each stratum and were calculated as the ratio of the population count to the sample count within that stratum. We computed the weights for key variables, including state, age, gender, area and education (see Appendix 2 in Supplemental Materials). These analytical weights were then applied to give more or less weight to each observation according to their relative representativeness in the population. The weight of an individual in a particular stratum is equal to the total known population size in that stratum divided by the sample size in that stratum.

If,

W_i = the poststratification weight for respondent i

N_h = known population size in stratum h

n_h = the sample size in stratum h

The poststratification weight, w_i for each respondent “i” in stratum “h” is calculated as follows:

$$W_i = N_h / n_h \quad (3)$$

In this study, we estimated weighted WTP per QALY based on state, area, gender, age categories and education profile using Census 2011 data.

Factors Affecting the WTP/QALY

Descriptive statistics were used to present the characteristics of respondents. A bivariate analysis was performed using an F-test and Student’s *t* test to assess respondent’s WTP per QALY (using individual ratios) based on their socio-demographic characteristics, such as age, consumption expenditure, total family members, education level, occupation, religion, place of residence, and marital status. To assess the relationship between socio-demographic factors and WTP per QALY, this study applied a mixed-effect regression model using Eq. (3). Given participants are organized across multiple levels, with individuals nested within larger contextual or aggregate units (such as PSU, district, and state), this introduces heterogeneity that can influence variations across study sites (ie, states will have an impact on the WTP per QALY estimates). To address this, a mixed effects regression model was used, recognizing that the observed variations stem from more than just the estimated variance alone. Therefore, the value of WTP/QALY is modelled with the following mixed effects regression model:

$$Log\ WTP/QALY_i = \beta_0 + \sum_{k=1}^{p} \beta_k X_{ik} + \mu_i + \epsilon_i \quad \ldots(4)$$

in which β_0 is the constant; X_{ik} is the k^{th} characteristic of i^{th} individual, which is used to estimate $WTP/QALY_i$,β_1, ….,β_p are the coefficients of the regression, which capture the fixed effects of the individual characteristics on $WTP/QALY_i$; μ_i is a random effect term associated with i^{th} individual, which takes into account the nonobserved effects of states that influence $WTP/QALY_i$. Each random effect is independent, with a mean of 0 and a variance of σ_u^2; ϵ_i,i=1,…,m, are the estimation errors; they are independent and of null mean and variance equal to $\sigma^2_{WTP/QALY_i}$. Before applying the mixed-effect regression model, its assumptions such as linearity and normality of error term were checked. The log transformation of continuous variables was done to address skewness in the data. Nominal variables were transformed into dummy variables. Normality of error term has been checked using “Kolmogorov Smirnov Test” with insignificant *P* values as .704.

Ethical Considerations

Ethical clearance for the study was granted by the Institutional Ethics Committee of the Postgraduate Institute of Medical Education and Research, Chandigarh, India, under the reference number PGI/IEC/2021/001452. All participants were recruited after obtaining written informed consent.

Results

Sample Characteristics

A total of 5708 interviews were conducted comprising of 22 838 observations. Out of the total 5708 interviews conducted, some were excluded from analysis due to various reasons: 33 interviews were dropped because they did not follow the established protocols, 143 were discarded because of software errors, and 72 interviews lacked essential information. As a result, 5460 interviews (21 840 observations) were included for analysis. The information in Table 2 provides a summary of the respondents’ profiles and their associated WTP/QALY metrics across various categories.

Assessment of Utility Values

We calculated the overall reported utility value for each health condition in India, as well as across the 6 states. We found that the highest utility value was reported for mild allergy (0.846 + 0.134). Conversely, the lowest utility value of 0.156 + 0.156 was reported for advanced-stage lung cancer (Fig. 1). Across all health conditions, we consistently observed a pattern in which the milder health states reported higher utility values compared with their severe counterparts.

Upon examining the reported utility values across different states, we noted an insignificant difference in the utility values of the milder health states for each health condition. However, there was a noticeable gradient across the severe health states. Specifically, Haryana reported the lowest utility values, whereas Tamil Nadu reported the highest utility values. This trend remained consistent across all severe health states. Detailed state-wise utility values are provided in Appendix 3 in Supplemental Materials.

Assessment of Willingness to Pay

The WTP results demonstrated a consistent pattern between the mild and severe health states across all pairs of health conditions (Fig. 2). Respondents generally expressed lower WTP to avoid mild health conditions compared with their severe counterparts.

Specifically, the WTP estimates for mild health states ranged from INR 612 123 (US$ 7331) for mild allergy to INR 1 341 868 (US $ 16 070) for chronic obstructive pulmonary disease. Conversely, for severe health states, the WTP spanned from INR 2 793 432 (US$ 33 454) for multiple joint pains to INR 6 390 298 (US$ 76 531) for advanced-stage lung cancer.

In examining the WTP across different Indian states for various health conditions, notably higher values were consistently reported for Haryana compared with other states across all health conditions (see Appendix 3 in Supplemental Materials). This observation persisted across the entire range of health conditions assessed in the study.

Assessment of Willingness to Pay per QALY

The estimates for health gain and WTP were combined to finally arrive at aggregated WTP per QALY. When examining the mean WTP per QALY for individual health conditions (Fig. 3), the estimates ranged from INR 1 70 414 (US$ 2034) for mild anxiety to INR 2 58 985 (US$ 3092) for lung cancer. Although individual health conditions reported significant differences in WTP values, the differences in WTP per QALY did not.

The mean unweighted estimate for India’s WTP per QALY was INR 3 29 301 (US$ 3931). When looking at WTP/QALY by states, akin to WTP estimates, Haryana consistently reported higher WTP/QALY estimates compared with other states (see Appendix 3 in Supplemental Materials). After adjustments using sample weights, the WTP/QALY for India was estimated at INR 212 307

Table 2. Sociodemographic characteristics and the corresponding willingness to pay (WTP) per quality adjusted life year (QALY).

Variables		*N* (%)	Mean WTP/QALY	Standard deviation	95% Confidence interval		*P* value
					Lower bound	Upper bound	
State	Haryana	998 (7.8%)	10 50 223	62 68 255	6 60 831	14 39 615	<.01
	Gujarat	1816 (14.2%)	1 63 415	3 88 040	1 45 558	1 81 271	
	Meghalaya	58 (0.5%)	1 33 045	2 57 529	65 183	2 00 907	
	Odisha	1256 (9.8%)	3 19 407	8 80 802	2 70 646	3 68 168	
	Tamil Nadu	2859 (22.4%)	1 78 909	2 84 265	1 68 484	1 89 333	
	Uttar Pradesh	5767 (45.2%)	2 35 515	4 82 138	2 23 069	2 47 961	
Age	19-29	3258 (25.5%)	2 01 377	7 25 412	1 76 459	2 26 294	.001
	30-49	6839 (53.6%)	2 80 225	21 39 296	2 29 513	3 30 936	
	50-69	2548 (20%)	3 97 784	19 37 435	3 22 514	4 73 053	
	70+	109 (0.9%)	3 42 441	5 03 616	2 46 960	4 37 922	
Gender	Male	8065 (63.2%)	3 44 078	22 37 181	2 95 247	3 92 910	<.01
	Female	4688 (36.8%)	1 80 910	6 86 404	1 61 257	2 00 563	
Area	Urban	5359 (42%)	2 69 621	10 79 785	2 40 704	2 98 537	.401
	Rural	7395 (58%)	2 94 587	22 18 792	2 44 009	3 45 166	
Education	Illiterate	497 (3.9%)	1 05 873	1 76 120	90 346	1 21 399	<.01
	Primary/middle	1341 (10.5%)	1 18 108	2 46 037	1 04 928	1 31 289	
	Matric/senior secondary	3259 (25.6%)	1 99 409	14 90 282	1 48 227	2 50 590	
	Graduate and above	7657 (60%)	3 60 779	21 44 119	3 12 746	4 08 812	
Religion	Hindu	11 499 (90.2%)	2 89 114	19 02 640	2 54 336	3 23 893	.165
	Muslim	465 (3.6%)	1 56 300	2 21 770	1 36 086	1 76 514	
	Christian	432 (3.4%)	1 88 074	3 17 675	1 58 018	2 18 130	
	Other	358 (2.8%)	4 04 572	16 24 112	2 35 784	5 73 359	
Marital status	Never married	2439 (19.1%)	2 73 051	15 12 101	2 13 015	3 33 087	.853
	Married	9856 (77.3%)	2 89 137	19 34 496	2 50 942	3 27 333	
	Widow/separated	412 (3.2%)	2 48 431	6 80 552	1 82 510	3 14 351	
Health insurance	Government funded	1581 (12.4%)	2 85 218	10 15 501	2 35 125	3 35 310	<.01
	Private health insurance	3643 (28.6%)	4 85 526	33 04 876	3 78 167	5 92 884	
	None	7363 (57.7%)	1 86 087	3 71 152	1 77 608	1 94 566	
Consumption expenditure	Poorest	2579 (20.2%)	1 05 551	1 89 017	98 253	1 12 849	<.01
	Poor	4190 (32.9%)	1 70 843	3 31 673	1 60 797	1 80 889	
	Middle	1658 (13%)	2 54 627	4 56 341	2 32 646	2 76 608	
	Rich	2658 (20.8%)	3 07 283	5 46 576	2 86 495	3 28 070	
	Richest	1669 (13.1%)	8 36 718	49 16 224	6 00 675	10 72 761	
Type of family	Nuclear	4991 (39.1%)	2 61 366	11 71 305	2 28 861	2 93 870	.199
	Joint	7743 (60.7%)	2 99 300	21 50 367	2 51 396	3 47 205	
Earning members	Single	4357 (34.2%)	2 24 260	5 72 860	2 07 246	2 41 273	<.01
	Multiple	8393 (65.8%)	3 15 285	22 15 665	2 67 876	3 62 694	
Occupation	Unemployed	3302 (25.9%)	1 83 480	5 68 303	1 64 089	2 02 872	.001
	Employed in public sector	1118 (8.8%)	3 91 370	8 38 395	3 42 172	4 40 567	
	Employed in private sector	7002 (54.9%)	3 19 856	23 80 221	2 64 096	3 75 616	
	Retired/other	1234 (9.7%)	2 61 227	9 31 031	2 09 223	3 13 232	

QALY indicates quality-adjusted life-year; WTP, willingness to pay.

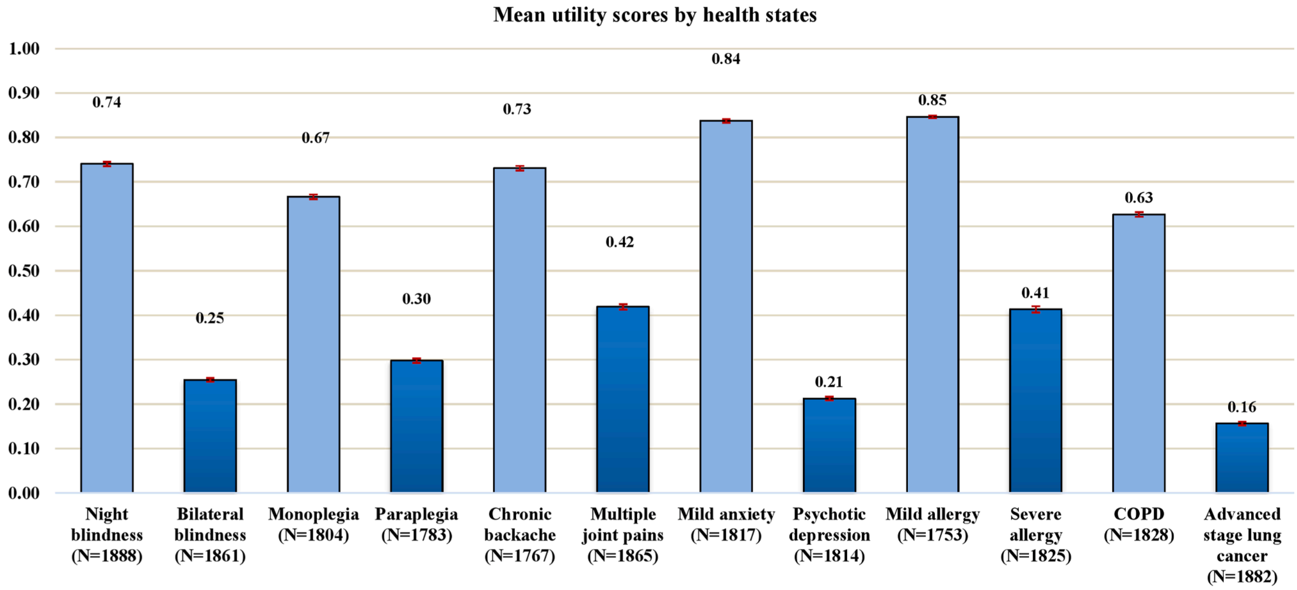
(US$ 2535). Furthermore, trimming the top 1% wealthiest individuals yielded an estimate of INR 194 660 (US$ 2323).

Variables such as age, sex, education level, marital status, occupation, health insurance status, consumption expenditure, total number of family members, and number of earning members of the household, were found to have a statistically significant impact on the WTP per QALY (Table 3). We observed that individuals with higher socioeconomic status, including those with higher consumption expenditure and education levels, reported a higher WTP per QALY. In addition to other factors, respondents employed in the private sector and possessing private health insurance also indicated a higher WTP per QALY.

Discussion

This study aimed to provide an estimate of the societal WTP for a QALY gained in India. Our estimate of untrimmed and trimmed WTP/QALY gained stands at 1.24 and 1 times the GDP per capita (the year 2022-2023), respectively. A recent systematic review of 20 publications from 17 countries, comparing WTP estimates from different country settings to GDP per capita, shows that the mean WTP/QALY values for the majority of countries (82.4%) fell within the range of 0.5 to 1.5 times GDP per capita.[32] The comparison with international literature demonstrates that our findings are similar to what has been reported by other countries when compared with the GDP figure.

Figure 1. Utility scores (mean and standard error) by health conditions as reported by Indian population.



There have been several efforts to estimate the CET for India from a supply-side perspective.[14,16,17] This approach evaluates CET based on current healthcare spending, providing an estimate of the current health system efficiency. It is important to recognize that both supply- and demand-side approaches are complementary, not opposing: the former reflects system efficiencies, whereas the latter captures population preferences. Bridging these perspectives is essential for informed healthcare decision making. Thus, a possible implication could be that for interventions for which the ICER is below the supply-side estimate of the CET, these should be included in the health benefits package without requiring additional budget increases. Conversely, for interventions with an ICER that exceeds the supply-side CET but falls below the demand-side WTP/QALY, inclusion in the health benefits package can be justified with additional funding. Finally, interventions with an ICER exceeding the WTP/QALY may not be justifiable purely on efficiency grounds. However, it is crucial to evaluate all interventions through the lenses of equity, fairness, ethical considerations, and budget impact.

The findings of this study also highlight significant variation in state-specific WTP/QALY, with Haryana reporting the highest value and Gujarat the lowest. Given India's federal structure and the decentralized nature of healthcare decision making—where

Figure 2. Mean willingness to pay by health conditions as reported by Indian population (in USD 2022).

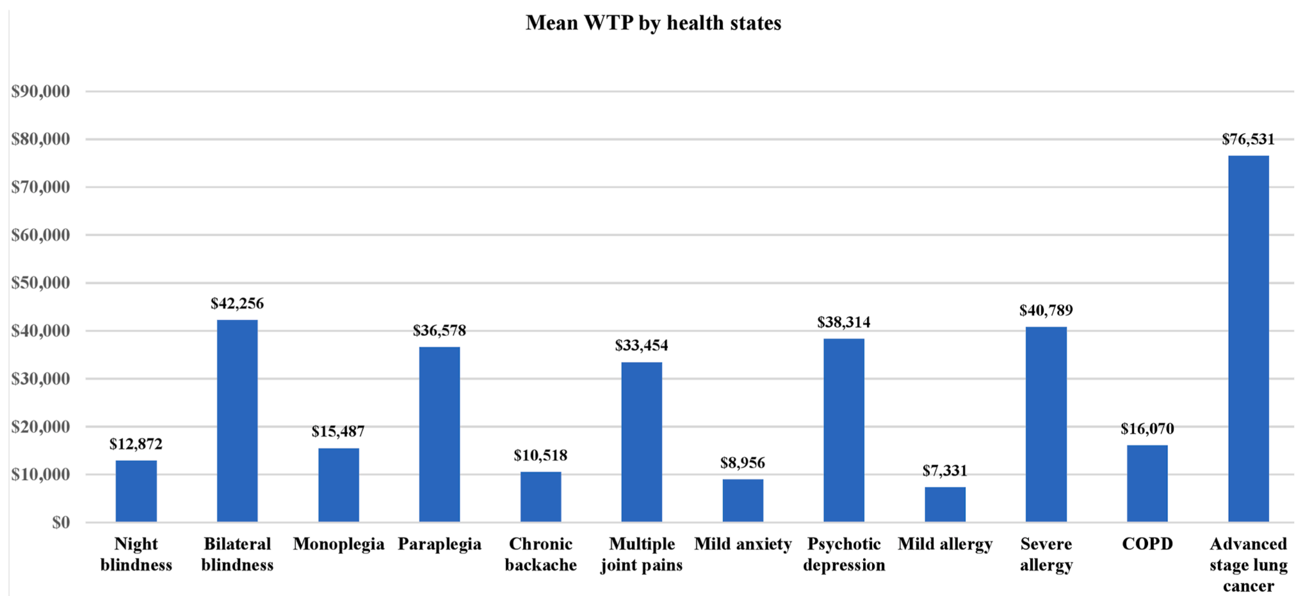
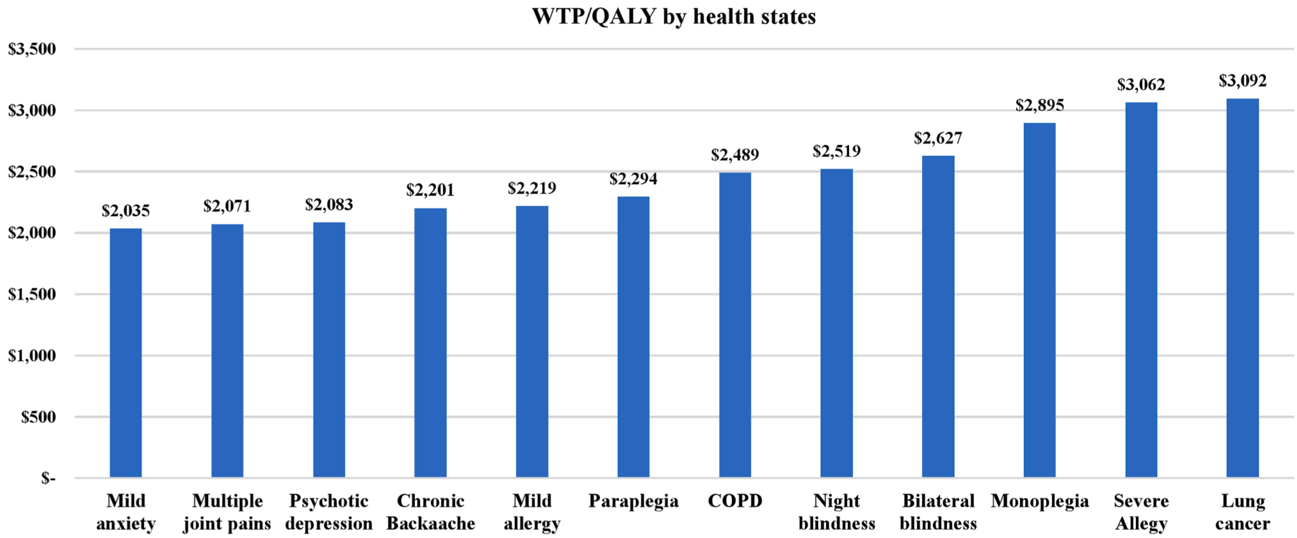


Figure 3. Mean willingness to pay per quality-adjusted life-year by health conditions as reported by the Indian population (in USD 2022).



approximately 60% of public health expenditure is managed by state governments—this complex landscape of health financing can influence the estimation of CET.[18] Although many decisions regarding the inclusion and exclusion of interventions in the benefits package are made centrally, a single CET may be appropriate for short-term applications. However, numerous decisions, such as the expansion of insurance coverage and the services offered under schemes such as Ayushman Bharat Pradhan Mantri Jan Arogya Yojana, are made at the state level. Additionally, state medical service corporations are responsible for negotiating drug prices, further emphasizing the importance of local decision making. The distribution of public and private spending, along with the respective efficiencies in financing different services, varies across states and shapes the healthcare interventions implemented in each region. In addition, the distribution of public and private spending and their respective efficiencies in financing differing services shape interventions in each state.[33,34] As a result, state-specific CETs may diverge from national estimates, suggesting that incorporating state-specific thresholds could be an important consideration for the future. However, although tackling regional disparities is essential, equally critical is designing practical funding mechanisms that facilitate equitable resource allocation, in which one may create perverse incentives if the distribution of public funds is skewed to the wealthier states. Therefore, such decisions need to be based on extensive consultative processes. Second, it is important to further explore the fiscal implications of such funding arrangements and its impact on equity.

Moving forward, there is a growing recognition of the need for higher thresholds that adequately reflect the complexity and severity of certain health conditions given the diverse nature of diseases. Several countries adjust thresholds using modifiers linked to disease severity, innovation, or rarity (see Appendix 4 in Supplemental Materials.[35] For example, England and Wales apply higher thresholds for end-of-life, ultrarare, and highly specialized technologies, with values ranging up to nearly 4 times GDP per capita.[35] Similarly, Japan allows higher thresholds for rare, pediatric, and oncology interventions, whereas Ireland and The Netherlands recognize ultrarare conditions and severity as valid modifiers. These international experiences demonstrate that thresholds can range between 1.4- and 8-times GDP per capita depending on the context.[35] Our study also provides estimates of WTP/QALY across a spectrum of health conditions ranging from 1 to 1.5 times the GDP per capita. Given the findings, for India, to balance efficiency with considerations of severity, innovation, and equity, one option could be to consider a CET of 1.5 times GDP per capita for those interventions targeting very severe, end-of-life, or rare conditions or involving high levels of innovation. However, these adjustments should be applied through a transparent, stakeholder-driven deliberative process, recognizing that CETs are guiding benchmarks rather than rigid rules, and they must be interpreted alongside concerns of equity, financial protection, and system-wide impact.

We also highlight that we report the mean WTP/QALY based on individual valuations of personal health gains, averaged across a representative sample to approximate societal preferences. This differs from a normative notion of "societal WTP," which would require citizens to value gains for others—a cognitively demanding and ethically complex task.[36,37] Several high-income countries have elicited WTP per QALY from a societal perspective, reflecting preferences for collectively financed health gains. In The Netherlands, estimates range from €52 000 to €83 000 per QALY, whereas in Switzerland societal WTP—particularly for children and vulnerable groups—exceeds CHF 200 000 per QALY.[38,39] The United Kingdom's NICE threshold, although not directly elicited, is viewed as an implicit societal value shaped by social preferences and political acceptability.[40] At the same time, eliciting WTP from individuals remains valuable for aligning resource allocation with people's aspirations for healthcare.

The determination of WTP per QALY improvements results from a multifaceted interplay of social, cultural, and contextual factors, exhibiting significant variation across populations and regions.[41,42] Our findings show higher WTP among individuals with greater socioeconomic status—marked by higher consumption expenditure, education, private sector employment, and private insurance—suggesting that affluence, risk aversion, and ability to pay strongly shape preferences for health gains.[36,43–45] Societal and cultural norms also influence WTP, with

Table 3. Factors affecting willingness to pay (WTP) per quality-adjusted life-year (QALY) using the mixed regression model.

S. No.	Variables	Categories	Coefficient	Standard error	$P > z$	[95% confidence interval]	
1		Constant	9.822	0.419	.000	9.001	10.644
2	Age (reference: 19-29)	30-49	0.225	0.044	.000	0.138	0.312
		50-69	0.616	0.083	.000	0.454	0.779
		70+	0.628	0.106	.000	0.421	0.836
3	Gender (reference: male)	Female	−00.211	0.059	.000	−0.327	−0.096
4	Education (reference: illiterate)	Primary/middle	−0.027	0.079	.737	−0.181	0.128
		Matric/senior secondary	0.250	0.180	.166	−0.104	0.603
		Graduate and above	0.563	0.145	.000	0.278	0.848
5	Occupation (reference: unemployed)	Employed in public sector	0.285	0.075	.000	0.138	0.432
		Employed in private sector	0.099	0.038	.009	0.025	0.174
		Retired/other	0.200	0.106	.060	−0.008	0.408
6	Health insurance (reference: none)	Government funded	−0.138	0.164	.400	−0.460	0.183
		Private health insurance	0.259	0.082	.002	0.099	0.420
7	Income group (reference: poorest)	Poor	0.438	0.114	.000	0.214	0.661
		Middle	0.796	0.131	.000	0.540	1.052
		Rich	0.893	0.229	.000	0.445	1.341
		Richest	1.195	0.397	.003	0.418	1.972
8	Earning member (reference: single)	Multiple	−0.106	0.051	.036	−0.206	−0.007
9	Experience of friends/family with illnesses described in the survey (reference: none)	Yes	−0.046	0.066	.488	−0.175	0.083
		Multiple	0.133	0.088	.129	−0.039	0.305
10	I can't continue to enjoy my life.	Yes	−0.058	0.108	.588	−0.270	0.153
11	I will suffer from the illness.	Yes	0.176	0.108	.104	−0.036	0.387
12	can't achieve my plan for future.	Yes	0.117	0.058	.043	0.004	0.231
13	I don't have access to treatment	Yes	0.172	0.155	.268	−0.132	0.475
14	I can't afford to pay for my treatment	Yes	−0.307	0.124	.014	−0.550	−0.063
15	I will become a burden on my family and friends.	Yes	0.011	0.016	.464	−0.019	0.042
16	Preference for spending on health (reference: value prevention more)	Value treatment more than prevention	0.243	0.101	.016	0.045	0.441
		Would pay anyways	0.282	0.046	.000	0.193	0.372
		Difficult to answer	−0.120	0.103	.243	−0.322	0.082
17	Preference for spending on health (reference: will pay only if cure is certain)	Will pay whether treatment results in cure or not	0.174	0.062	.005	0.053	0.296
		Difficult to answer	0.205	0.135	.130	−0.060	0.470
	AIC			40 514.53			
	BIC			40 776.39			
	RMSE			1.410			
	MAE			1.077			

AIC indicates Akaike information criterion, BIC, Bayesian information criterion; MAE, mean absolute error; RMSE, root mean squared error.

variations across regions and healthcare contexts.[41,42,46] Community norms, cultural beliefs, and life experiences deeply shape how QALY gains are valued, whereas contextual factors, such as healthcare availability, insurance coverage, and governmental policies, further shape WTP decisions.[47-49]

These aspects raise 3 critical areas for further exploration: (1) a deeper exploration of how social, cultural, and contextual factors affect WTP assessment; (2) the estimation of state-specific thresholds considering the variations in socioeconomic and health statuses; and (3) the need to dynamically assess CET once every 3 to 5 years. Finally, further exploration of the effect of methodological choices on the CET also needs to be explored.

This study's threshold, drawn from 21 840 WTP per QALY observations from 6 states of India, is the most comprehensive study conducted to date and has several methodological strengths. Our interview tool includes 12 health states, randomly presented, covering mild to severe conditions to understand how WTP changes with severity. First, the choice of time horizon significantly affects WTP estimation—too short underestimates and too long overestimates. Moreover, there exists huge variation over the choice of appropriate time horizon for the assessment of WTP.[50-53] To tackle this, we extrapolated health gains for an individual's remaining life based on age and life expectancy. Second, to assess utility gain, we first measured individuals' current health utility, followed by the utility of the diseased health state. This approach avoids assuming a return to perfect health, which would underestimate WTP elicited only to treat the explained health state. Finally, we opted to describe various health conditions, rather than using EQ-5D states because it is easier for the Indian population, especially the rural majority, to imagine and assess their WTP for treatment.[51,52,54,55] We would also like to mention that for calculating the mean WTP per QALY, weights were estimated based on state, area, gender, age categories and education profile using Census 2011 data. Although census projections were available for the study year (2021), it did not have information on the education profile. Therefore, we used census 2011 data calculating the weighted WTP/QALY.

Conclusions

CETs play a pivotal role in shaping the healthcare landscape by promoting evidence-based and transparent decision making, ensuring value for money. Empirically estimated thresholds can minimize inefficiencies, support fairer price negotiations, and optimize resource use. Given our findings, a gradient ranging from 1.0 to 1.5 times GDP per capita could be considered, with higher thresholds applied for interventions addressing very severe conditions or high levels of innovation.

More importantly, CETs are not rigid cutoffs but guiding benchmarks, with final decisions also reflecting budget impact, feasibility, ethical considerations, equity, and out-of-pocket expenditures. Nonetheless, incorporating thresholds mitigates the influence of stakeholders with potential conflicts of interest and ensures that decisions are rooted in evidence rather than subjective deliberation alone. Thus, although CET is one of many factors, it is essential for guiding fair, transparent, and informed healthcare decisions.

Author Disclosures

Author disclosure forms can be accessed below in the Supplemental Material section.

Supplemental Material

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.jval.2025.10.007.

Article and Author Information

Accepted for Publication: October 14, 2025

Published Online: November 21, 2025

doi: https://doi.org/10.1016/j.jval.2025.10.007

Author Affiliations: Department of Community Medicine & School of Public Health, Postgraduate Institute of Medical Education and Research, Chandigarh, India (Chugh, Jyani, Prinja); Department of Preventive and Social Medicine, Jawaharlal Institute of Postgraduate Medical Education & Research, Puducherry, India (Kar); Department of Community Medicine and Family Medicine, All India Institute of Medical Sciences, Bhubaneshwar, Odisha, India (Patro); Indian Institute of Public Health Gandhinagar, Gujarat, India (Trivedi); Indian Institute of Public Health Shillong, Meghalaya, India (Albert); Academy of Management Studies, Lucknow, Uttar Pradesh, India (Raman); Department of Health Research, Ministry of Health and Family Welfare, New Delhi, India (Rajsekar).

Correspondence: Shankar Prinja, MD, Department of Community Medicine and School of Public Health, Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh, India. Email: shankarprinja@gmail.com

Authorship Confirmation: All authors certify that they meet the ICMJE criteria for authorship.

Collaborators: India cost-effectiveness threshold (CET) estimation study group: Aarti Goyal, PhD (Department of Community Medicine and School of Public Health, Postgraduate Institute of Medical Education and Research, Chandigarh, India), Prakash Singh, MPH (Department of Community Medicine and School of Public Health, Postgraduate Institute of Medical Education and Research, Chandigarh, India), PVM Lakshmi, MD (Department of Community Medicine and School of Public Health, Postgraduate Institute of Medical Education and Research, Chandigarh, India), Cam Donaldson, PhD (Yunus Centre for Social Business and Health, Glasgow Caledonian University, Glasgow, Scotland, United Kingdom).

Funding/Support: The study is funded by the Department of Health Research, Ministry of Health and Family Welfare, Government of India vide grant number F.NO.T.11011/02/2017-HR (Part-1)/3176774 and F. No.T.11011/05/2024-HTA/ (FTS NO. 8300276).

Role of the Funder/Sponsor: The funder had no role in the design, conduct, preparation of the manuscript, or decision to publish this study.

Acknowledgment: The authors sincerely acknowledge the India CET estimation Study Group for their collective contributions that were instrumental to this work. The sustained commitment of the group played a vital role in bringing this study to fruition.

The authors also gratefully acknowledge the valuable inputs of the members of the technical appraisal committee, HTAIn, Department of Health Research, Ministry of Health and Family Welfare, Government of India on the research protocol and outcome report of the study. The authors are also grateful to Prof Rachel Baker, Director of the Yunus Centre for Social Business and Health, Glasgow Caledonian University, Glasgow, Scotland, United Kingdom for her initial input on the analytical approach.

REFERENCES

1. Downey L, Mehndiratta A, Grover A, et al. Institutionalising health technology assessment: establishing the Medical Technology Assessment Board in India. *BMJ Glob Health*. 2017;2(2):e000259.
2. Prinja S, Downey LE, Gauba VK, Swaminathan S. Health technology assessment for policy making in India: current scenario and way forward. *Pharmacoecon Open*. 2018;2(1):1–3.
3. Kumar M, Taylor FC, Chokshi M, et al. Health technology assessment in india: the potential for improved healthcare decision-making. *Natl Med J India*. 2014;27:149–163.
4. Department of Health Research, Ministry of Health and Family Welfare, Government of India. *Health Technology Assessment in India: A Manual*. New Delhi: Department of Health Research; 2018.
5. Ochalek JM, Lomas J, Claxton KP. *Cost per DALY Averted Thresholds for Low- and Middle-Income Countries: Evidence From Cross Country Data. CHE Research Paper*122. York, UK: Centre for Health Economics, University of York; 2015:1–50.
6. Marseille E, Larson B, Kazi D, Kahn J, Rosen S. Thresholds for the cost–effectiveness of interventions: alternative approaches. *Bull World Health Organ*. 2014;93(2):118–124.
7. Bertram MY, Lauer JA, De Joncheere K, et al. Cost–effectiveness thresholds: pros and cons. *Bull World Health Organ*. 2016;94(12):924.
8. Baker R, Chilton S, Donaldson C, et al. Searchers versus surveyors in estimating the monetary value of a QALY: resolving a nasty dilemma for NICE. *Health Econ Policy Law*. 2011;6(4):435–447.
9. Claxton K, Martin S, Soares M, et al. Methods for the estimation of the NICE cost-effectiveness threshold. *Health Technol Assess*. 2015;19(14):1–504.
10. Culyer AJ. Cost-effectiveness thresholds in health care: a bookshelf guide to their meaning and use. *Health Econ Policy Law*. 2016;11(4):415–432.
11. Neumann PJ, Cohen JT, Weinstein MC. Updating cost-effectiveness — the curious resilience of the $50,000-per-QALY threshold. *N Engl J Med*. 2014;371(9):796–797.
12. Pearson SD, Bach PB. How Medicare could use comparative effectiveness research in deciding on new coverage and reimbursement. *Health Aff (Millwood)*. 2010;29(10):1796–1804.
13. Institute for Clinical and Economic (ICER). Webinar series: perspectives on U.S. cost-effectiveness thresholds. https://icer.org/wp-content/uploads/2023/08/ICER_2019_Perspectives-on-Cost-Effectiveness-Threshold-Ranges.pdf; 2019. Accessed June 17, 2025.
14. Pichon-Riviere A, Drummond M, Palacios A, Garcia-Marti S, Augustovski F. Determining the efficiency path to universal health coverage: cost-effectiveness thresholds for 174 countries based on growth in life expectancy and health expenditures. *Lancet Glob Health*. 2023;11(6):e833–e842.

15. Ochalek J, Lomas J. Reflecting the health opportunity costs of funding decisions within value frameworks: initial estimates and the need for further research. *Clin Ther*. 2020;42(1):44–59.
16. Ochalek JM, Asaria M, Chuar PF, Lomas JR, Mazumdar S, Claxton KP. Assessing health opportunity costs for the Indian health care systems. https://ideas.repec.org/p/chy/respap/161cherp.html. Accessed December 15, 2023.
17. Woods B, Revill P, Sculpher M, Claxton K. Country-level cost-effectiveness thresholds: initial estimates and the need for further research. *Value Health*. 2016;19(8):929–935.
18. National Health Systems Resource Centre (NHSRC). *National health accounts estimates for India 2019-20*. New Delhi: Ministry of Health and Family Welfare, Government of India; 2023. https://nhsrcindia.org/sites/default/files/2023-04/National%20Health%20Accounts-2019-20.pdf. Accessed September 10, 2024.
19. Prinja S, Sundararaman T, Muraleedharan VR. Cost-effectiveness threshold and health opportunity cost. *Econ Pol Wkly*. 2020;55(2):19.
20. National Sample Survey Organisation. *(2017–18).* Social Consumption and Health in India -NSS 75th Round, 2017-18 *New Delhi: Ministry of Statistics and Programme Implementation*. Government of India; 2019.
21. World Health Organization. *Annual Report on Monitoring Progress on UHC and Health-Related SDGs*. Geneva: World Health Organization. Regional Office for South-East Asia; 2020.
22. Chugh Y, Jyani G, Trivedi M, et al. Protocol for estimating the willingness-to-pay-based value for a quality-adjusted life year to aid health technology assessment in India: a cross-sectional study. *BMJ Open*. 2023;13(2):e065591.
23. Reserve Bank of India. Handbook of Statistics on the Indian Economy 2019-20. [Internet] New Delhi: Reserve Bank of India. [Cited on 4 August 2023]. https://www .rbi.org.in/Scripts /AnnualPublications.aspx? head=Handbook+of+Statistics+on+Indian+States. Accessed November 17, 2025.
24. Registrar General and Census Commissioner of India. *Estimates of Mortallity Indiacators*. New Delhi: Vital statistics division, Ministry of Home Affairs, Government of India; 2020 [Cited on 04 August 2023]. https://censusindia.gov.in/nada/index.php/catalog/42687. Accessed November 17, 2025.
25. Ministry of Statistics & Programme Implementation. *Annual Report – Periodic Labour Force Survey (PLFS) July 2022–June 2023*. New Delhi: MoSPI; 2023. https://www.mospi.gov.in/sites/default/files/publication_reports/AR_PLFS_2022_23N.pdf. Accessed December 15, 2024.
26. Vaughan WJ, Russell CS, Darling AH. *Determining the Optimal Sample Size for Contingent Valuation Surveys*. Tennessee: Department of Economics, Vanderbilt University; 2000.
27. Rabin R, de Charro F. EQ-5D: a measure of health status from the EuroQol Group. *Ann Med*. 2001;33(5):337–343.
28. Oppe M, Rand-Hendriksen K, Shah K, Ramos-Goñi JM, Luo N. EuroQol protocols for time trade-off valuation of health outcomes. *Pharmacoeconomics*. 2016;34(10):993–1004.
29. Mitchell RC, Carson RT. *Using Surveys to Value Public Goods: the Contingent Valuation Method*. Washington DC: resources for the future; 1989.
30. National Commission on Population, Ministry of Health and Family Welfare, Government of India. Report of the Technical Group on Population. Projections.https://nhm.gov.in/New_Updates_2018/Report_Population_Projection_2019.pdf; 2019. Accessed July 12, 2024.
31. Baker R, Bateman I, Donaldson C, et al. Weighting and valuing quality-adjusted life-years using stated preference methods: preliminary results from the Social Value of a QALY project. *Health Technol Assess*. 2010;14(27):1–162.
32. Iino H, Hashiguchi M, Hori S. Estimating the range of incremental cost-effectiveness thresholds for healthcare based on willingness to pay and GDP per capita: a systematic review. *PLOS One*. 2022;17(4):e0266934.
33. Statista. India - States With Highest Public Health Expenditure 2018. https://www.statista.com/statistics/685200/india-highest-public-health-expenditure-by-state/; 2023. Accessed December 17, 2023.
34. Ram H. Public and Private Divide in Health Care Spending in India: What Factors Explains the Gap? New Delhi: Munich Personal RePEc Archive (MPRA).
35. Zhang K, Garau M. *International cost-effectiveness thresholds and modifiers for HTA decision making. OHE consulting report*. London: Office of Health Economics; 2020. https://www.ohe.org/wp-content/uploads/2020/05/OHE_HTA-agencies-thresholds-review_FINAL.pdf. Accessed September 22, 2025.
36. Bobinac A, Van Exel NJ, Rutten FF, Brouwer WB. Willingness to pay for a quality-adjusted life-year: the individual perspective. *Value Health*. 2010;13(8):1046–1055.
37. Dolan P, Edlin R. Is it really possible to build a bridge between cost-benefit analysis and cost-effectiveness analysis? *J Health Econ*. 2002;21(5):827–843.
38. Trujillo Jara K, Voormolen DC, Brouwer W, van Exel J. The value of health and well-being from a societal perspective: A willingness to pay experiment in the Netherlands. *Eur J Health Econ*. 2025. https://doi.org/10.1007/s10198-025-01814-2.
39. Fischer B, Telser H, Zweifel P, von Wyl V, Beck K, Weber A. The value of a QALY towards the end of life and its determinants: experimental evidence. *Soc Sci Med*. 2023;326:115909.
40. National Institute for Clinical Excellence (NICE). Guide to the methods of technology. appraisal.https://www.nice.org.uk/process/pmg9/resources/guide-to-the-methods-of-technology-appraisal-2013-pdf-2007975843781. Accessed July 19, 2025.
41. Martín-Fernández J, Polentinos-Castro E, del Cura-González MI, et al. Willingness to pay for a quality-adjusted life year: an evaluation of attitudes towards risk and preferences. *BMC Health Serv Res*. 2014;14(1):287.
42. Steigenberger C, Flatscher-Thoeni M, Siebert U, Leiter AM. Determinants of willingness to pay for health services: a systematic review of contingent valuation studies. *Eur J Health Econ*. 2022;23(9):1455–1482.
43. Song HJ, Lee EK. Evaluation of willingness to pay per quality-adjusted life year for a cure: A contingent valuation method using a scenario-based survey. *Medicine*. 2018;97(38):e12453.
44. Jahanbin SF, Yusefzadeh H, Nabilou B, Alinia C. Value of willingness to pay for a QALY gained in Iran; a modified chained-approach. *BMC Health Serv Res*. 2021;21(1):1–2.
45. Mavrodi A, Aletras V. A contingent valuation study for eliciting a monetary value of a quality-adjusted life-year in the general Greek population. *Value Health Reg Issues*. 2020;22:36–43.
46. McDougall JA, Furnback WE, Wang B, Mahlich J. Understanding the global measurement of willingness to pay in health. *J Mark Access Health Policy*. 2020;8(1):1717030.
47. Mahlich J, Dilokthornsakul P, Sruamsiri R, Chaiyakunapruk N. Cultural beliefs, utility values, and health technology assessment. *Cost Eff Resour Alloc*. 2018;16:1–8.
48. Hernandez LM, Blazer DG, eds. *Genes, Behavior, and the Social Environment: Moving Beyond the Nature/Nurture Debate*. Washington (DC): National Academies Press (US); 2006.
49. Schwappach DL. Resource allocation, social values and the QALY: a review of the debate and empirical evidence. *Health Expect*. 2002;5(3):210–222.
50. Shiroiwa T, Igarashi A, Fukuda T, Ikeda S. WTP for a QALY and health states: more money for severer health states? *Cost Eff Resour Alloc*. 2013;11:22.
51. Thavorncharoensap M, Teerawattananon Y, Natanant S, Kulpeng W, Yothasamut J, Werayingyong P. Estimating the willingness to pay for a quality-adjusted life year in Thailand: does the context of health gain matter? *Clinicoecon Outcomes Res*. 2013;5:29–36.
52. Shafie AA, Lim YW, Chua GN, Hassali MAA. Exploring the willingness to pay for a quality-adjusted life-year in the state of Penang, Malaysia. *Clinicoecon Outcomes Res*. 2014;6:473–481.
53. Igarashi A, Goto R, Yoneyama-Hirozane M. Willingness to pay for QALY: perspectives and contexts in Japan. *J Med Econ*. 2019;22(10):1041–1046.
54. Robinson A, Gyrd-Hansen D, Bacon P, et al. Estimating a WTPbased value of a QALY: the “chained” approach. *Soc Sci Med*. 2013;92:92–104.
55. Nimdet K, Ngorsuraches S. Willingness to pay per qualityadjusted life year for life-saving treatments in Thailand. *BMJ Open*. 2015;5(10):e008123.