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Preference-Based Assessments

An EQ-5D-5L Value Set for Ghana Using an Adapted EuroQol Valuation Technology Protocol

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ABSTRACT

Introducción: El caso de referencia de la evaluación económica de Ghana recomienda los años de vida ajustados por calidad (AVAC) como medida de resultado para la realización de análisis de costo-utilidad. No existe ningún conjunto de valores ghaneses disponible para utilizar en la estimación de los AVAC. Este estudio tuvo como objetivo desarrollar un conjunto de valores para Ghana utilizando el instrumento EQ-5D-5L.

Método: Se recopilaron datos de preferencia cara a cara de 300 adultos en tres regiones de Ghana utilizando la versión adaptada del protocolo de valoración estandarizado de la tecnología de valoración EuroQol (EQ-VT); con técnicas de obtención de experimentos de elección discreta (DCE) y compensación de tiempo compuesto (cTTO). Los datos de cTTO y DCE se modelaron individualmente o en conjunto para proporcionar resultados complementarios sobre las preferencias de servicios públicos de los encuestados. Los modelos explorados fueron mínimos cuadrados generalizados, Tobit, heterocedástico, logit e híbrido. Se seleccionó el modelo que mejor se ajustaba al conjunto de valores en función de su consistencia lógica, teniendo en cuenta los datos censurados por la izquierda y de heterocedasticidad, y la significación estadística de los parámetros.

Resultados: Las 300 entrevistas proporcionaron 4500 respuestas cTTO y 4200 respuestas DCE. El modelo preferido elegido para el conjunto de valores de Ghana fue el modelo híbrido-tobit-aleatorio con restricciones heterocedásticas. El valor previsto para el peor estado de salud alcanzable (55555) fue -0,493 y el mejor estado de salud (11112) fue 0,969. La mayor disminución se registró en el nivel 5 de movilidad (0,369), seguido del dolor/malestar (0,312), el autocuidado (0,273), la ansiedad/depresión (0,271) y las actividades habituales (0,268).

Conclusión: Este es el primer valor del EQ-5D-5L de Ghana establecido en función de la preferencia social derivada de una muestra representativa a nivel nacional. El conjunto de valores desempeñará un papel clave en el uso de estudios de evaluación económica para informar el establecimiento de prioridades en Ghana, donde se pueden comparar diferentes tecnologías sanitarias.

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ABSTRACT

Objectives: Ghana's economic evaluation reference case recommends quality-adjusted life-years as an outcome measure for the conduct of cost-utility analysis. There is no Ghanaian value set available to be used in estimating quality-adjusted life-years. This study aimed to develop a value set for Ghana using the EQ-5D-5L instrument.

Methods: Face-to-face preference data were collected from 300 adults across 3 regions of Ghana using the adapted version of the EuroQol valuation technology (EQ-VT) standardized valuation protocol; with composite time-trade-off (cTTO) and discrete-choice experiments (DCEs) elicitation techniques. The cTTO and DCE data were modeled individually or together to provide complementary results on respondents' utility preferences. Models explored were generalized least squares, Tobit, heteroskedastic, logit, and hybrid. The best-fitting model for the value set was selected based on its logical consistency, accounting for left-censored and heteroscedasticity data, and the statistical significance of parameters.

Results: The 300 interviews provided 4500 cTTO responses and 4200 DCE responses. The preferred model chosen for the Ghana value set was the Hybrid Tobit random effect heteroscedastic-constrained model. The predicted value for the worst attainable health state (55555) was −0.493 and the best health state (11112) was 0.969. The largest decrement was registered for level 5 mobility (0.369) followed by pain/discomfort (0.312), self-care (0.273), anxiety/depression (0.271), and usual activities (0.268).

Conclusions: This is the first Ghanaian EQ-5D-5L value set based on social preference derived from a nationally representative sample. The value set will play a key role in the use of economic evaluation studies to inform priority setting in Ghana where different health technologies can be compared.

Keywords: EQ-5D-5L, Ghana value set, valuation studies, utility weights.

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Introduction

As part of efforts toward attaining universal health coverage (UHC), Ghana has developed a UHC roadmap "ensuring that all individuals receive the healthcare they require without financial hardship." As part of the roadmap to UHC, there have been progressive efforts toward achieving this goal, including the implementation of a national health insurance scheme in 2003.[1] A key component of the UHC is adopting strategies that would enable the government of Ghana to work within an effective priority setting and resource allocation framework to optimize the available scarce healthcare resources. In operationalizing this, the Ministry of Health is institutionalizing health technology assessment (HTA) to guide its resource allocation decisions. The implementation of HTA is used as an evidence-based strategy, to guide the decision-making process to ensure the optimal use of health interventions for the population.[2,3] As part of the HTA guidelines in Ghana, a reference case has been developed to guide economic evaluation, which recommends the conduct of cost-utility analysis (CUA) for health technologies using outcomes including quality-adjusted life-years (QALYs).[4] QALYs offer a measure of value and will be considered an important HTA outcome measure in Ghana, in line with HTA guidelines in several countries.[5,6]

QALYs measure health outcomes as a combination of the length of time spent in a health state and a quality-of-life weight (utility weights) assigned to the health state.[7,8] Utility weights can be derived using a range of valuation methods. These estimate values for a subset of health states and model the results to generate a "value set" for all health states. Commonly used methods have been time trade-offs, standard gamble, rating scales, and discrete choice experiments (DCEs).[9-17] A key issue related to derivation of utility weights is whose values should be used in decision making—that is, specific patient groups or from the general population (social values).[18-20] Social values are usually preferred for CUA.

Health states are measured by multiattribute utility instruments (MAUIs).[21,22] The 3 most widely used MAUIs are the EQ-5D, the Health Utility Index, and the Short Form 6D.[23-25] Among these, the EQ-5D instrument was found to be the preferred instrument in most pharmacoeconomic guidelines.[21] For example, the National Institute of Health and Care Excellence in the UK prefers the EQ-5D,[5] the Pharmaceutical Benefits Advisory Committee in Australia accept EQ-5D values among others,[6] and many countries in Europe recommend the use of EQ-5D.[26] In many recent studies, the larger 5-level EQ-5D-5L instrument (with accompanying valuation protocol) has been used in preference over the previous 3-level EQ-5D-3L because the former has been found to reduce ceiling effects and provide improved discriminative capacity with greater ability to detect differences between groups.[27-29] The EQ-5D-5L summarizes health in terms of 5 dimensions (mobility, self-care, usual activities, pain/discomfort, anxiety/depression) and 5 levels of problems (no = 1, slight = 2, moderate = 3, severe = 4, extreme/unable to = 5).

The availability and use of the EQ-5D-5L value set for CUA is limited in Africa. Only 3 African countries (Egypt, Ethiopia, and Uganda) have developed and published an EQ-5D-5L value set for use in CUA.[9,16,30] Currently, there is no EQ-5D-5L value set available for the Ghanaian population, which currently limits its use in decision making. Nevertheless, the institutional efforts to incorporate HTA into the health sector resource allocation decision-making in Ghana necessitates that a value set be developed to allow the estimation of QALYs to support HTA. Economic evaluation studies in Ghana and most of Africa have used disability-adjusted life-years as the main outcome measure.[2] The availability of EQ-5D-5L value sets will provide options for economic evaluation studies. This study therefore aimed to develop an EQ-5D-5L value set for Ghana by eliciting the preferences of Ghanaians. This will enable the EQ-5D-5L to be used as a standard health outcome measure for HTA and inform decision making and the allocation of scarce healthcare resources.

Methods

Study Design

This study was an interviewer-administered cross-sectional survey of a representative sample of the Ghanaian population. Data were collected through face-to-face interviews using the EuroQol valuation technology (EQ-VT) standardized valuation protocol developed specifically for EQ-5D-5L valuation studies[31] and its associated computer-assisted interview software version 2.1. Ethical clearance was obtained for the study (CHS-Et/M.10 - P4.4/2021-2022 and ETH22-7271). We followed the checklist for reporting valuation studies of multiattribute utility-based instruments to report the key elements of the Ghanaian valuation study.[32]

The EQ-5D-5L Descriptive System

The instrument underpinning the EQ-VT protocol is EQ-5D-5L, a generic, internationally used, and validated self-completed MAUI that describes health in terms of 5 domains: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression.[33] Each domain has 5 levels of severity: no, mild, moderate, severe, and unable/extreme. A health state is achieved as a combination of the 5 domains and their levels and is described by a 5-digit number: ranging from 11111 (no problems in any of the 5 domains) to 55555 (unable to/extreme problems in all the domains). The proxy for severity; "level sum score" is calculated as the sum of the 5 digits for a given health state.[34]

Valuation Technique

The study used an adapted version of the EQ-VT protocol design that elicits preferences using composite time trade-off (cTTO) and DCEs methodological approach. This adapted version of the EQ-VT protocol was developed by the EuroQol office specifically for Australia to be used for a smaller sample size. It consists of 15 cTTO tasks and 14 DCE tasks administered per respondent than the standard protocol that has 10 cTTO and 7 DCE tasks administered. The 15 cTTO tasks consist of all the 86 health states in the original design administered in 6 blocks of 14 plus 55555 health states and the 14 DCE tasks consist of all the 196 choice sets in the original design administered by allocating 2 of the original 28 block to each respondent.[35] Two published different adapted versions of the standard protocol (1 with 11 cTTO and 22 DCE tasks, and the other with 20 cTTO tasks only) have produced values comparable to other value sets using the standard approach.[11,30] The use of this adapted approach enabled us to maximize the number of observations given that a smaller sample than that recommended in the EQ-VT protocol was recruited.

cTTO uses conventional TTO to value health states considered better than death[36,37] and a "lead-time" TTO to value health states considered to be worse than death.[38] In this study, TTO interviews started with "conventional" TTO for all health states and shifted to lead time TTO if needed[38] when the respondent indicated valuing the health state as being "worse than dead." The 86 health states from the primary design developed for the EQ-VT protocol were allocated to 6 blocks of 15 health states using a severity stratification approach (all blocks included the worse state, at least 1 mild state, and a number of mild states were repeated in the blocks). Each respondent valued a block of 15 health states. For each block, respondents valued the worst health state (described as 55555, or extreme problems/unable to on all dimensions) and at least 1 of the mildest health states (eg, 21111, slight problems on 1 dimension, and no problems on the others).

For the DCE component of the study, respondents completed 14 choice sets within the EQ-VT. The EQ-VT DCE design includes 196 choice sets allocated to 28 blocks of 7, using the blocking approach described by Oppe et al.[39] In the modified version used in this study, 2 of the blocks of 7 were allocated to each respondent, with the order of appearance also randomized. For the DCE task, the respondents were presented with pairs of EQ-5D-5L health states and asked to choose which of the 2 health states was better. A detailed description of the EQ-VT valuation protocol and cTTO and DCE elicitation techniques has been published elsewhere.[31,37-39]

Sampling and Recruitment

Respondents were recruited across Ghana using the 3 ecological zone levels of the country (Savannah, Forest, and Coastal), which mimics its agroecological and cultural characteristics. Three regions were selected, 1 from each zone: Northern, Ashanti, and Greater Accra, respectively. Using the sampling frame from the 2021 Population and Housing Census conducted in Ghana by the Ghana Statistical Service, the study sample was stratified and selected in 2 stages. In the first stage, 27 enumeration areas (a geographical area with an average of 140 households), with 20 in urban areas and 7 in rural areas were selected. In the second stage, 15 households were randomly selected from each enumeration area selected in the first stage, yielding a total sample size of 405 households. A total of 300 (out of the 405) randomly selected households were used for the main study. Each sampled household was invited verbally to be part of the study. Once the invitation was accepted, a member of the household was interviewed face-to-face. Data were collected from August 2022 to October 2022. Each respondent was given GHS 100 (US dollar 8.5) to compensate for their time.

Survey Administration

The EQ-VT interview guide was translated into Twi (Ghanaian language) by a language translation company in Ghana and was reviewed by the study team. The EQ-VT system instructions were translated into Twi by the study team. All documents translated to Twi were back-translated to English to ensure consistency. Interviews were conducted in either English or Twi depending on the respondent's language preference using Windows-based laptops. During the interview, respondents completed general and valuation-specific tasks. The general tasks were self-report EQ-5D-5L and EQ-visual analog score, and sociodemographic questions. The valuation-specific tasks were an introduction to the cTTO exercise (including 3 warm-up tasks), 15 cTTO valuation tasks, "cTTO Feedback Module" questions that allowed respondents to review and confirm their responses, 14 DCE tasks, and DCE feedback questions.

The TTO concept was explained during the introduction exercise using "being in a wheelchair" as an example, in which respondents were asked to compare being in full health to being in a wheelchair. During this process, respondents were taken through different health states to familiarize them with the cTTO task and to help them understand the concept of health states, "better than death" and "worse than dead."

Interviewer Training and Quality Control

Three postgraduate students were recruited and trained for data collection following the EQ-VT guideline that expects an interviewer to complete 80 to 100 interviews to minimize interviewer effects.[40-42] Interviewers were trained over 8 days inclusive of practice sessions and pilot studies. The training was led by the first author and included an introduction to EQ-5D and its application, interview content, and interviewer skills, field preparation, quality control (QC) process and report, mock interviews, and trial interviews by interviewers. The QC process was established using the QC tool developed by the EuroQol Group to improve protocol compliance and the quality of data collected.[41] The QC tool provides information about mean values by health state severity and compliance to the EQ-VT protocol such as the time taken for an interviewer to explain the cTTO and wheelchair example, complete each task, and the entire interview. Interviewer effects were identified by the QC tool where the report compared the distributions of the cTTO data across the 3 interviewers for any skewed distributions or spikes at −1, −0.5, 0, or 1. During data collection, a cyclic QC process was established, which involved the following: (1) daily assessment of data collected for the provision of feedback to interviewers where necessary; and (2) generating QC report for data collected, reviewing the report with the EQ-VT support team, and providing feedback to the interviewers on where improvements can be made in the data collection process to promote overall quality of data collected. Things assessed in the QC report included unusual data characteristics that indicated face validity issues, assessing inconsistencies such as the following: (1) respondents valuing the worst state as the same or better than mildest states; (2) percentage of observations with 0 values, negative values, and nontraders; (3) respondents had a clear inconsistency in their TTO ratings; (4) interviewer spending less than 5 minutes on the 15 cTTO tasks; (5) interviewer spending at least 3 minutes on the wheelchair example; (6) and interviewer not entering the worse than dead element of 1 of the wheelchair examples. The value distribution and clustering at certain values were also checked.[41] A total of 7 QC meetings were held during the data collection period, more frequently in the initial stages of data collection: 6%, 11%, 19%, 30%, 50%, 73%, and 100% of data collected. The use of the QC protocol reduced protocol violation to a minimum as detailed in the Supplementary data (see Appendix 1 in Supplemental Materials found at https://doi.org/10.1016/j.vhri.2024.101045) whereby a total of 7% of data collected was flagged for quality reasons.

Data Analysis

The study used the STATA statistical package for data analysis. We used descriptive statistics to summarize the demographic characteristics, self-reported health, and cTTO and DCE responses of respondents.

Data modeling

The EQ-5D-5L values for all health states were estimated using different preference models. Both the cTTO and DCE data were modeled individually or together to provide complementary results on respondents' utility preferences by considering the heterogeneity of respondents' views on health utilities, the nature of "censored" preference data, and the heteroskedasticity of the error terms. Heteroskedasticity refers to the considerable differences observed in how respondents valued health states, which is especially prominent for moderate and severe health states.[43] In modeling the cTTO data only, the dependent variable was the disutility, defined as 1 minus the cTTO value observed for a given health state. In increasing order of complexity, we explored the following models for the cTTO-only data: (1) generalized least square (GLS) random intercept model without censoring was used to test for heterogeneity of responses from the respondents and account for the panel structure of the data (Model 1); (2) Model 1 was followed by a random-effects Tobit model to account for the censored nature of data (Model 3), and (3) both GLS and Tobit models were specified as a heteroskedastic model to account for the heteroskedasticity of the error term as the variance observed for the cTTO values increased with increasing severity of the health states (Models 2 and 4). The final models presented were estimated with the constant suppressed because the intercept term for the cTTO models was close to 0 and statistically nonsignificant (0.092).

The DCE-only data were analyzed using the conditional logit model (model 5), in which the dependent variable was a binary outcome variable (0 and 1): the choice of health state A or B demonstrating the respondent's choice for each pair of the EQ-5D-5L states of the DCE tasks.

To compare the modeled results of the cTTO and DCE data, the coefficients of the DCE model were rescaled using the rescaling parameter of the TTO model estimations[40,41] under the assumption that the cTTO model coefficients are proportional to the DCE model coefficients. The coefficients derived represented the utility decrements for the rescaled DCE model (model: DCE (rescaled coefficient)).

To maximize the information of all data collected, the cTTO and DCE data were combined and analyzed in a single hybrid model using the "hyreg" command developed by Ramos-Goñi et al.[31,41] The hybrid models were also estimated with the constants constrained because the cTTO-only models tested with an intercept were statistically nonsignificant and the DCE model had no intercept. Hybrid models explored in order of complexity were the following: (1) hybrid linear random effects (model 6); (2) hybrid Tobit model for the same reasons enumerated above (model 8); and (3) both the hybrid linear random effects and the Hybrid Tobit models were specified as a heteroskedastic model for the same reasons listed above and to address the nonhomogenous nature of the variance of the cTTO data by censoring the cTTO responses at −1 (Models 7 and 9, respectively).

The models presented in this article were estimated as follows:

$$Y = \beta 1 \times MO2 + \beta 2 \times MO3 + \beta 3 \times MO4 + \beta 4 \times MO5 + \beta 5 \times SC2 + \beta 6 \times SC3 + \beta 7 \times SC4 + \beta 8 \times SC5 + \beta 9 \times UA2 + \beta 10 \times UA3 + \beta 11 \times UA4 + \beta 12 \times UA5 + \beta 13 \times PD2 + \beta 14 \times PD3 + \beta 15 \times PD4 + \beta 16 \times PD5 + \beta 17 \times AD2 + \beta 18 \times AD3 + \beta 19 \times AD4 + \beta 20 \times AD5$$

Evaluation of model performance

The model performance was evaluated using the logical consistency of the parameter estimates—that is, their monotonicity (increasing coefficients as severity levels increase) and the significance level of the parameters ($P < .05$). Other model validity/performance indicators such as handling of censored values were also used for comparable models as necessary.[12,41,44] The robustness of the models was tested by including health states that were flagged by respondents in a sensitivity analysis.

Choosing a preferred model and value set

To choose a preferred model, the models were compared by estimating a value set for each, then plotting a kernel density plot of all models for visual inspection (see Appendix 1 in Supplemental Materials found at https://doi.org/10.1016/j.vhri.2024.101045). Upon visual inspection, all the models looked similar; therefore, other criteria were used to select a preferred model.

Due to the left censoring nature of the data (resulting from some respondents trading below the left lower bound at -1 for the 'worse than dead' health states), the Tobit model is conceptually preferred over the GLS model and it is also the preferred choice in recent literature.[10,12,13,45-48] The traditional method for comparing models using akaike information criterion and bayesian information criterion was not used to compare cTTO models, DCE model, and hybrid models as the log-likelihood of the hybrid models are larger than its constituent parts from the random-effects Tobit model and conditional logit model. The study did not consider the use of mean squared error or mean absolute error for comparing the hybrid models to their counterparts Tobit and conditional logit models as recently seen in the literature as there is no sufficient evidence supporting its use.[43]

Results

Participants Characteristics

A total of 300 interviews were completed between August and October 2022, with a 100% response rate. The majority (96.67%) of the interviews were conducted in English. The sample was representative of Ghana for religious background, level of education, and marital status (Table 1). The sample included more males than females in the Ghanaian population. This may be because males are the household heads in most Ghanaian cultures and are likely to be the ones to receive visitors and subsequently volunteers to complete the survey. Females are mostly involved in the absence of males. Like the population structure of Ghana, the sample was dominated by young people between the ages of 18 and 34 years (young people between the ages of 15 and 35 years constitute 38.2% of the Ghanaian population). Most respondents had no children, were not affected by a chronic disease, and had not been hospitalized in the last 5 years.

Self-Reported Health Using the EQ-5D-5L Descriptive System

The respondents' self-reported health is presented in Table 2. Using the visual analog scale, most respondents reported themselves to be in good health (mean 84.61 ± 12.31). The proportion of reported health problems varied from 5% for self-care to 41% for pain/discomfort, while no respondent reported perfect health, no problems in any dimension.

cTTO and DCE Data

The 300 interviews provided 4500 cTTO responses and 4200 DCE responses. The mean (SD) duration of the interview was 71.27 (±27.20) minutes; attributed to respondents' first-time exposure to the cTTO methods and interviewers spending enough time on the practice cTTO to ensure respondents understanding and consequent appropriate responses. The mean time spent on the feedback module was 3.98 (±2.32). Only 2 respondents were nontraders. The data recorded 11.47% inconsistencies. A total of 176 (3.97%) of the health states were flagged in the TTO feedback module; these were retained in the analysis as their impact on the analysis was negligible (refer to sensitivity analysis subsection for details). The overall distribution of the TTO values was well dispersed with the highest clustering being reported for 0.5 and 0.7 (9.4%), −1, and 0.6 (7.3%) (Fig. 1). The mean observed cTTO value of 86 health states was 0.66 ranging from 0.96 for health

Table 1. Background characteristics of study participants.

Characteristics	n	Percentage	General population
Age (years)			
18-24	55	18.33	24.35
25-34	154	51.33	28.73
35-44	56	18.67	20.92
45-54	25	8.33	13.07
>54	10	3.33	12.93
Sex			
Female	127	42.33	50.70
Male	173	57.67	49.30
Religion			
Christians	195	65.00	71.30
Islam	96	32.00	19.90
Traditionalist	2	0.67	3.20
Spiritualist	0	0.00	NA
No religion	6	2.00	1.10
Others (specify)	1	0.33	4.50
Marital status			
Single	167	55.67	47.80
Married/cohabiting/de-facto	123	41.00	42.10
Divorced/separated	8	2.67	4.80
Widowed	2	0.67	5.30
Children			
>5 years			
Yes	99	30.00	NA
No	201	70.00	NA
5-16 years			
Yes	88	29.33	NA
No	212	70.67	
>16 years			
Yes	55	11.67	NA
No	265	88.33	NA
Highest level of education			
None	2	0.67	NA
Basic/primary	6	2.00	NA
Junior high school	28	9.33	33.70
Senior high school	83	27.67	38.90
Certificate	13	4.33	3.10
Diploma/HND	66	22.00	8.10
Bachelor's degree	84	28.00	13.6
Postgraduate/Higher degree	18	6.00	2.60
General Health rating			
Excellent	43	14.33	NA
Very good	166	55.33	NA
Good	82	27.33	NA
Fair	8	2.67	NA
Poor	1	0.33	NA
Chronic disease			
Hypertension	11	3.67	NA
Diabetes	3	1.00	NA
Stroke	1	0.33	NA
Cancer	1	0.33	NA
Breathing problems	5	1.67	NA
Mental illness/disorder	0	0.00	NA
Others (specify)	10	3.33	NA
None	272	90.67	NA
Hospitalization in the last 5years			
Yes	61	20.33	NA
No	239	79.67	NA
Experience of serious illness			
In self	143	47.67	NA
In family	196	65.33	NA
In caring for others	109	36.33	NA
Language used for survey			
English	290	96.67	NA
Twi	10	3.33	NA

NA indicates not available.

state 11121 to −0.63 for health state 55555. There were 12 health states with a negative mean observed value out of the 86 health states included in the cTTO design.

Modeling Results

The modeled results for cTTO data are presented in Tables 3-5. The GLS random model with constrained intercept showed logically consistent coefficients but mobility level 2 and self-care level 2 were not significantly different from level 1. The heteroscedasticity of the data (demonstrated by an insignificant constant close to 1) was accounted for by specifying an interval regression heteroscedasticity model (model 2), which showed logically consistent coefficients that were all significant except mobility levels 2 and 3. To account for left censoring at −1 observed in the data, a Tobit random effect model (model 3) was specified and resulted in logically consistent coefficients but nonsignificant for mobility levels 2 and 3 and self-care level 2. Model 4 specifies a Tobit random effect heteroscedastic model in which an interval regression was fitted to further account for heteroscedasticity (specified as a function of observables). This model produced illogically ordered coefficients and insignificant parameters for mobility level 4, self-care level 3, usual activity level 4, and pain/discomfort level 3, hence was not taken forward.

The DCE data was modeled using a conditional logit model. Disutility for the DCE model (Table 4) was calculated by rescaling the coefficients of the DCE model using a rescaling factor (5.37), which was derived from the theta value from the hybrid model (1.68) and the Euler number (2.618). All parameters were statistically significant and logically ordered.

Table 2. Self-reported health using the EQ-5D-5L descriptive system and the EQ VAS.

EQ-5D-5L descriptive system with scores in %					
Parameter	**Mobility**	**Self-care**	**Usual activities**	**Pain/ discomfort**	**Anxiety/ depression**
No problems	89.33	95.00	84.67	59.33	61.00
Slight problems	8.67	4.00	14.00	35.67	31.33
Moderate problems	1.00	0.67	0.33	4.67	5.67
Severe problems	1.00	0.00	0.33	0.00	2.00
Unable/extreme problems	0.00	0.33	0.67	0.33	0.00
	Mean	SD	25^{th} percentile	50^{th} percentile	75^{th} percentile
VAS score	84.61	12.31	80	90	92

VAS indicates visual analog scale.

The parameter estimates for the hybrid models are presented in Tables 4 and 5. Model 6, a hybrid linear random effect model reports logically consistent coefficients with a nonsignificant parameter for anxiety/depression level 2. The hybrid model was tested for heteroscedasticity (model 7) and even though the constant was significant all the hybrid models were specified with constraint to the intercept because the *P* value (.020) was considered too far off from the *P* values (.000) of all the parameter estimates that were significant at less than 1% (.000). Model 7 was logically consistent with significant parameters. Model 8, a Hybrid Tobit reported logically consistent and significant parameters. Model 9, a Hybrid Tobit heteroscedastic, was logically ordered, and all parameters were significant.

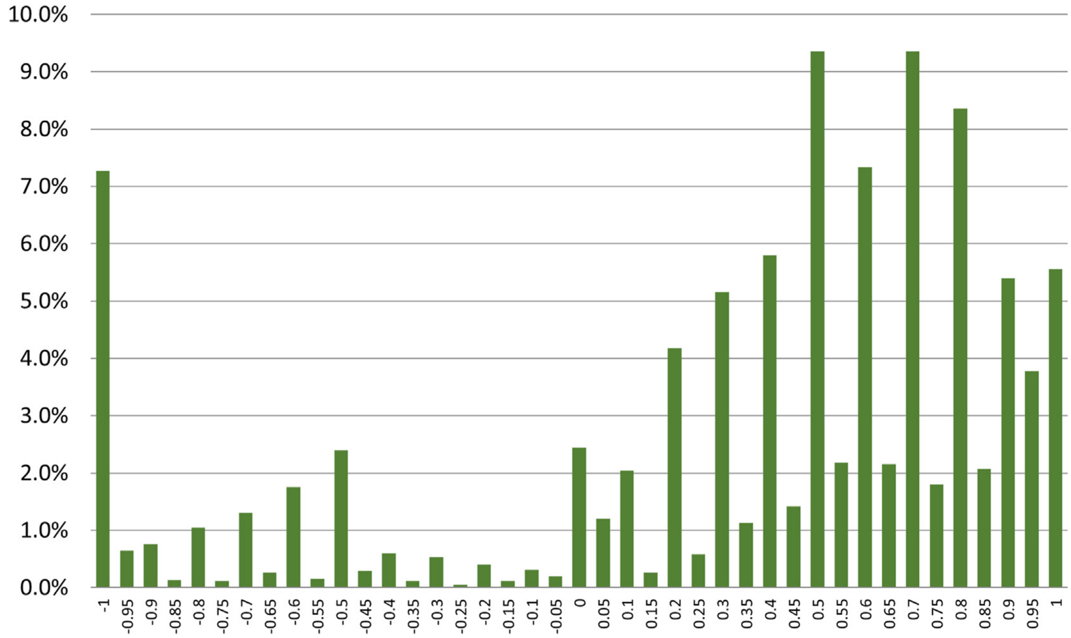
Preferred Model and Value Set

A model accounting for left censoring of the data—that is, censoring at −1—is a feature considered valuable[45] for data derived from the EQ-VT software because of how it was constructed.[38,45] In addition, any model with the ability to handle the heteroscedasticity of the error term is considered favorable. A choice of a Tobit model is empirically justified because of the left censoring of the data at −1 (7.3%). Model 9 satisfies these conditions and reports logically consistent and significant parameters, hence, the best model of choice for the Ghana value set. The predicted value for the worst attainable health on the EQ-5D-5L (ie, 55555) was −0.493 and the best health state (11112, except full health) was 0.969. The largest decrement was registered for level 5 mobility (0.369) followed by pain/discomfort (0.312), self-care (0.273), anxiety/depression (0.271), and usual activities (0.268). In addition, the dimension ranking of model 9 aligns with the relative importance of dimensions of other hybrid models explored. For any given health state, the utility value can be estimated by subtracting the parameter estimates for each dimension level of the health state from 1. For example, the utility value for health state 11213 will be calculated as 1 − (0.037+ 0.090) = 0.873.

Sensitivity Analysis

Excluding the health states that were flagged by respondents did not qualitatively change the model estimates. The dimension ranking remains unchanged for both models. The range of differences between the parameters of the 2 models is −0.001 to 0.009,

Figure 1. Observed cTTO value distribution.



cTTO indicates composite time trade-off.

Table 3. Model parameters.

Parameters	Model 1: cTTO (GLS constrained)			Model 2: cTTO (GLS, heteroscedastic, constrained)			Model 3: cTTO (Tobit RE constrained)			Model 4: cTTO (Tobit RE heteroscedastic, constrained)		
	Coefficient	SE	*P* value	Coefficient	SE	*P* value	Coefficient	SE	*P* value	Coefficient	SE	*P* value
MO												
MO2	0.002	0.016	.884	0.016	0.015	.302	−0.002	0.017	.896	0.152	0.025	.000
MO3	0.034	0.017	.040	0.029	0.020	.151	0.025	0.018	.150	0.092	0.026	.000
MO4	0.209	0.019	.000	0.244	0.024	.000	0.203	0.020	.000	-0.050	0.031	.098
MO5	0.317	0.017	.000	0.315	0.134	.000	0.327	0.018	.000	-0.237	0.031	.000
SC												
SC2	0.031	0.015	.045	0.038	0.019	.005	0.032	0.0162	.052	0.251	0.026	.000
SC3	0.050	0.020	.010	0.066	0.021	.001	0.051	0.021	.015	-0.005	0.031	.883
SC4	0.238	0.018	.000	0.235	0.021	.000	0.244	0.019	.000	-0.144	0.032	.000
SC5	0.287	0.018	.000	0.258	0.018	.000	0.309	0.017	.000	-0.246	0.032	.000
UA												
UA2	0.045	0.017	.011	0.039	0.015	.011	0.044	0.019	.020	0.158	0.031	.000
UA3	0.117	0.017	.000	0.103	0.019	.000	0.119	0.018	.000	0.108	0.029	.000
UA4	0.203	0.018	.000	0.198	0.021	.000	0.209	0.019	.000	-0.040	0.033	.223
UA5	0.295	0.016	.000	0.281	0.020	.000	0.317	0.017	.000	-0.174	0.028	.000
PD												
PD2	0.043	0.015	.004	0.036	.012	.002	0.040	0.016	.011	0.289	0.025	.000
PD3	0.076	0.018	.000	0.060	.021	.004	0.079	0.019	.000	0.004	0.029	.902
PD4	0.261	0.016	.000	0.232	.019	.000	0.270	0.017	.000	-0.228	0.025	.000
PD5	0.388	0.017	.000	0.371	.022	.000	0.411	0.0182	.000	-0.255	0.033	.000
AD												
AD2	0.058	0.017	.001	0.053	.012	.000	0.058	0.018	.001	0.592	0.034	.000
AD3	0.085	0.018	.000	0.072	.020	.000	0.079	0.019	.000	0.568	0.037	.000
AD4	0.241	0.016	.000	0.224	.019	.000	0.244	0.017	.000	0.301	0.037	.000
AD5	0.320	0.016	.000	0.315	.018	.000	0.335	0.017	.000	0.187	0.037	.000
Logical inconsistency	0	NA	NA	0	NA	NA	0	NA	NA	5	NA	NA
Ranking of dimensions	PD > AD > UA > SC > MO			PD > AD > UA > MO > SC			PD > AD > UA > SC > MO			PD > AD > UA > SC > MO		

NA indicates not available.

as presented in Table 5. The difference between the predicted value for the worst and best attainable health states for the 2 models was also insignificant: −0.009 and −0.001, respectively. In addition, a kernel density plot of the 2 models (see Appendix 1 in Supplemental Materials found at https://doi.org/10.1016/j.vhri.2024.101045) showed visually similar models. The mean value for health profile 55555 for the 2 models was 1.491 (model 9) and 1.484 (model 10). Based on these observations, the flagged responses were not excluded from the main analysis. The differences in value set per language under which the interview was conducted could not be explored because of the smaller proportion of interviews conducted in the local language (3%) than in English (97%).

Discussion

This study is the first to estimate the EQ-5D-5L value set for Ghana and West Africa using an international protocol, which allows for comparison with EQ-5D-5L studies conducted in other countries. The study also adds to the few existing EQ-5D-5L valuation studies to be conducted in Africa.[9,16,30] It is also the first published EQ-5D-5L valuation study to use the adapted version of the EQ-VT protocol where a smaller sample completed more cTTO and DCE tasks than the standard protocol. The model of choice, Hybrid Tobit RE heteroscedastic unconstrained, allowed the study to use all available data collected and accounted for the left-censored and heteroscedasticity nature of the data. The choice of a hybrid model is consistent with other high-quality recently published EQ-VT EQ-5D-5L valuation studies in recent times.[12,14,16,20,45,49]

There was a 100% response rate to the survey, which authors attribute to the amount of money, GHS 100 (US dollar 8.5), received by the respondents as compensation for their time given the current economic situation in Ghana, where the majority of people are experiencing financial hardships. In addition, interviewers conducted a preassessment of every community before data collection to establish the times respondents were likely to be home. Contrary to the findings from other valuation studies, no respondent self-reported perfect health (no problems in all

Table 4. Model parameters continued.

Parameters	Model 5: DCE (conditional logit constrained)			DCE (rescaled coefficient)			Model 6: Hybrid (linear, RE, constrained)			Model 7: Hybrid (linear, RE heteroscedastic, unconstrained)		
	Coefficient	SE	*P* value	coefficient	SE	*P* value	Coefficient	SE	*P* value	Coefficient	SE	*P* value
MO												
MO2	0.556	0.075	.000	0.105	NA	NA	0.062	0.012	.000	0.059	0.010	.000
MO3	0.583	0.090	.000	0.110	NA	NA	0.075	0.013	.000	0.076	0.012	.000
MO4	1.397	0.094	.000	0.265	NA	NA	0.230	0.013	.000	0.228	0.012	.000
MO5	2.176	0.114	.000	0.412	NA	NA	0.372	0.013	.000	0.359	0.012	.000
SC												
SC2	0.444	0.081	.000	0.084	NA	NA	0.055	0.012	.000	0.053	0.010	.000
SC3	0.644	0.086	.000	0.122	NA	NA	0.094	0.013	.000	0.089	0.012	.000
SC4	1.358	0.095	.000	0.257	NA	NA	0.240	0.013	.000	0.226	0.012	.000
SC5	1.663	0.092	.000	0.315	NA	NA	0.288	0.012	.000	0.269	0.011	.000
UA												
UA2	0.380	0.076	.000	0.072	NA	NA	0.032	0.012	.006	0.036	0.010	.000
UA3	0.514	0.090	.000	0.097	NA	NA	0.078	0.012	.000	0.077	0.011	.000
UA4	1.094	0.093	.000	0.207	NA	NA	0.183	0.013	.000	0.184	0.012	.000
UA5	1.478	0.097	.000	0.280	NA	NA	0.276	0.012	.000	0.264	0.011	.000
PD												
PD2	0.519	0.082	.000	0.098	NA	NA	0.057	0.012	.000	0.0567	0.009	.000
PD3	0.697	0.091	.000	0.132	NA	NA	0.089	0.013	.000	0.0896	0.012	.000
PD4	1.314	0.096	.000	0.249	NA	NA	0.230	0.013	.000	0.2230	0.012	.000
PD5	1.660	0.102	.000	0.315	NA	NA	0.331	0.013	.000	0.3109	0.013	.000
AD												
AD2	0.260	0.085	.002	0.049	NA	NA	0.022	0.012	.072	0.0368	0.009	.000
AD3	0.570	0.091	.000	0.108	NA	NA	0.080	0.013	.000	0.0910	0.012	.000
AD4	1.209	0.097	.000	0.229	NA	NA	0.208	0.012	.000	0.2173	0.011	.000
AD5	1.388	0.097	.000	0.263	NA	NA	0.272	0.012	.000	0.2722	0.012	.000
Constant	NA	NA	NA	NA	NA	NA	NA	NA	NA	−0.0143	0.006	.020
Logical inconsistency	0	NA	NA	0	NA	NA	0	NA	NA	0	NA	NA
Ranking of dimensions	MO > PD > SC > UA > AD			MO > PD > SC > UA > AD			MO > PD > SC > AD > UA			MO > PD > SC > AD > UA		

NA indicates not available.

dimensions: 11111). The reason for this observation is not entirely understood. The proportion of respondents who self-reported "no problems" in each dimension of the EQ-5D-5L descriptive system, however, was highest for self-care (95%) and lowest for pain/discomfort (59%). This is similar to other valuation studies including in Africa.[11-14,43,50]

This study generated a logically consistent value set, which was all statistically significant. The largest decrement was registered for level 5 mobility (0.369) followed by pain/discomfort (0.312), self-care (0.273), anxiety/depression (0.271), and usual activities (0.268). The marked difference observed between the disutility associated with mobility and the other dimensions further reflects the importance Ghanaians associate with their ability to "move." This preference can be explained by the fact that most Ghanaians are self-employed, thus, mobility is strongly associated with earning a living. Other Ghanaian studies have reported an association of perceived well-being, good health, and quality-of-life to work and economic engagement.[51-53] In addition, unlike in developed countries, there is little access to a social welfare system that provides support including income for individuals who are disabled or out of a job. Furthermore, people with a mobility disability face many access barriers to infrastructure including public buildings and transportation,[54,55] which makes living independently in Ghanaian society difficult for them. The overall ranking of the dimensions also reflects the Ghanaian public's perception of the importance of disabilities and symptoms as described by the EQ-5D-5L. Similar to Ghana, mobility was reported as the most important dimension in Egypt[9] and other Asian countries[14,20,49] with similar social welfare systems and infrastructure that support people living with mobility problems. Similar to studies in Africa[9] and other continents,[12,13,45,49,56] usual activities were considered the least important.

Table 5. Model parameters Continued.

Parameters	Model 8: Hybrid (Tobit, RE, constrained)			Model 9: Hybrid (Tobit, RE heteroscedastic, constrained)			Model 10 Sensitivity analysis Hybrid (Tobit, RE heteroscedastic, constrained excluding flagged responses)			Observed difference in coefficients of parameters for Model 9 and the Model 10		
	Coefficient	SE	*P* value	coefficient	SE	*P* value	Coefficient	SE	*P* value	Coefficient	SE	*P* value
MO												
MO2	0.061	0.012	.000	0.060	0.010	.000	0.058	0.010	.000	0.002	NA	NA
MO3	0.073	0.014	.000	0.077	0.012	.000	0.076	0.012	.000	0.001	NA	NA
MO4	0.234	0.014	.000	0.233	0.013	.000	0.227	0.013	.000	0.006	NA	NA
MO5	0.386	0.014	.000	0.367	0.013	.000	0.364	0.013	.000	0.003	NA	NA
SC												
SC2	0.055	0.012	.000	0.053	0.009	.000	0.051	0.009	.000	0.002	NA	NA
SC3	0.095	0.014	.000	0.089	0.012	.000	0.084	0.012	.000	0.005	NA	NA
SC4	0.245	0.014	.000	0.228	0.013	.000	0.219	0.012	.000	0.009	NA	NA
SC5	0.301	0.013	.000	0.273	0.012	.000	0.271	0.012	.000	0.002	NA	NA
UA												
UA2	0.030	0.012	.005	0.037	0.010	.000	0.035	0.010	.000	0.002	NA	NA
UA3	0.077	0.013	.000	0.075	0.011	.000	0.074	0.011	.000	0.001	NA	NA
UA4	0.187	0.013	.000	0.187	0.012	.000	0.186	0.012	.000	0.001	NA	NA
UA5	0.288	0.013	.000	0.268	0.012	.000	0.268	0.012	.000	0.000	NA	NA
PD												
PD2	0.055	0.012	.000	0.050	0.009	.000	0.050	0.008	.000	0.001	NA	NA
PD3	0.089	0.014	.000	0.086	0.012	.000	0.087	0.012	.000	-0.001	NA	NA
PD4	0.236	0.013	.000	0.223	0.012	.000	0.225	0.012	.000	-0.002	NA	NA
PD5	0.347	0.014	.000	0.312	0.014	.000	0.313	0.014	.000	-0.001	NA	NA
AD												
AD2	0.018	0.013	.000	0.032	0.009	.000	0.031	0.009	.000	0.001	NA	NA
AD3	0.078	0.014	.000	0.090	0.012	.000	0.088	0.012	.000	0.002	NA	NA
AD4	0.210	0.013	.000	0.216	0.011	.000	0.214	0.012	.000	0.002	NA	NA
AD5	0.280	0.013	.000	0.273	0.012	.000	0.268	0.012	.000	0.005	NA	NA
Logical inconsistent	0	NA	NA	0	NA	NA	0	NA	NA	NA	NA	NA
Ranking of dimensions	MO > PD > SC > AD > UA			MO > PD > SC > AD > UA			MO > PD > SC > AD > UA			NA		

AD indicates anxiety/depression; cTTO indicates composite time-trade-off; DCE, discrete-choice experiments MO, mobility; NA, not available; PD, pain/discomfort; RE, random effect; SC, self-care; UA, usual activities.

Compliance to study QC protocol and resulting limited impact of interviewer effects on data collected was revealed in the low percentage of clustering at critical cTTO data points: −1, −0.5, 0, 0.5, and 1. In the cTTO task, 7.3% of observations were clustered at −1. Ghanaian participants traded 20 years of their lives to avoid living in certain health states; this is lower than reported for Egypt (13.3%),[9] Ethiopia (8.04%),[16] Italy (7.92),[12] and the USA (14.7%),[13] and higher than that of Uganda (2.32%)[30] and Mexico (6.9%).[50] Furthermore, there was less clustering observed at −0.5 (2%), 0 (2.4%), and 1 (5.6%) than other published EQ-VT EQ-5D-5L valuation studies[9,12,13]: −0.5 (Egypt 4%), 0 (USA 5.1%) and 1 (Italy 11.14%; USA 20.5%, Egypt 12.3%).

The predicted value for the worst attainable health on the EQ-5D-5L was -0.493 similar to that reported for Malaysia (−0.442)[49] but lower than reported in most published valuation studies using the standardized EQ-VT protocol.[9,12-14,20,30,45,50,56]

Some strengths of this study are worth highlighting. All 3 interviewers adhered to the QC protocol compliance indicators resulting in low clustering of values and limited interviewer effects, which is suggestive of a high-quality EQ-VT EQ-5D-5L valuation study. The availability of a Ghanaian tariff would facilitate the use of QALYs in economic evaluation studies and support adherence to the Ghana economic evaluation reference case that mandates the use of QALYs as an outcome measure. A Ghanaian tariff will further strengthen efforts at institutionalizing HTA for priority setting in the Ghanaian health system. It also presents an opportunity to compare the cost-effectiveness of different interventions and health technologies using the same outcome measure, QALY, for priority setting in addition to other factors deemed important by Ghanaian decision-makers.

One notable limitation of this study is the fact that the sample size was smaller than other valuation studies and respondents were asked to complete more tasks to generate more observations. Completing more tasks could have led to both interviewer and interviewee fatigue and consequently responses observed. Strict adherence to the QC protocol ensured this effect was minimized. In addition, the distribution of participants interviewed deviated from the gender composition of the Ghanaian population; however, the demographic characteristics of study participants still had the required diversity and were representative of the distribution of the Ghanaian population on other demographic characteristics.

Conclusion

To our knowledge, this is the first Ghanaian EQ-5D-5L value set based on social preference derived from a nationally representative sample. It is also one of the few EQ-5D-5L valuation studies to be conducted in Africa. The value set will play a key role in the institutionalization of HTA in Ghana and the use of economic evaluation studies to inform priority settings where different health technologies can be compared. This study also supports the feasibility of conducting EQ-5D-5L valuation studies in a resource-constrained setting and the use of the adapted version of the EQ-VT protocol in the derivation of a value set, comparable to those derived with the standard protocol.

Author Disclosures

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

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