Who prefers death to life in composite time trade-off interviews, and why? A mixed-methods study among Asians in Singapore

ABSTRACT

Objectives The EuroQol Valuation Technology (EQ-VT) uses composite time trade-off (cTTO) with a 10-year lead-time to value health state worse than dead (WTD) to a range between –1 and 0 (dead). While WTD responses are common in EQ-5D-5L studies, their drivers remain understudied in Asia. This mixed-methods study explored socio-demographic factors and reasoning behind WTD preferences in Singapore.

Methods We recruited 500 adult Singaporeans using quota sampling. Each participant completed 20 cTTO tasks through computer-assisted interviews, followed by open- and closed-ended questions. Two-part regression models assessed both the likelihood and the extent of WTD ratings, and qualitative content analysis evaluated participants' reasoning for their health state valuations.

Results Of the 500 participants (mean age 48.1 years; 52.6% held tertiary education), 76.8% identified as Chinese. Overall, 33.0% assigned WTD values, and 16.1% assigned "–1" values. Age, education, marital status, interviewer, and caregiving experience were associated with WTD ratings, though none remained significant in multivariable analysis. Similar factors were linked to "–1" values, with middle age being the only factor that remained significant in the multivariable analysis. Qualitative data showed that middle-aged participants often cited worries about imposing physical, mental, or financial burdens on their families.

Conclusions Preferences for immediate death over living in poor health are common in Singapore, particularly among middle-aged respondents. Concerns about burdening family members appear to drive these preferences, reflecting broader cultural values. These insights may clarify the high frequency of "–1" values in EQ-5D valuation studies across Asia.

Keywords: EQ-VT, EQ-5D-5L, Health-related quality of life, Valuation, Factors, cTTO

Key Points

- This study addresses an evidence gap in understanding why Asian populations, particularly in Singapore, assign negative values ("–1" or worse than death) in EQ-5D health state valuations.
- Findings reveal that concerns about burdening family, especially among middle-aged adults, drive preferences for death over life with severe impairment.
- The study highlights the importance of using culturally sensitive preference data to value health interventions and to inform health policies.

1 Introduction

Health state valuation underpins health economic evaluation by informing resource allocation and policy decisions [1,2]. The EQ-5D-5L, developed by the EuroQol Research Foundation, is among the most widely used tools in this domain. It measures health-related quality of life across five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression [3,4] and provides utility values for the measured health states. The EQ-5D-5L is valued for its simplicity and genericity, making it broadly applicable across diverse populations and health conditions [5,6]. It has been validated in many countries [7] and numerous country-specific EQ-5D-5L utility value sets have been developed for calculating quality-adjusted life years (QALYs) based on the health preferences of the populations of interest [8].

To derive health-state utility values, several methods are available, including time trade-off (TTO), standard gamble, discrete choice experiments, and visual analogue scales [9]. For the EQ-5D-5L, the primary approach is the composite time trade-off (cTTO) method, implemented via the EuroQol Valuation Technology (EQ-VT) [10-12]. The cTTO method first values health states considered better than dead (BTD), using a 10-year timeframe to determine their utility within the range of 0 to 1. For health states perceived as worse than dead (WTD), the method incorporates a 10-year lead time, extending the total duration to 20 years and generating utility values in the range of –1 to 0 (with 0 corresponding to being dead) [10,13,14].

WTD values indicate that respondents prefer death over living in certain health states during the cTTO tasks. Many cTTO-based valuation studies reported a high prevalence of WTD values, though observed rates may show less variation than might be expected given the diversity of cultural settings [15]. For example, in Taiwan, 45.1% of respondents assigned WTD values to one or more EQ-5D-5L health states [16], while in Peru and Uganda, the figures were 43.6% [17] and 40.3% [18], respectively. Additionally, some EQ-5D-5L valuation studies recorded a large proportion of "-1" values, the lowest possible cTTO value, reflecting extreme aversion towards very poor health outcomes [19-21]. For instance, Iran reported 23.3% "-1" values [19], Hong Kong (17.1%) [21], and Ireland (16.2%) [20]. These findings suggest that negative health state utility values are common across cultural settings [22].

Demographic and psycho-social characteristics are often associated with WTD preferences in health state valuations [23], including religiosity, age, sex, education level, and geographical region [24-27]. However, findings on these associations remain inconsistent. For instance, some studies have found higher likelihoods of WTD valuations among urban residents, men, or those with higher education [25,26,28], while other studies report stronger associations for rural dwelling, women, or lower education [27,29,30]. Similarly, factors such as religiosity, serious illness experience, belief in an

afterlife, and limited social connections have also been linked to WTD preferences [27-30]. Conflicting findings in existing literature suggest that determinants of WTD preferences are highly context-dependent and not easily generalisable across national or cultural boundaries. Consequently, empirical research tailored to the local population is required to reliably identify associated factors. Moreover, the motivations behind preferring death over living in severe ill health remain unclear. The limited use of targeted or qualitative data to examine WTD further constrains our understanding. Most studies rely on secondary analyses of EQ-VT data, which typically include only quantitative socio-demographic information collected primarily for sample description, whereas our study incorporated both quantitative and qualitative data.

This study aims to identify the characteristics of respondents who assign worse-than-dead (WTD) values and the underlying reasons for such preferences. Building on an existing EQ-5D-5L valuation study in Singapore, we employed a mixed-methods design to collect quantitative and qualitative data, addressing two research questions:

1) Which socio-demographic and individual characteristics are associated with assigning WTD values?
2) What reasons do respondents provide for preferring death over certain health states?

2 Methods

2.1 Data and ethics

We used the latest version of the EuroQol Valuation Technology (EQ-VT) (version 2.1) [10] to conduct an EQ-5D-5L valuation study in Singapore [31], collecting preference data specifically for this research in accordance with the established protocol. Ethical approval was obtained from the National University of Singapore Institutional Review Board (NUS-IRB-2022-598).

2.2 Study design, sampling and eligibility criteria

We conducted a cross-sectional study to collect health state valuations from adult Singaporeans [31]. Singapore is a multi-ethnic society with four official languages (English, Mandarin, Malay, and Tamil) [32]. Given logistical constraints, only the English and Mandarin versions of the EQ-VT were administered, which together cover 87% of the population based on language proficiency statistics [33]. We employed quota sampling to align the sample with national distributions of age, sex, ethnicity, and education as reported in the Singapore 2021/2022 Population Estimate [34,35].

Participants were primarily recruited from the Singapore Multi-Ethnic Cohort, which includes over 20,000 residents tracked by the Saw Swee Hock School of Public Health at the National University

of Singapore [36,37]. Cohort members received a registration link via email if they expressed interest. To reach minority and hard-to-reach groups, including those with limited formal education, we also used social media recruitment strategies.

The inclusion criteria were: (1) aged 21 years or older (the legal age of adulthood in Singapore); (2) ability to read and communicate in English or Mandarin; and (3) adequate physical and mental capacity to complete an interview in person or via Zoom. We excluded individuals with prior experience in an EQ-VT study. All participants provided informed consent and received SGD$40 (approximately US$30) as compensation.

2.3 Data collection procedures

Data collection was conducted via computer-assisted personal interviews between November 2023 and April 2024. While in-person interviews were preferred, video conferencing was used as necessary, particularly in response to COVID-19-related restrictions. All interviews followed a standardised protocol to ensure consistency across modes. Five trained interviewers (research staff and graduate students at the National University of Singapore) carried out the interviews. They had previously administered EQ-VT interviews for a multi-country EQ-5D-Y valuation study. Comprehensive training on cTTO tasks was provided, including both face-to-face and virtual sessions. Interviewers' performance was monitored throughout data collection as part of the EuroQol Group's standard quality control [38].

The interviews were structured into four sections. Section 1 introduced the study, while Section 2 collected participants' demographic information and health status using the EQ-5D-5L questionnaire. Section 3 comprised 20 cTTO valuation tasks, preceded by a tutorial including an "in wheelchair" example and three practice tasks. The cTTO approach merges two valuation methods to capture how respondents view health states relative to death. For health states considered BTD, the conventional 10-year TTO approach is used. Here, respondents choose between living varying durations (x years, adjusted up or down) in full health (*Life A*) and 10 years in a given impaired state (*Life B*), to identify the point at which they consider both scenarios equivalent. The health state value is calculated as x/10. In this scenario, respondents choose between a life of 20 years consisting of an initial period of 10 years in full health followed by 10 years in the impaired state (*Life B*), and a shorter period x in full health (*Life A*), where x is varied by the interviewer, after which death occurs. The amount of lead time in full health (x, varied by the interviewer) is adjusted until the respondent expresses indifference between the two alternatives. The health state value is then calculated as (x − 10)/10, and values cannot fall below –1, which represents the worst possible health state. WTD values thus represented preferences for death when respondents rated certain health states as worse than

being dead. Each participant completed 20 cTTO valuation tasks. Five blocks of 20 health states were created by combining the standard EQ-5D-5L blocks (each including the 55555 state) and substituting one 55555 with one of five second-poorest health states (45555, 54555, 55455, 55545, 55554) in each block. In total, 91 health states (the 86 standard plus five second-poorest states) were valued in this 'lite' protocol, with each participant randomly assigned to one block.

Section 4 explored participants' reasoning behind their cTTO choices through closed- and open-ended questions. In the closed-ended component, participants were asked whether specific factors influenced their decision when comparing Life A and Life B. These included medical costs, living expenses, loss of jobs and income, financial and physical burden, mental burden, loss of dignity and independence, loss of enjoyment in life, loss of opportunities for personal achievement, and specific time-related goals. Participants were also asked to indicate their preference between living in poor health versus dying, and between dying versus living in poor health. Following this, each respondent was asked three distinct open-ended questions in sequence: (1) "*Can you explain your reasoning for how you valued these health states?*" (2) "*What factors influenced your decision when valuing these health states?*" and (3) "*Which considerations were most important in shaping your decision?*" Responses to each question were collected separately to ensure a comprehensive and systematic exploration of participants' motivations and considerations.

2.4 Data analysis

Socio-demographic characteristics and health state preferences, including the total number of health states assigned a WTD value, were summarised using means and standard deviations (SD) for continuous variables and frequency distributions for categorical variables.

Due to the zero-inflated distribution of responses (**Figure 1**; many participants assigned no WTD values) [39], we used two-part models (mixed discrete-continuous outcomes) to identify socio-demographic factors associated with WTD value. For the first part, we used logistic regression to estimate the probability of assigning at least one WTD rating. For the second part, we used linear regression to analyse the number of WTD ratings among participants who assigned at least one. The independent variables and covariates included in both regression models were: age group, gender, ethnicity, education, marital status, employment status, religion, housing type, prior experience with serious illness (in self, family, or caregiving), and interviewer. These variables were selected based on established relevance in the health literature [23-30] and their availability in our dataset. To further characterise extreme negative valuations, we applied the same two-part approach to analyse "–1" ratings. This methodology examined both the occurrence and extent of negative valuations. We also analysed participants' priorities when comparing *Life A* (full health) and *Life B* (impaired health) using

frequency distributions, with Fisher's exact test assessing age-group differences. All analyses were conducted in STATA 18.0 (StataCorp LP, College Station, TX), with statistical significance set at $p < 0.05$ (two-sided).

To complement the quantitative analysis, we examined qualitative feedback from open-ended responses through content analysis [40]. Responses were systematically coded and categorised to identify recurring themes and patterns, with stratification by age group to explore variations in stated priorities and tendencies to assign death-preferring values. Integration of quantitative and qualitative findings was achieved by comparing regression results and frequency distributions with content analysis themes, thereby identifying areas where participants' stated reasons aligned with or provided additional context for observed numeric patterns.

3 Results

3.1 Characteristics of participants

A total of 500 participants were included in the study, with a mean age of 48.1 years (SD = 16.6). Their demographic profiles closely aligned with the national adult population as reported in the Singapore 2021/2022 Population (**Table 1**). Most were aged 21–64 years (77.8%), and the gender distribution was nearly even (49.8% female, 50.2% male). Ethnic representation was as follows: 76.8% Chinese, 14.2% Malay, 6.8% Indian, and 2.2% other ethnicities. More than half (52.6%) had tertiary qualifications, 42.4% had secondary or post-secondary education, and 5.0% had primary education or less.

Marital status was distributed as 54.6% married, 35.2% single, 6.8% divorced/separated, and 3.4% widowed. Religious affiliation was led by Christianity (31.4%) and Buddhism (23.0%), followed by no religion (21.0%). Most participants resided in public housing, with 36.6% in four-room flats and 26.0% in five-room or executive flats. Employment status showed 67.4% working or self-employed, 16.8% retired, 9.0% students, 5.0% homemakers, and 1.8% undisclosed. Most interviews (93.8%) were conducted in English, with 6.2% in Mandarin. Interview distribution was approximately equal among the five interviewers, except for interviewer #5. A substantial proportion reported health-related experiences: 25.6% had experienced a serious illness, 58.6% had a family member with a serious illness, and 46.2% had provided care for someone with a serious illness.

3.2 WTD and -1 values and associated socio-demographic characteristics

A total of 33.0% of participants assigned at least one WTD rating, and 16.1% assigned at least one "–1" rating. The mean number of WTD ratings was 6.60 (SD 5.48), while the mean number of "–1" ratings was 3.22 (SD 4.57) (**Table 1**). In univariable analyses, several socio-demographic and health-related

characteristics were associated with the number of health states valued as WTD or "–1" (**Tables 2-3**). For WTD ratings, education level and caregiving experience, as well as interviewer, showed associations at the $p<0.10$ level, while for "–1" ratings, age, education, marital status, and caregiving experience were significant predictors.

In the multivariable two-part model, most socio-demographic associations with WTD ratings attenuated after adjustment (**Table 2**). In the logit part, the likelihood of assigning at least one WTD rating did not differ significantly by education or caregiving status. In the linear part, among those assigning at least one WTD rating, non-tertiary education showed a borderline positive association (β = 0.85, 95% CI –0.09 to 1.78; $p = 0.08$). For "–1" ratings, caregiving experience showed a borderline association with the likelihood of assigning at least one "–1" rating (β = 0.44, 95% CI 0.003 to 0.87; $p = 0.05$). In the linear part, no socio-demographic variables were independently associated with the number of "–1" states among those assigning at least one (**Table 3**).

Model fit statistics for the two-part models are presented in the **Table S1**. Both the logistic models for the total number of WTD and "–1" ratings demonstrated significant likelihood ratio chi-square values (p = 0.001 and p = 0.002, respectively). Overall log pseudolikelihoods and model comparison metrics, including Bayesian Information Criterion and Akaike Information Criterion, are reported to facilitate comparisons and support model adequacy.

3.3 Age-related differences in prioritisation of health and quality of life concerns

Distinct age-related differences emerged in the prioritisation of concerns when comparing *Life A* and *Life B* (**Table 4**). Younger participants (21–44 years) less frequently cited medical costs (64.3%) compared to those aged 45–64 (78.2%) and ≥65 (73.0%; p = 0.009). Similarly, younger respondents considered increased living costs less often (64.8% vs. 74.3% and 76.6%; p = 0.04), but reported job and income loss more frequently than those aged ≥65 (56.2% vs. 40.5%; p = 0.01). No significant differences were observed across age groups for financial, physical, or mental burdens (p > 0.05). Younger participants more commonly emphasised loss of enjoyment in life (80.0%) compared to older cohorts (70.9% and 69.4%; p = 0.04).

3.4 Participants' considerations for health-state valuation

The most frequently cited considerations when comparing Life A (in full health) and Life B (in impaired health) were physical (89.0%), mental (83.2%), and financial (78.8%) burdens. Medical costs (71.2%) and increased living costs (70.8%) were also commonly mentioned, whereas time-specific goals (44.4%) and missed opportunities for personal growth (46.0%) were less frequently noted. A majority (79.0%)

preferred death over living with severely impaired health, while 21.0% indicated a preference to remain alive despite poor health.

Content analysis (**Figure 2**) indicated that the desire to avoid imposing physical and mental burdens on family members was a central reason for preferring death to life in poor health across all age groups. Younger respondents (21–44 years) emphasised pain and discomfort (20%) and family burdens (14%), as well as concerns about losing enjoyment and dignity. For example, one participant stated, "*I should be able to do things that I like*" (Male, Chinese, 26 years). In the 45–64 group, the most frequent concerns were burdening family and friends (20%) and pain and discomfort (19%). As one participant explained, "*I don't want to burden people around me and waste money on hospital bills*" (Female, Malay, 49 years), while another added, "*The cost of treatment can burden my family*" (Male, Malay, 46 years). Among those ≥65, the primary concerns were burdening others (20%), pain and discomfort (16%), and mobility (11%). Older participants focused more on preserving autonomy and minimising dependency compared to younger respondents.

4 Discussion

This study provides new insights into preferences for health states considered WTD in a representative sample of the Singaporean population. Our quantitative analysis found that no socio-demographic characteristic was associated with the assignment of WTD values. This pattern suggests that the propensity to regard certain health states as worse than dead is broadly distributed, rather than being confined to specific demographic groups, and may reflect a widespread phenomenon within the population. This observation aligns with findings from previous EQ-5D-5L valuation studies in other contexts [27-29], which have also reported limited or inconsistent associations between socio-demographic factors and WTD valuations. In contrast, the analysis of the most extreme negative values ("–1" ratings) indicated that middle-aged individuals in Singapore may be particularly inclined to assign such preferences; comparable age-related trends have been observed in some international studies [29,41,42], though results remain mixed. Overall, these findings highlight both the general prevalence of WTD preferences in Singapore and the nuanced contribution of age to the extremity of health-state valuations.

This study also highlighted the interplay between physical, mental, and financial burdens in shaping preferences for life with impaired health. Physical, mental, and financial burdens emerged as the most salient concerns, with medical and living costs also being cited frequently. Notably, a substantial proportion of participants, particularly those in middle age, expressed a preference for death over enduring very poor health, a finding supported by both quantitative and qualitative data. Middle-aged participants were especially concerned about burdening their families, while younger and older

individuals placed greater emphasis on the loss of enjoyment and dignity. These age-related differences likely reflect shifting social roles and familial responsibilities across the life course, underscoring the dynamic nature of health priorities (see Figure 2).

Our findings are consistent with the literature on the "sandwich generation", wherein middle-aged adults simultaneously care for both children and ageing parents, amplifying their exposure to physical, mental, and financial pressures [43-45]. This dual caregiving role, coupled with economic stressors, may explain the greater tendency among this group to prefer death over health states perceived as imposing additional burdens on loved ones [46]. These insights underscore the need for policymakers to prioritise caregiver support in ageing societies such as Singapore by expanding long-term care services, enhancing financial assistance, and strengthening mental health resources [47]. Such interventions could help alleviate caregiver burden and potentially moderate the assignment of extreme negative health state valuations.

The study also demonstrates that health priorities are dynamic and shift across the lifespan. Younger adults placed particular emphasis on autonomy, independence, and sustaining an active lifestyle, whereas older adults were more likely to prioritise dignity and the reduction of dependency [48,49]. These patterns are consistent with prior research showing that younger adults benefit most from interventions focused on preventive care, physical fitness, and mental well-being [50], while older adults are more responsive to programmes that uphold dignity and facilitate ageing in place through personalised care and assistive technologies [51]. Taken together, these findings underscore the importance of age-tailored health strategies: preventive and wellness-oriented initiatives for younger adults, and dignity-preserving, community-based support systems paired with robust caregiver resources for older populations.

A key cultural insight from this study is the prominence of family-related concerns in health state valuations, especially among middle-aged respondents. The desire to avoid burdening family members was a recurring theme, reflecting the centrality of familial responsibility in Asian societies, including Singapore, where family cohesion and filial piety are deeply embedded [52,53]. In collectivist cultures, individuals may prioritise family well-being over their own, leading to a higher incidence of WTD valuations [54]. This cultural context may partly explain the elevated rates of extreme "–1" ratings in Asian EQ-5D studies compared to Western cohorts [16]. Further research is warranted to explore how cultural norms and values shape health state valuations across diverse settings.

4.1 Limitations

This study has several limitations. First, the study was limited to English and Chinese versions of the EQ-VT, potentially excluding non-English and non-Chinese speakers and thus affecting the representativeness of Singapore's multi-ethnic population. Second, the use of non-probability quota sampling, although aligned with census data, may introduce selection bias. Third, the adaptation of EQ-VT interviews for virtual administration during the COVID-19 pandemic may have influenced participant responses, despite evidence suggesting minimal differences between virtual and in-person modes [55-57]. Despite strict quality control, including random audits and continuous interviewer feedback, reliance on self-reported data remains a concern. Participants may have offered socially desirable answers or misreported their experiences, which could impact reliability. Additionally, our qualitative questions explored general factors influencing health state valuations, rather than probing WTD preferences specifically. Nevertheless, we conducted sensitivity analyses stratifying participants who valued 0, 1–4, 5–9, 0–9, and ≥10 health states as "–1". The consistent findings across all these subgroups provided empirical justification for pooling the qualitative results.

5 Conclusions

Preferences for immediate death over living in extremely poor health are common among Singaporeans, particularly those in middle age. Concerns about imposing physical, emotional, and financial burdens on family members appear to be key drivers of these preferences. Middle-aged adults, who often occupy intergenerational caregiving roles, may feel these pressures most acutely. Such perspectives likely contribute to the lower health-state values observed in the Singapore EQ-5D valuation study and the frequent assignment of "–1" scores reported in other Asian contexts. These findings highlight the importance of of using culturally sensitive preference data to value health interventions and to inform health policies.

Availability of Data and Materials

The datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request.

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