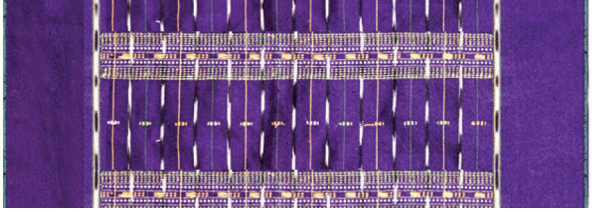

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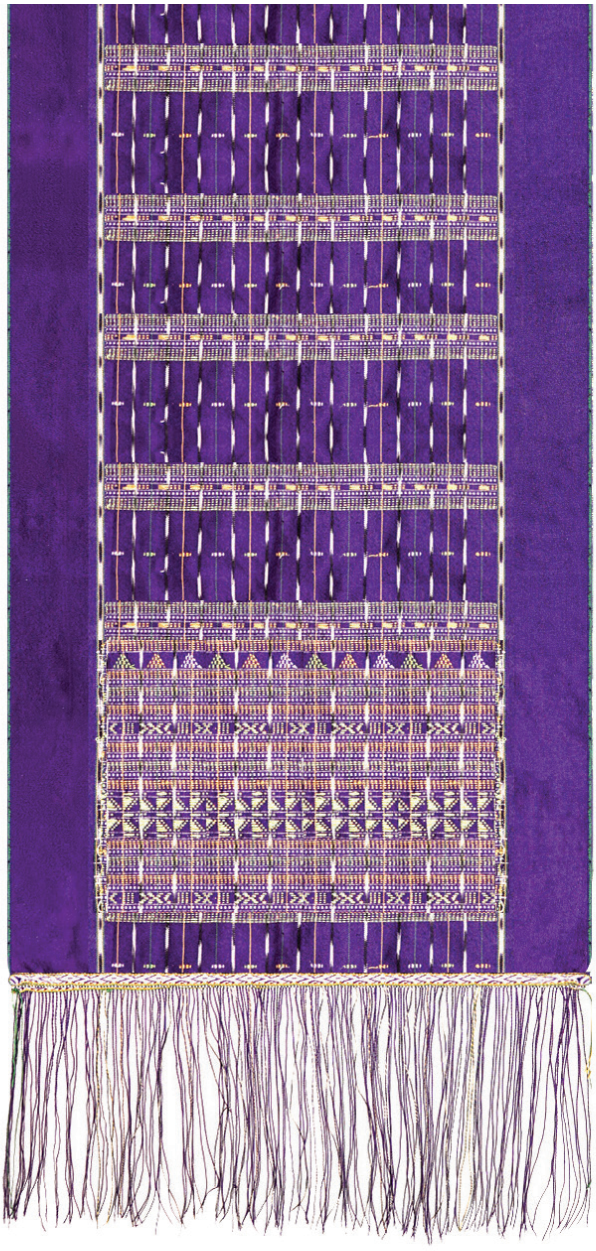

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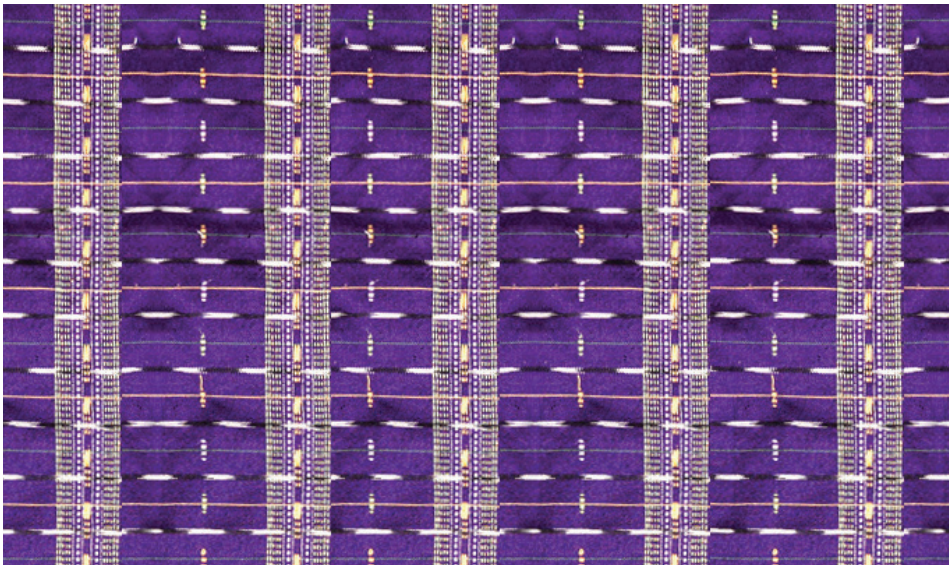

Fredrick Dermawan Purba

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Kwaliteit van leven meting en de toepassing in Indonesië

Thesis

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CHAPTER 1

General introduction

In Indonesia, health-related quality of life (HRQOL) measurement has become important, as the government aims for a health policy based on reasonable benefits for the scarce health care budget. This requires objective estimates of HRQOL. Indeed, several internationally-accepted HRQOL measures, such as WHOQOL-BREF and EQ-5D-5L have been translated into Bahasa Indonesia and are used in investigations in Indonesia. To ensure valid use of these questionnaires, it is necessary to establish their psychometric properties in Indonesia, their population norms, and '*health economic value sets*'. This thesis sets out to investigate these aspects of WHOQOL-BREF and EQ-5D-5L in Indonesia in a large, representative sample of the general population. Moreover, the investigations presented in this thesis explore the introduction of quality control in sampling and administration of the questionnaires, thus ensuring state-of-the-art sampling and administration. The use of the questionnaires and their norm scores is illustrated by investigating the quality of life of people living on the banks of the polluted Ciliwung river in Jakarta.

Indonesia and quality of life

Indonesia consists of 13.466 islands and 255.5 million inhabitants in 2015 [1]. The current president, Joko Widodo, launched a national development agenda entitled Nawa Cita, consisting of nine development priorities [2]. One of the nine priorities was to improve the quality of life of its people. Quality of life is defined by the World Health Organization (WHO) as: "*individuals' perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns*" [3]. This thesis focuses on HRQOL, i.e. the health aspects of quality of life [4,5]. Health itself is defined by WHO as '*a state of complete physical, social and mental well-being and not merely the absence of disease or infirmity*' [6]. Different national programs have been implemented to improve the quality of life of the Indonesian people, including by the Ministry of Health (MoH), one of whose major programs has been basic national health insurance provided for everyone in Indonesia, regardless of socio-economic status. This 'Jaminan Kesehatan Nasional' was implemented in 2014 and aims to include all Indonesian citizens by 2019 [7]. It was predicted by the MoH that the implementation of the insurance scheme had the potential to increase the need for medication and medical devices. Even though the economy of the country has grown steadily, the health budget is limited: to about 2.5% of the total national budget [8]. The limited budget available to meet the 'infinite' demands of health care services and insurance produces a challenge for priority setting in decision-making. Hence, a scientifically-based strategy with respect to decision-making in the utilization of the health budget could ensure the optimal use of medication and medical devices for the population. Health economic studies provide such a strategy. In addition to medical interventions, there are programs run by other ministries that

indirectly affect the population's health that require scientifically-based policy, for example, efforts to reduce pollution, improve traffic conditions, or provide decent housing. To measure the effects of these efforts to improve the quality of life of the Indonesian population, objective estimates of HRQOL are also required.

HRQOL measurement

HRQOL instruments are commonly utilized: i) to monitor perceived health status in epidemiological surveys, ii) to assess the subjective health and well-being of the general population, and specific groups, such as patients, iii) to measure outcomes in effectiveness studies, and iv) to compare cost-effectiveness between different health interventions in health technology assessment. HRQOL questionnaires can be classified as generic and disease-specific. The generic measures are used to measure HRQOL across all kinds of respondents, from healthy populations to patient groups: e.g. the EuroQol EQ-5D, the World Health Organization Quality of Life-BREF (WHOQOL-BREF), and RAND's Short Form Health Survey-36 (SF-36). The disease-specific questionnaires are designed with a focus on the health-related problems in specific diagnosis, treatment, or age groups. Examples are the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30), the quality-of-life index for pediatric inflammatory bowel disease (IMPACT), and the Asthma Quality of Life Questionnaire (AQLQ) [9]. Further, the generic HRQOL instruments can be grouped into two: i) those describing the profiles of HRQOL domains (multidimensional), and ii) those producing '*utilities*' used for economic evaluation (unidimensional) [10].

The WHOQOL-BREF instrument, developed by WHO, is an example of the first type of generic HRQOL instrument. It measures four domains of quality of life: physical, psychological, social and environmental. It was designed based on a cross-cultural methodology to be used in epidemiological studies and transcultural investigations [3,11] and has been proven valid across many health conditions in various countries [11-18]. WHOQOL-BREF presents a differentiated picture of health-related quality of life, addressing the domains listed above [19].

EQ-5D-5L is an example of the second type of generic HRQOL instrument. It is provided by the EuroQol Group, consists of five items covering five health state dimensions (descriptive system): mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, with five levels of severity of problems; followed by a self-rating of overall health status on a visual analogue scale (EQ-VAS) ranging from 0 ("worst imaginable health state") to 100 ("best imaginable health state") [20]. EQ-5D-5L has been shown to be valid in many settings and countries [21-27]. To be utilized in economic evaluations, EQ-5D descriptive responses should be converted into an 'index score' using a value set representing societal preferences: a national value set [28,29]. The index score is often referred to as a 'utility'. Several national

Health Technology Assessment (HTA) organizations, for example in the UK and Thailand, have recommended EQ-5D as the preferred method for deriving utilities to be used in economic evaluation in their respective countries [30,31].

While the two questionnaires are increasingly being used in different types of investigations in Indonesia [32-38], the literature on the psychometric properties of both instruments in the Indonesian general population and in different sub-populations, e.g., patients and marginalized communities such as those living on an impoverished riverbank, is limited. Moreover, neither population norms nor a national value set are available for the two questionnaires. Hence this thesis reports on the investigations implemented to arrive at such norm data and value sets.

Psychometric properties and valuation of HRQOL instruments for the Indonesian population

There are several studies investigating the validity and reliability of EQ-5D-5L and WHOQOL-BREF in Indonesian samples. These showed that EQ-5D-5L is valid and reliable in human papilloma virus (HPV)-related cancer patients [39], and WHOQOL-BREF in the Indonesian elderly [40]. Yet, no previous investigation reported test-retest results for the two questionnaires. Such reliability tests would support the use of both questionnaires in HRQOL measurement in Indonesia if they were indeed proven to be reliable over time.

Furthermore, no previous study reported Indonesian national representative norm scores for the two questionnaires. These norm scores are needed as reference values for various patient groups or for any particular group of individuals. Different stakeholders, such as clinicians, researchers, public health experts, epidemiologists, and health care workers could utilize such norm scores in their investigations or interventions.

Indonesia has no national EQ-5D-5L value set. Previous investigations used the values derived from citizens of the United Kingdom (UK) or Malaysia [35,34]. Since the health preferences among the countries are different [41-44], and because values might not compatible with the different languages of the UK and Malaysia, it is best for research be conducted in Indonesia to utilize a value set that represents the living standards and culture of the Indonesian people.

To obtain the EQ-5D-5L value set, a standardized method has been implemented, namely the EuroQol Valuation Technology (EQ-VT). EQ-VT implements two value elicitation techniques: the composite Time Trade-Off (C-TTO), and Discrete Choice Experiments (DCE) [45,46]. This standardized protocol tries to ensure that each person being interviewed is exposed to the same stimuli and all answers are recorded in the same manner, in order to ensure as much as possible that differences in answers cannot be attributed to the interview process, but to

differences among respondents. To ensure that interviews would be standardized in different valuation studies, a quality control (QC) report tool was implemented [47]. This thesis sets out to test whether this QC tool can be employed and refined in Indonesia.

The EQ-VT protocol has been implemented in different countries to obtain national value sets [48-54]. However, no evidence has been reported on the test-retest reliability of the valuation methods used: C-TTO and DCE. Such psychometric evidence would support the use of EQ-VT, and even the C-TTO and DCE, not only in Indonesia but also at an international level.

Application of HRQOL measurement in a specific population: people living on a riverbank

In this thesis, the two questionnaires were used: (i) to measure HRQOL of an underprivileged group - people living on a polluted riverbank - and to compare their scores with those of the general population. (ii) to report on the relationships between socio-demographic factors such as age, gender, income, and living on a polluted riverbank, and HRQOL.

Outline and aims of this thesis

The thesis presents EQ-5D-5L health state values provided by the general population (the 'value set') and EQ-5D-5L and WHOQOL-BREF norm scores. The process of ensuring a standardized procedure for data collection and the implementation of a quality control tool is also presented. The application of the two questionnaires to the measurement of HRQOL in a community that lived on the Ciliwung riverbank in Jakarta, and comparison with the normative scores, is presented subsequently.

The research objectives in this thesis are as follows:

1. To obtain the values of different EQ-5D-5L health states according to the Indonesian general population in a standardized way.
2. To establish the test-retest reliability of the methods used to obtain the value set: C-TTO and DCE utilizing EQ-VT.
3. To establish the test-retest reliability of two frequently-used HRQOL measures: EQ-5D-5L and WHOQOL-BREF.
4. To obtain population norm scores for EQ-5D-5L and WHOQOL-BREF.
5. To apply these instruments in a specific population: people living on a polluted riverbank.

Chapter 2 provides insights into (i) the experiences of the interviewers in the field and their respondents during data collection, and (ii) the improvement of the interviewers' performances in conducting standardized EQ-VT interviews with the help of a quality control (QC) tool and continuous feedback. The problems encountered by the interviewers included finding

respondents, conducting the interviews, and overcoming technical difficulties. Chapter 2 presents the solutions found.

Chapter 3 presents the test-retest reliability of the two techniques used in the EQ-VT interviews to elicit values of health states: C-TTO and DCE. The stability over time of these two techniques is checked from two perspectives, the respondent perspective and the health states perspective.

In **Chapter 4**, the EQ-5D-5L value set obtained from the Indonesian general population is presented, including the procedure for obtaining the value set and the different modelling approaches.

The investigation on the test-retest reliability of EQ-5D-5L and WHOQOL-BREF and the normative scores of the two questionnaires from the Indonesian general population are presented in **Chapter 5**, including the subgroups analysis in respect of residence, gender, level of education, age, religion and ethnicity groups.

In **Chapter 6,** the quality of life and health status of a specific population in Indonesia: people living on the banks of Ciliwung river in Jakarta, are reported, along with happiness, life satisfaction, and perceived economic circumstances. This is undertaken in comparison with a matching control group. In addition, the people living on the banks of Ciliwung river are compared to the inhabitants of Jakarta in general, and with the Indonesian general population.

Chapter 7 presents a general discussion on the findings of the studies presented in this thesis, including recommendations for relevant stakeholders and future research.

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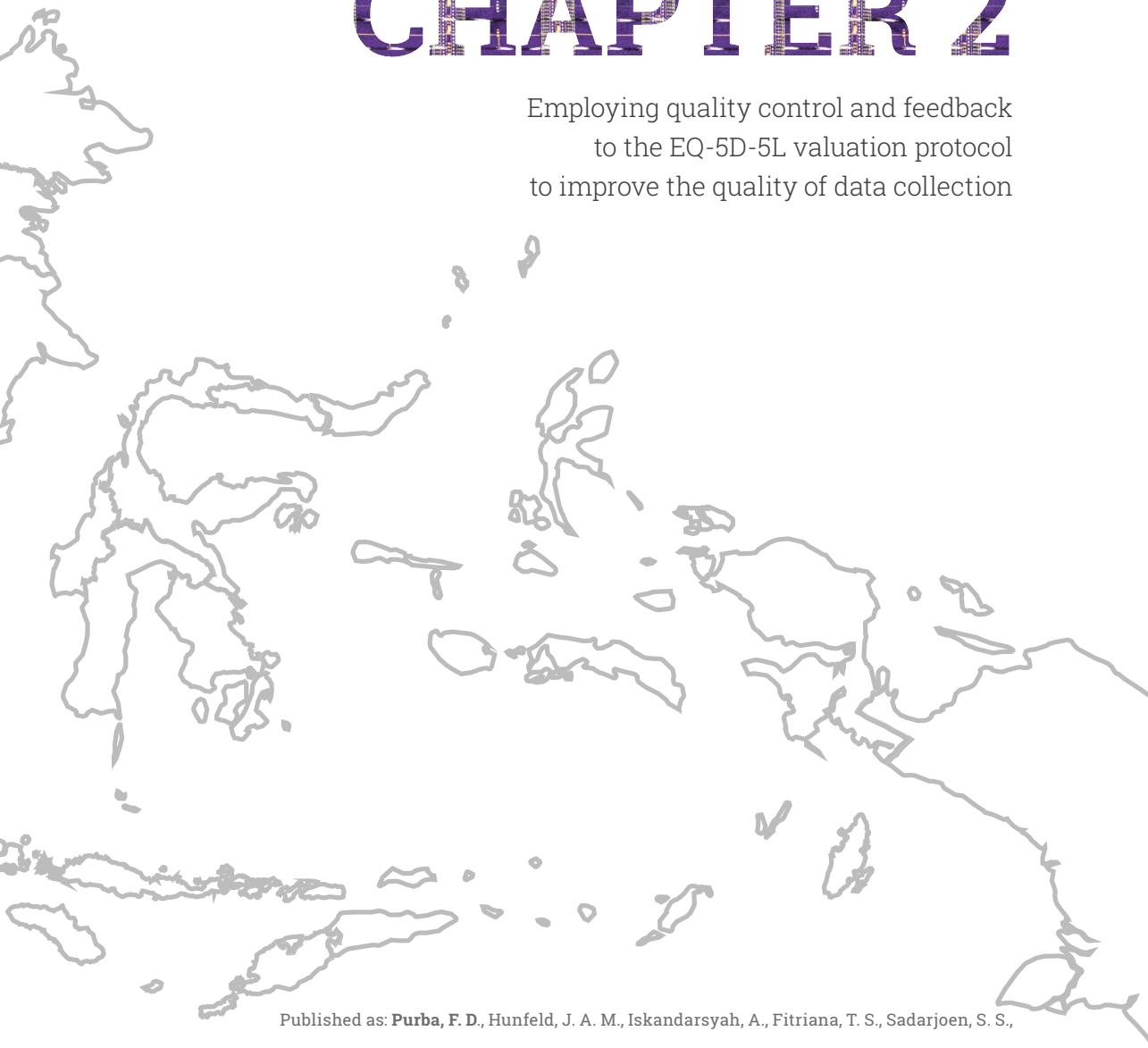
CHAPTER 2

Employing quality control and feedback to the EQ-5D-5L valuation protocol to improve the quality of data collection



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Abstract

OBJECTIVES: In valuing health states using generic questionnaires such as EQ-5D, there are unrevealed issues with the quality of the data collection. The aims were to describe the problems encountered during valuation and to evaluate a quality control report and subsequent retraining of interviewers in improving this valuation.

METHODS: Data from the first 266 respondents in an EQ-5D-5L valuation study was used. Interviewers were trained and answered questions regarding problems during these initial interviews. Thematic analysis was used and individual feedback was provided. After completion of 98 interviews, a first quantitative quality control (QC) report was generated, followed by a one-day retraining program. Subsequently individual feedback was also given on the basis of follow-up QCs. The Wilcoxon Signed-Rank Test was used to assess improvements based on 7 indicators of quality as identified in the first QC and the QC conducted after a further 168 interviews.

RESULTS: Interviewers encountered problems in recruiting respondents. Solutions provided were: optimization of the time of interview, the use of broader networks, and the use of different scripts to explain the project's goals to respondents. Solutions applied to help respondents during interview were: developing the technical and personal skills of the interviewers and stimulating the respondents' thought processes. There were also technical problems related to hardware, software and internet connections. There was an improvement in all 7 indicators of quality after the second QC.

CONCLUSION: Training before and during a study, and individual feedback on the basis of a quantitative QC, can increase the validity of values obtained from generic questionnaires.

Introduction

The EQ-5D instrument is a generic health questionnaire developed by the EuroQol Group and widely used to measure health outcomes. The EuroQol Group released the newer version of EQ-5D in 2011, consisting of five levels of severity in each dimension [1]. Several valuation studies of this new questionnaire were conducted internationally with the aim of developing country-specific algorithms for EQ-5D-5L [2-7]. For such valuation studies, the EuroQol Group promotes a standardized protocol: the EQ Valuation Technology, or EQ-VT. This EQ-VT protocol includes a computer supported time trade-off (TTO) exercise, a visual analog scale (VAS), and a discrete choice experiment (DCE) [8]. In earlier TTO, VAS, and DCE administrations researchers noticed problems with the quality of the responses such as 'non-traders' (those not willing to trade life-years for health), and illogical answers, both of which could affect the quality of the data [9]. Another problem has been in obtaining values below the value of dead [10]. One of the reasons the EQ-VT was developed was to overcome such problems [11].

In addition to these efforts, several investigations were conducted in the area of methodology [8,12], approaches and techniques [13-15], and data analysis [16,17], in order to increase the quality of the data collection and data reporting, but none of these investigations focused on the interviewers. Such a focus is warranted, since training for interviewers, before and during data collection, has been shown to relate to data quality [9]. However, it is not yet clear how this training is undertaken in a valuation procedure, such as the EQ-VT protocol, nor what are the results of such training. The EuroQol Group has recognized the quality of data collection as a relevant topic and has developed a continuous quality monitor for data collection: the quality control (QC) report tool. How interviewers and supervisors improve in response to this QC report is as yet unknown.

The main purposes of this study were (i) to describe the problems of the interviewers. First of all, finding sufficient subjects who are representative for the general population, the problems interviewers encountered during their interviews, and the problems they perceived in their respondents as these respondents endeavored to undertake the TTO, DCE and VAS exercises; (ii) to evaluate quantitatively the improvement in interviewers' skills displayed after a retraining program based on the QC provided by the EuroQol Group office, individual feedback, and the advice from the daily supervisor.

Methods

Respondents and interviewers

This study is part of a larger valuation study using a health-related quality of life measurement tool, EQ-5D-5L, for the general Indonesian population. Thirteen interviewers were hired to interview 1000 respondents in three different cities (Jakarta, Bandung and Jogjakarta) and their surrounding areas. Quota sampling was used to make the sample representative of the Indonesian population with regard to six demographic characteristics: location (urban-rural), gender, age, level of education, religion, and ethnicity [18]. The majority of the interviewers had Bachelors' degrees in various disciplines, especially quality of life-related majors (e.g. Psychology, Management, Development Communication, Economics). One interviewer had obtained a Master's degree in Psychology. Each interviewer was included as a participant if she/he fulfilled the following inclusion criteria: present at the first training session and at a retraining program, and completion of at least 15 interviews after retraining.

Instruments

EQ-5D-5L Valuation Technology (EQ-VT)

To generate national health state values for EQ-5D-5L, and to standardize EQ-5D-5L valuation studies, the EuroQol Group developed a valuation protocol [8] and the EQ-VT computer program. The protocol consists of five parts: (i) general welcome, (ii) introduction to the EQ-5D-5L descriptive system, the VAS, and the socio-demographic background questions, (iii) composite time trade-off (cTTO) tasks [19]; (iv) DCE tasks, and (v) round up. All steps were accomplished using computer-assisted face-to-face interviews employing the EQ-VT software provided by the EuroQol Group.

Open-ended Questionnaire

An open-ended questionnaire comprising three questions was given to the interviewers. (i) 'What were the problems that you as an interviewer faced whilst conducting EQ-5D-5L valuation study interviews?' (ii) 'What were the problems that you think your respondents faced in completing EQ-5D-5L valuation study interviews?' (iii) 'What were the solutions that you applied to overcome your problems as an interviewer and the problems of your respondents?'

Quality Control (QC) Report

The QC report takes the form of a Microsoft Excel file that provides a number of statistics related to the quality of the data collected so far, differentiated per interviewer. It measured

interviewers' compliance with the valuation study protocol. Seven protocol compliance indicators were used:

i. The number of health states given a value of zero in the TTO tasks over all the interviews.
ii. The mean number of iterative TTO steps used in the wheelchair example by the interviewer, over all his or her interviews. More steps used means the interviewer explained the wheelchair example more thoroughly than less amount of steps.
iii. The number of times when a respondent had an inconsistency where the TTO rating of state 55555 was not rated as the state with the lowest value and at least 0.5 higher than the state with the lowest value. If such an inconsistent response was found, the whole interview was deemed to be of low quality and as such 'flagged'.
iv. The number of times when the duration of time an interviewer used to explain the 'wheelchair example' preceding the actual valuation task was less than 180 seconds. The interview was flagged as being of low quality.
v. Interview duration: the minutes taken to complete the TTO valuation task. If the TTO task lasted less than 5 minutes, the interview was flagged.
vi. Wheelchair lead time flagged: the interviewer was required to explain the worse-than-dead element of the wheelchair example. If not, then the interview was flagged.
vii. The overall indicator of quality was the percentage of flagged interviews per interviewer. It was considered that this should be below 40%. The daily supervisor used this indicator as the starting point for the conversation with the interviewer during feedback sessions.

Training and retraining

The primary training of the interviewers comprised of three sessions: (i) introduction of related concepts, such as health-related quality of life and EQ-5D-5L as a generic questionnaire used to value health states, (ii) explanation of the EQ-VT protocol and interviewer instructions, and (iii) practice in groups.

After 98 interviews, the first quality report was received based on the protocol compliance indicators. The overall indicator of quality, expressed by the percentage of flagged interviews, was 53%. This was deemed to be quite disappointing by the team since this should be below 40%. Hence the decision was made to discard the first 98 interviews, and hold further sampling until the interviewers were retrained, using the feedback from the quality report.

All interviewers were invited to the retraining program. The retraining program led by the daily supervisor (FDP) was held in each center and was attended by interviewers from that center only. First, FDP presented the QC report to show overall quality of each center's interviews based on seven objective indicators of compliance with the protocol. FDP then presented the compliance data of each interviewer. The interviewer explained their difficulties

to meet each indicator and provide suitable solutions to overcome these problems. A list of these problems and solutions was made in each center and shared to other centers.

To ensure interviewers adhere to every indicator of protocol compliance after the retraining program, FDP created QC reports once in two days. He made notes at a group level and on an individual level and sent this feedback to the interviewers so that they were able to learn from their own and other interviewers' performance.

Procedure

The valuation study was approved by the Health Research Ethics Committee, Faculty of Medicine, Padjadjaran University, Indonesia. The daily supervisor (FDP) created two QC reports using the Quality Control Microsoft Excel file provided by the EuroQol Group office. The first report generated on March 16th, 2015 consists of ninety-eight interviews conducted by the interviewers. This report was used as a basis for a retraining program held March 21st – 24th, 2015. The second report generated on May 18th, 2015 consists of 168 interviews conducted after the retraining program. On May 18th, 2015 the FDP sent an open-ended questionnaire by e-mail to each interviewer, asking them to return the questionnaire within one week. Three days later, all interviewers had sent their answers.

Data Collection and Analysis

The data regarding problems encountered by interviewers and respondents, and solutions applied to overcome these problems was considered as qualitative data and analyzed using a thematic analysis approach in order to provide relevant themes. The guidelines of Braun and Clarke [20] were and a qualitative software program, NVivo, was utilized. The first author (FDP) read all the answer documents from the interviewers and built an initial coding directory. Using this initial directory, FDP and two groups consisting of two coders (from the interviewers) each coded the transcripts separately. FDP and one group of coders coded that part of the interviewers' answers regarding problems encountered by interviewers and the solutions applied. FDP and the second group of coders discussed the other part of the data, the problems perceived by the interviewers as encountered by respondents and the solutions applied. During the coding process, coders frequently contacted the corresponding interviewer to clarify any unclear answer. A discussion was held to achieve agreement on differences that occurred in the initial coding. Codes were collated into potential themes, reviewed by FDP and the other coders, to generate a thematic map of the analysis. Finally, a discussion was held to produce definitions and names for each theme (the coding tree is available upon request). The thematic map, themes and sub-themes' names and definition were discussed

with all interviewers for additional comments. Frequencies for each theme and sub-theme were calculated and typical citations were noted.

Data from two QC reports regarding interviewers' performance was treated as quantitative data and analyzed using quantitative statistics software. To analyze the improvement in performance of the interviewers before and after the retraining program, software program SPSS version 21 for Windows was utilized. The Wilcoxon Signed-Rank Test was used to assess the improvement in interviewers' performance, based on 266 respondents' data (98 respondents before and 168 respondents after the retraining) on the seven previously-mentioned indicators.

Results

Interviewer characteristics

In total, 11 out of 13 interviewers were eligible to participate and returned their answers. One interviewer conducted a limited number of interviews in the second wave (below 15) and thus failed to fulfill the inclusion criteria. The other excluded interviewer was not present at the first training session and did not interview any respondent prior to the retraining program. As shown in Table 1, there were 2 male and 9 female interviewers. The interviewers' ages ranged from 21 to 27 years. The majority were Moslems and the rest Christians. Ethnicity also varied, namely Batak, Minang, Jawa, Sunda, Nusa Tenggara, and Ambon. All had a Bachelor's degree or a higher degree.

Table 1. Interviewer Demographics (n = 11)

Variable	n (%)
Gender	
Male	2 (18)
Female	9 (82)
Age Range	
21-24	7 (64)
25-27	4 (36)
Level of education	
Bachelor's degree	10 (91)
Master's degree	1 (9)
Religion	
Islam	8 (72)
Christian	3 (28)

Table 1 (continued). Interviewer Demographics (n = 11)

Ethnicity	
Ambon	1 (9)
Batak	1 (9)
Jawa	3 (28)
Minang	3 (28)
Nusa Tenggara	1 (9)
Sunda	2 (17)

Problems and solutions

Thematic data analysis provided two broad areas/themes: (i) Interviewing problems and solutions, and (ii) technical problems and solutions. A distinction can also be made between (i) problems in interviewing encountered by interviewers, and (ii) problems in interviewing encountered by respondents (as perceived by interviewers).

Problems in the Interviewing Process Encountered by Interviewers

Recruitment of Respondents. This theme concerned any problem related to finding a respondent and receiving his/her consent to participate in the study. Table 2 shows that the most frequently mentioned problem was to find suitable respondents. Obstacles identified were time and activity of the respondents, and local government permission to collect data.

An interviewer highlighted time and activity of respondents as her most frequent obstacles: "Sometimes it was difficult to make a schedule and arrange an appointment that matched the respondent's free time, considering that the interview usually takes more than 1 hour." Another interviewer wrote: "When an appointment is already agreed, but a respondent asks to change the day or time of interview."

In Indonesia is it common to ask the local official and unofficial authorities for permission to undertake any kind of research. The time and effort required to obtain such permission to collect data was also a problem for interviewers. "Some rural areas that we contacted earlier asked for a formal permission letter from the kecamatan (district) office, then permission from the kelurahan (smaller district), and from the head of the desa (village). This is the formal procedure."

Some respondents with specific characteristics were also difficult to find, especially ethnicities other than Jawa and Sunda in the rural areas and respondents aged over 50. "To find respondents with difficult-to-find characteristics, such as ethnicities non-Jawa and Sunda or respondents aged more than fifty."

Interview Process. This theme was defined as any problem related to conducting the data collection process, including following the protocol and dealing with the respondent's and interviewer's personal issues. Most interviewers mentioned at least one problem within this theme. To explain the procedure and practice section of the EQ-VT protocol was the most frequently mentioned problem. This was not only the case for lower-level education respondents: as one interviewer wrote "It took a long time to explain TTO to lower-level education respondents", but also for some of the higher- level education respondents. "Because my respondents are usually people with a higher level of education, they are more critical with respect to some health states that are illogical in their opinion, such as 'have no difficulty to walk' but 'can't take a bath.'"

Another problem was to deal with physical and psychological issues that resulted from the long duration of the interview. Respondents became tired and bored during the TTO and DCE exercises. "Respondents usually became tired after the Feedback Module."

Four interviewers admitted personal issues in conducting the interviews, including becoming bored during the interview session themselves, carelessness, not having the confidence to build good rapport, and confusion about how to explain the instructions and questions in a well-understood way. "At the beginning, it was difficult for me to explain to the respondents about this research because I didn't know the best way and tricks to explain it better."

Table 2. Problems of interviewers

No	Problems	Frequency[a]
1	Recruiting respondents	28
a	Finding respondents	24
b	Acquiring participation consent	4
2	Interview process	24
a	Conducting protocol steps (TTO and DCE)	15
b	Dealing with respondents	4
c	Interviewer personal issues	5

[a] *number of times the related problem was mentioned by interviewers*

Problems in Interviewing Encountered by Respondents (as perceived by Interviewers)

Participation. This theme comprised negative thoughts and feelings which were expressed regarding participation in the study during the explanation of informed consent. Five interviewers reported evidence of this, including respondents: (i) suspecting the interviewer of deception, or that this was not real research, (ii) being afraid of the possibility his/her answers would be recorded on a recorder tape, and (iii) hesitating to write their real name and

address. “Some respondents were hesitant because they were afraid that this research was a fraud or had a hidden agenda.”

Interview Process. This theme was defined as problems faced by respondents during the interview session, as perceived by the interviewers. As shown in table 3, cognitive difficulty was the most frequently mentioned issue, with 8 interviewers mentioning respondent cognitive difficulties during interviews, especially the difficulties in differentiating between different the dimensions and levels of EQ-5D-5L and the different questions in TTO and DCE. One interviewer wrote “Some respondents had difficulty to differentiate between the levels of health states (no problem until severe)”.

The second problem most frequently mentioned by the interviewers was strong religious beliefs and respect for life that interfered with how the respondent should follow the data collection process. The majority of interviewers encountered this problem. Some respondents believed that every word they said was a prayer, so it was difficult for them to choose instant death in a TTO question. One interviewer wrote “For respondents who have strong religious beliefs, they believed that every word they said was like a prayer. Some refused to continue their participation because of the option of Instant Death in TTO. Others preferred not to choose Instant Death even though the health state in the question was really bad. They believed that there would be someone else who would help them and because they believed that life and death were in God’s hands”. Other respondents had a strong preference for life and did not want to sacrifice a year or only sacrifice six months to a maximum of one year for any TTO question. “Some respondents had a strong belief that no matter how bad the health status was, they would not sacrifice any year. They believed that in that bad situation they could still do something useful.”

For some respondents, their physical condition interfered with their efforts at completing the interview. “For some respondents aged more than fifty years old, I had to read the feedback module section for them because their eye function was already reduced and it was difficult for them to read a screen full of small letters.” Boredom and fatigue were also experienced by some respondents when completing the TTO and DCE tasks. The problems came not only from the respondents themselves but also from the presence of others, whether or not they knew these people. Their presence was distracting the respondents from the task or interfered with how they answered or wished to answer the questions. “One of my respondents was interviewed in her house in the presence of her little daughter in the room. When she selected the instant death choice in one of the TTO questions, her daughter displayed a shocked reaction that resulted in the respondent changing her answer.”

Table 3. Problems of respondents (as perceived by interviewers)

No	Problems	Frequency[a]
1	Participation	8
2	Interview process	68
a	Cognitive difficulties	30
b	Emotional difficulties	7
c	Physical difficulties	4
d	Religious beliefs	17
e	Presence of others	10

[a] *number of times the related problem was mentioned by interviewers*

Solutions applied by interviewers

Recruitment of respondents. This theme concerns the efforts made to solve the problems of finding respondents to participate in the study. There were 3 main solutions that the interviewers applied: (i) take into account a variety of factors which would enable suitable respondents to be found, (ii) expand networks, and (iii) explain the study thoroughly (see table 4).

i. Interviewers considered specific characteristics with respect to respondents in finding them for the quota sample. Two main factors to considered are time of availability and areas where many potential respondents lived. Since a respondent's time was the obstacle most frequently mentioned by interviewers, arranging appointments at times when respondents had the most free time was the most frequently employed strategy. People with fixed daily schedules, housewives, and people who worked as merchants in tourist spots were usually chosen to be interviewed. Weekends, evening, and lunch time were preferable times to conduct interviews for interviewers. "Conduct an interview at lunch hour or after office hours when the respondent is free."

ii. Interviewers used their networks to find suitable respondents, such as their relatives, friends, and even the respondents themselves. "Contact families and friends who might have access to people with specific characteristics, such as people with lower-level education or females aged above 50 years old."

iii. Interviewers persuaded respondents to participate in the study by utilizing the local government permission procedure and explaining thoroughly the goals and benefits of the study. For some respondents, a letter from the local authority was enough for them to participate. For other respondents, explaining that the results of the study would be used by the Indonesian government and other stakeholders for the benefit of the Indonesian people in the future encouraged them to participate. "Explain slowly about the goals

of this research in more concrete words, such as this survey is about health and will measure the perceptions of Indonesian people about health and health problems. The results will be used by the Indonesian government to create useful health policies. So your participation is really valuable for the improvement of the healthcare system in Indonesia."

Interview process. This theme comprised any effort to solve respondents' difficulties during data collection by stimulating them using various means, and by developing interviewer's personal skills. The majority of interviewers helped their respondents to complete interviews by putting extra effort into the process of interviewing. This could involve: (i) giving additional explanation or rephrasing the explanation in words that were easier to understand, (ii) asking the respondent to imagine concrete examples of the question, (iii) guiding the respondent to look in detail at each health state, (iv) reassuring the respondent about the implications of his/her answer. For example, to help respondents who had difficulty in comparing life A and life B in the DCE exercise, an interviewer did the following: "I helped my respondents to choose by asking them to compare each dimension in life A and life B, not just to read it quickly and give an answer." With respect to the problem of religious beliefs, further explanation concerning the nature of the TTO exercise, i.e. that this should be considered as a cognitive task, was quite effective in reassuring some respondents. "I explained that this was research concerning his opinions on a number of health states, not his prayer to God. My respondent then understood and provided appropriate answers based on his opinions."

Some interviewers chose to focus on their relationship with the respondent by talking about other things (for instance family or work), encouraging him/her to continue, and praising him/her after finishing each part of the interview. "Talk about other things first before going into an interview, usually about the respondent's daily life." In addition to working/training with their respondents during interviews, some interviewers also developed their own skills in order to improve the quality of their interviews, by additional reading and practice in order to get used to the protocol and the software as quickly as possible. "After I get used to this EQ-VT protocol and guideline, I can explain it better to the respondents."

Table 4. Solutions applied by interviewers

No	Solution	Frequency[a]
1	Recruiting respondents	49
a	Selective search	22
b	Using networks	6
c	Explaining in detail	21
2	Process of interview	72
a	Developing self	14
b	Stimulating respondent	58

[a] *number of times the related solution mentioned by interviewers*

Technical problems and solutions

Technical problems were defined by any problems faced by interviewers and respondents that were related to technical tools used in the study, including hardware (laptop), software (EQ-VT software, www.qol-id.org, Mozilla Firefox, Teamviewer) and internet connections. As shown in table 5 three themes emerged with respect to technical problems.

Hardware problems. Four interviewers reported having problems with their laptops during data collection. For 3 interviewers these related to short battery life, limiting the number of respondents seen in one day to no more than 2, or they had to find an interview location that provided an electric socket. Another interviewer had limited random access memory (RAM) in her laptop that made it work more slowly than usual.

Software problems. Five interviewers had problems with software. They had to register their respondents on a website created specifically for the Indonesian valuation study, and received a respondent code, which they used as external ID in EQ-VT software. The problems they encountered varied, such as difficulties in registering a respondent, accessing the offline ULP, and uploading the interview data. "I can't access the EQ-VT offline ULP in my laptop so I couldn't conduct the interview."

Internet connection problems. This problem is related to the availability and functionality of connection to the internet during the Indonesian valuation study. One interviewer wrote, "Before starting an interview, I have to register my respondent online in order to get a respondent code. If I have to register a respondent that I find without any previous appointment, this online registration becomes a problem when my phone signal is weak, or there is even no connection at all."

Table 5. Technical problems

No	Problems	Frequency[a]
1	Hardware	9
2	Software	13
3	Internet connection	5

[a] *number of times the related problem mentioned by interviewers*

Technical solutions. This theme comprises the efforts of interviewers to solve any problems related to tools used in the study (laptop, software, network) with and without help from others. Table 6 shows the two sub-themes that emerged from the analysis.

Independent problem solving. This sub-theme was defined by the efforts of the interviewer to solve problems related to tools used in the study independently without help from others. "Find a place to conduct the interview where electrical socket available" was one interviewer's effort to overcome a laptop battery problem. Another interviewer wrote, "I make sure my laptop is fully charged before I conduct an interview, especially the offline EQ-VT software. I also regularly upload my interviews so that my Firefox will download new questionnaires every day". To cope with network problems, another interviewer always took along a mobile internet modem.

Dependent problem solving. This sub-theme involved help from others. Interviewers asked for help from their fellow interviewers when this related to laptop and network problems, and from the EuroQol Office when it concerned EQ-VT software problems.

Table 6. Technical problems

No	Solutions	Frequency[a]
1	Independent problem solving	16
a	Laptop	4
b	Software	8
c	Internet connection	4
2	Dependent problem solving	9
a	Laptop	1
b	Software	7
c	Internet connection	1

[a] *number of times the related solution mentioned by interviewers*

Improvement of interviewers' performance

From the 286 potential respondents asked to participate, 266 respondents were interviewed (93% response rate). Table 7 shows that all seven indicators of interviewers' performance - monitored in the Quality Control process - in conducting EQ-VT interviews were found to be significantly improved (post-retraining scores, $p<0.05$). For example, the percentages of flagged interviews, which was the main indicator of quality, showed a large improvement from 59% to 3% between pre-retraining and post-retraining. Moreover, the wheelchair explanation moves increased from 14.66 to 58.98 and flagged TTO interview time decreased from 15.3% to 1.2% which is indicators of more engagement and less hurry on the part of the interviewers while preparing the participants through wheelchair example and conducting the 10 TTO tasks.

Table 7. Results of Wilcoxon Signed-Rank Test of indicators of performance.

Indicator	Pre-retraining	Post-retraining	p-value
Number of interviews	98	168	
Number of health states given a zero TTO value	275 (28.1%)	65 (3.5%)	0.003*
Mean wheelchair explanation moves	14.66	58.98	0.003*
Inconsistencies flagged	6 (6.1%)	2 (1.2%)	0.046*
Wheelchair explanation time flagged	39 (39.8%)	1 (0.6%)	0.003*
TTO interview time flagged	15 (15.3%)	2 (1.2%)	0.026*
Wheelchair lead time flagged	20 (20.4%)	1 (0.6%)	0.027*
Flagged interviews[a]	58 (59%)	6 (3%)	0.005*

The amount of 'flags' based on corresponding indicator of quality
** $p < 0.05$.*
[a] An interview can have more than one flag, therefore the column cannot be summed to a total.

Discussion

This study enlisted sampling and technical problems encountered by the Indonesian EQ-5D-5L valuation study interviewers. Moreover, the substantial quality issue with the first 98 interviews has been described. A comprehensive strategy to acquire suitable respondents, including involving personal and formal networks and optimizing interview times according to the availability of respondents was implemented by the interviewers to overcome sampling problems. Technical problems were dealt with, using the capabilities of the interviewers to improvise on a local level and technical support from the EuroQol Group office at a central level. To improve the quality of interviews, a retraining program and subsequent feedbacks based on the quality control (QC) report were implemented which lead to good quality data.

The first problem encountered by interviewers was to find respondents who were willing to participate in the study. Some participation problems have been mentioned in the literature [21,22], although not with particular reference to TTO and DCE exercises. For example, some respondents were anxious about their participation in our research. This might happen because individuals realized that they would be asked to answer personal questions [23] or had minimal knowledge of what would happen [24]. Being well-prepared and having a good ability to establish rapport as an interviewer are known to be essential to reduce respondents' levels of anxiety [24]. Respondents also prefer interviewers that they know [25], have similar characteristics to them [26], and use their preferred language [27]. Solutions applied by the interviewers in this study, such as involving personal networks and explaining informed consent in simple, easy-to-understand words, were effective in coping with the problem of finding respondents. Another problem was to match a respondent's availability with the interviewer's schedule in terms of time and place. Choosing a time most suitable for the respondent to be focused on the interview and a comfortable location that is convenient, are vital in ensuring an optimal interview process [24]. It turned out that some interviewers specialized in groups of subjects, such as the young, the elderly or the working population. When quota sampling is stratified per interviewer, it is not possible to explore this specialization. Hence, we allowed interviewers to specialize in categories of respondents, until the category was full at the aggregate sample level. Evidently, given possible interviewer effects, the situation should be avoided that interviewers be solely responsible for filling one category of subjects. In our study, this exclusive interviewing was not the case.

The second problem was to conduct an interview that followed the essential parts of the protocol but was adaptive enough to help respondents complete the interview. Respondents experienced various difficulties, from cognitive and emotional to physical. To solve this problem, interviewers' interviewing and communication skills play important roles [24]. This study's interviewers had some training in interviewing skills during their Bachelor's degrees and/or followed a one-day interviewing skills workshop held by the first author (FDP) before the start of the valuation study. Attentive listening and ability to direct interviews using various means are essential to keep respondents focused on their tasks [28]. Asking questions to stimulate the thought process, especially in the TTO section of the interview, and giving examples that closely relate to a respondent's experiences are effective interview tools [26]. All of this was confirmed in our study.

This study found that the interviewers struggled to implement the standard valuation protocol for an EQ-5D-5L valuation study, based on the first QC report. A similar problem was also reported by Papadimitropoulos et al. [10] in the United Arab Emirates, in which their interviewers were from a market research agency. Their recommendation was to

train academic researchers in health state valuation and state preference methods in order to increase the availability of skillful interviewers. Tasks such as TTO and DCE have high cognitive burdens. The presence of experienced interviewers is essential in ensuring the validity of such tasks. This means that the training of interviewers plays an important role in assuring data quality [19]. To meet these criteria, we hired interviewers with academic backgrounds related to the topic of quality of life such as Psychology, Management, Development Communication, and Economics. To equip interviewers with the relevant knowledge of health state valuation and stated preference methods, we conducted one-day training sessions before commencing the study where interviewers learned about the basic concept of quality of life and its measurement. They also learned about how to value quality of life, in this case by using the TTO and DCE approaches. Time and tools for interviewers were provided to practice using EQ-5D-5L valuation software and protocols. Nevertheless, we still encountered the same problem as in UAE regarding protocol compliance. When the initial training proved insufficient to guarantee the expected quality of the data, a retraining program was conducted. This program and a series of QC reports and feedback led to higher compliance by the interviewers to the protocol. This was demonstrated in the QC report by significantly less flags (indicating quality problems), less zero values, less flagged inconsistencies, less flagged TTO time, less flagged wheelchair explanation time, and more wheelchair lead time and wheelchair moves. We can expect that this protocol compliance problem will emerge in any valuation study regardless of the interviewers' background characteristics; hence the similar solution should be implemented: utilization of quality control (QC) report through training and consistent feedback.

Indonesia is a country where religious belief plays a big role in its residents' lives [29]. Religious belief and respect for life also appeared to influence respondents' perceptions of the TTO questions, especially with respect to 'instant death' and 'worse-than-dead.' [10,30]. It was believed that 'words are prayer' which resulted in hesitation or even rejection in choosing the instant death and worse-than-dead answers. Some respondents even withdrew from the interview during the worse-than-dead explanation in the wheelchair example due to this belief. Similar problem was reported by researchers from United Arab Emirates (UAE), Malaysia and Singapore [10,30,31]. This issue is less problematic during valuation studies in more secular countries in the western hemisphere such as the United Kingdom and The Netherlands [2,5]. Interviewers have to ensure the cultural safety of research participants, i.e. by taking their religious beliefs into account [32]. Therefore, we expect similar will happened during valuation study in the countries where Islam is the majority religion or in the Islamic subset of a population. A solid rapport and various strategies, such as further explanation, rephrasing the explanation in words that were easier to understand, and stressing the goals

and benefits of the study to encourage respondents to give their cognitive opinions instead of emotional responses, proved effective enough to handle this situation.

Strengths and Limitations

This is the first study using Quality Control report to optimizing performance of interviewers and the quality of the data collected in a valuation of EQ-5D-5L. Furthermore, this study comprehensively describes the problems and solutions of interviewers and respondents in performing TTO and DCE tasks, as well as technical and methodological issues. Finally, several possible solutions and their impact on the quality of the interviews also provided. The lessons learned from this study could serve as examples discussed in the initial training of EQ-5D-5L valuation study.

Several limitations of this study should be considered. First, the study shows that a QC report was an important factor in optimizing performance at interviews and the quality of the data collected. However, this was a formal process and focused on several objective indicators, such as consistency, duration, etc., which did not take into account what was actually said, let alone the non-verbal interaction between interviewer and respondent. Nevertheless, it was the first step in getting a grip on and improving the interview process.

Second, respondent recruitment might raise questions about the objectivity/ representativeness of the study sample since one of the solutions employed was to use personal networks related to the respondents. This might have entailed some bias in terms of interdependent data collection. However, since this was done in order to find respondents to fit into the missing categories in the quota sample (for example those with low education and the relatively old), it was judged that this was a lesser problem than insufficiently filled categories in the quota sampling. This was because the quotas were determined on those variables that were seen beforehand to be important as defining representativeness. In that respect, we have constructed a representative sample. Nevertheless, a limitation could be that the sample might be in part the networks of the interviewers. It remains to be seen whether this is a problem.

Third, it is not known what kind of problems were associated with those who did not want to participate, i.e. 20 people out of 286 asked to participate.

Fourth, the classification of urban and rural in this study was based on the governmental administrative definition. During the process, it was found that some areas classified by municipal administrations (kabupaten) as rural in no way represented the characteristics of a rural area. They were Jatinangor where Universitas Padjadjaran is located and Depok Sleman where Universitas Gadjah Mada is located. Respondents from these two areas were, therefore, categorized as urban respondents instead of rural.

Fifth, the interviewers' improvement analysis was based upon data from 266 respondents, 25% of the targeted number of respondents. It may thus be wondered how representative the problems discovered were for the complete sample, as this 25% were in particular young, relatively well-educated and urban respondents. Of the 266 respondents, only 39 elderly respondents (14.6%), 5 low-educated respondents (1.8%), and 53 rural respondents (19.9%) were interviewed. Hence it could be stated that the interviewers started with an easy, smart and 'well behaved' sample. One can question whether this a problem, or an advantage. It can be seen as a problem, as interviews with 'difficult' subjects were less frequently undertaken. On the other hand, it makes sense to learn the interview skills first in a relatively 'easy' sample, and then to undertake the more difficult interviews later, when the interviewer would be well-trained. Indeed, we would recommend commencing with the easy interviews and moving on to the more difficult.

Sixth, all interviews were conducted in 3 cities on Java island, even though some ethnicities interviewed were not originally from Java (e.g. Sumatera, Bali, Madura, and Sulawesi). We do not know whether different problems, such as language barrier, would emerge if the interviews were to be conducted in the home towns of these ethnicities.

Seventh, the interviewers were asked about their problems and solutions during the interview by the researchers, who was also the person who hired them and evaluate their quality of work. This would potentially influence the interviewers to provide more positive answers compared to the actual situation in the field. However, since we perceived the discussion during feedback sessions as positive, open, and equal, we think that we have been as careful as possible in that respect. The interviewers' feedback to the researchers at the end of valuation study data collection showed the same conclusion.

Lastly, the retrospective character of the study, in which the interviewers received the questionnaire at a later date, might have been liable to recall bias and led to the omission of some information.

Recommendations

Given the limitations of this study, there are some suggestions for future research. Regarding the method of controlling the quality of interviewers' performances, it would be better to put the interviews from a small representative sample of interviewers before and after the retraining program on video to establish which elements of the retraining yielded improvement. Interviewers should be asked to note the problems occurring whilst interviewing immediately instead of at a later date. Recruiting more elderly, more lower-educated, and more rural respondents at the outset could give more information about the specific problems of these categories of respondents. In order to avoid disappointment and frustration in the research

team, an interviewer's first 10 interviews could be used as a pilot to measure quality, to provide feedback and to ensure good quality subsequently. Evidently such a pilot phase for each interviewer would increase costs, but it would reduce the costs associated with modelling low-quality data. This leads to a recommendation to limit the number of interviewers, in order to optimize the quality per interview. It is further recommended that information regarding the problems and solutions encountered during valuation studies should also incorporated in future interviewer training manuals.

Conclusion

This study has identified several sampling issues and technical problems in conducting the standard EQ-5D-5L valuation protocol. Moreover, substantial quality issues in the interviews process have been described. Sampling problems could be overcome by a comprehensive search strategy involving broader networks and optimization of interview times for respondents. Quality issues in the interview could be dealt with using feedback from the QC report, a comprehensive training program, and increased supervision at the start of, and during the study. If the interviewers were to become more engaged in the research, the quality of the interviews should improve. We recommend limiting the number of interviewers and relying on academically-skilled interviewers who could be expected to fully understand the research aims. Using a quality control feedback module, organizing continuous feedback sessions, and accepting a pilot phase for each interviewer, should help to optimize the quality of data collection.

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Informed consent: Informed consent was obtained from all individual participants included in the study.

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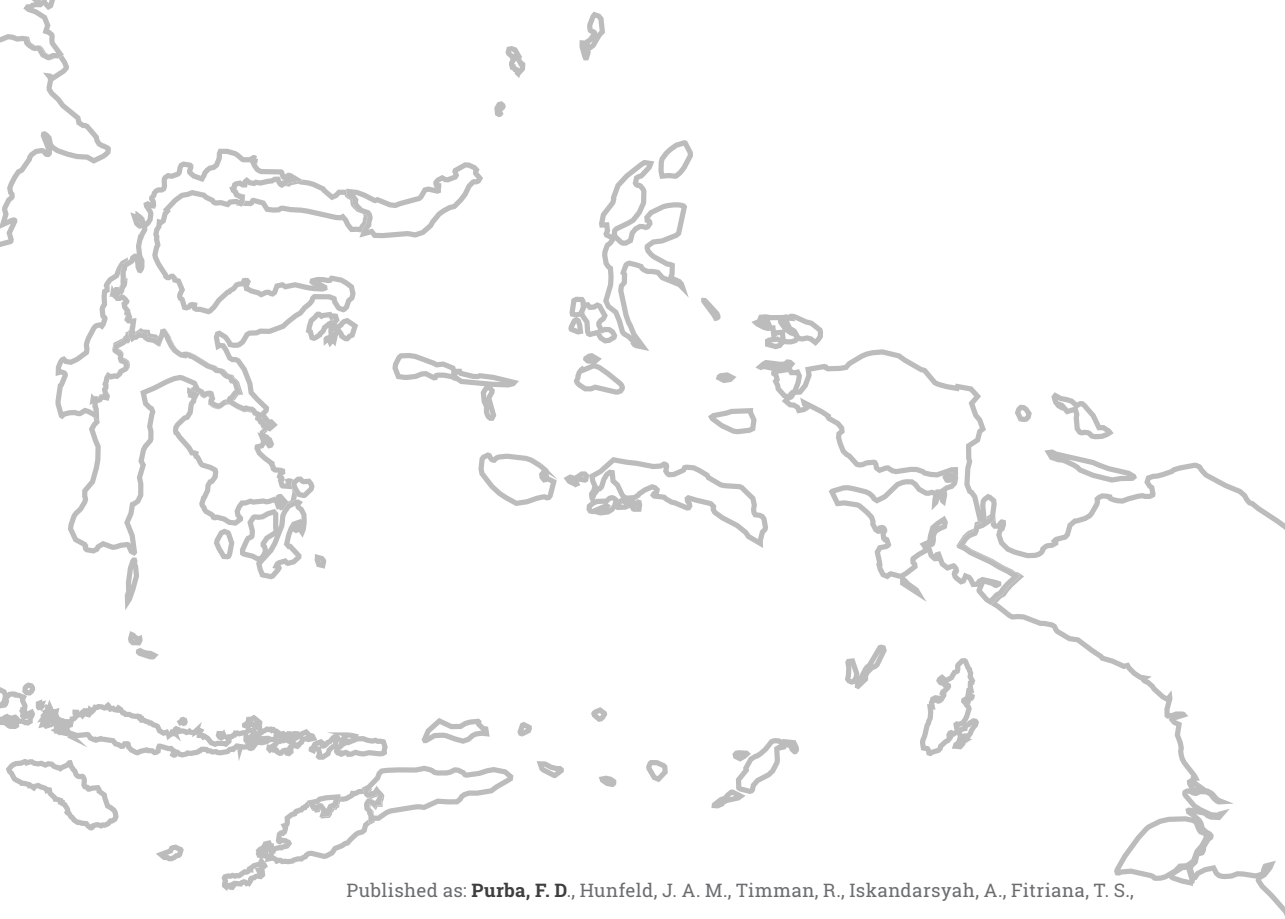
CHAPTER 3

Test-retest reliability of EQ-5D-5L valuation techniques: the composite time trade-off and discrete choice experiments



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Abstract

OBJECTIVES: To explore the test–retest reliability of the Composite time trade-off (C-TTO) and discrete choice experiments (DCE) used in the Indonesian five-level EuroQol five-dimensional questionnaire (EQ-5D-5L) valuation study.

METHODS: A representative sample aged 17 and over was recruited from the Indonesian general population by stratified quota sampling with respect to residence, gender, and age. Trained interviewers administered computer-assisted face-to-face interviews with the EQ valuation technology (EQ-VT). Each respondent valued 10 health states using C-TTO and 7 pairs of health states in a DCE exercise. The retest interview was conducted after a 2-week by the same interviewer. The Wilcoxon matched-pairs signed-rank test, intraclass correlation coefficient (ICC), and multilevel regression were applied in comparing the C-TTO test and retest data. For DCE, the analysis of proportions was used.

RESULTS: 226 respondents with characteristics similar to the Indonesian population completed the retest interview. For C-TTO, 82 of 86 (95.3%) of health states had no significant mean value differences between test and retest. The mean value of the second test was statistically significantly higher than the first test by 0.042. For DCE, 72.5% of responses were identical. DCE retest showed a different pattern concerning the relative importance of the dimensions, while the C-TTO remained the same.

CONCLUSIONS: C-TTO is stable over time, while in DCE the relative values of the dimensions shift. The results support the use of the C-TTO, in particular the Indonesian EQ-5D-5L value set and suggest a critical examination of the reliability of DCE results over time.

Highlights

- This is the first paper to report on the test-retest reliability of the 5-level valuation of EQ-5D.
- Composite time trade-off (C-TTO) and discrete choice experiments (DCE) are the standard elicitation techniques in the EQ-5D-5L valuation protocol
- We found little difference between the test-retest results of the C-TTO, which suggests good reliability with respect to the EQ-5D-5L valuation exercise
- The DCE seems to show a shift in the relative values of the dimensions between the two tests that will change the ranking of health states, and thus the prioritization of interventions.

Introduction

The EQ-5D-5L is a generic measure of health outcomes and comprises two parts: a descriptive system and a visual analogue scale (EQ-VAS). The descriptive system consists of five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. The - EQ-5D-5L version has 5 levels for each dimension: no problems, slight problems, moderate problems, severe problems, and unable/extreme problems [1].

In order to be utilized in economic evaluations, EQ-5D descriptive responses should be converted into an index score using a value set representing societal preferences [2,3]. This value set is usually obtained using techniques such as the standard gamble (SG), time trade-off (TTO) and discrete choice experiments (DCE). In 2014 the EuroQol Group developed a valuation protocol for EQ-5D-5L, together with the EuroQol valuation Technology (EQ-VT) computer platform, to be facilitated and standardize EQ-5D-5L valuation studies across the world. In this protocol, the 'composite TTO' (C-TTO) and DCE were the chosen elicitation techniques [4].

Several studies concluded that the clinical administration of the descriptive part of the EQ-5D-5L was valid and reliable [5-11]. Three studies [12-14] evaluated the reliability of the valuation techniques used to obtain value sets. This reliability could not be tested using Cronbach's alpha, or any other 'internal test', as no questionnaire items related to the traits of the respondent, instead the respondent valued health states. Hence reliability could only be tested with to 'test-retest reliability'. The reliability of the values elicitation technique is important, as otherwise it would be difficult to advocate the use of a national value set in health care for budgeting decisions if the values provided by the respondent were to change over time. Van Agt et al. [12] investigated test-retest reliability of value sets based on the EQ-VAS. Badia et al. [13] used EQ-VAS and TTO, while Robinson [14] used TTO and PTO (Person Trade-Off). All used the old 3-level version of EQ-5D, and in those days the valuation protocol was not fully standardized. The Van Agt and Badia studies applied generalizability analysis and found that the variability of the values was mostly due to differences between individuals and differences between health states, while the variability attributable to the timing of the tests was almost zero. This very low value is difficult to interpret, as one would expect at least some unreliability, given the difficulty of the task. The low value was probably the result of the high variance between the states on the scale, and the variance between individual respondents, which would diminish the variance between the test and the retest exercises. Multi-level analysis would be more appropriate, as this could account for dependencies between health state values provided by one respondent and the dependencies of the values of the test and the retest exercises since they were also given by the same respondent. Moreover, we could include an interviewer level, as interviewers have an effect on values [15]. Robinson's study

confirmed the stability of TTO based on intra-class correlation coefficient (ICC) analysis, which would overcome some of the problems just mentioned, but not all. Robinson also concluded that the use of TTO for the valuation of EQ-5D-3L was highly reliable.

There is no published test-retest study for the new EQ-VT with respect to the new EQ-5D-5L using C-TTO and DCE. Such a study would be timely, as the new EQ-VT protocol has already been implemented in numerous valuation studies across the globe [16-23]. Therefore, the objective of our study was to measure the test-retest reliability of C-TTO and DCE used in the Indonesian EQ-5D-5L valuation study.

Methods

This study was part of a larger study that focused upon the Indonesian national valuation of EQ-5D-5L, using a face-to-face setting. See the study report of this valuation study also for details of the current test-retest study [23]. The study was approved by the Health Research Ethics Committee, Faculty of Medicine, Padjadjaran University, Indonesia

Sampling and data collection

A quota method stratified with respect to residence (urban/rural), gender, and age (17-30/31-50/above 50) resulted in 12 quota groups. The pre-defined quotas were based on data from the Indonesian Bureau of Statistics [24]. Fourteen interviewers conducted interviews in 6 cities and their surroundings, located in different parts of the country: Jakarta, Bandung, Jogjakarta, Surabaya, Medan, and Makassar.

After the first interview, the interviewer judged the respondent's problems concerning the interview, based on completion time (e.g. more than two hours), verbally expressed comment(s) indicating frustration, or frequent interruptions indicating tiredness. When these signs were absent, the interviewer asked the respondent's consent to be interviewed again (retest). The interval between the first test and the retest ranged from 10 days to two months. The retest interview was held by the same interviewer.

Valuation Interview Protocol

The valuation protocol (EQ-VT) consists of six components [4,25]

i. A general welcome and informed consent.
ii. Completion of the descriptive system page, the EQ-VAS, and background questions.
iii. The composite time trade-off (C-TTO, see below) tasks. Three debriefing questions regarding the C-TTO tasks' difficulties were added at the end of this section.

iv. A discrete choice experiment (DCE, see below) task followed by three debriefing questions regarding this task.
v. A round-up.
vi. Country-specific questionnaire: paper-and-pencil version of the World Health Organization Quality of Life instrument abbreviated version (WHOQOL-BREF) and Family Resilience Assessment Scale (FRAS)

All sections, except for the country-specific questionnaires, were administered by computer-assisted face-to-face interviews using the EQ-VT platform.

Composite Time Trade-Off (C-TTO)

The C-TTO exercise applied conventional TTO to obtain better-than-dead (BTD) values, and lead-time TTO to obtain worse-than-dead (WTD) values (Appendix Figure A1). Details of the C-TTO approach can be found in Oppe et al. [25] and Purba at al. [23].

The EuroQol valuation protocol included 86 EQ-5D-5L health states to be valued using C-TTO. The 86 health states were distributed into 10 blocks with a similar level of severity. Each block contained 8 unique EQ-5D-5L health states, plus 1 very mild state (i.e. only 1 dimension at level 2 and all others at level 1, e.g.: '11112') plus the most severe/'pits' state ('55555') [4]. Respondents were randomly assigned to one of the 10 C-TTO blocks. Each state in the block was presented in random order to respondents.

Discrete Choice Experiments (DCE)

DCE tasks were conducted by presenting 2 health states and asking the respondent to select the preferred state (Appendix Figure A2). The DCE design consisted of 196 pairs of EQ-5D-5L health states distributed over 28 blocks, each consisting of 7 pairs with similar severity. The 7 paired comparisons were presented in random order utilizing the EQ-VT framework, the right-left order of the two health states presented was also randomized [4]. Each respondent was given one block of DCE tasks to complete.

Statistical analysis

We first described the current sample's characteristics in comparison with the Indonesian general population using percentages for discrete variables and data from the Indonesian Bureau of Statistics [24].

The test-retest exercises for C-TTO and DCE were analyzed from two perspectives, the respondent perspective and the health states perspective, and also at an aggregate level, employing pooled data.

For the C-TTO respondent perspective analysis, we investigated any significant change in the mean of 10 health states values given by each respondent at test and retest applying Wilcoxon matched-pairs signed-rank tests. For the health state perspective analysis, three calculations were conducted. First, we investigated any significant change in the mean of 86 health states valued by applying the Wilcoxon matched-pairs signed-rank test. Second, we evaluated the intraclass correlation coefficient (ICC, two-way random effects, absolute agreement) of each health state. We applied the following reliability guideline for the strength of the ICC values: <0.40=poor, 0.40-0.59=fair, 0.60-0.74=good, and >0.74= excellent [26]. Lastly, we investigated the proportions of respondents per health state who were consistent in choosing a better-than-dead (positive) value or worse-than-dead (negative) value between the two tests.

For the pooled data, the relationship between the test and retest data was analyzed using multilevel regression analysis to deal with the dependency in the data. On the one hand, the two test times (test and retest) were nested within respondents and respondents were nested within interviewers, on the other hand, the two test times were nested within health states. However, the health states were not nested within interviewers or within respondents or the other way around. Hence, we could not perform one analysis that included all four: i.e. two test times, respondents, interviewers, and health states. Instead, we performed a three-level model analysis and a two-level model analysis. The three-level model included the two tests as the lower level, the respondents as the middle level and the interviewers as the upper level, whereas the two-level model included the two tests as the lower level and the health states as the upper level. The necessity to include the levels was determined by the deviance statistic, using restricted maximum likelihood [27]. The dependent variable was the C-TTO value given by the participants on both occasions and time was postulated as a fixed covariate. The effect size Cohen's d was calculated by dividing the time effect by the standard deviation derived from the model. P-values <0.05 were considered significant.

For the respondent respective in DCE, we identified the proportion of identical choices displayed by a respondent. For the pair of health states perspective, we calculated the proportion of consistent choices of the 196 DCE pairs completed twice by the respondents. The pattern of consistency stratified by the severity level difference between the health states in a pair was also investigated. The severity level difference was calculated using the severity level of the health state A minus the severity level of health state B in a pair, for example, the severity level difference of pair 153 (‘22123’ vs ‘11155’) was -3 (10-13).

In addition, we compared the relative importance of the five dimensions and the relative utility decrement between each of the five levels between test and retest. These were done for the C-TTO, DCE, and combination of the two datasets. We first modelled the C-TTO data with a Tobit model, the DCE data with conditional logit, and a combination of the two datasets with a

Hybrid model. This last model was used in the national Indonesian valuation study and details of this approach can be found in work by Purba et al. [23]. The three models used 20 dummy variables representing levels 2, 3, 4 and 5 for each dimension: mobility (MO), self-care (SC), usual activities (UA), pain/discomfort (PD) and anxiety/depression (AD), was implemented. The level 1 (no problems) served as the reference level. Thus, MO4 meant the utility decrement for mobility level 4. This model specification is also known as the 'main effects' model. The coefficients from each model were then used to compare the relative importance of the five dimensions and the relative utility decrement between each of the five levels between test and retest. The relative importance of the five dimensions involved two calculation steps. First, we divided each level of each dimension coefficient by the mean of a similar level from all the dimensions. This resulted in adjusted coefficients for every level of every dimension: e.g. the adjusted coefficient for mobility level 3 was obtained by the MO3 coefficient divided by the mean of all 5 level 3 coefficients [(MO3+SC3+UA3+PD3+AD3)/5]. Second, we calculated the average of all adjusted coefficients for each dimension, resulting in 5 values each representing the relative importance attributed to the EQ-5D dimensions. A similar approach was applied by Rand-Hendriksen et al. [28]. The relative utility decrements between each of the 5 levels were obtained in two steps: first, we calculated the total of each level coefficient from all dimensions, e.g. the sum of the level 2s of all dimensions. Second, we divided the sum of each level coefficient by the total of level 5 coefficients: e.g. the relative decrement of level 2 was the total coefficient of level 2 divided by the total coefficient of level 5.

Whether the change in respondents' own health affected their valuation scores (C-TTO) was checked by taking the following steps: (i) transforming respondents' self-reported health states into index scores using the Indonesian value set[23] at the two measurements points, then calculating the differences, (ii) calculating the change in the mean of the 10 health state values given by each respondent in the C-TTO test and retest, (iii) checking their associations with Spearman's rho test.

Results

From 227 respondents who completed the test-retest exercises, 1 respondent was excluded because of technical error: he received different C-TTO and DCE block of health states. Thus, the sample tested numbered 226 respondents. The mean interval between the first and second interviews was 19.90 days (SD= 9.32; range: 10-59). The characteristics of the test-retest respondents were similar to those of the Indonesian general population in terms of residence, gender and age (Table 1). The respondents reported small problems in understanding the tasks

(Mean C-TTO: 1.67 of 5; DCE: 1.34, the higher means more difficult), easy to differentiate between health states (1.8; 1.68) and moderate difficulties to decide their answers (3.4; 2.78). More details are presented elsewhere[29]. We did not find an association between the respondents' change of health and change of the C-TTO values (rho = 0.037, P-value= 0.646).

Table 1. General characteristics of test-retest respondents

Characteristics	Sample N = 226 (%)	Indonesian population[a] (%)	Differences (%)
Residence			
Rural	106 (46.90)	46.70	+0.20
Urban	120 (53.10)	53.30	-0.20
Gender			
Female	113 (50.00)	49.65	+0.35
Male	113 (50.00)	50.35	-0.35
Age			
17-30	86 (38.05)	36.73	+1.32
31-50	99 (43.81)*	40.76	+3.05
>50	41 (18.14)*	22.51	-4.37
Education level[b]			
Basic	21 (9.29)*	35.18	-25.89
Middle	158 (69.91)*	51.72	+18.19
High	47 (20.8)*	13.10	+7.70

[a] *Data from Indonesian Bureau of Statistics (BPS)*
[b] *basic (primary school and below), middle (primary school plus at least 1 year of high school) and high (all others).*
** Significant difference at a = 0.05 from z test*

C-TTO data characteristics

The 226 respondents provided 2260 C-TTO responses (each respondent valued 10 health states) per test, resulting in total of 4520 responses. In the first test, 1358 responses (60.1%) were positive (that is better than death) and 1454 (64.3%) were positive at the retest. In the first test 36 responses (1.6 %) had the value 0, and in the retest, this was also 36 (1.6 %). Of the 2260 responses, 553 (24.5%) were identical in the first and the retest; 909 (40.2%) increased and 798 (35.3%) decreased. The absolute differences between test and retest ranged up to almost the possible maximum: there was one response with a test-retest difference of 1.95. Histograms of the health states values obtained in the first and second tests are reported in Figure 1. The distributions were not normal, since they exhibited multiple peaks, as in other valuation studies using the EQ-VT.

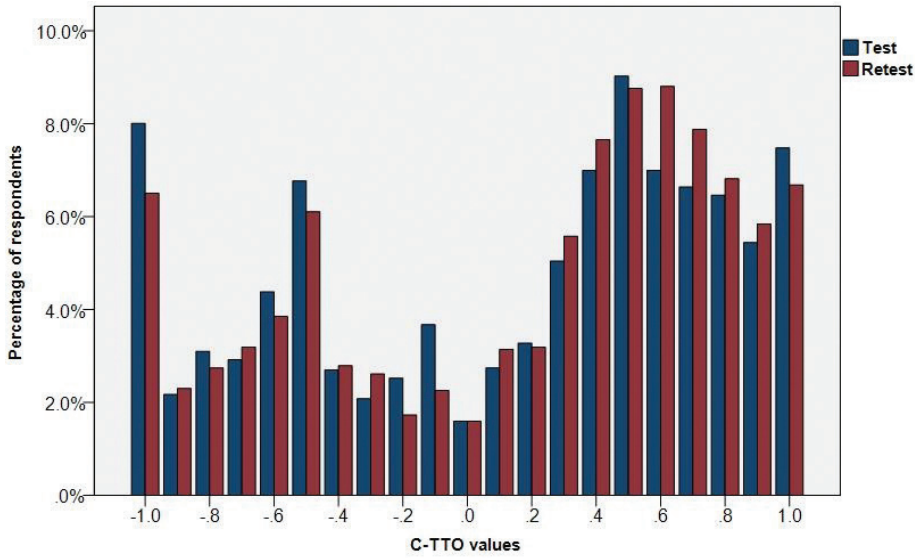

Figure 1. Distribution of C-TTO values at test and retest

For the respondent perspective, we found that 71 out of 226 respondents (31.4%) assigned statistically significant different mean values to 10 C-TTO health states between the two tests (Appendix Table A1).

The mean observed values for the first test and the retest were negative for 30 and 26 health states respectively out of 86 used in the C-TTO design. The mean absolute difference (MAD) between test and retest ranged from 0.00 (state '24553') to 0.23 (state '55233) with an average MAD of 0.079 (Appendix Table A2). There were 4 health states with significant changes of mean value, namely state '55555' (mean difference = 0.064), '32443' (0.103), '12514' (0.141), '25331' (0.185). From the health state perspective, the percentage of significant differences in valuations at test and retest can be considered small: less than 10% of health states. The ICC ranged from -0.16 (state '11421') to 0.81 (state '24553'): 24.4% of the health states were considered to have a poor agreement between test and retest, 36.1% were fair, 29.1% were good, and 10.5% were judged as having an excellent agreement. Note that 70 out of 86 (81.4%) health states' ICCs were statistically significant (P-value<0.05). With respect to better-than-dead (positive) and worse-than-dead (negative) values, the majority (average 81.6%) of values given in the first test for each health state did not cross over from worse-than-dead to better-than-dead or the other way around in the retest. Details can be found in the Appendix Table A2.

Multilevel regression analysis showed that the second test resulted in very small (Cohen's d=0.067) but statistically significant higher values than the first test: 0.042 (Table 2). As could be expected given that the health states were spread intentionally over the scale, the differences

at the health state level were much larger than the differences between interviewers and respondents. This resulted in 'more significant' differences between the two administration times in the two-level model compared to the three-level model. The interviewer level was highly significant ($x^2_{(1)}$=62.34; p<0.001), as well as the respondent level ($x^2_{(1)}$=284.77; p<0.001) and the health state level ($x^2_{(1)}$=2655.3; p<0.001). This meant that in addition to the significant difference of 0.04 points between the two tests, there were large differences between health states, interviewers and respondents.

Table 2. Multilevel models

Including interviewer and respondent level			
Effect	**Estimate**	**[95% CI]**	**p-value**
Intercept	0.130	[0.020, 0.240]	0.024
Time	0.042	[0.010, 0.075]	0.012
Including health state level			
Effect	**Estimate**	**[95% CI]**	**p-value**
Intercept	0.164	[0.085, 0.242]	<0.001
Time	0.042	[0.016, 0.069]	0.002

DCE data

The DCE dataset consisted of 1582 DCE responses (all respondents completed 7 paired comparisons) per test, hence in total 3164 responses for the test-retest exercise. From the 1582 DCE responses in the first test, 1147 (72.5%) were identically chosen in the second test.

For the respondent analysis, 35 of the 226 answered all 7 choices the same in the first test and the retest. The two most inconsistent respondents gave only one (14.3%) identical answer. The median of consistent choices per respondent was 5 out of 7 (Appendix Table A3)

For the health state pairs analysis, 35 of the 196 pairs could be considered the most consistent pairs since all the respondents who were presented with this choice chose the identical option at test and retest. On the other hand, there was one pair where the 2 respondents who were presented with the choice both chose differently at test and retest: i.e. pair 153 (health state '22123' vs '11155', Appendix Table A4). When stratified by the severity level difference, the percentage of respondents who chose A in both tests was similar across different severity level differences (Figure 2).

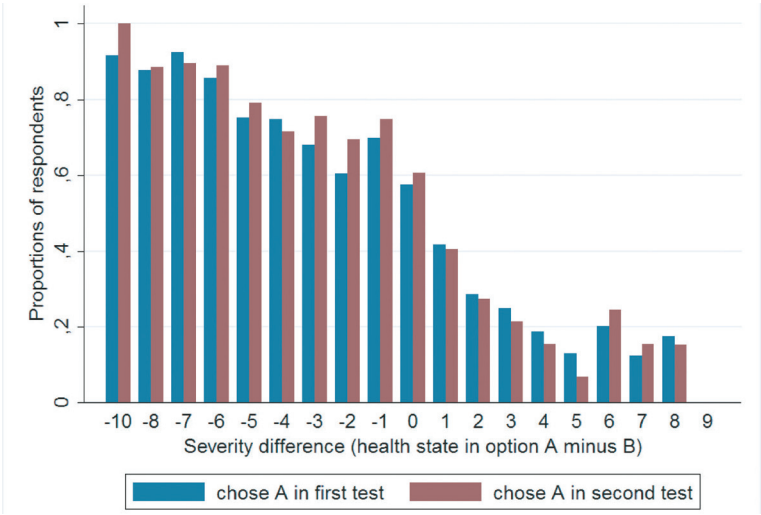

Figure 2. Percentage of respondents who chose option A in first and second tests stratified by severity difference (sum of numbering of all levels in the health state: 11113 vs 11112 = 7 – 6 = 1)

Analysis of the relative importance of the five dimensions and the relative utility decrement between each of the five levels showed that no distinctive difference in the test and retest pattern was perceived for the Hybrid Model (Figure 3 and Appendix Figure A3). This was also true for the results based on only the C-TTO, but for the DCE the results were different (Appendix Figure A4 and A5). Using DCE, the retest gave substantial more weight to mobility (MO) and usual activities (UA), and consequently put less weight on the other dimensions of the EQ-5D-5L. Notably, the DCE weight of the levels seems relatively stable. A summary of all the findings can be seen in Table 3.

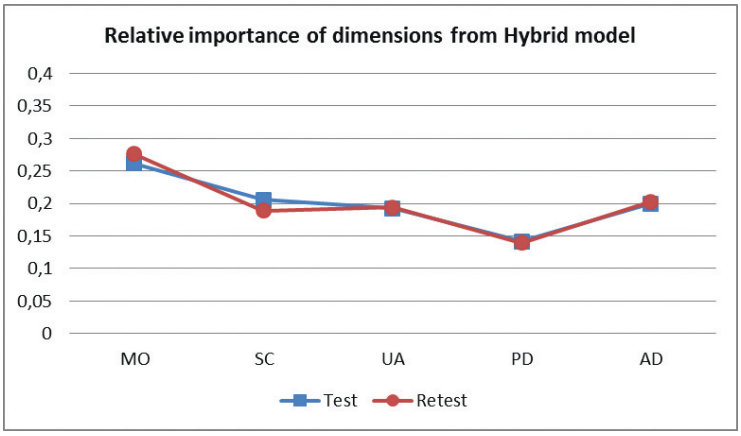

Figure 3. The relative importance of EQ-5D-5L dimensions based on the Hybrid model

Table 3. Summary of findings

Analysis	C-TTO	DCE
Respondents perspective	68.6% of the respondents had no significant difference of mean values between test and retest	15.5% of the respondents gave 7 identical choices in test-retest, whereas 2 gave only 1 identical answers. The median of consistent choices per respondent was 5 out of 7 pairs that they valued
Health states perspective[a]	95.3% of the health states had no significant difference of mean values between test and retest	Among 196 pairs of health states in the DCE design, 90.3% had more than 50% responses that were identically chosen in test and retest. Moreover, 35 pairs out of the 196 pairs had 100% of the respondents chose the identical option.
	81.4% of the health states ICCs were statistically significant (P-value<0.05). 24,4% poor agreement between test and retest, 36.1% were fair, 29,1% were good, and 10,5% were excellent.	
	83.2% of the responses were consistent in the first test did not crossover from worse-than-dead to better-than-dead or the other way around	
Aggregate/ pooled data	Mean value of the second test was statistically significant higher than the first test by 0.042. It is around or below the minimal clinically important difference (MID) of EQ-5D-5L utilities.	From the 1582 DCE responses in the first test, 72.5% were identically chosen in the second test
	No different patterns concerning the relative importance of the five dimensions and the relative utility decrement between each of the five levels.	Concerning the relative importance of the five dimensions, DCE retest gave substantial more weight to mobility and usual activity, and consequently put less weight on the other dimensions of the EQ-5D-5L.

C-TTO, composite time trade-off; DCE, discrete choice experiment; EQ-5D-5L, five-level EuroQol five-dimensional questionnaire; ICC, intraclass correlation coefficient.

[a] *Pairs of health states in DCE*

Discussion

We studied the test-retest of the EQ-VT in 226 respondents representative for the Indonesian population. For C-TTO, it was shown that 68.6% of the respondents and 95.3% of the health states displayed no different values between the two tests, although the overall mean was 0.042 higher in the retest. For DCE, 72.5% of the responses were identical. No different pattern was found for the C-TTO and Hybrid Model between test-retest. DCE results showed that mobility and usual activity were given more weight in the retest. The DCE weight of the levels seems relatively stable.

Several limitations of this study should be considered. First, we only did a retest in respondents who had limited difficulty with the task, resulting in a higher educated retest population. Indeed, as the retest population is of a higher educational level, one can expect that our results have a bias to favourable test-retest variation compared with "real-life" valuations.

Second, the health state of the respondents might have changed from the first to the second measurement. As values of hypothetical health states related to own health states, this could have influenced the reliability indicators. However, we found that the association between the respondents' change of health and change of C-TTO values was not significant.

Third, 143 (6.33%) out of 2260 responses were considered highly inconsistent, that is, they had absolute value differences between both tests in the range 1.00-1.95: 10 years to 19.5 years in the 20 years C-TTO time-frame. It could be argued that this was the result of interactions between factors influencing health state valuations: severity level, interviewer effects, and respondents (different socio-demographic backgrounds). With respect to the health states, we applied Spearman's rank correlations and found a statistically significant correlation between the absolute value difference and the severity level of a health state ($r=0.1472$, $p<0.001$). Descriptive analysis of the 143 inconsistent values showed that two-thirds were recorded by four interviewers, emphasizing the interviewer effect. Indeed, inconsistent values were spread across socio-demographic characteristics: residence, gender, and age groups, which made the interviewer an important additional source of variance. The possible interaction between health state valuations, interviewers and respondents might not be completely avoidable. However, extensive use of the quality control report component of EQ-VT, training and retraining programs, and continuous individual feedback could be effective in reducing a significant amount of inconsistency in the data - less than 10% in the present study - thus resulting in high quality data [29].

Several study findings are worth highlighting. First, this is the first report on the test-retest reliability of the current 5 level version of the EQ-5D and the new standard EQ-VT valuation study design. We found that C-TTO was consistent over time which is in line with previous

studies of the 3-level version [13,14]. Moreover, the average value of the retest data was 0.042 higher than that of the first test: respondents traded off fewer years of life (±5.0 months), as also shown by other studies using TTO [14]. The fact that this small difference was statistically significant should be seen in the light of the high statistical power of the more than 4000 observations. The value 0.042 was around or below the minimal clinically important difference (MID) of EQ-5D-5L utilities. For instance, McClure et al., found MID was between 0.037 and 0.069 for valuation studies, depending on the country [30]. The patient-based MCIDs were 0.05 (COPD patients) and 0.10 (stroke patients) [31,32]. Whether the MID is a valid yardstick to compare test-rest against remains unclear. Indeed, MID has limited relevance in cost-effectiveness analysis, as the size of the effects has to be weighed against the costs, and not necessarily to the judgment of the individual patient. In any case, a 4% upwards shift of the values in the retest seems something to be acknowledged. One explanation for the higher C-TTO value in the second test could be an adaptation to the stimulus of the health state. Another might be that respondents adapted to the process. Perhaps the respondents were gaining experience with the health states asked in the first test, and then considered them more positively in the second test, hence the values were higher or in other terms they 'were sacrificing less life-years'. This would be similar to patients who have already adapted to their 'illness' and thus placed higher values on impaired health states [33]. Another explanation could be that respondents learned from the first test that the task was completed faster if they achieved a point of equivalence, i.e. clicked the button 'life A and life B are about the same' faster. Hence, they did not explore more iteration steps and the values obtained were higher. We indeed found that the number of iteration steps was significantly lower at the second test compared to the first (P-value = 0.001).

Second, we found that the DCE showed a different pattern concerning the relative importance of the dimensions resulting in quite different values for the health states in test-retest. The different pattern was not observed in C-TTO and Hybrid model. It appears that DCE is a less reliable method compared to C-TTO (using the quality control as employed in this investigation) in terms of test-retest reliability when it is implemented in health state valuations. This is the first time such a finding could be shown because no one has yet presented a head-to-head comparison between the test-retest of DCE and TTO. The low test-retest validity of DCE found in this investigation has implications for the implementation of DCE. Given this evidence that DCE values change over time (while the C-TTO remains stable), it questions whether we can rely on DCE in health state valuations. Indeed, in TTO large progress in quality control is made, while in DCE such quality control is not yet implementing, at least not on the scale as done in this study. We might have been misguided by the relatively simple administration of DCE compared to TTO, but DCE might be too difficult for the respondent,

resulting in low test-retest reliability. Indeed, in TTO one compares one health state with five dimensions with a remaining life time in full health. Full health will always be the same, which assures that the respondent 'only' has to deal with the changing 5 dimensions and life time. In DCE the respondent compares two health states, each with 5 dimensions, and all these 10 dimensions can be different in every comparison. This cognitive task might be more complex than TTO, resulting in less reliable results. Note that from the number of consistent choices: i.e. 72.5% of 1582 responses were identically chosen between the two interviews, one could conclude that DCE is reliable. But when looking at the consequences of the weight of the dimensions, the results are less favorable. Our conclusion is that the enthusiasm with which DCE is employed in health state valuations should be critically examined, given that the results of DCE differ over time.

Conclusion

This is the first time that test-retest data of the EQ-VT valuation methods is presented. We found an upwards shift of about 4% in C-TTO data. Moreover, in DCE there also seems to be a shift in the relative values of the dimensions between the two time of administration. Especially the last is concerning, as this will change the ranking of health states, and thus the prioritization of interventions. When modelling the C-TTO separately or when modeling the C-TTO and DCE together (the Hybrid Model) the results are much more stable, and little difference can be seen in the relative dimensions and levels. This supports the use of the C-TTO values and the combination of C-TTO and DCE in values sets, in particular, the Indonesian EQ-5D-5L value set. Our investigation suggests a critical examination of DCE, as test-retest seems to change the ranking of health states.

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Appendix

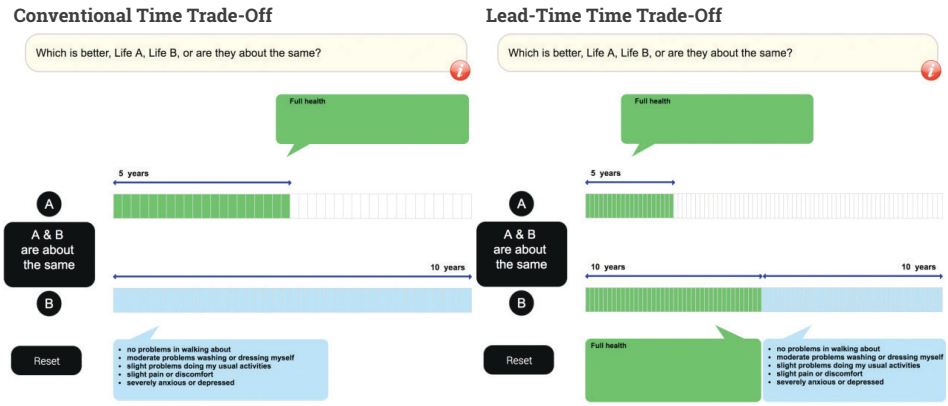


Figure A1. Composite Time Trade-Off (C-TTO)

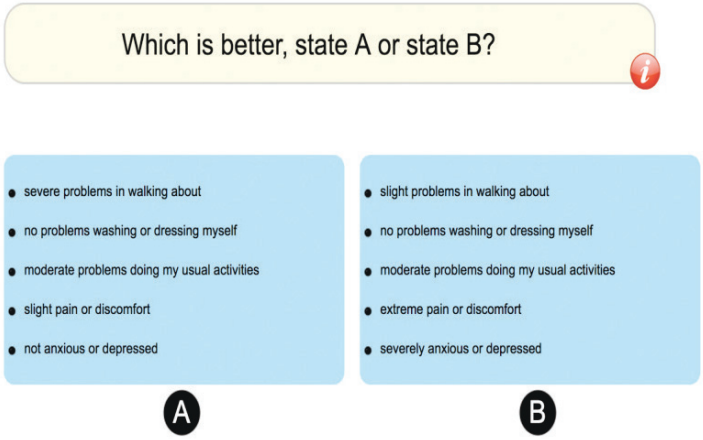


Figure A2. Discrete Choice Experiments (DCE)

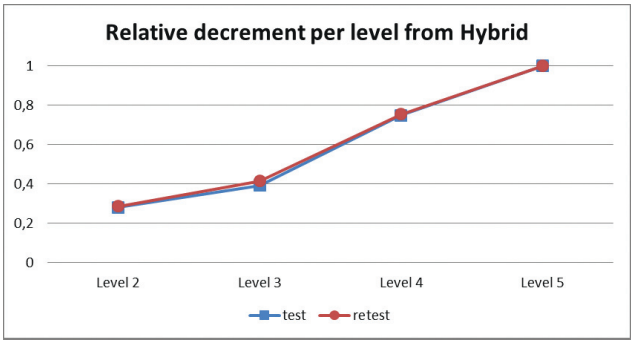


Figure A3. Relative decrements per level of EQ-5D-5L based on the Hybrid model

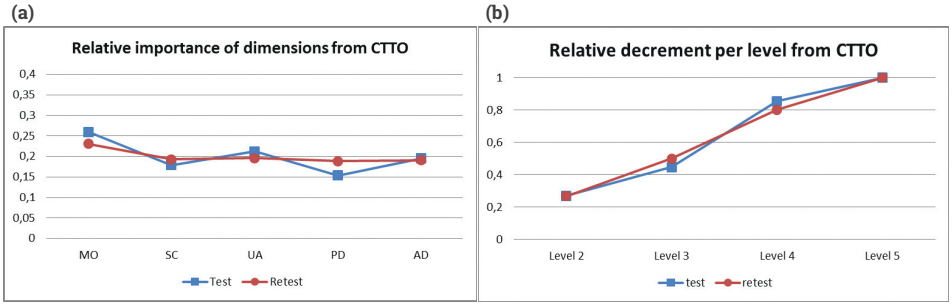


Figure A4. (a) relative importance of EQ-5D-5L dimensions and (b) relative decrements per level - based on the C-TTO model

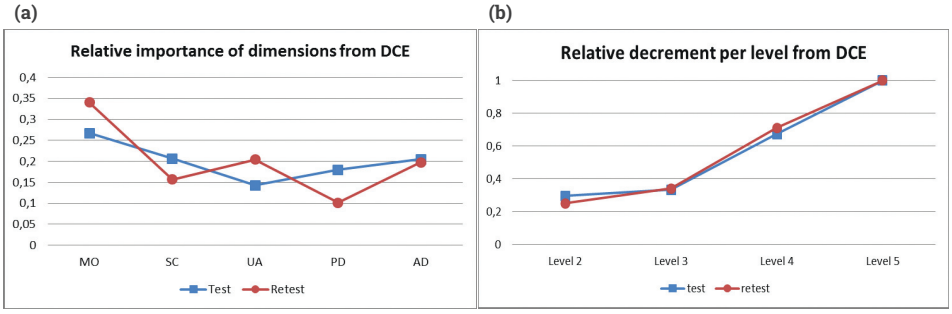


Figure A5. (a) relative importance of EQ-5D-5L dimensions and (b) relative decrements per level - based on the DCE model

Table A1. Count of identical, increased and decreased values, comparison of mean of both tests' value per respondent

Resp.	Value direction[a]			z-statistic[b]	P-value	Resp.	Value direction			z-statistic	P-value
	=	<	>				=	<	>		
1	9	0	1	-1.000	0.317	114	2	3	5	-0.492	0.623
2	7	1	2	-0.577	0.564	115	2	3	5	-1.689	0.091
3	7	1	2	0.000	1.000	116	2	3	5	-1.684	0.092
4	7	1	2	-0.816	0.414	117	2	3	5	-0.213	0.832
5	7	1	2	0.000	1.000	118	2	4	4	-0.704	0.482
6	7	2	1	-0.577	0.564	119	2	4	4	-0.352	0.725
7	6	0	4	-1.826	0.068	120	2	4	4	-0.282	0.778
8	6	1	3	-1.134	0.257	121	2	4	4	-0.141	0.888
9	6	1	3	-0.557	0.577	122	2	4	4	-0.350	0.726
10	6	2	2	-0.552	0.581	123	2	4	4	-0.283	0.777
11	6	3	1	-0.756	0.450	124	2	4	4	-0.985	0.325
12	6	4	0	-1.826	0.068	125	2	4	4	-0.283	0.777
13	6	4	0	-1.841	0.066	126	2	4	4	-0.560	0.575
14	5	0	5	-2.023	0.043*	127	2	5	3	-0.562	0.574
15	5	0	5	-2.032	0.042*	128	2	5	3	-1.489	0.137

Table A1 (continued). Count of identical, increased and decreased values, comparison of mean of both tests' value per respondent

Resp.	Value direction[a]			z-statistic[b]	P-value	Resp.	Value direction			z-statistic	P-value
	=	<	>				=	<	>		
16	5	1	4	-1.625	0.104	129	2	5	3	-0.709	0.478
17	5	2	3	-0.141	0.888	130	2	5	3	-0.917	0.359
18	5	2	3	-0.271	0.786	131	2	5	3	-0.981	0.326
19	5	2	3	-1.219	0.223	132	2	5	3	-0.568	0.570
20	5	3	2	-0.135	0.892	133	2	6	2	-1.265	0.206
21	5	3	2	-0.412	0.680	134	2	6	2	-2.103	0.035*
22	5	3	2	-0.272	0.785	135	2	6	2	-0.986	0.324
23	5	4	1	-0.707	0.480	136	2	6	2	-0.570	0.569
24	5	4	1	-1.414	0.157	137	2	6	2	-0.912	0.362
25	5	5	0	-2.060	0.039*	138	2	6	2	-2.113	0.035*
26	5	5	0	-2.070	0.038*	139	2	6	2	-1.752	0.080
27	4	0	6	-2.264	0.024*	140	2	6	2	-2.106	0.035*
28	4	0	6	-2.232	0.026*	141	2	7	1	-1.404	0.160
29	4	1	5	-2.020	0.043*	142	2	7	1	-2.173	0.030*
30	4	1	5	-1.590	0.112	143	2	7	1	-2.383	0.017*
31	4	1	5	-1.682	0.093	144	2	7	1	-2.200	0.028*
32	4	2	4	-0.949	0.343	145	2	8	0	-2.533	0.011*
33	4	2	4	-0.850	0.395	146	2	8	0	-2.536	0.011*
34	4	2	4	-0.954	0.340	147	1	0	9	-2.668	0.008*
35	4	2	4	-0.431	0.666	148	1	0	9	-2.673	0.008*
36	4	2	4	-1.581	0.114	149	1	0	9	-2.673	0.008*
37	4	2	4	-1.577	0.115	150	1	0	9	-2.670	0.008*
38	4	3	3	-0.108	0.914	151	1	0	9	-2.680	0.007*
39	4	3	3	-0.631	0.528	152	1	1	8	-2.497	0.013*
40	4	3	3	-0.318	0.750	153	1	1	8	-2.142	0.032*
41	4	3	3	-0.422	0.673	154	1	1	8	-2.494	0.013*
42	4	4	2	-1.294	0.196	155	1	1	8	-2.494	0.013*
43	4	4	2	-0.318	0.750	156	1	1	8	-2.501	0.012*
44	4	4	2	-0.954	0.340	157	1	4	5	-1.13	0.260
45	4	4	2	-0.841	0.400	158	1	3	6	-0.179	0.858
46	4	5	1	-1.725	0.084	159	1	3	6	-0.612	0.541
47	4	5	1	-0.946	0.344	160	1	3	6	-1.086	0.277
48	4	5	1	-1.897	0.058	161	1	3	6	-1.127	0.260
49	4	6	0	-2.201	0.028*	162	1	3	6	-1.485	0.138
50	4	6	0	-2.214	0.027*	163	1	4	5	-0.780	0.436
51	4	6	0	-2.232	0.026*	164	1	4	5	-1.130	0.258
52	3	0	7	-2.375	0.018*	165	1	4	5	-0.357	0.721
53	3	0	7	-2.366	0.018*	166	1	4	5	-0.538	0.590
54	3	0	7	-2.410	0.016*	167	1	4	5	-0.889	0.374

Table A1 (continued). Count of identical, increased and decreased values, comparison of mean of both tests' value per respondent

Resp.	Value direction[a]			z-statistic[b]	P-value	Resp.	Value direction			z-statistic	P-value
	=	<	>				=	<	>		
55	3	0	7	-2.366	0.018*	168	1	5	4	-1.130	0.258
56	3	1	6	-2.120	0.034*	169	1	5	4	-0.238	0.812
57	3	1	6	-1.293	0.196	170	1	5	4	-0.179	0.858
58	3	1	6	-1.980	0.048*	171	1	5	4	-0.892	0.372
59	3	1	6	-1.866	0.062	172	1	6	3	-1.604	0.109
60	3	1	6	-1.194	0.233	173	1	6	3	-0.895	0.371
61	3	1	6	-2.120	0.034*	174	1	7	2	-0.979	0.327
62	3	2	5	-0.170	0.865	175	1	7	2	-1.793	0.073
63	3	2	5	-1.706	0.088	176	1	8	1	-1.604	0.109
64	3	2	5	-0.170	0.865	177	1	8	1	-2.380	0.017*
65	3	2	5	-0.509	0.611	178	1	8	1	-2.494	0.013*
66	3	2	5	-1.022	0.307	179	1	9	0	-2.670	0.008*
67	3	3	4	-1.192	0.233	180	1	9	0	-2.680	0.007*
68	3	3	4	-0.423	0.672	181	1	9	0	-2.680	0.007*
69	3	3	4	-0.171	0.864	182	1	9	0	-2.714	0.007*
70	3	3	4	-0.857	0.391	183	1	9	0	-2.692	0.007*
71	3	3	4	-1.109	0.268	184	0	0	10	-2.816	0.005*
72	3	3	4	-0.512	0.609	185	0	0	10	-2.913	0.004*
73	3	4	3	-0.682	0.495	186	0	0	10	-2.807	0.005*
74	3	4	3	-0.632	0.527	187	0	0	10	-2.807	0.005*
75	3	4	3	-0.175	0.861	188	0	1	9	-2.620	0.009*
76	3	4	3	-0.086	0.931	189	0	1	9	-1.820	0.069
77	3	4	3	-0.175	0.861	190	0	1	9	-2.705	0.007*
78	3	4	3	-0.847	0.397	191	0	2	8	-2.456	0.014*
79	3	5	2	-1.018	0.309	192	0	2	8	-2.295	0.022*
80	3	5	2	-1.706	0.088	193	0	2	8	-1.886	0.059
81	3	5	2	-0.862	0.389	194	0	2	8	-2.100	0.036*
82	3	5	2	-1.781	0.075	195	0	3	7	-0.772	0.440
83	3	5	2	-1.016	0.310	196	0	3	7	-1.287	0.198
84	3	5	2	-1.022	0.307	197	0	4	6	-1.074	0.283
85	3	5	2	-1.866	0.062	198	0	5	5	-0.716	0.474
86	3	5	2	-1.035	0.301	199	0	5	5	-0.258	0.796
87	3	6	1	-1.897	0.058	200	0	5	5	-0.411	0.681
88	3	6	1	-2.213	0.027*	201	0	5	5	-0.679	0.497
89	3	6	1	-1.709	0.088	202	0	7	3	-0.777	0.437
90	3	6	1	-1.187	0.235	203	0	8	2	-2.100	0.036*
91	3	7	0	-2.460	0.014*	204	0	8	2	-2.522	0.012*
92	3	7	0	-2.375	0.018*	205	0	9	1	-2.324	0.020*
93	2	0	8	-2.555	0.011*	206	0	10	0	-2.823	0.005*

Table A1 (continued). Count of identical, increased and decreased values, comparison of mean of both tests' value per respondent

Resp.	Value direction[a]			z-statistic[b]	P-value	Resp.	Value direction			z-statistic	P-value
	=	<	>				=	<	>		
94	2	0	8	-2.524	0.012*	207	1	0	9	-2.759	0.006*
95	2	0	8	-2.536	0.011*	208	2	7	1	1.644	0.100
96	2	0	8	-2.527	0.012*	209	1	3	6	-1.226	0.220
97	2	0	8	-2.524	0.012*	210	3	4	3	-0.052	0.959
98	2	0	8	-2.536	0.011*	211	0	9	1	2.655	0.008*
99	2	1	7	-2.056	0.040*	212	3	2	5	-1.402	0.161
100	2	1	7	-2.240	0.025*	213	3	6	1	1.609	0.108
101	2	1	7	-2.010	0.044*	214	3	6	1	1.664	0.096
102	2	1	7	-2.200	0.028*	215	2	5	3	0.308	0.758
103	2	2	6	-1.620	0.105	216	2	5	3	1.439	0.150
104	2	2	6	-1.262	0.207	217	2	2	6	-1.440	0.150
105	2	2	6	-0.780	0.436	218	0	6	4	-0.051	0.959
106	2	2	6	-0.421	0.674	219	0	7	3	0.714	0.475
107	2	2	6	-1.755	0.079	220	1	1	8	-2.247	0.025*
108	2	2	6	-1.407	0.159	221	2	7	1	1.952	0.051
109	2	2	6	-1.335	0.182	222	1	3	6	-1.327	0.185
110	2	2	6	-1.843	0.065	223	1	2	7	-1.889	0.059
111	2	2	6	-2.043	0.041	224	3	6	1	1.817	0.069
112	2	3	5	-1.051	0.293	225	1	4	5	-0.868	0.385
113	2	3	5	-1.693	0.090	226	3	6	1	1.926	0.054

[a] Value of the second test compared to the first test per health state valued by each respondent (N=10); identical (=), decrease (<) or increase (>)
[b] z-statistic obtained from Wilcoxon matched-pairs signed-rank test to compare observed C-TTO values provided by each respondent in both measurement points
** difference between mean observed C-TTO value of the first test and second test is statistically significant (p-value<0.05)*

Table A2. Changes in mean health state observed values, Intraclass correlation (ICC) coefficients, number of total value changes count of increased and count of decreased valuations, and percentage of respondents who maintained better-than-dead or worse-than-dead valuation after per health state.

Health State	N[a]	Mean observed		Mean absolute difference[b]	z statistics	P-value of Wilcoxon	ICC	P-value of ICC	Change values (% of all valuation)[c]		Increased value	Decreased value	% Stay WTD or BTD in retest[d]
		Test	Retest										
1 1 1 1 2	46	0.887	0.875	0.012	-0.716	0.474	0.801	0.000**	22	(47.83)	10	11	100.0
1 1 1 2 1	40	0.921	0.911	0.010	-0.705	0.481	0.267	0.048**	17	(42.50)	7	10	100.0
1 1 1 2 2	30	0.848	0.798	0.050	-1.829	0.067	0.690	0.000**	20	(66.67)	5	13	100.0
1 1 2 1 1	49	0.901	0.882	0.019	-0.937	0.349	0.184	0.102	31	(63.27)	11	15	100.0
1 1 2 1 2	18	0.769	0.803	0.033	1.055	0.291	0.680	0.001**	14	(77.78)	9	4	100.0
1 1 2 2 1	22	0.798	0.850	0.052	1.310	0.190	0.179	0.206	11	(50.00)	7	3	100.0
1 1 2 3 5	22	0.475	0.586	0.111	1.785	0.074	0.744	0.000**	17	(77.27)	11	5	100.0
1 1 4 1 4	24	0.338	0.475	0.138	0.917	0.359	0.550	0.002**	21	(87.50)	12	8	85.7
1 1 4 2 1	21	0.676	0.631	0.045	-0.140	0.889	-0.156	0.747	17	(80.95)	8	6	88.9
1 1 4 2 5	19	0.326	0.421	0.095	0.383	0.702	0.472	0.019**	18	(94.74)	6	9	81.3
1 2 1 1 1	52	0.911	0.886	0.025	-0.573	0.566	0.192	0.084	29	(55.77)	12	16	100.0
1 2 1 1 2	18	0.767	0.794	0.028	0.474	0.636	0.395	0.051	11	(61.11)	5	5	100.0
1 2 1 2 1	30	0.745	0.782	0.037	-0.628	0.530	0.184	0.164	21	(70.00)	7	10	96.2
1 2 2 4 4	21	0.471	0.400	0.071	-0.820	0.412	0.545	0.004**	19	(90.48)	7	9	94.4
1 2 3 3 4	22	0.330	0.345	0.016	-0.491	0.623	0.798	0.000**	17	(77.27)	7	10	81.8
1 2 3 4 4	16	0.153	0.116	0.038	-0.366	0.714	0.660	0.003**	12	(75.00)	5	7	81.3
1 2 5 1 3	16	0.341	0.325	0.016	-0.285	0.776	-0.070	0.599	15	(93.75)	6	9	75.0
1 2 5 1 4	22	0.330	0.470	0.141	2.362	0.018*	0.810	0.000**	20	(90.91)	14	5	95.2
1 2 5 4 3	30	0.258	0.160	0.098	-1.743	0.081	0.724	0.000**	27	(90.00)	8	16	76.9
1 3 1 2 2	19	0.658	0.684	0.026	0.428	0.669	0.300	0.106	15	(78.95)	6	6	93.8
1 3 2 2 4	30	0.317	0.337	0.020	-0.237	0.812	0.271	0.075	25	(83.33)	10	13	67.9
1 3 3 1 3	21	0.595	0.531	0.064	-1.017	0.309	0.385	0.037**	16	(76.19)	6	8	100.0

Table A2 (continued). Changes in mean health state observed values, Intraclass correlation (ICC) coefficients, number of total value changes count of increased and count of decreased valuations, and percentage of respondents who maintained better-than-dead or worse-than-dead valuation after per health state.

Health State	N[a]	Mean observed		Mean absolute difference[b]	z statistics	P-value of Wilcoxon	ICC	P-value of ICC	Change values (% of all valuation)[c]		Increased value	Decreased value	% Stay WTD or BTD in retest[d]
		Test	Retest										
1 4 1 1 3	24	0.415	0.569	0.154	1.635	0.102	0.580	0.001**	15	(62.50)	10	4	86.4
1 4 5 5 4	16	-0.244	-0.188	0.056	0.575	0.566	0.642	0.003**	12	(75.00)	7	5	81.3
1 5 1 5 1	24	0.288	0.427	0.140	1.360	0.174	0.624	0.000**	22	(91.67)	14	6	86.4
2 1 1 1 1	39	0.881	0.886	0.005	0.348	0.728	0.446	0.002**	23	(58.97)	11	8	100.0
2 1 1 1 2	16	0.791	0.800	0.009	-1.896	0.058	0.294	0.138	8	(50.00)	1	7	93.8
2 1 3 1 5	24	0.119	0.208	0.090	1.270	0.204	0.724	0.000**	18	(75.00)	11	6	81.8
2 1 3 3 4	22	0.386	0.345	0.041	0.690	0.490	0.245	0.138	16	(72.73)	10	6	81.8
2 1 3 4 5	18	0.092	0.119	0.028	0.479	0.632	0.190	0.228	18	(100.00)	10	6	68.8
2 1 4 4 4	24	0.021	0.242	0.221	1.588	0.112	0.474	0.005**	21	(87.50)	12	6	76.2
2 2 4 3 4	19	0.058	0.232	0.174	1.782	0.075	0.624	0.001**	12	(63.16)	7	3	87.5
2 3 1 5 2	18	0.444	0.294	0.150	-0.850	0.395	0.207	0.189	18	(100.00)	8	8	68.8
2 3 2 4 2	22	0.320	0.314	0.007	0.407	0.684	0.370	0.046**	19	(86.36)	10	9	86.4
2 3 5 1 4	30	0.238	0.185	0.053	-1.453	0.146	0.631	0.000**	27	(90.00)	7	17	88.5
2 4 3 4 2	22	0.168	0.259	0.091	0.802	0.423	0.659	0.000**	17	(77.27)	8	9	81.8
2 4 4 4 3	24	-0.183	-0.029	0.154	1.587	0.113	0.671	0.000**	22	(91.67)	12	8	72.7
2 4 4 4 5	30	-0.343	-0.282	0.062	0.556	0.578	0.576	0.000**	27	(90.00)	14	11	75.0
2 4 5 5 3	19	-0.018	-0.018	0.000	0.794	0.427	0.811	0.000**	14	(73.68)	6	5	87.5
2 5 1 2 2	21	0.388	0.469	0.081	1.552	0.121	0.348	0.054	18	(85.71)	10	5	88.9
2 5 2 2 2	24	0.406	0.421	0.015	0.445	0.657	0.442	0.016**	20	(83.33)	9	8	81.0
2 5 3 3 1	24	0.215	0.400	0.185	2.486	0.013*	0.704	0.000**	14	(58.33)	10	2	90.5
3 1 5 1 4	24	0.050	0.254	0.204	1.250	0.211	0.470	0.006**	19	(79.17)	11	6	76.2
3 1 5 2 4	24	-0.092	0.106	0.198	1.864	0.062	0.679	0.000**	20	(83.33)	12	6	81.8
3 1 5 2 5	21	0.236	0.143	0.093	-0.576	0.564	0.318	0.077	17	(80.95)	7	7	61.1

3 2 3 1 4	22	0.318	0.323	0.005	0.131	0.896	0.420	0.026**	17	(77.27)	10	7	81.8
3 2 4 4 3	30	0.165	0.062	0.103	-2.182	0.029*	0.564	0.000**	27	(90.00)	7	16	80.8
3 3 2 5 3	22	0.130	0.189	0.059	0.846	0.398	0.410	0.029**	19	(86.36)	11	8	77.3
3 4 1 5 5	30	0.120	-0.005	0.125	-1.866	0.062	0.700	0.000**	23	(76.67)	8	12	80.8
3 4 2 3 2	30	0.207	0.273	0.067	0.484	0.628	0.520	0.001**	26	(86.67)	13	11	78.6
3 4 2 4 4	18	-0.025	-0.075	0.050	-0.174	0.862	0.490	0.019**	16	(88.89)	7	7	75.0
3 4 5 1 5	22	-0.011	0.086	0.098	1.550	0.121	0.761	0.000**	18	(81.82)	11	6	90.5
3 5 1 4 3	24	0.088	0.119	0.031	0.258	0.796	0.546	0.003**	20	(83.33)	10	7	71.4
3 5 2 4 5	22	0.130	0.175	0.045	0.179	0.858	0.558	0.003**	20	(90.91)	8	11	76.2
3 5 3 1 1	30	0.305	0.360	0.055	0.634	0.526	0.455	0.006**	22	(73.33)	11	9	78.6
3 5 3 3 2	19	0.129	0.187	0.058	0.525	0.600	0.560	0.006**	16	(84.21)	6	7	68.8
4 2 1 1 5	19	0.103	0.255	0.153	0.747	0.455	0.625	0.001**	18	(94.74)	9	6	87.5
4 2 3 2 1	30	0.208	0.270	0.062	0.600	0.549	0.409	0.012**	24	(80.00)	11	11	75.0
4 3 3 1 5	24	-0.140	-0.067	0.073	1.231	0.218	0.722	0.000**	21	(87.50)	13	6	77.3
4 3 5 1 4	18	-0.128	-0.114	0.014	0.022	0.983	0.709	0.000**	15	(83.33)	6	7	68.8
4 3 5 4 2	30	-0.018	-0.128	0.110	-1.323	0.186	0.348	0.028**	24	(80.00)	7	13	80.8
4 3 5 5 5	30	-0.423	-0.342	0.082	0.125	0.900	0.512	0.002**	21	(70.00)	10	10	82.1
4 4 1 2 5	16	-0.241	-0.225	0.016	-0.494	0.621	0.676	0.002**	13	(81.25)	5	8	75.0
4 4 3 4 5	16	-0.481	-0.472	0.009	-0.468	0.640	0.623	0.005**	13	(81.25)	5	8	87.5
4 4 5 5 3	18	-0.450	-0.281	0.169	1.533	0.125	0.483	0.014**	11	(61.11)	7	3	87.5
4 5 1 3 3	30	0.093	0.153	0.060	0.010	0.992	0.413	0.012**	26	(86.67)	10	12	69.2
4 5 1 4 4	22	-0.086	0.025	0.111	0.945	0.344	0.555	0.003**	18	(81.82)	10	7	71.4
4 5 2 3 3	21	0.019	-0.017	0.036	-0.192	0.848	0.425	0.028**	18	(85.71)	8	7	61.1
4 5 4 1 3	19	-0.100	0.016	0.116	0.550	0.583	0.307	0.097	14	(73.68)	8	5	62.5
5 1 1 5 2	19	-0.008	0.134	0.142	1.099	0.272	0.551	0.005**	14	(73.68)	7	4	81.3
5 1 4 5 1	22	-0.005	0.098	0.102	0.573	0.567	0.785	0.000**	17	(77.27)	9	7	81.0
5 2 2 1 5	30	0.105	0.167	0.062	0.755	0.450	0.750	0.000**	24	(80.00)	12	8	88.5

Table A2 (continued). Changes in mean health state observed values, Intraclass correlation (ICC) coefficients, number of total value changes count of increased and count of decreased valuations, and percentage of respondents who maintained better-than-dead or worse-than-dead valuation after per health state.

Health State	N[a]	Mean observed		Mean absolute difference[b]	z statistics	P-value of Wilcoxon	ICC	P-value of ICC	Change values (% of all valuation)[c]		Increased value	Decreased value	% Stay WTD or BTD in retest[d]
		Test	Retest										
5 2 3 3 5	30	-0.215	-0.223	0.008	-0.363	0.717	0.718	0.000**	23	(76.67)	10	11	78.6
5 2 4 3 1	24	-0.088	-0.002	0.085	0.798	0.425	0.508	0.005**	17	(70.83)	10	6	81.8
5 2 4 5 5	21	-0.386	-0.290	0.095	1.535	0.125	0.426	0.024**	18	(85.71)	10	5	66.7
5 3 2 2 1	16	-0.222	-0.153	0.069	0.261	0.794	0.573	0.009**	12	(75.00)	6	6	62.5
5 3 2 4 3	24	-0.165	-0.154	0.010	0.101	0.920	0.602	0.001**	19	(79.17)	9	7	81.0
5 3 2 4 4	24	-0.204	-0.177	0.027	0.172	0.864	0.635	0.000**	21	(87.50)	10	8	81.0
5 3 4 1 2	22	-0.139	0.030	0.168	1.011	0.312	0.376	0.037**	18	(81.82)	10	7	72.7
5 4 1 5 3	24	-0.290	-0.073	0.217	1.605	0.108	0.442	0.008**	20	(83.33)	13	5	72.7
5 4 2 3 1	22	0.036	0.161	0.125	1.190	0.234	0.794	0.000**	18	(81.82)	10	3	95.2
5 4 3 4 2	16	-0.406	-0.434	0.028	-0.209	0.834	0.641	0.004**	12	(75.00)	6	6	81.3
5 5 2 2 5	22	-0.377	-0.211	0.166	1.614	0.107	0.694	0.000**	18	(81.82)	12	6	86.4
5 5 2 3 3	21	0.014	-0.217	0.231	-1.916	0.055	0.459	0.007**	18	(85.71)	5	10	61.1
5 5 4 2 4	18	-0.417	-0.286	0.131	1.090	0.276	0.495	0.014**	17	(94.44)	8	7	81.3
5 5 5 5 5	226	-0.668	-0.604	0.064	3.239	0.001*	0.644	0.000**	129	(57.08)	82	34	87.4

**: difference between mean observed value of the first test and second test is statistically significant (p-value<0.05)*
***: the ICC is statistically significant (p-value<0.05)*
[a] *amount of respondents who valued each health state*
[b] *Mean difference: the difference (in absolute value) between mean value in the first and second test.*
[c] *amount of values that were change between the two tests*
[d] *percentages of responses that stay in BTD: better-than-dead (positive) value or WTD: worse-than-dead (negative) value between the two tests*

Table A3. Percentage of respondents with consistent responses between test and retest in DCE

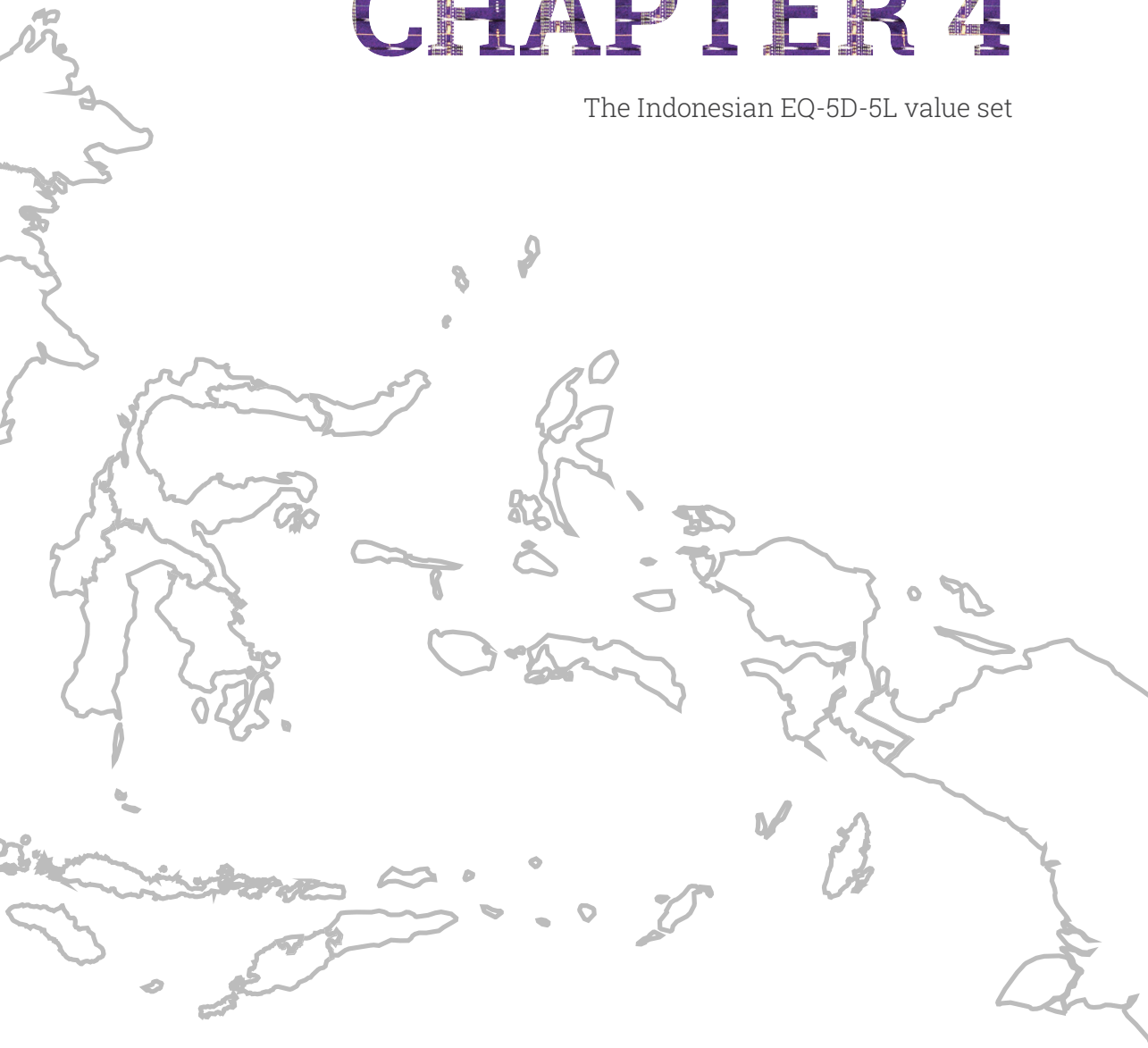
Consistent choice made (%); N=7		Respondent (%); N=226	
1	(14.3)	2	(0.88)
2	(28.6)	9	(3.98)
3	(42.9)	20	(8.85)
4	(57.1)	43	(19.03)
5	(71.4)	52	(23.01)
6	(85.7)	65	(28.76)
7	(100.0)	35	(15.49)

Table A4. Percentage of pairs of health states with consistent responses between test and retest in DCE

Percentage of consistent responses (%)	Number of pairs N=196 (%)	
0.00-9.99	1	(0.51)
10.00-19.99	0	(0.00)
20.00-29.99	3	(1.53)
30.00-39.99	2	(1.02)
40.00-49.99	13	(6.63)
50.00-59.99	32	(16.33)
60.00-69.99	31	(15.82)
70.00-79.99	34	(17.35)
80.00-89.99	37	(18.88)
90.00-100.00	43	(21.94)

CHAPTER 4

The Indonesian EQ-5D-5L value set



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Abstract

BACKGROUND: The EQ-5D is one of the most used generic health-related quality of life (HRQOL) instrument worldwide. To make the EQ-5D suitable for use in economic evaluations, a societal-based value set is needed. Indonesia does not have such value set.
OBJECTIVE: To derive an EQ-5D-5L value set from the Indonesian general population.
METHODS: A representative sample aged 17 years and over was recruited from the Indonesian general population. A multi-stage stratified quota method with respect to place of living, gender, age, level of education, religion and ethnicity was utilized. Two elicitation techniques, the composite time trade-off (C-TTO) and discrete choice experiments (DCE) were applied. Interviews were undertaken by trained interviewers using computer-assisted face-to-face interviews with the EuroQol Valuation Technology (EQ-VT) platform. To estimate the value set, a hybrid regression model combining C-TTO and DCE data was used.
RESULTS: 1054 respondents who completed the interview formed the sample for the analysis. Their characteristics were similar to those of the Indonesian population. Most self-reported health problems were observed in the pain/discomfort dimension (39.66%) and least in the self-care dimension (1.9%). In the value set, the maximum value was 1.000 for full health (health state '11111') followed by the health state '11112' with value 0.921. The minimum value was -0.865 for the worst state ('55555'). Preference values were most affected by mobility and least by pain/discomfort.
CONCLUSIONS: We now have a representative EQ-5D-5L value set for Indonesia. We expect our results will promote and facilitate health economic evaluations and HRQOL research in Indonesia.

Key Points for Decision Makers

- Indonesia does not have an EQ-5D value set.
- An EQ-5D-5L value set was derived from a highly representative sample of the Indonesian general population.
- Data were collected using a rigorous quality control procedure which led to logical and significant models.
- This Indonesian EQ-5D-5L value set is now becoming available and will be used by all health economic evaluations and health-related quality of life studies in Indonesia that use EQ-5D.

Introduction

The Indonesian government wishes to improve equal access to health care by introducing universal health insurance. To ensure health technology assessment (HTA) can be undertaken for such an insurance scheme, Indonesia intends to employ cost-effectiveness analysis for new and existing medical interventions. To value the outcomes of a medical intervention in quality-adjusted life years (QALYs) requires a quality of life instrument that can value the health states of patients using societal preferences, such as the EQ-5D instrument. At present no Indonesian EQ-5D value set is available for the calculation of QALYs. There exists a standardized valuation protocol for the 5-level version of EQ-5D. We employed this protocol with over 1000 respondents' representative of the Indonesian population. Below we describe in more detail (i) the social economic and organizational HTA setting which determine the demand and specifications for an Indonesian valuation study; (ii) a brief introduction to the EQ-5D-5L, its valuation protocol and the place of the EQ-5D in HTA; and (iii) we describe why we cannot rely on values set from European countries and/or neighbouring countries.

Indonesia is located in South East Asia with 255.5 million inhabitants in 2015 [1]. Commencing in January 2014, Indonesia has implemented universal health care coverage organized by the 'Badan Penyelenggara Jaminan Sosial Kesehatan' or BPJS Kesehatan: The Healthcare and Social Security Agency. The aim of the BPJS Kesehatan is to include all Indonesian citizens in the National Health Insurance system to enable them to obtain access to health-care benefits and to provide protection with respect to basic health needs [2]. The decision-making process related to the implementation of this national health coverage and the adoption of new technologies can benefit from an evidence-based strategy and the application of HTA, a decision-making process involving economic evaluation and other considerations such as those of an ethical and organizational nature, to ensure the optimal use of health technologies for the population. In 2015, the Ministry of Health of Indonesia formed a national HTA committee (Komite Penilaian Teknologi Kesehatan). The committee's expected output is a policy recommendation to the Minister on the feasibility of the health service(s) to be included in the National Health Insurance benefit package [3, 4].

Economic evaluation uses clinical evidence to provide systematic consideration of the effects of all available alternatives regarding health, health care costs, and other effects regarded as valuable [5]. Cost-utility analysis (CUA) is used to evaluate health-related quality of life (HRQOL) outcomes and to compare costs and outcomes between different health care programmes in terms of cost per QALY [5, 6]. A QALY is obtained by integrating a health state utility function, measured by multi-attribute utility instruments (MAUIs), differentiated over a lifetime. The 3 most widely used MAUIs are the EQ-5D, the Health Utility Index (HUI),

and the Short Form 6D (SF-6D) [5-8]. Several national HTA organizations, for example in the United Kingdom and Thailand, have recommended EQ-5D as the preferred method for deriving utilities [9,10]. Developed by the EuroQol Group, EQ-5D is a standardized generic instrument that collects descriptive HRQOL data on five dimensions: mobility, self-care, usual activities, pain/discomfort, anxiety/depression); followed by a self-rating of overall health status on a visual analogue scale (EQ VAS) ranging from 0 ("worst imaginable health state") to 100 ("best imaginable health state") [11, 12]. In 2011, the EuroQol Group expanded the levels of severity of the classic version of EQ-5D, renamed EQ-5D-3L, from 3 to 5 levels. This new instrument is designated 'EQ-5D-5L' [12]. Recent studies have shown that EQ-5D-5L produces a richer description of health states, a higher discriminatory power, and a lower ceiling effect compared to EQ-5D-3L [13-18]. The EuroQol Group has also developed a valuation protocol for EQ-5D-5L [19], and the EuroQol Group Valuation Technology (EQ-VT) template computerised the interview method to standardize EQ-5D-5L valuation studies in different countries. This protocol provides a value set for the calculation of QALYs using a societal perspective, the preferred perspective in health economics [5].

Indonesia does not have an EQ-5D value set, either for the 3-level or for the new 5-level version. Previous EQ-5D studies conducted in Indonesia measured health preferences using the Malaysian value set or values derived from citizens of the United Kingdom [20, 21]. However, for a value set to be valid for Indonesia, it should represent the culture and living standards of Indonesia [22]. Moreover, the values should match the particular wording of the Indonesian instrument: for instance, if "cukup" (that is "moderate") is less worse in Bahasa Indonesia than in the Malaysian language ("sederhana") or in English, then the values should match that difference. For these reasons the aim of our study was to obtain preferences from the general population in order to derive a national EQ-5D-5L value set for the calculation of QALYs from a societal, Indonesian perspective.

Methods

Respondents

A representative sample was recruited from the Indonesian general population, with a minimum of 1000 respondents aged 17 and over, based on the work of Ramos-Goñi et al.: to obtain a 0.01 standard error (SE) of the observed mean C-TTO, 9735 C-TTO responses were needed. Therefore 1000 respondents interviewed will provide 10000 C-TTO and 7000 DC responses to estimate the models [23]. The adult population was defined as aged 17 and over, because in Indonesia, the legal age to obtain an ID card, a driving license, and the access to

voting is 17. To ensure the representativeness of the final sample for the Indonesian general population, we used a multi-stage stratified quota method with respect to: location (urban/rural, as registered by the official national register); gender (male/female); age (17-30/31-50/above 50); and level of education, basic (primary school and below), middle (primary school plus at least one year of high school) and high (all others). This resulted in the first stage of 36 quota groups. Two other categories: religion (Islam/Christian/Others) and ethnicity (own-declared ethnicity: Jawa/Sunda/Sumatera/Sulawesi/Madura-Bali/Others) were considered important as well. However, including them in the same way as residence, gender, age, and education would result in 36 x 3 x 6 = 3888 quota groups. We therefore used religion and ethnicity quota independently from the other factors. So, religion and ethnicity are representative over the whole sample, but within the individual 36 quota groups, this might not be it the case. To take account of this second layer of sampling, we called this a 'multi-stage stratified quota'. The predefined quotas were based on updated data from the Indonesian Bureau of Statistics [1].

We designed and used an online tool to ensure that the recruitment of respondents was in accordance with predefined quotas while the sampling was employed in different parts of the country. Interviews were conducted in the following 6 cities and their surroundings, located in different parts of Indonesia: Jakarta, Bandung, Jogjakarta, Surabaya, Medan, and Makassar. Respondents were recruited through a mixed strategy, i.e. through personal contact, local leader assistance, and from public places such as mosques and shopping streets. We also asked respondents to introduce us to other potential respondents. Interviews were conducted at the respondents' or interviewers' homes. For their participation, all respondents received a mug or a t-shirt specifically designed for the valuation study. Informed consent was obtained from all respondents included in the study. The study was approved by the Health Research Ethics Committee, Faculty of Medicine, Padjadjaran University, Indonesia.

Instruments

EQ-5D-5L

We used the official EQ-5D-5L Bahasa Indonesia version provided by the EuroQol Group. This translation of EQ-5D-5L was produced using a standardized translation protocol that followed international recommendations [24]. As briefly mentioned in the introduction, EQ-5D-5L consists of five dimensions: mobility (MO), self-care (SC), usual activities (UA), pain/discomfort (PD), and anxiety/depression (AD). Each dimension has five levels: no problems, slight problems, moderate problems, severe problems, and extreme problems [12]. The EQ-5D-5L instrument describes 3125 (5^5) unique health states. A 1-digit number expresses the level selected for that specific dimension. Hence, combining a 5-digit number for 5 dimensions will describe a specific health state. For example, state '11111' indicates 'no problems on any

of the five dimensions', while state '54321' indicates 'unable to walk about, severe problems washing or dressing, moderate problems doing usual activities, slight pain or discomfort, and no anxiety or depression' [12]. Each health state has a so called 'sum score of the level digits' means the sum of the levels across domains, e.g. '11111' sum score of the level digits is 5 and '54321' is 15. This EQ-5D descriptive system is followed by self-rating of overall health status on a visual analogue scale (EQ VAS) ranging from 0 ("worst health you can imagine") to 100 ("best health you can imagine").

Valuation Protocol

The EQ-5D-5L valuation protocol consists of five sections [19]:

i. A general welcome, where the interviewer explains the objectives of the research, followed by filling in the informed consent when the individuals agree to participate.
ii. Introduction to and completion of the descriptive system, visual analogue scale (VAS), and background questions (age, sex, experience of illness, religion, ethnicity, and education).
iii. Composite Time Trade-Off (C-TTO; see section 2.2.3. below) tasks followed by a 'Feedback Module' task. Each respondent has to complete one example (health state: being in a wheelchair), 3 practice health states (mild: '21121'; severe: '35554'; and moderate but difficult to imagine: '15411') and 10 'real' C-TTO tasks valuing hypothetical EQ-5D-5L health states. In the Feedback Module task, the respondents check whether they agree with the order of the health states they valued before. The EQ-VT screen shows 10 C-TTO tasks' health states arranged based on their value given by the respondents: from the lowest value at the bottom to the highest value at top. Respondents are allowed to 'flag' the health state(s) with which they do not agree with the previously given relative position to other health states, but they are not allowed to alter their initial values. Three debriefing questions regarding the difficulties of the C-TTO tasks are added at the end of this section.
iv. A discrete choice experiment (DCE, see section 2.2.3. below) followed by three debriefing questions regarding the DCE. Each respondent has to complete 7 forced pair comparisons.
v. A round-up, where respondents can comment on the valuation tasks
vi. (if any) Country-specific questionnaire(s)

All sections were administered utilising computer-assisted face-to-face interviews employing the EQ-VT platform version 2.0.

Preference elicitation methods

Time trade-off (TTO) has been widely used as a standard method to elicit preferences [25, 26]. C-TTO uses conventional TTO to elicit better-than-dead (BTD) values, and lead-time TTO

to elicit worse-than-dead (WTD) values. Details regarding C-TTO can be found in the study by Oppe et al. [27]. In summary, respondents were first faced with 'conventional' TTO where they had to choose between 10 years in an impaired health state (Life B) and 10 years of full health (Life A). After a series of choice-based iterations, respondents achieved a point of equivalence between the length of time in full health (Life A): 'x' and a period of time 10 years in the impaired health state (Life B). The impaired health state value is defined as x/10. For example, if a respondent could not differentiate between 3 years of full health in Life A and 10 years living in Life B, then that health state value would be 0.3 (3/10). For a really poor health state, respondents might prefer to die immediately, i.e. the value for that specific health state is lower than 0 (death value = 0). In this case, the lead-time TTO approach was introduced to allow respondents to express a value below the value of death, that is below 0. The 2 lives in the lead-time TTO are 10 years of full health (Life A) and 10 years of full health followed by 10 years in the impaired health state (Life B). When respondents reach an indifference point between the amount of time 'x' in Life A and Life B, the health state value is defined as (x-10)/10. Hence, -1 is the lowest possible value of a given health state, generated from trading the full 10 years of Life A in a lead-time TTO.

The EQ-5D-5L valuation protocol included 86 EQ-5D-5L health states to be valued using C-TTO. The 86 health states were distributed into 10 blocks with a similar level of severity. 80 unique heath states were selected using Monte Carlo simulation (8 unique included in each block), 5 very mild states (only one dimension at level 2 and all others at level 1, e.g: '11112') (each included in 2 blocks) and the most severe/'pits' state ('55555') (included in all blocks) [19]. Respondents were randomly assigned to one of the 10 C-TTO blocks. Each state of the block was presented in random order to respondents using the EQ-VT platform.

However, it was realized that TTO has its limitations. EuroQol Group considered different valuation techniques to be used in conjunction with TTO to make the valuation studies more robust and valid. Previous experiments with DCE, like the study by Stolk et al. using EQ-5D-3L [28] or Ramos-Goñi et al. using EQ-5D-5L [29], showed that Discrete Choice Experiments (DCE) is a valid valuation technique to get health preference from respondents. Since both TTO and DCE try to measure the same concept, it was anticipated that DCE, could be used in combination with TTO [30]. In the light of this reasoning, DCE was included in the EuroQol VT protocol.

Each DCE task was conducted by presenting 2 health states and asking the respondent to select the preferred state for him/her. The DCE design consisted of 196 pairs of EQ-5D-5L health states distributed over 28 blocks, each consisting of 7 pairs with a similar severity [19]. The 7 paired comparisons were presented in random order by the EQ-VT, in addition, the right-left order of the 2 health states presented was also randomized.

Data Collection

At the outset 13 interviewers were recruited and trained intensively in a one-day workshop at 2 locations: (i) Jakarta for interviewers who worked in Jakarta, Bandung, and Makassar; and (ii) Jogjakarta for interviewers who worked in Jogjakarta, Surabaya and Medan. Each interviewer performed at least 5 pilot interviews in the week after training. Their experiences were discussed, and feedback was given by the daily supervisor. Only after this was they permitted to conduct real data interviews. Three additional interviewers were hired during the data collection, and they received similar training and met similar requirements to the first 13. Interviews were performed between March 9, 2015, and January 24, 2016. After 102 interviews we evaluated the quality of the interviews (see section 2.5. below), and we concluded that their quality was not yet sufficient. Hence, we retrained the interviewers and treated the 102 interviews collected thus far as pilot interviews, so excluding the 102 interviews in the data analysis. A detailed description of this decision-making process and the retraining of the interviewers is provided elsewhere [30].

Exclusion Criteria

There were two main criteria for data exclusion: lack of completion of an interview and characteristics of respondents' answers that related to poor understanding of the task or to errors [31]. Note that the first criterion concerns excluding respondents and the second excludes respondent answers/responses.

With respect to the first criterion, interviews were excluded when respondents did not finish the interview for the following reasons: (i) the respondent indicated that he/she did not want to continue the interview process, (ii) interviewers concluded that the respondent was unable to differentiate between the different dimensions and levels of EQ-5D-5L, (iii) interviewers concluded that the respondent was not able to comprehend the C-TTO task during the practice session. When an interview had to be stopped during the C-TTO task, it was excluded from the study.

With respect to the second criterion, completed interview responses were excluded on account of any of the following characteristics: (i)a respondent had a positive slope on the regression between his/her values on C-TTO and the 'sum score of the level digits', as this would indicate that the respondent provided higher utility values for poorer health states on average. The slope of the regression between C-TTO and the 'sum score of the level digits' was generated as part of the standard quality control report; (ii) when a response in the C-TTO tasks was judged to be irrational: for instance preferring life B (10 years in the corresponding health state) to life A (10 years in full health) and not shifting after his/her initial response was reconfirmed by the interviewer; (iii) responses that were marked by the respondents in the

Feedback Module task, which was a sign that the respondents disagreed with the valuation of those responses.

Quality control

To ensure data quality, we followed the quality control (QC) process described by Ramos-Goñi *et al.* [32], which consisted of minimum quality criteria and cyclical feedback to improve interviewers' skills. The EuroQol Group facilitates use of the EQ-VT QC tool, which is a software programme that automates the production of QC reports based on data from EQ-VT studies. Bi-weekly meetings (teleconference-based) were organized to discuss the QC reports with the EQ-VT support team. The aim of these meetings was to evaluate and improve the interviewers' performance and to check for possible non-compliance with the interview protocol.

Minimum quality criteria

The QC reports provided a number of statistics related to the quality of the data collected thus far, differentiated by interviewer.

i. Wheelchair time: when the duration of time an interviewer used to explain the 'wheelchair example' preceding the actual C-TTO tasks was less than three minutes.
ii. Wheelchair lead-time: when the interviewer did not explain the WTD element of the wheelchair example.
iii. C-TTO duration: if completing the ten C-TTO tasks took less than five minutes.
iv. Inconsistency: the value for state '55555' was not the lowest and it was at least 0.5 higher than that of the state with the lowest value.

If any of the above-mentioned 4 signs are observed, the interview is 'flagged' as being of suspicious quality. If 4 or more out of the interviews are flagged as being poor quality, all 10 interviews thus far conducted by that specific interviewer are removed and retraining of that interviewer is conducted. After a further 10 interviews, the performance and compliance are re-evaluated. If again 4 or more interviews are flagged, the next set of 10 interviews will also be removed, and the interviewer is removed from the data collection process. Quality control focused on the interviewer; responses in flagged interviews were not removed from the data that was analyzed.

The DCE part of the valuation study was also monitored to detect suspicious response patterns. Assuming that A is the health state at the left of the screen and B is the health state at the right of the screen, then a consistent preference for the left (A) would be suspicious (AAAAAAA). The same would apply to the response pattern BBBBBBB, ABABABA, BABABAB. This was also reported in the QC report.

Cyclical feedback

The retraining programme conducted by the daily supervisor was held in 2 locations: (i) Jakarta for interviewers who worked in Jakarta, Bandung and Makassar; and (ii) Jogjakarta for interviewers who worked in Jogjakarta, Surabaya, and Medan. The QC reports for their interviews were presented, discussions were held to address non-compliance problems, and suitable solutions were agreed upon among the interviewers. After the retraining programme, the daily supervisor continuously created QC reports, made notes at the group and individual levels, and sent feedback to the interviewers, so that they were able to learn from their own and other interviewers' performance.

Data Analysis

We describe the sample characteristics including self-reported health on the EQ-5D-5L descriptive system and the EQ-VAS using percentages for discrete variables and means and standard deviations for continuous variables in comparison with the Indonesian population. A general z-test was used to investigate whether the proportions in the sample were similar to, or different from, the general population.

In this investigation, we used TTO (specifically C-TTO) and DCE. TTO has limitations such as loss of aversion [33] but also has advantages as the TTO based value sets are anchored on a scale of (0) death (1) full health. DCE is not except of limitations, as lexicographic behavior from respondent has been widely reported in the literature [34]. It is also noticeable that DCE, in its present form, where time is not incorporated in health state presentations, it does not anchor value sets on a (0) death (1) full scale. Therefore, DCE produces value sets on an arbitrary scale based on the relative distances between health states.

However, both techniques attempt to measure health states preference, but using different underlying assumptions and seem to do not share same limitations. Therefore, the data obtained from these two elicitation methods could be seen as complementary, not necessary competing with each other. Hence, we chose the solution presented by Oppe et al. [35], who combined DCE with C-TTO in a 'hybrid model', imposing the (0) death (1) full health scale as determined by C-TTO.

To illustrate how the hybrid model combined C-TTO and DCE responses in this study, we also present the results from the models estimated from each C-TTO and DCE separately, with the same assumptions as those used for the hybrid model. We used the 20-parameter main effects model which estimates 4 parameters for the 5 levels of each of the 5 dimensions: i.e. mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each coefficient represents the additional utility decrement of moving from one level to another. Hence the overall decrement of moving from "no problems" to "unable/extreme problems" is calculated

as the sum of the coefficients of "no problems to slight problems", "slight problems to moderate problems", "moderate problems to severe problems", and "severe problems to unable".

Presenting the TTO, the DCE, and the hybrid model, also allows us to compare the value distribution in the form of the correlations between the predicted values of the models, and we can compare the weights of the individual dimensions. This gives information about construct validity in the form of 'convergent validity', or 'concordance'.

Modelling was undertaken using the STATA statistical package. C-TTO data were modelled using the response values as dependent variables and the health states as explanatory variables. This was achieved by the implementation of a Tobit model (hyreg with ll() option), which assumes a latent variable Y*it underlying the observed Yit of C-TTO values when there is either left- or right-censoring in the dependent variable. The C-TTO data, in particular the lead-time C-TTO for WTD health states, is by nature censored at -1 (ll(-1) option on hyreg command). This means that observed preference values were valued by the C-TTO method at -1, despite the latent preferences of respondents possibly including values lower than -1 [36]. The Tobit model accounts for this censoring by estimating the latent variable Y*it, which can take on predicted preference values extrapolated beyond the range of the observed values. Variance of C-TTO data is not homogeneous among health states; this led us to model C-TTO data as heteroskedastic data. We used the hetcont() option of the hyreg command as suggested by Ramos-Goñi *et al.* [37]. The dummy variables included in the hetcont() option were the same as those included in the main model, i.e., the 20 dummies that specified the main effects model.

DCE (forced pair comparisons in our case) responses were modelled as a conditional logistic regression model including the same 20 dummy parameters as those used for the C-TTO data. Nevertheless, we did not use the coefficients estimated from a conditional logit model because they were expressed on a latent arbitrary utility scale. We rescaled the DCE coefficients using the same parameter θ that was estimated in the hybrid model. This rescaling assumes that the C-TTO model coefficients are proportional to the DCE model coefficients. For more details on the modelling see Ramos-Goñi et al. [37, 23].

Pearson product-moment correlation analysis was applied to measure the strength and direction of association that exists between C-TTO, DCE rescaled, and hybrid predicted values for 3125 health states.

Results

Respondent characteristics

In total 1056 of 1117 respondents who were approached after the retraining of the interviewers completed the interview. Reasons for interview failure were: refusal to participate (36, 3.2%), conflicting schedules (14, 1.25%), discontinuation of the interview at the respondent's request (10, 0.89%), and discontinuation of the interview by the interviewer's decision because of the respondent's lack of understanding (1, 0.09%). From the remaining 1056 respondents, we excluded 2 respondents who had a positive slope on the regression between their values on C-TTO and the sum score of the level digits of the health states, indicating that the respondent provided higher utility values for poorer health states on average, leaving 1054 respondents in the final sample. No interviewers were removed because of persistent low-quality data.

Characteristics of the respondents in the final sample were similar to those of the Indonesian population in terms of residence, gender, and religion. There were some statistically significant differences in some of the age groups, education levels, and ethnicities, but the absolute differences are small as these are lower than 4% (Table 1).

Table 1. Characteristics of the study respondents/general population

Characteristics		**Study Sample (N = 1054)**		**Indonesia General Population**[a]	**Differences**
		n	**(%)**	**(%)**	**(%)**
Residence	Urban	549	52.09	53.30	-1.21
	Rural	505	47.91	46.70	+1.21
Gender	Female	526	49.91	49.65	+0.26
	Male	528	50.09	50.35	-0.26
Age	17-19	159	15.09*	12.35	+2.74
	20-29	236	22.39	24.37	-1.98
	30-39	264	25.05	22.68	+2.37
	40-49	180	17.08	18.08	-1.00
	50-59	164	15.56*	11.84	+3.72
	60-69	43	4.08*	6.36	-2.28
	70+	8	0.76*	4.31	-3.55
Education	Low	339	32.16*	35.18	-3.02
	Middle	550	52.18	51.72	+0.46
	High	165	15.65*	13.10	+2.55
Religion	Islam	920	87.29	87.18	+0.11
	Christian	103	9.77	9.86	-0.09
	Others	31	2.94	2.96	-0.02

Table 1 (continued). Characteristics of the study respondents/general population

Characteristics		Study Sample (N = 1054)		Indonesia General Population[a]	Differences
		n	(%)	(%)	(%)
Ethnicity	Jawa	441	41.84	40.22	+1.62
	Sunda	199	18.88*	15.50	+3.38
	Sumatera	128	12.14*	15.02	-2.88
	Sulawesi	63	5.98*	8.09	-2.11
	Madura - Bali	52	4.93	4.70	+0.23
	Others	171	16.22	16.47	-0.25

**Significant difference at α = 0.05 from z-test*
[a] data from Indonesian Bureau of Statistics (BPS)

Self-reported health problems

Table 2 shows that the highest proportion of health problems was reported in the pain/discomfort dimension (39.66% reported 'any problems') and the lowest in the self-care dimension (1.9%). From the final sample, 464 (44.02%) reported no health problems on any dimension ('11111').

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

EQ-5D-5L descriptive system with scores in %					
	Mobility	**Self-Care**	**Usual Activities**	**Pain/ Discomfort**	**Anxiety/ Depression**
No Problems	92.03	98.1	89.18	60.34	65.75
Slight Problems	6.74	1.71	9.68	36.53	28.18
Moderate Problems	1.04	0.09	1.14	2.56	5.50
Severe Problems	0.19	0.09	0.00	0.57	0.38
Unable/Extreme Problems	0.00	0.00	0.00	0.00	0.19
	Mean	**SD**	**25th Percentile**	**Median**	**75th Percentile**
VAS Score	79.38	14.01	70.00	80.00	90.00

EQ EuroQol, VAS visual analogue scale

Data Characteristics

The 1054 respondents provided 10540 C-TTO observations (respondents valued 10 health states each). We exclude 45 observations because they were 'irrational answers': preferring life B (10 years in the corresponding health state, which is worse than full health) to life A (10 years in full health) and not shifting after his/her initial response was reconfirmed by the interviewer. Furthermore, 1033 observations that were pointed out by the respondents in the Feedback Module task were removed. Accordingly, the C-TTO dataset contained 9462 observations. 187 of 9462 (1.97%) observations relayed the value 0, and another 3349 (35.39.5%) were negative values (see Figure 1 for the histogram of the observed C-TTO values) The 86 observed mean

C-TTO values ranged from -0.719 for state '55555' to 0.909 for state '12111'. The mean observed values were negative for 29 health states out of 86 used in the C-TTO design (see the online resource 1 of this manuscript).

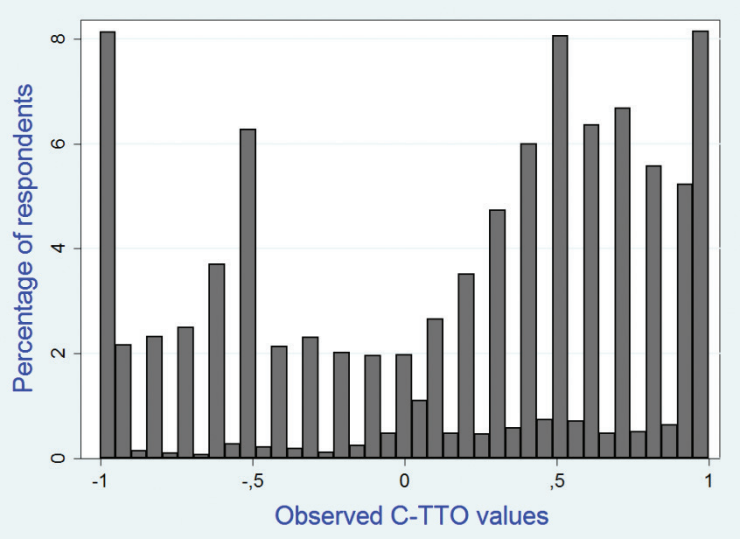

Figure 1. Observed C-TTO values. *C-TTO* composite time trade-off

The DCE dataset comprised 7378 observations (all respondents completed 7 paired comparisons). Twenty respondents (1.89%) answered with suspicious patterns: AAAAAAA (always chose the health state at the left of the screen), BBBBBBB (always chose the health state at the right of the screen), ABABABA, BABABAB. However their responses were not excluded from the final dataset.

Modelling Results

There were 657 (6.92%) left-censored C-TTO observations: when respondent gave the lowest possible value (-1) for a health state in the C-TTO task. The Tobit C-TTO model results were logically consistent. Conditional logistic regression was used to model the DCE responses which were also logically consistent (we used the rescaled DCE coefficients). C-TTO and rescaled DCE predicted values for 3125 health states were correlated, as figure 2A shows (r= 0.9881, p-value<0.0001). Table 3 shows that both sets of coefficients were in relative agreement, i.e. the most important dimension was mobility and the least important pain/discomfort. The hybrid model, which utilized both C-TTO and DCE data, was also in relative agreement with both C-TTO and DCE models. Figures 2B and 2C show a high correlation of hybrid predicted

utility with models predicted from C-TTO (r= 0.995, p-value<0.0001) and rescaled DCE (r= 0.997, p-value<0.0001).

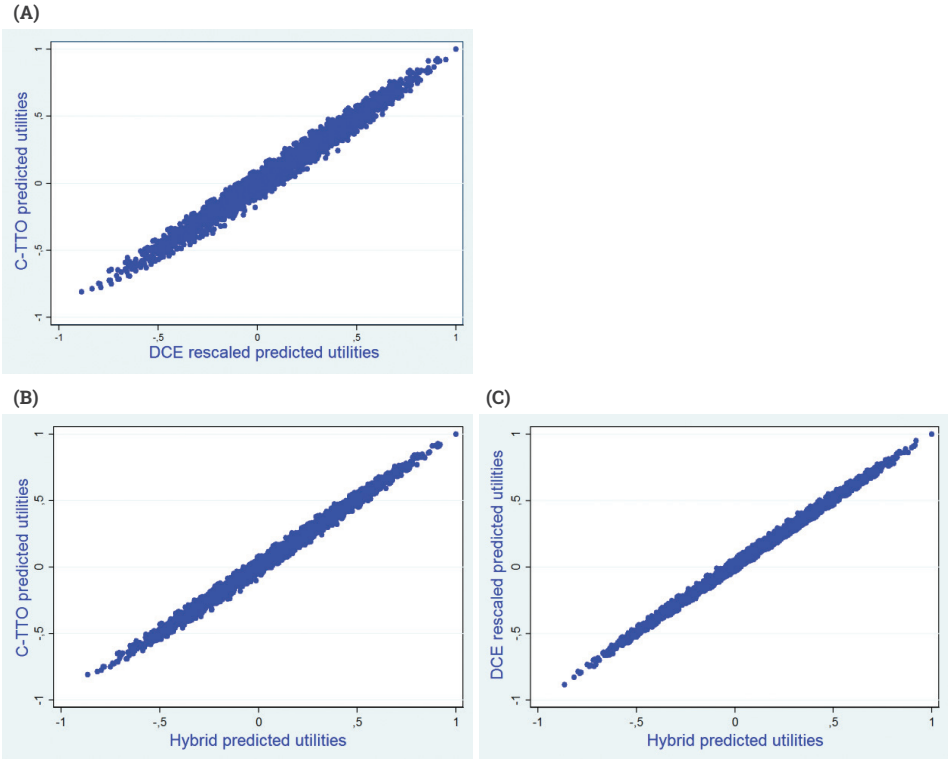

Fig. 2 a Comparison of C-TTO and DCE rescaled predicted utilities. **b** Comparison of C-TTO and hybrid predicted utilities. **c** Comparison of DCE rescaled, and hybrid predicted utilities. *C-TTO* composite time trade-off, *DCE* discrete choice experiment

The hybrid model with main effects was logically consistent (Table 3). Using this as the final model to obtain 3125 EQ-5D-5L health states, the maximum value was 1.000 for full health (health state '11111') followed by the health state '11112' with value 0.921. The minimum value was -0.865 for the '55555' state. 1108 of the 3125 health states (35.46%) had negative values using the hybrid model. The coefficients from the hybrid model were also in agreement with the previous two models regarding mobility appearing as the most important dimension and pain/discomfort as the least important.

Table 3. Estimation Results for C-TTO model, DCE rescaled model, and Hybrid Model

		C-TTO Tobit model censored at -1 C-TTO			DCE conditional logistic model rescaled			Hybrid model censored C-TTO values at -1 (final value set)		
	Independent variables of the model	**Coeff.**	**(SE)**	**P**	**Coeff.**	**(SE)**	**P**	**Coeff.**	**(SE)**	**P**
Mobility	No problems to slight problems	0.088	(0.015)	0.000	0.139	(0.015)	0.000	0.119	(0.008)	0.000
	Slight problems to moderate problems	0.086	(0.017)	0.000	0.080	(0.017)	0.000	0.073	(0.011)	0.000
	Moderate problems to severe problems	0.250	(0.019)	0.000	0.196	(0.016)	0.000	0.218	(0.013)	0.000
	Severe problems to Unable	0.170	(0.018)	0.000	0.219	(0.018)	0.000	0.203	(0.012)	0.000
Self-Care	No problems to slight problems	0.085	(0.014)	0.000	0.101	(0.016)	0.000	0.101	(0.007)	0.000
	Slight problems to moderate problems	0.056	(0.018)	0.002	0.038	(0.018)	0.032	0.039	(0.010)	0.000
	Moderate problems to severe problems	0.128	(0.018)	0.000	0.085	(0.019)	0.000	0.108	(0.013)	0.000
	Severe problems to Unable	0.035	(0.016)	0.030	0.097	(0.017)	0.000	0.068	(0.012)	0.000
Usual Activities	No problems to slight problems	0.071	(0.015)	0.000	0.092	(0.016)	0.000	0.090	(0.006)	0.000
	Slight problems to moderate problems	0.106	(0.017)	0.000	0.051	(0.017)	0.003	0.066	(0.011)	0.000
	Moderate problems to severe problems	0.137	(0.019)	0.000	0.154	(0.017)	0.000	0.145	(0.013)	0.000
	Severe problems to Unable	0.061	(0.018)	0.001	0.091	(0.017)	0.000	0.084	(0.013)	0.000
Pain/ Discomfort	No problems to slight problems	0.089	(0.013)	0.000	0.081	(0.016)	0.000	0.086	(0.006)	0.000
	Slight problems to moderate problems	0.007	(0.019)	0.721	0.012	(0.018)	0.513	0.009	(0.011)	0.395
	Moderate problems to severe problems	0.135	(0.018)	0.000	0.085	(0.017)	0.000	0.103	(0.013)	0.000
	Severe problems to extreme problems	0.024	(0.019)	0.211	0.053	(0.018)	0.003	0.048	(0.013)	0.000
Anxiety/ Depression	No problems to slight problems	0.079	(0.014)	0.000	0.050	(0.017)	0.003	0.079	(0.006)	0.000
	Slight problems to moderate problems	0.055	(0.018)	0.002	0.061	(0.017)	0.000	0.055	(0.011)	0.000
	Moderate problems to severe problems	0.086	(0.017)	0.000	0.114	(0.018)	0.000	0.093	(0.012)	0.000
	Severe problems to extreme problems	0.062	(0.016)	0.000	0.085	(0.018)	0.000	0.078	(0.012)	0.000
	Log likelihood		-6189.97			-3958.62			-9325.84	
	AIC		12421.93			7957.24			18735.69	
	BIC		12572.19			8109.23			19060.41	

Examples of estimated utility values			
U(21111)	0.912	0.861	0.881
U(31111)	0.826	0.781	0.808
U(41111)	0.576	0.585	0.590
U(51111)	0.406	0.366	0.387
U(12345)	0.225	0.268	0.240
U(21231)	0.745	0.676	0.696
U(55555)	-0.810	-0.884	-0.865

AIC Akaike information criteria, BIC Bayesian information criteria, C-TTO composite time trade-off, DCE discrete choice experiments, SE standard error

To obtain utility for an EQ-5D-5L health state, for instance '12345', the following calculation based on the hybrid model (final value set) is needed:

Utility weight ('12345') = 1 – no problems in MO (0) – no problems to slight problems in SC (0. 101) – no problems to slight problems in UA (0.090) – slight problems to moderate problems in UA (0.066) – no problems to slight problems in PD (0.086) – slight problems to moderate problems in PD (0.009) – moderate problems to severe problems in PD (0.103) – no problems to slight problems in AD (0.079) – slight problems to moderate problems in AD (0.055) – moderate problems to severe problems in AD (0.093) – severe problems to extreme problems in AD5 (0.078) = 0.240.

Note that each coefficient represents the additional utility decrement of moving from one level to another.

Discussion

The aim of this study was to obtain social preferences and thus derive an EQ-5D-5L value set from the Indonesian general population. To obtain values for 3125 EQ-5D-5L health states, 1054 respondents were interviewed using the computer-assisted EuroQol Group valuation protocol. C-TTO and DCE were part of the protocol employed in 6 cities and their surrounding areas. We used an iterative quality control approach in order to obtain high quality data. The socio-demographic characteristics of the respondents were similar to those of the Indonesian population with respect to residence, gender, age, level of education, ethnicity, and religion. This makes EQ-5D-5L suitable for health economic evaluations that will benefit the national health insurance scheme. Furthermore, non-HTA studies in Indonesia such as those using patient-reported outcome measures (PROMs), clinical trials, or improvements in hospital care, could use EQ-5D-5L as an instrument to measure HRQOL, with the notion that the values attached to the health states are societal values.

Several limitations of this study should be considered. It could be argued that there are still statistically significant differences in the distribution of background variables in the sample compared with the data provided by the National Bureau of Statistics. There are statistically significant differences, but these are small, and limited to some age groups, some education levels, and some ethnicity groups. As a check to see if such small differences were of importance, we compared observed C-TTO values for each health state between respondents with different levels of age, education, and ethnicity. There was no clear pattern of differences in the health state values. Moreover, as can be seen in Table 1, the percentage deviations were small and statistical significance should be seen in the light of the statistical power of more

than 1000 respondents. Given these observations, and given that weighting for background variables would add additional complexity, we chose not to introduce weighting for these small deviations from full representativeness.

The strategy of finding respondents using personal networks of the interviewers and the respondents could raise questions about the objectivity/ representativeness of the study sample. Yet we preferred this way of recruitment in order to find respondents who fit into the pre-determined quota groups because we judged it to be a lesser problem than insufficiently filled categories in the quota sampling. The quota groups were determined on the variables that were considered to be important in defining representativeness. In that respect, we have constructed a representative sample based on pre-determined variables: rural/urban, gender, age, level of education, religion, and ethnicity. A further investigation could be conducted to find out whether recruiting respondents via personal network of the interviewer and/or respondents is not preferable or acceptable.

Indonesia has 5 major islands which are inhabited by 93.5% of the population [1]. However, 92.9% of respondents interviewed in this study were living on Java Island. This might raise questions about the representativeness of the study sample. However, we focused the data collection on Java island because it is the most populous island (57% of the population) and the main target of migration from all over Indonesia. The diversity of its residents in terms of ethnicity helps to fulfil all the categories in our quota sampling in a cost-effective way. We do not know whether the values obtained in Java from these migrants would have differed from the values should the interviews have been conducted on their original islands. One way to investigate whether location is indeed an issue in valuing health in Indonesia would be to sample values for health states at different places/islands in the republic. For instance, the same health states could be valued in Aceh (west), Java (middle) and Papua (east). Such a study could then be used to provide the motivation for additional studies that sample the values for people living in other parts of the archipelago. For the time being, we conclude that the present value set is the best representative values set for the EQ-5D-5L now available of the Indonesian.

Several study findings are worth highlighting. First, this is the first study in Asia to have used the hybrid model to maximize information obtained from C-TTO and DCE. The models demonstrated logical consistency and significant regression coefficients. Two possible reasons that the data led to logical and significant models could be that the data were of high quality, which was assured by i) the extensive use of the QC report provided by the EuroQol Group, and ii) the retraining programme conducted after dropping the first 102 interviews owing to their poor quality [30]. The QC report identified the first 102 interviews as problematic; indeed, further analysis using the hybrid model demonstrated that the results of these interviews

showed logical inconsistencies in self-care and pain/discomfort dimensions, together with a regression coefficient that was not significant for pain/discomfort level 4 (P-value=0.179). The lesson learned here is that even sophisticated models profit from high quality data.

Second, the Indonesian results present more negative values than any other EQ-5D-5L valuation studies undertaken so far, i.e. in the UK, the Netherlands, Canada, Uruguay, Japan, and Korea [38-43]. It could be argued that the high number of negative values is the result of interaction between process-related factor: quality control process and cultural-related factor: interdependence among the members of a society (collectivism vs individualism). This study implemented quality control process rigorously. It is possible that this quality control process provides the interviewer with better feedback and therefore better skills to administer the complex worse-than-dead trade-offs. So, the more valid administration of the C-TTO, means that more interviewers follow the protocol, which could have led to higher proportion of negative values. The cultural factor, namely collectivism, might play a role. People from collectivistic cultures, such as Indonesia, are more concerned with how their illness might affect their closest circles such as family and friends [44]. Moreover, they are more reluctant to explicitly asked for help [45]. Some comments from our respondents support this: having severe or extreme/unable problems in EQ-5D dimensions was very bad for themselves but will also be a burden for their closest circles (family and friends). For other respondents, they prefer to die than to bother their families and friends when they have a severe illness. The EQ-5D-3L value set of Singapore, the neighbouring country of Indonesian and a collectivistic country as well, showed the all-worst state '33333' was -0.769 [46]. When more national valuation studies are published, it will be possible for a further investigation to disentangled the effect of these factors on proportion of worse-than-dead values in EQ-5D-5L valuation study.

Third, we had a low level of non-response: only 61 of the 1117 respondents. Our recruitment strategy, which involved local leaders and asking respondents to recommend our study to other people, contributed to this low number.

Fourth, this study was performed according to the EuroQol Group's EQ-5D-5L valuation protocol. Hence the results are comparable to findings obtained in other countries. The final Indonesian value set shows that the mobility dimension influenced utility estimates the most, similar to EQ-5D-5L valuation study results from Uruguay and South Korea [41, 43]. The pain/discomfort dimension had the least influence on utility estimates, quite the opposite of the EQ-5D-5L value sets of England and the Netherlands where this dimension was in the top two most influential, after anxiety/depression [38, 39]. Perhaps this was because, in countries such as the Netherlands and the UK, problems with mobility had less influence, due to better infrastructure provision and less emphasis on manual labour. It could also be argued that Indonesian people have adapted to mild levels of pain or discomfort, or perhaps

they considered a mild level of pain or discomfort something they have to live with. The same line of reasoning applies to anxiety/depression: Indonesian people report more problems in anxiety/depression and have adapted to these mild levels of anxiety/ depression, or they consider this as part of normal life. It could also be a result of small differences in translation. If the translated Indonesian words for depression and anxiety refer to a lighter problem, then it makes sense that the prevalence was higher and the disutility lower. Indeed, there are some indications that this was the case. In the Indonesian EQ-5D translation the word 'sedih', which might also be translated as 'sadness', is added to the description of the anxiety/ depression dimension. These kinds of interactions between the description of the dimensions and the values attached justify attempts to utilise local and linguistically matched value sets for utility questionnaires such as EQ-5D. If not, value sets based on other languages might apply the wrong (higher) utilities to the descriptors. For instance, it is now clear that one cannot use the UK value for anxiety/depression for the Indonesian descriptor with an additional word 'sadness'.

Several policy implications of the present study can be considered. The finding that the mobility dimension most affects utility could be implemented in Indonesian government policies, such as allocating more funds to the prevention of diabetic foot ulcers or other interventions that improve mobility like better wheelchairs. Moreover, the anxiety and depression problems reported should be addressed. If so, the discussion concerning the translation of the anxiety and depression dimension mentioned in the paragraph above should be taken into account. If indeed, anxiety and depression are such common afflictions in Indonesia, mental health treatment by professionals such as psychologists and psychiatrists within the national health insurance scheme should be considered.

Indonesia is endeavouring to implement HTA comprehensively. The present research shows that in measuring and valuing quality of life, Indonesia bears comparison with the leading countries employing HTA. Evidently Indonesia still has ground to conquer when dealing with models, cost data, and decision-making. Nevertheless, this research shows that it is possible to arrive at an established level of HTA methodology in a short time-span when cooperating at an international level.

Conclusion

This paper contains the EQ-5D-5L value set for Indonesia based on Indonesian citizens' health preferences. We expect our results to promote and facilitate health economic evaluations in Indonesia which can help to inform decision makers concerning resource allocation decisions.

Data Availability Statement

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

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Author Contribution

JB, JP, and JH designed the study and acquired the funding. SS and AI provided detail information regarding data collection process in Indonesia during study design phase. FDP coordinated the data acquisition, assisted by TSF and AI. FDP and JMR conceived the analysis. FDP prepared the first draft of the manuscript. All authors played a role in the review of the analysis, interpretation of the results, and reviewed and recommended revisions to the final submitted manuscript to ensure accuracy and fair balance.

Compliance with Ethical Standards

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee [Padjadjaran University Health Research Ethics Committee (no: 065/UN6.C1.3.2/KEPK/PN/2015)]

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Conflicts of Interest

The following authors are members of the EuroQol Research Foundation (the copyright holders of EQ-5D-5L): JB and JMR. There are no other conflicts of interest.

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Appendix

Table A Observed mean C-TTO values and SDs

State	Mean ± SD	State	Mean ± SD	State	Mean ± SD
1 1 1 1 2	0.906 ± 0.125	2 1 3 4 5	0.237 ± 0.485	4 3 3 1 5	-0.136 ± 0.479
1 1 1 2 1	0.908 ± 0.111	2 1 4 4 4	0.077 ± 0.474	4 3 5 1 4	-0.132 ± 0.480
1 1 1 2 2	0.869 ± 0.115	2 2 4 3 4	0.223 ± 0.473	4 3 5 4 2	-0.214 ± 0.516
1 1 2 1 1	0.902 ± 0.112	2 3 1 5 2	0.389 ± 0.442	4 3 5 5 5	-0.381 ± 0.492
1 1 2 1 2	0.787 ± 0.244	2 3 2 4 2	0.426 ± 0.420	4 4 1 2 5	-0.093 ± 0.521
1 1 2 2 1	0.775 ± 0.233	2 3 5 1 4	0.217 ± 0.463	4 4 3 4 5	-0.354 ± 0.460
1 1 2 3 5	0.537 ± 0.367	2 4 3 4 2	0.200 ± 0.462	4 4 5 5 3	-0.452 ± 0.410
1 1 4 1 4	0.499 ± 0.352	2 4 4 4 3	-0.088 ± 0.509	4 5 1 3 3	0.017 ± 0.544
1 1 4 2 1	0.608 ± 0.305	2 4 4 4 5	-0.190 ± 0.562	4 5 1 4 4	-0.146 ± 0.497
1 1 4 2 5	0.333 ± 0.479	2 4 5 5 3	-0.035 ± 0.546	4 5 2 3 3	0.000 ± 0.515
1 2 1 1 1	0.909 ± 0.106	2 5 1 2 2	0.473 ± 0.389	4 5 4 1 3	-0.190 ± 0.496
1 2 1 1 2	0.764 ± 0.251	2 5 2 2 2	0.497 ± 0.364	5 1 1 5 2	0.091 ± 0.523
1 2 1 2 1	0.779 ± 0.190	2 5 3 3 1	0.360 ± 0.427	5 1 4 5 1	-0.112 ± 0.528
1 2 2 4 4	0.405 ± 0.421	3 1 5 1 4	0.164 ± 0.432	5 2 2 1 5	0.041 ± 0.534
1 2 3 3 4	0.438 ± 0.418	3 1 5 2 4	0.051 ± 0.485	5 2 3 3 5	-0.169 ± 0.501
1 2 3 4 4	0.157 ± 0.528	3 1 5 2 5	0.176 ± 0.468	5 2 4 3 1	-0.197 ± 0.460
1 2 5 1 3	0.351 ± 0.482	3 2 3 1 4	0.394 ± 0.411	5 2 4 5 5	-0.370 ± 0.501
1 2 5 1 4	0.359 ± 0.397	3 2 4 4 3	0.028 ± 0.525	5 3 2 2 1	0.052 ± 0.542
1 2 5 4 3	0.220 ± 0.541	3 3 2 5 3	0.233 ± 0.473	5 3 2 4 3	-0.140 ± 0.467
1 3 1 2 2	0.646 ± 0.288	3 4 1 5 5	0.028 ± 0.561	5 3 2 4 4	-0.253 ± 0.444
1 3 2 2 4	0.468 ± 0.390	3 4 2 3 2	0.269 ± 0.431	5 3 4 1 2	-0.113 ± 0.492
1 3 3 1 3	0.560 ± 0.371	3 4 2 4 4	-0.055 ± 0.509	5 4 1 5 3	-0.244 ± 0.498
1 4 1 1 3	0.553 ± 0.364	3 4 5 1 5	-0.054 ± 0.496	5 4 2 3 1	-0.036 ± 0.494
1 4 5 5 4	-0.010 ± 0.544	3 5 1 4 3	0.213 ± 0.478	5 4 3 4 2	-0.277 ± 0.487
1 5 1 5 1	0.409 ± 0.463	3 5 2 4 5	0.007 ± 0.508	5 5 2 2 5	-0.326 ± 0.459
2 1 1 1 1	0.876 ± 0.213	3 5 3 1 1	0.379 ± 0.432	5 5 2 3 3	-0.149 ± 0.459
2 1 1 1 2	0.763 ± 0.223	3 5 3 3 2	0.145 ± 0.491	5 5 4 2 4	-0.449 ± 0.400
2 1 3 1 5	0.364 ± 0.434	4 2 1 1 5	0.228 ± 0.485	5 5 5 5 5	-0.719 ± 0.401
2 1 3 3 4	0.469 ± 0.386	4 2 3 2 1	0.219 ± 0.453		

CHAPTER 5

Quality of life of the Indonesian general population: test-retest reliability and population norms of the EQ-5D-5L and WHOQOL-BREF

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Abstract

OBJECTIVES: The objective of this study is to obtain population norms and to assess test-retest reliability of EQ-5D-5L and WHOQOL-BREF for the Indonesian population.

METHODS: A representative sample of 1056 people aged 17-75 years was recruited from the Indonesian general population. We used a multistage stratified quota sampling method with respect to residence, gender, age, education level, religion, and ethnicity. Respondents completed EQ-5D-5L and WHOQOL-BREF with help from an interviewer. Norms data for both instruments were reported. For the test-retest evaluations, a sub-sample of 206 respondents completed both instruments twice.

RESULTS: The total sample and test-retest sub-sample were representative of the Indonesian general population. The EQ-5D-5L shows almost perfect agreement between the two tests (Gwet's AC: 0.85-0.99 and percentage agreement: 90-99%) regarding the five dimensions. However, the agreement of EQ-VAS and index scores can be considered as poor (ICC: 0.45 and 0.37 respectively). For the WHOQOL-BREF, ICCs of the four domains were between 0.70 and 0.79, which indicates moderate to good agreement. For EQ-5D-5L, it was shown that female and older respondents had lower EQ-index scores, whilst rural, younger and higher-educated respondents had higher EQ-VAS scores. For WHOQOL-BREF: male, younger, higher-educated, high-income respondents had the highest scores in most of the domains, overall quality of life, and health satisfaction.

CONCLUSIONS: This study provides representative estimates of self-reported health status and quality of life for the general Indonesian population as assessed by the EQ-5D-5L and WHOQOL-BREF instruments. The descriptive system of the EQ-5D-5L and the WHOQOL-BREF have high test-retest reliability while the EQ-VAS and the index score of EQ-5D-5L show poor agreement between the two tests. Our results can be useful to researchers and clinicians who can compare their findings with respect to these concepts with those of the Indonesian general population.

Introduction

Health-related quality of life (HRQOL) questionnaires are commonly utilized (i) to monitor perceived health status in epidemiological surveys, (ii) to assess the subjective health and well-being of populations and patients, (iii) to measure outcomes in effectiveness studies, and (iv) in health technology assessment (1). HRQOL questionnaires can be classified as generic and disease-specific. The former is used to measure HRQOL across all kinds of respondents. The latter is designed to narrow the scope of assessment to the health-related problems in specific diagnosis, treatment, or age groups (2).

There are several generic measures of HRQOL that are widely used in the world, including EQ-5D and WHOQOL-BREF (World Health Organization Quality of Life Scale – Abbreviated form). The EQ-5D-5L instrument, provided by the EuroQol Group, consists of five items covering five health state dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression (3). The descriptive system constructed from these dimensions can be converted into an index score by applying health preference weights elicited from a general population. This index score can also be used in economic evaluations to assess the cost-effectiveness of health interventions and is as such one of the most widely used HRQOL questionnaires in the world (4).

The WHOQOL-BREF instrument, developed by the World Health Organization (WHO), measures four domains of quality of life: physical, psychological, social and environmental with its 26 items. It was devised from a cross-cultural methodology to be used in epidemiological studies and in transcultural investigations (5, 6). The WHOQOL-BREF presents a differentiated picture of quality of life, addressing social, psychological, physical, and environmental functioning (7).

These two instruments have been proved valid in many contexts, and across many health conditions in many countries (6, 8-16), including Indonesia (17, 18). In Indonesia, both questionnaires are increasingly being used in different types of investigations, for example in the measurement of quality of life in different patient groups (19-22) and cost-effectiveness studies (23-25). Thus far, no investigation has measured the stability over time of both questionnaires when measuring the HRQOL of the Indonesian general population: the test-retest reliability. It would be difficult to defend the use of a quality of life instrument if the results change over time due to its unreliability. Moreover, increasing use of both questionnaires in Indonesia demands the need for normative scores to be used as reference values for various patient groups or any particular group of individuals comparison. This need is particularly felt as in the coming years a new national health insurance system is implemented in the whole of Indonesia, requiring a monitoring system for evaluation of its

effect. These general population norms, provide a useful guide to interpret the results of different studies of quality of life. Such population norms are not available in Indonesia. Therefore, the aims of this study were to measure the test-retest reliability of EQ-5D-5L and WHOQOL-BREF and to derive Indonesian adult general population norms for both instruments according to different socio-demographic characteristics, i.e. residence, gender, age, education level, income, religion, and ethnicity.

Methods

This study was part of a larger study focused upon the adult general population, in which several questionnaires were tested in a face-to-face setting at the home/office of the interviewers or the homes of the subjects. The present manuscript is focused on presenting the frequency distribution of the responses on the descriptive part of EQ-5D-5L and WHOQOL-BREF (see below) as obtained in the Indonesian general population. This study must be distinguished from the study in which we 'valued' the health states of the EQ-5D with Time Trade-Off (TTO) and Discrete Choice Experiments (DCE) (26) using the same population. The outcome of that study is of interest for the use of the EQ-5D-5L in health economics and Health Technology Assessment. The present study reports on the more classical way of presenting norm score, that is the frequency of the score in the general population. The study was approved by the Health Research Ethics Committee, Faculty of Medicine, Padjadjaran University, Indonesia.

Sampling and data collection

The details of sampling and interviewers could be found elsewhere (26). In short, a multistage stratified quota method was utilized with respect to residence (urban/rural), gender (male/female), age (17-30/31-50/above 50), level of education (basic: primary school and below/middle: high school/high: all others), religion (Islam/Christian/Others) and ethnicity (self-declared: Jawa/Sunda/Sumatera/Sulawesi/Madura-Bali/Others). The pre-defined quotas were based on data from the Indonesian Bureau of Statistics (27). Each respondent received a mug or a t-shirt specifically designed for this study as a token of appreciation.

Sixteen interviewers were hired to collect the data. Data collection was conducted in six cities and their surroundings located in different parts of Indonesia: Jakarta, Bandung, Jogjakarta, Surabaya, Medan, and Makassar. Signed informed consent was obtained from all the respondents.

After the first interview, the interviewer asked for a respondent's consent to be interviewed again (retest). The interval between the first test and the retest ranged from 10 days to a month. The retest interview was held by the same interviewer. The characteristics of the test-retest sub-sample were matched with the Indonesian general population for three factors: residence, gender, and age. The other three characteristics: level of education, religion, and ethnicity, were not matched due to logistical constraints in finding respondents who were suitable and willing to participate in the second interview.

Instruments

EQ-5D-5L was developed by the EuroQol Group. It assesses HRQOL on five dimensions: mobility (MO), self-care (SC), usual activities (UA), pain/discomfort (PD), and anxiety/depression (AD). Responses are recorded on a 5-point scale indicating levels of severity: no problems, slight problems, moderate problems, severe problems, and unable/extreme problems. This 'descriptive system' is followed by a self-rating of overall health status on a visual analogue scale (EQ-VAS) ranging from 0 ("The worst health you can imagine") to 100 ("The best health you can imagine"). Since Bahasa Indonesia is the national and official language that is spoken throughout the country, we used the official EQ-5D-5L Bahasa Indonesia version 1.0 provided by the EuroQol Group. This translation of EQ-5D was produced using a standardized translation protocol (28) and has been proven as a valid and reliable questionnaire to be used in Indonesia (17). Completion of EQ-5D-5L was undertaken using an online version of the questionnaire, as part of the EuroQol EQ-Valuation Technology (EQ-VT) platform version 2.0.

The WHOQOL-BREF was developed by the WHOQOL Group as a short version of the WHOQOL-100. This instrument comprises 26 questions, two of which measure the overall quality of life and general health. The other 24 questions are divided into four domains: physical, psychological, social relationships, and environmental. Each item is scored on a scale from 1 to 5. The scores are then transformed into a linear scale between 0 and 100, with 0 being the least favourable quality of life and 100 being the most favourable (5). The Indonesian version of the WHOQOL-BREF is available and has been proven as a valid and reliable questionnaire to be used in Indonesia (18). In line with the manual of the English version of the WHOQOL-BREF (29), we chose to apply a time-frame for the WHOQOL-BREF of four weeks, and our version was acknowledged by the WHO as the revised official Bahasa Indonesia version. We used the self-administered paper-based WHOQOL-BREF for this study.

Demographic data was collected using a questionnaire, which included: name, place, and date of birth, ethnicity, religion, education level, work status, monthly income, and marital status.

Statistical analysis

Categorical data was analyzed using cross-tabulation. Means and standard deviations (SD) were calculated for continuous data. We calculated the test-retest reliability of both questionnaires using the Gwet's agreement coefficient (Gwet's AC) test (30). This test was chosen to tackle the 'Kappa paradoxes': i.e. high percentage agreement but low kappa which usually occurs in the sample with a low prevalence of cases or problems, such as in general population. Details can be found in the work of Gwet (30) and Wongpakaran (31). This Gwet's AC was also used to calculate the test-retest reliability of overall quality of life and general health from WHOQOL-BREF. Percentage of agreement among test and retest were also calculated. Test–retest reliability of the EQ-VAS, the EQ-5D-5L index scores, and the four domains scores of WHOQOL-BREF were evaluated by the intra-class correlation coefficient (ICC, two-way random effects, absolute agreement). When the data is non-normally distributed, we transformed the data: i.e. log, square and cubic transformation, and reapplied the ICC. We applied the following reliability guideline for strength of the ICC values: <0.5=poor, 0.5-0.75=moderate, 0.75-0.9=good, and >0.90=excellent (32). Analysis of concordance by Lin's concordance correlation coefficient (CCC) was conducted to provide additional analysis of non-normally distributed data. In addition, we used the Bland-Altman plots for the EQ-VAS, index scores, and the four domains of WHOQOL-BREF to examine visually the agreement between test and retest scores. To obtain EQ-5D-5L 'utility' index scores, the new Indonesian value set was used (26). For the self-reported health profile obtained from EQ-5D-5L, we calculated the percentage of respondents who responded to each level of each dimension and calculated those percentages across different socio-demographic characteristics, i.e.: residence, gender, age, education level, religion, ethnicity, and income. We compared the proportions of self-reported health for the different socio-demographic characteristics with the Chi-square test. For the population norms, the EQ-5D-5L mean scores (i.e. EQ-VAS scores and index scores) and WHOQOL-BREF mean scores (domain scores, overall quality of life, and general health) were calculated across different socio-demographic characteristics. For comparison of scores between two groups (residence and gender), Welch's unequal variances t-test was used, given the skewed data and different variances. ANOVA was used to compare more than two groups: age, education level, religion, ethnicity, and income.

All statistical analyses were carried out using the STATA version 13 software.

Results

Characteristics of the respondents

In total 1056 of 1117 respondents who were approached completed the two questionnaires. As can be seen in Table 1, the differences between the study sample and the target distribution as provided by the Indonesian Bureau of Statistics were small (< 4%).

Table 1. General socio-demographics of the study respondents[a]

Characteristics	Study Sample N = 1056	(%)	Indonesian population (%)	Differences (%)
Residence				
Rural	507	48.01	46.70	+1.31
Urban	549	51.99	53.30	-1.31
Gender				
Female	528	50.00	49.65	+0.35
Male	528	50.00	50.35	-0.35
Age				
17-30	419	39.68	36.73	+2.95*
31-50	438	41.48	40.76	+0.72
>50	199	18.84	22.51	-3.67*
Education				
Low	340	32.20	35.18	-2.98*
Middle	551	52.18	51.72	+0.46
High	165	15.63	13.10	+2.53*
Religion				
Islam	922	87.31	87.18	+0.13
Christian	103	9.75	9.86	-0.11
Others	31	2.94	2.96	-0.02
Ethnicity				
Jawa	442	41.86	40.22	+1.64
Sunda	200	18.94	15.50	+3.44*
Sumatera	128	12.12	15.02	-2.90*
Sulawesi	63	5.97	8.09	-2.12*
Madura - Bali	52	4.92	4.70	+0.22
Others	171	16.19	16.47	-0.28
Monthly income**				
0-500 (0-35)	515	48.77	-	-
500 – 2.500 (35-176)	361	34.19	-	-
2.500 – 5.000 (176-353)	130	12.31	-	-
> 5.000 (>353)	50	4.73	-	-

Table 1 (continued). General socio-demographics of the study respondents[a]

General characteristics of test-retest respondents				
Characteristics	**Test-retest Sample N = 206**	**(%)**	**Indonesian population (%)**	**Differences (%)**
Residence				
Rural	103	50.00	46.70	+3.30
Urban	103	50.00	53.30	-3.30
Gender				
Female	103	50.00	49.65	+0.35
Male	103	50.00	50.35	-0.35
Age				
17-30	79	38.35	36.73	+1.62
31-50	86	41.75	40.76	+0.99
>50	41	19.90	22.51	-2.61

**: p-value<0.05*
***: Monthly income in thousands of Rupiah and Euro in brackets*
[a]This data is also presented, with some slight differences, in Purba et al (26)

Test-retest reliability

From 227 participants who completed the two questionnaires twice, 21 participants were excluded because the time interval between both interviews (i.e. test-retest) was more than a month, which was considered as too long for a retest interview. Thus, the sample tested numbered 206 respondents. The mean interval between the first and second interviews was 17.45 days (SD=4.71). The characteristics of the remaining test-retest respondents were similar to those of the Indonesian general population and the total sample in terms of residence, gender and age (see Table 1).

The EQ-5D-5L shows almost perfect agreement between the two tests (Gwet's AC: 0.85-0.99 and percentage agreement: 90-99%) regarding the five dimensions. However, the agreement of EQ-VAS and index scores can be considered to be poor with ICC scores of 0.45 and 0.37 respectively. Transforming the data resulted in small increases only to the ICCs. Similar scores were shown by the concordance correlation analysis. These results can be seen in Table 2. Inspection of the Bland –Altman plot of the EQ-VAS shows that there were 5.3% of data points where agreement is considered as poor: i.e. lies outside the ±1.96 SD limits of agreement. The majority of these data points were from the lower part of the scale: mean score of 70 and less. For the index score, majority of the 7.3% of the poor agreements data points were between the 0.8 and 0.9 mean index score. For the two measures: EQ-VAS and index score, higher agreement between the two tests were shown by respondents with better health: i.e. all the data points of EQ-VAS mean score of 85 and above and between mean index scores of 0.9 and 1.0 were within the limits of agreement (see Fig 1).

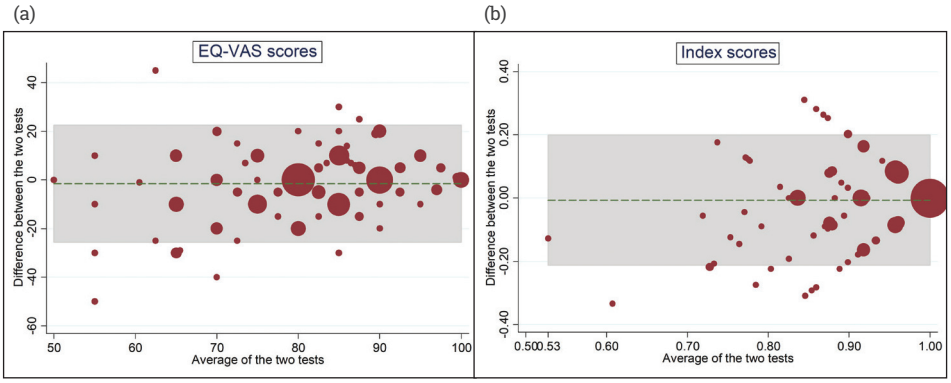

Fig 1 - Test-retest Bland-Altman plot of the EQ-5D-5L (a) VAS scores: 5.3% outside the limit of agreements (b) Index scores: 7.3%

Agreement coefficient (AC) of two overall items of WHOQOL-BREF: quality of life and general health, were 0.91 and 0.86, and the percentage agreement were 94.4% and 92.6%, respectively. These indicate almost perfect agreement between test and retest. ICCs of WHOQOL-BREF' four domains were between 0.70 and 0.79, which indicates moderate to good agreement (see Table 2). The Bland-Altman plot shows that the percentage of data points that lies outside the limits of agreement were 4.9% for the physical and environmental domains, 5.9% for the psychological domain, and 6.3% for the social domain. The majority of these poor agreements data points lies between mean score of 60 to 80. On the other hand, the data points in the lower part (below 60) and higher part (above 80) of the scales were all still located within the limits of agreement (see Fig 2).

Table 2. Agreement coefficient, percentage agreement, Intraclass correlation coefficient and Concordance correlation coefficient

EQ-5D-5L						
Dimension	**Agreement coefficient[a]**	**Percentage Agreement**		**ICC Non[b]**	**ICC Transf[c]**	**CCC[d]**
Mobility	0.97	97.45	EQ-VAS	0.45	0.40; 0.48; 0.49	0.45
Self-care	0.99	99.15	Index score	0.37	0.38; 0.36; 0.35	0.37
Usual activities	0.96	96.72				
Pain/Discomfort	0.86	91.02				
Anxiety/depression	0.85	89.93				
WHOQOL-BREF						
Domain	**Agreement coefficient[a]**	**Agreement (%)**	**Domain**	**ICC**	**CCC**	
Overall QoL	0.91	94.39	Physical	0.79	0.79	
General health	0.86	92.56	Psychological	0.70	0.70	
			Social	0.70	0.70	
			Environmental	0.72	0.72	

[a] *Gwet's Agreement Coefficient*
[b] *Data is not transformed*
[c] *Data is transformed: log, squared, and cubic and the results presented following the order of transformation*
[d] *Lin's concordance correlation coefficients*

EQ-5D-5L population norms

EQ-5D-5L population norms were derived from the following: (i) self-reported health profiles, (ii) EQ-VAS scores, and (iii) index scores based on the Indonesian value set.

The EQ-5D-5L self-reported health profiles in the total sample and sub-samples by residence, gender, age, education level, religion, ethnicity and monthly income can be seen in Table 3. Nearly half of the samples (44.07 %) responded with response pattern '11111': no problems on any of the five dimensions. The proportions of respondents with health state among different demographic characteristics can be seen in Fig 3. The two dimensions with the highest proportions of respondents who reported having problems (level 2-5) were pain/discomfort (39.7%) and anxiety/depression (34.3%), whereas the lowest was in the self-care dimension (1.9%). The proportions of self-reported problems differed between all socio-demographic subsamples for at least one dimension. For instance, females reported having significantly more problems than males in mobility, usual activities and pain/discomfort. Older respondents reported having more problems in all dimensions mobility, self-care, usual activities and pain/discomfort compared to younger ones, while the opposite is shown for

the anxiety/depression dimension with more anxiety/depression problems experienced by younger respondents.

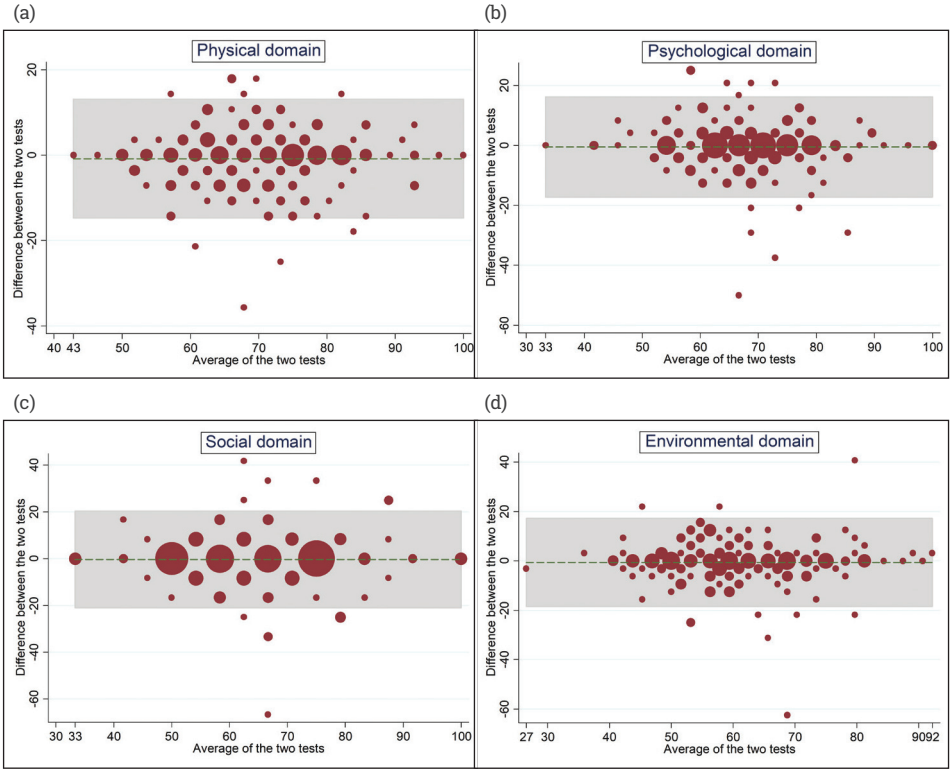

Fig 2 - Test-retest Bland-Altman plot of the WHOQOL-BREF (a) physical domain: 4.9% outside the limit of agreements (b) psychological domain: 5.9% (c) social domain: 6.3% (d) environmental domain: 4.9%

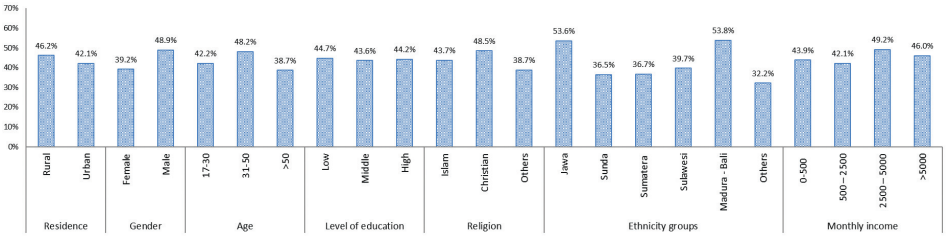

Fig 3 - Percentage of respondents reporting no problems on any of the 5 dimensions (health state '11111') (N=465)

Table 3 (continued). EQ-5D-5L Self-reported health profiles in the total population sample and sub-samples by residence, gender, age, education level, religion, ethnicity and monthly income (%)

	MOBILITY					SELF-CARE				
Socio-demographic	**No problems**	**Slight Problems**	**Moderate problems**	**Severe Problems**	**Unable/ extreme problems**	**No problems**	**Slight Problems**	**Moderate problems**	**Severe Problems**	**Unable/ extreme problems**
All respondents	92.05	6.72	1.04	0.19	0.00	98.11	1.71	0.09	0.09	0.00
Residence										
Rural	93.69*	4.73	1.58	0.00	0.00	97.83	1.78	0.20	0.20	0.00
Urban	90.53*	8.56	0.55	0.36	0.00	98.36	1.64	0.00	0.00	0.00
Gender										
Female	89.02*	9.28	1.52	0.19	0.00	98.11	1.52	0.19	0.19	0.00
Male	95.08*	4.17	0.57	0.19	0.00	98.11	1.89	0.00	0.00	0.00
Age										
17-30	96.42*	2.86	0.48	0.24	0.00	98.57*	1.43	0.00	0.00	0.00
31-50	92.24*	7.31	0.23	0.23	0.00	98.86*	1.14	0.00	0.00	0.00
>50	82.41*	13.57	4.02	0.00	0.00	95.48*	3.52	0.50	0.50	0.00
Education										
Low	90.59	8.53	0.88	0.00	0.00	97.06	2.65	0.29	0.00	0.00
Middle	92.20	6.17	1.45	0.18	0.00	98.37	1.45	0.00	0.18	0.00
High	94.55	4.85	0.00	0.61	0.00	99.39	0.61	0.00	0.00	0.00
Religion										
Islam	92.08	6.62	1.09	0.22	0.00	98.48*	1.30	0.11	0.11	0.00
Christian	92.23	6.80	0.97	0.00	0.00	97.09*	2.91	0.00	0.00	0.00
Others	90.32	9.68	0.00	0.00	0.00	90.32*	9.68	0.00	0.00	0.00
Ethnicity										
Jawa	95.70*	3.62	0.68	0.00	0.00	98.42*	1.58	0.00	0.00	0.00
Sunda	94.00*	5.00	1.00	0.00	0.00	99.00*	1.00	0.00	0.00	0.00
Sumatera	87.50*	10.94	1.56	0.00	0.00	97.66*	1.56	0.78	0.00	0.00
Sulawesi	84.13*	11.11	4.76	0.00	0.00	96.83*	1.59	0.00	1.59	0.00
Madura - Bali	92.31*	7.69	0.00	0.00	0.00	98.08*	1.92	0.00	0.00	0.00
Others	86.55*	11.70	0.58	1.17	0.00	97.08*	2.92	0.00	0.00	0.00
Monthly income (in thousand Rupiahs)										
0-500	90.87	7.18	1.55	0.39	0.00	98.25*	1.36	0.19	0.19	0.00
500 – 2500	93.91	5.26	0.83	0.00	0.00	97.78*	2.22	0.00	0.00	0.00
2500 – 5000	92.31	7.69	0.00	0.00	0.00	99.23*	0.77	0.00	0.00	0.00
>5000	90.00	10.00	0.00	0.00	0.00	96.00*	4.00	0.00	0.00	0.00

Socio-demographic	USUAL ACTIVITIES					PAIN/DISCOMFORT				
	No problems	Slight Problems	Moderate problems	Severe Problems	Unable/ extreme problems	No problems	Slight Problems	Moderate problems	Severe Problems	Unable/ extreme problems
All respondents	89.20	9.66	1.14	0.00	0.00	60.32	36.55	2.56	0.57	0.00
Residence										
Rural	89.94	8.68	1.38	0.00	0.00	59.76	36.09	3.35	0.79	0.00
Urban	88.52	10.56	0.91	0.00	0.00	60.84	36.98	1.82	0.36	0.00
Gender										
Female	86.74*	11.55	1.71	0.00	0.00	56.82*	39.02	3.03	1.14	0.00
Male	91.67*	7.77	0.57	0.00	0.00	63.83*	34.09	2.08	0.00	0.00
Age										
17-30	88.54*	10.02	1.43	0.00	0.00	63.01*	35.08	1.43	0.48	0.00
31-50	91.78*	7.99	0.23	0.00	0.00	62.33*	34.70	2.28	0.68	0.00
>50	84.92*	12.56	2.51	0.00	0.00	50.25*	43.72	5.53	0.50	0.00
Education										
Low	90.88*	7.94	1.18	0.00	0.00	60.00	35.59	3.82	0.59	0.00
Middle	87.30*	11.98	0.73	0.00	0.00	60.80	36.48	2.00	0.73	0.00
High	92.12*	5.46	2.42	0.00	0.00	59.39	38.79	1.82	0.00	0.00
Religion										
Islam	89.26	9.44	1.30	0.00	0.00	60.41	36.23	2.71	0.65	0.00
Christian	89.32	10.68	0.00	0.00	0.00	63.11	34.95	1.94	0.00	0.00
Others	87.10	12.90	0.00	0.00	0.00	48.39	51.61	0.00	0.00	0.00
Ethnicity										
Jawa	94.34*	5.20	0.45	0.00	0.00	67.19*	30.77	2.04	0.00	0.00
Sunda	86.00*	12.00	2.00	0.00	0.00	53.50*	41.50	4.00	1.00	0.00
Sumatera	84.38*	13.28	2.34	0.00	0.00	50.78*	43.75	4.69	0.78	0.00
Sulawesi	82.54*	15.87	1.59	0.00	0.00	57.14*	36.51	4.76	1.59	0.00
Madura - Bali	88.46*	11.54	0.00	0.00	0.00	69.23*	28.85	1.92	0.00	0.00
Others	85.96*	12.87	1.17	0.00	0.00	56.14*	42.69	0.00	1.17	0.00
Monthly income (in thousand Rupiahs)										
0-500	87.38	10.87	1.75	0.00	0.00	62.33	33.59	2.91	1.17	0.00
500 – 2500	90.86	8.31	0.83	0.00	0.00	55.68	41.83	2.49	0.00	0.00
2500 – 5000	89.23	10.77	0.00	0.00	0.00	66.15	32.31	1.54	0.00	0.00
>5000	96.00	4.00	0.00	0.00	0.00	58.00	40.00	2.00	0.00	0.00

Table 3 (continued). EQ-5D-5L Self-reported health profiles in the total population sample and sub-samples by residence, gender, age, education level, religion, ethnicity and monthly income (%)

	ANXIETY/DEPRESSION				
Socio-demographic	**No problems**	**Slight Problems**	**Moderate problems**	**Severe Problems**	**Unable/ extreme problems**
All respondents	65.72	28.22	5.49	0.38	0.19
Residence					
Rural	67.65	26.63	5.13	0.39	0.20
Urban	63.93	29.69	5.83	0.36	0.18
Gender					
Female	62.88	30.30	6.44	0.38	0.00
Male	68.56	26.14	4.55	0.38	0.38
Age					
17-30	59.90*	30.31	8.59	0.72	0.48
31-50	70.32*	25.80	3.65	0.23	0.00
>50	67.84*	29.15	3.02	0.00	0.00
Education					
Low	65.88	27.65	6.18	0.29	0.00
Middle	65.88	28.68	4.54	0.54	0.36
High	64.85	27.88	7.27	0.00	0.00
Religion					
Islam	66.05	27.87	5.42	0.43	0.22
Christian	66.99	28.16	4.85	0.00	0.00
Others	51.61	38.71	9.68	0.00	0.00
Ethnicity					
Jawa	66.29	28.28	4.53	0.68	0.23
Sunda	67.50	24.50	7.50	0.50	0.00
Sumatera	61.72	32.03	6.25	0.00	0.00
Sulawesi	69.84	23.81	6.35	0.00	0.00
Madura - Bali	71.15	21.15	7.69	0.00	0.00
Others	61.99	33.33	4.09	0.00	0.58
Monthly income (in thousand Rupiahs)					
0-500	66.02	26.02	7.18	0.58	0.19
500 – 2500	62.88	33.24	3.60	0.28	0.00
2500 – 5000	73.08	21.54	4.62	0.00	0.77
>5000	64.00	32.00	4.00	0.00	0.00

*= the proportions of self-reported health in the corresponding dimension between the demographic groups differs statistically significant, p-value <0.05

Table 4 shows the mean EQ-VAS and index scores of the overall sample for different socio-demographic characteristics. The mean EQ-5D VAS for the overall sample was 79.39. Mean EQ-VAS scores differed between residence, age, level of education, and ethnicity groups. For instance, older respondents reported lower EQ-VAS scores than younger respondents and higher-educated respondents reported higher EQ-VAS scores than lower-educated respondents. The mean EQ-5D-5L index score was 0.911. Similar to EQ-VAS scores, gender differences were clearly observed where males had higher index scores than females. Significant differences in index scores were also reported between different age and ethnicity groups, but no clear pattern was observed.

Table 4. Mean scores and SD of EQ-5D-5L VAS and Index scores in the total Indonesian general population sample and sub-samples by socio-demographic characteristics

	EQ-VAS		Index score	
	Mean	**SD**	**Mean**	**SD**
All respondents	79.39	14.01	0.91	0.11
Residence				
Rural	80.36*	14.15	0.91	0.11
Urban	78.49*	13.82	0.91	0.11
Gender				
Female	79.08	14.52	0.90*	0.12
Male	79.70	13.48	0.92*	0.10
Age				
17-30	80.54*	13.48	0.91*	0.11
31-50	79.42*	14.18	0.92*	0.10
>50	76.88*	14.45	0.89*	0.13
Education				
Low	76.64*	15.66	0.91	0.11
Middle	79.92*	13.30	0.91	0.11
High	83.25*	11.40	0.92	0.11
Religion				
Islam	79.54	14.00	0.91	0.11
Christian	78.81	14.17	0.92	0.11
Others	76.81	13.63	0.88	0.12
Ethnicity				
Jawa	79.37*	13.64	0.93*	0.10
Sunda	82.86*	14.29	0.91*	0.10
Sumatera	77.49*	14.44	0.89*	0.12
Sulawesi	80.84*	15.32	0.89*	0.14
Madura - Bali	79.52*	13.80	0.93*	0.11
Others	76.22*	13.02	0.89*	0.12

Table 4 (continued). Mean scores and SD of EQ-5D-5L VAS and Index scores in the total Indonesian general population sample and sub-samples by socio-demographic characteristics

	EQ-VAS		Index score	
	Mean	**SD**	**Mean**	**SD**
Monthly income**				
0-500	79.84	14.90	0.91	0.12
500 – 2500	78.08	13.52	0.91	0.10
2500 – 5000	80.79	12.01	0.93	0.09
>5000	80.50	12.19	0.91	0.11

**= the mean score between the demographic groups differs statistically significant, p-value <0.05*
***=in thousand Rupiah*

Details of means, standard deviations, and percentiles scores of EQ-5D-5L visual analogue scale (EQ-VAS) and index scores of the subgroups stratified by residence, gender, age, and education level could be found in the S1 Table.

WHOQOL-BREF population norm

The EQ-5D-5L administration was accomplished in the first part of the interview, followed by the WHOQOL-BREF. Ten of the 1056 respondents of the EQ-5D-5L did not complete the WHOQOL-BREF, as they refused further involvement or because they did not have time to complete the paper questionnaire. Hence, data for the 1046 respondents was analyzed for the WHOQOL-BREF population norms. The sample mean scores for each domain, overall quality of life, and general health are presented in Table 5. There were differences in the mean quality of life scores for some sub-groups. Males reported better HRQOL in almost all domains when compared to females. Older respondents scored significantly lower on physical and social functioning. A pattern of increasing quality of life scores in all domains was observed when the level of education increased, although these differences were only statistically significant in the social and environmental domains. Regarding ethnicities, Sundanese people had the lowest mean scores in all domains whereas Maduranese and Balinese presented the highest scores in almost all domains. An income-gradient was present in almost all domains where respondents with incomes of more than 5 million Rupiah a month reported the highest quality of life.

Table 5 shows an age gradient regarding overall quality of life and general health obtained by the WHOQOL-BREF instrument: the older the respondents, the lower their overall quality of life and the more dissatisfied they were with their general health. The opposite pattern was observed for level of education and monthly income: the higher the respondents' education and income, the better their overall quality of life and the more satisfied respondents were with their health. Details of the means, standard deviation, and percentiles scores of WHOQOL-BREF dimensions score of the subgroups stratified by residence, gender, age, and education level of this table can be found in the S2 Table.

Table 5. Mean scores and standard deviation (SD) of WHOQOL-BREF domains and global scores in the total population sample and sub-samples by socio-demographic characteristics

		Overall quality of life		General health		Physical		Psychological		Social		Environmental	
	N	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
All respondents	1046	3.65	0.65	3.60	0.79	69.23	11.49	66.74	12.89	63.13	14.38	58.53	13.43
Residence													
Rural	502	3.63	0.63	3.57	0.78	68.99	11.27	67.08	12.56	62.63	13.57	58.53	13.43
Urban	544	3.66	0.67	3.64	0.80	69.45	11.70	66.43	13.19	62.63	13.57	59.25	13.74
Gender													
Female	523	3.66	0.64	3.53	0.80	68.04*	11.11	65.35*	12.46	61.82*	13.43	58.48	12.90
Male	523	3.63	0.67	3.67	0.78	70.41*	11.76	68.14*	13.17	64.44*	15.17	58.59	13.95
Age													
17-30	415	3.69*	0.66	3.65	0.81	69.82*	11.07	67.28	13.12	63.21*	14.34	59.65	13.15
31-50	434	3.65*	0.65	3.61	0.78	69.83*	11.57	66.74	13.12	64.19*	14.60	57.94	13.68
>50	197	3.55*	0.63	3.49	0.78	66.68*	11.87	65.59	11.80	60.62*	13.72	57.50	13.35
Education													
Low	334	3.44*	0.60	3.54	0.75	69.03	12.22	65.54	13.74	60.63*	14.55	56.94*	14.29
Middle	547	3.71*	0.65	3.62	0.82	69.23	11.00	67.09	12.44	63.92*	14.22	58.23*	12.70
High	165	3.85*	0.67	3.67	0.80	69.61	11.63	68.03	12.44	65.56*	13.91	62.76*	13.20
Religion													
Islam	914	3.64	0.65	3.60	0.80	69.07	11.34	66.50	12.80	63.05	14.51	58.07*	13.15
Christian	101	3.65	0.73	3.61	0.76	70.76	12.17	69.45	13.28	64.27	14.26	60.42*	15.14
Others	31	3.87	0.56	3.84	0.73	68.78	13.52	65.05	13.64	61.83	10.71	66.13*	13.33

Table 5 (continued). Mean scores and standard deviation (SD) of WHOQOL-BREF domains and global scores in the total population sample and sub-samples by socio-demographic characteristics

		Overall quality of life		General health		Physical		Psychological		Social		Environmental	
	N	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Ethnicity													
Jawa	435	3.57*	0.66	3.61	0.73	69.78*	11.47	67.55*	12.72	62.20*	14.30	57.79*	13.13
Sunda	200	3.67*	0.62	3.46	0.87	66.48*	10.74	64.33*	11.57	61.29*	13.98	56.30*	12.16
Sumatera	127	3.68*	0.74	3.59	0.86	70.73*	11.46	68.45*	13.09	64.11*	13.91	60.46*	14.01
Sulawesi	63	3.76*	0.59	3.70	0.69	67.06*	10.53	66.01*	14.30	67.20*	15.25	61.06*	13.81
Madura - Bali	50	3.60*	0.61	3.68	0.89	74.15*	13.39	69.42*	15.78	67.17*	14.13	63.69*	16.16
Others	171	3.77*	0.61	3.71	0.81	69.28*	11.46	65.74*	12.81	64.23*	14.68	59.17*	13.56
Monthly income**													
0-500	511	3.59*	0.66	3.54*	0.81	68.59	11.97	65.75*	13.13	62.08*	13.85	57.81*	13.86
500 – 2.500	355	3.61*	0.63	3.61*	0.78	69.39	11.07	66.81*	13.04	62.89*	15.33	57.10*	12.74
2.500 – 5.000	130	3.81*	0.62	3.72*	0.77	70.11	10.89	68.57*	11.95	65.51*	12.99	61.70*	11.47
>5.000	50	4.04*	0.60	3.94*	0.68	72.36	10.55	71.75*	9.93	69.33*	14.33	67.94*	13.74

**= the mean score between the demographic groups differs statistically significant, p-value <0.05*
***=in thousand Rupiah*

Discussion

This is the first study to derive norm scores for the EQ-5D-5L and WHOQOL-BREF from the Indonesian general adult population, which is the fourth most populous country in the world. We sub-divided the norm scores of the 1056 respondents according to socio-demographic characteristics, i.e. residence, gender, age, education level, income, religion, and ethnicity. We also investigated the test-retest reliability of these two instruments in 206 respondents from the original Indonesian general population sample. The EQ-5D-5L dimensions show almost perfect agreement between the two tests but poor agreement of the EQ-VAS and index scores. The WHOQOL-BREF instrument showed almost perfect agreements of the two general items and good to moderate agreement of the four domains. These findings are further discussed below.

Several limitations of this study should be considered. The respondents in our total sample mainly lived on Java island. One could therefore question the representativeness of the sample with respect to the population living over the whole archipelago. It has to be mentioned that Java is the island with the largest population of Indonesia: 57% of the population live in the island and that we also included other ethnic groups than Javanese. One way to solve this would be to interview respondents from different locations other than Java, for instance in Sumatera (west), Kalimantan (middle) and Papua (east) to determine any significant differences. Such a study could then motivate additional studies about the quality of life of people living in other parts of the archipelago.

Another limitation is that the interval time of the second test is intersect with the WHOQOL-BREF's reference period of four weeks. This might potentially bias the test-retest result. However, this might also be considered as an advantage, since it implies that the respondent was looking partly back to a same health condition. Therefore, concerning the overlap, variation between test-retest cannot be explained by a change in the respondent's health.

Our study found that the Indonesian EQ-5D-5L shows high agreement coefficients and percentages agreement of the five domains, but poor agreement for the EQ-VAS and the index score. The high percentage of "no problems" in the EQ-5D dimensions scores in a general population sample is common to find: e.g. South Korea (15), South Australia (33), Japan (34), and Poland (35). The general population is usually healthy or at least has no health problem where a medical intervention or hospital admitted is needed. When no significant event that affects their health happens in the interval time of test-retest, it is encouraging that they reported similar health state in the EQ-5D-5L. On the other hand, our data has high number of respondents who reported no problems in all dimensions (health state'11111'): 44.07 %. Only 33

out of 3125 (1.06%) possible health states were reported. About 80% of the test-retest respondents reported no more than one-point difference of the so-called 'Misery index' (i.e. sum score of the level digits) between the two tests. It can be concluded that the EQ-5D-5L data in the general population is highly skewed and shows low variance. Since ICC relies on variance, it can be expected that the ICC score is low in this population (16). In patient data the ceiling effect is less and there is more variation in health states, hence the ICC is more favourable (17, 36-39).

The Indonesian version of WHOQOL-BREF shows good agreement of the four domains, which is consistent with previous studies in Bangladesh and Malaysia (41, 42). The two global items of the WHOQOL-BREF: overall quality of life, and general health were in almost perfect agreement. Moreover, the data points which are considered as poor agreement were less than 10% for all the domains. It can be concluded that the WHOQOL-BREF is a consistent and stable instrument to measure the quality of life of Indonesian general population.

The most self-reported health problems were observed in the pain/discomfort dimension (39.66%) and the least in the self-care dimension (1.9%). These findings were consistent with EQ-5D-5L population norm reports from other countries (15, 33-35, 40, 41). It could be argued that self-care is a rather 'easy' task which is not accompanied by problems in healthy people, whilst pain/discomfort is a quite a common sign of various types of problems for which there is not one and only answer, hence respondents possibly reported problems related to pain/discomfort more often.

The mean index score of the Indonesian population was 0.91 while the mean EQ-VAS score was 79.4. The difference between index score and EQ-VAS as shown in our study is also reported by studies in South Korean (index: 0.96; EQ-VAS: 80.4) and South Australian general population (0.91; 78.6) (15, 33). The score of WHOQOL-BREF's domains were between 58.3 to 69.3, which is closer to the EQ-VAS score than the index score of the EQ-5D-5L. The explanation is that the top anchor of the EQ-VAS is 'best imaginable health state', while the best EQ-5D levels are labeled 'no problems'. Many respondents in the general populations have a rational view on their health: although they might not experience any health problem, they are not in the best imaginable health state. For instance, a person may think that he/she is overweight, should exercise more, stop smoking, or feel a bit tired, low on energy, or have a little cold but nevertheless does not consider that a real health problem. Note that the WHOQOL-BREF also allows to estimate a value of health beyond 'no problems'. For instance, a respondent can fill in that 'he/she has completely enough energy for everyday life' or 'he/she has completely enough money to meet his/her needs'. Therefore, the EQ-VAS and WHOQOL-BREF might capture aspects in the high region of quality of life that was not captured by the five dimensions of EQ-5D reflected in the index score. To obtain an estimation of quality of life in the general population, one might consider using the WHOQOL-BREF and EQ-VAS rather

than the EQ-5D-5L, as the former two might pick up variance which is not captured by the 'no problem level' of the EQ-5D. Note that beyond 'no problem', it might be in the area of 'pleasure seeking', instead of 'pain avoiding' (42), and thus should be left to private responsibility instead of collective responsibility through national health policy. However, if one would intend to use the EQ-VAS and/or index score for a sample from the general population, despite its low test-retest reliability score, it should be in a large sample size since the sample size determines the (random) error.

Similar to EQ-5D-5L results, health-related quality of life in different domains measured by WHOQOL-BREF depended on gender and age. Men had higher values in almost all domains than women. An age-gradient was present in almost all domains, especially when comparing respondents above 50 years old to those below 30. Moreover, for WHOQOL-BREF education and income influenced almost all quality of life domains, overall quality of life, and general health. The higher the respondents' education levels and incomes, the better their quality of life and the more satisfaction with their general health. These gender, income, and education patterns were also found in studies in Denmark, Southern Brazil, and Australia, except for the age-related pattern (43-45).

Estimation of EQ-5D-5L and WHOQOL-BREF norms can contribute to the improvement of the overall health status of the Indonesian population. The population norms are important for different parties: (i) for clinicians as reference data, comparing patient data with the same demographic characteristics as in the general population, (ii) for researchers to form control groups in case series or other types of uncontrolled studies, (iii) for public health experts to assess health-related problems and to identify vulnerable groups, and (iv) for epidemiologists to determine the burden of diseases; and (v) for health care workers to determine the impact of their interventions.

Conclusion

This study provides representative estimates of self-reported health status and quality of life for the general Indonesian population as assessed by the EQ-5D-5L and WHOQOL-BREF instruments. The descriptive system of the EQ-5D-5L and the WHOQOL-BREF have high test-retest reliability while the EQ-VAS and the index score of EQ-5D-5L show poor agreement between the tests in the general population. Our results can be useful to researchers and clinicians who can compare their findings with respect to these concepts with those of the Indonesian general population.

Supporting information

S1 Table. Population norm of the EQ-5D-5L VAS and index score stratified by subgroups

S2 Table. Population norm of the WHQOL-BREG domains stratified by subgroups

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S1 Table. Mean, standard deviation, and percentiles scores of EQ-5D-5L visual analogue scale (VAS) and utility score of the subgroups by residence, gender, age, and education level

Rural, Female, 17-30 years, Low education (N=28)			Rural, Female, 17-30 years, Middle education (N=55)			Rural, Female, 17-30 years, High education (N=15)		
	VAS	Utility		VAS	Utility		VAS	Utility
Mean	82.0	0.93	Mean	84.4	0.92	Mean	83.0	0.90
SD	17.7	0.10	SD	9.9	0.11	SD	9.8	0.08
Perc. 5	50.0	0.78	Perc. 5	70.0	0.63	Perc. 5	70.0	0.75
Perc. 10	50.0	0.78	Perc. 10	70.0	0.77	Perc. 10	70.0	0.78
Perc. 25	70.0	0.91	Perc. 25	80.0	0.91	Perc. 25	75.0	0.84
Perc. 50	82.5	0.96	Perc. 50	90.0	0.92	Perc. 50	80.0	0.91
Perc. 75	100.0	1.00	Perc. 75	90.0	1.00	Perc. 75	91.0	1.00
Perc .90	100.0	1.00	Perc .90	95.0	1.00	Perc .90	100.0	1.00
Perc. 95	100.0	1.00	Perc. 95	100.0	1.00	Perc. 95	100.0	1.00

Rural, Female, 31-50 years, Low education (N=41)			Rural, Female, 31-50 years, Middle education (N=50)			Rural, Female, 31-50 years, High education (N=15)		
	VAS	Utility		VAS	Utility		VAS	Utility
Mean	83.4	0.92	Mean	78.3	0.92	Mean	87.5	0.96
SD	13.9	0.08	SD	15.8	0.10	SD	9.0	0.06
Perc. 5	60.0	0.80	Perc. 5	50.0	0.72	Perc. 5	70.0	0.84
Perc. 10	70.0	0.83	Perc. 10	55.0	0.75	Perc. 10	79.0	0.84
Perc. 25	70.0	0.87	Perc. 25	70.0	0.84	Perc. 25	80.0	0.91
Perc. 50	85.0	0.91	Perc. 50	80.0	1.00	Perc. 50	90.0	1.00
Perc. 75	90.0	1.00	Perc. 75	90.0	1.00	Perc. 75	95.0	1.00
Perc .90	100.0	1.00	Perc .90	100.0	1.00	Perc .90	100.0	1.00
Perc. 95	100.0	1.00	Perc. 95	100.0	1.00	Perc. 95	100.0	1.00

Rural, Female, >50 years, Low education (N=22)			Rural, Female, >50 years, Middle education (N=23)			Rural, Female, >50 years, High education (N=7)		
	VAS	Utility		VAS	Utility		VAS	Utility
Mean	68.0	0.82	Mean	78.0	0.84	Mean	85.3	0.89
SD	16.2	0.17	SD	15.6	0.18	SD	12.2	0.08
Perc. 5	50.0	0.53	Perc. 5	50.0	0.62	Perc. 5	70.0	0.80
Perc. 10	50.0	0.55	Perc. 10	60.0	0.62	Perc. 10	70.0	0.80
Perc. 25	50.0	0.78	Perc. 25	70.0	0.75	Perc. 25	70.0	0.84
Perc. 50	67.5	0.84	Perc. 50	80.0	0.91	Perc. 50	90.0	0.87
Perc. 75	75.0	1.00	Perc. 75	90.0	1.00	Perc. 75	97.0	1.00
Perc .90	90.0	1.00	Perc .90	95.0	1.00	Perc .90	100.0	1.00
Perc. 95	100.0	1.00	Perc. 95	100.0	1.00	Perc. 95	100.0	1.00

S1 Table (continued). Mean, standard deviation, and percentiles scores of EQ-5D-5L visual analogue scale (VAS) and utility score of the subgroups by residence, gender, age, and education level

Rural, Male, 17-30 years, Low education (N=31)			Rural, Male, 17-30 years, Middle education (N=53)			Rural, Male, 17-30 years, High education (N=16)		
	VAS	Utility		VAS	Utility		VAS	Utility
Mean	78.4	0.94	Mean	81.1	0.9	Mean	83.9	0.91
SD	17.5	0.11	SD	12.5	0.10	SD	7.6	0.09
Perc. 5	50.0	0.78	Perc. 5	51.0	0.69	Perc. 5	70.0	0.72
Perc. 10	60.0	0.84	Perc. 10	70.0	0.83	Perc. 10	71.0	0.78
Perc. 25	70.0	0.91	Perc. 25	70.0	0.84	Perc. 25	80.0	0.84
Perc. 50	80.0	1.00	Perc. 50	80.0	0.91	Perc. 50	82.5	0.92
Perc. 75	90.0	1.00	Perc. 75	90.0	1.00	Perc. 75	90.0	1.00
Perc .90	100.0	1.00	Perc .90	100.0	1.00	Perc .90	95.0	1.00
Perc. 95	100.0	1.00	Perc. 95	100.0	1.00	Perc. 95	96.0	1.00

Rural, Male, 31-50 years, Low education (N=40)			Rural, Male, 31-50 years, Middle education (N=50)			Rural, Male, 31-50 years, High education (N=15)		
	VAS	Utility		VAS	Utility		VAS	Utility
Mean	75.6	0.96	Mean	80.7	0.91	Mean	87.7	0.98
SD	16.5	0.07	SD	12.6	0.10	SD	9.2	0.05
Perc. 5	47.5	0.78	Perc. 5	60.0	0.72	Perc. 5	70.0	0.84
Perc. 10	55.0	0.87	Perc. 10	67.5	0.83	Perc. 10	80.0	0.91
Perc. 25	70.0	0.96	Perc. 25	70.0	0.84	Perc. 25	80.0	1.00
Perc. 50	70.0	1.00	Perc. 50	80.0	0.92	Perc. 50	90.0	1.00
Perc. 75	90.0	1.00	Perc. 75	90.0	1.00	Perc. 75	95.0	1.00
Perc .90	100.0	1.00	Perc .90	100.0	1.00	Perc .90	100.0	1.00
Perc. 95	100.0	1.00	Perc. 95	100.0	1.00	Perc. 95	100.0	1.00

Rural, Male, >50 years, Low education (N=22)			Rural, Male, >50 years, Middle education (N=17)			Rural, Male, >50 years, High education (N=7)		
	VAS	Utility		VAS	Utility		VAS	Utility
Mean	78.4	0.91	Mean	75.7	0.89	Mean	81.4	0.89
SD	11.4	0.09	SD	15.3	0.11	SD	10.3	0.13
Perc. 5	60.0	0.75	Perc. 5	50.0	0.62	Perc. 5	70.0	0.64
Perc. 10	65.0	0.78	Perc. 10	50.0	0.63	Perc. 10	70.0	0.64
Perc. 25	70.0	0.84	Perc. 25	70.0	0.84	Perc. 25	70.0	0.83
Perc. 50	80.0	0.91	Perc. 50	80.0	0.91	Perc. 50	80.0	0.91
Perc. 75	90.0	1.00	Perc. 75	90.0	1.00	Perc. 75	95.0	1.00
Perc .90	90.0	1.00	Perc .90	90.0	1.00	Perc .90	95.0	1.00
Perc. 95	90.0	1.00	Perc. 95	100.0	1.00	Perc. 95	95.0	1.00

S1 Table (continued). Mean, standard deviation, and percentiles scores of EQ-5D-5L visual analogue scale (VAS) and utility score of the subgroups by residence, gender, age, and education level

Urban, Female, 17-30 years, Low education (N=33)			Urban, Female, 17-30 years, Middle education (N=57)			Urban, Female, 17-30 years, High education (N=18)		
	VAS	Utility		VAS	Utility		VAS	Utility
Mean	73.2	0.91	Mean	79.2	0.91	Mean	80.5	0.87
SD	11.6	0.08	SD	14.1	0.09	SD	15.5	0.12
Perc. 5	50.0	0.82	Perc. 5	50.0	0.75	Perc. 5	40.0	0.63
Perc. 10	60.0	0.84	Perc. 10	60.0	0.78	Perc. 10	60.0	0.67
Perc. 25	70.0	0.84	Perc. 25	70.0	0.84	Perc. 25	75.0	0.78
Perc. 50	70.0	0.92	Perc. 50	80.0	0.92	Perc. 50	80.0	0.91
Perc. 75	80.0	1.00	Perc. 75	90.0	1.00	Perc. 75	92.0	1.00
Perc .90	90.0	1.00	Perc .90	95.0	1.00	Perc .90	98.0	1.00
Perc. 95	90.0	1.00	Perc. 95	100.0	1.00	Perc. 95	100.0	1.00

Urban, Female, 31-50 years, Low education (N=32)			Urban, Female, 31-50 years, Middle education (N=62)			Urban, Female, 31-50 years, High education (N=18)		
	VAS	Utility		VAS	Utility		VAS	Utility
Mean	74.8	0.85	Mean	75.3	0.89	Mean	86.7	0.89
SD	17.8	0.14	SD	13.8	0.13	SD	8.0	0.13
Perc. 5	30.0	0.52	Perc. 5	50.0	0.71	Perc. 5	75.0	0.69
Perc. 10	57.0	0.72	Perc. 10	60.0	0.72	Perc. 10	75.0	0.84
Perc. 25	67.0	0.80	Perc. 25	70.0	0.84	Perc. 25	80.0	0.91
Perc. 50	70.0	0.85	Perc. 50	80.0	0.91	Perc. 50	90.0	1.00
Perc. 75	90.0	1.00	Perc. 75	80.0	1.00	Perc. 75	90.0	1.00
Perc .90	100.0	1.00	Perc .90	90.0	1.00	Perc .90	100.0	1.00
Perc. 95	100.0	1.00	Perc. 95	90.0	1.00	Perc. 95	100.0	1.00

Urban, Female, >50 years, Low education (N=20)			Urban, Female, >50 years, Middle education (N=25)			Urban, Female, >50 years, High education (N=7)		
	VAS	Utility		VAS	Utility		VAS	Utility
Mean	75.9	0.85	Mean	78.4	0.89	Mean	80.0	0.92
SD	13.2	0.13	SD	16.5	0.13	SD	9.6	0.08
Perc. 5	55.0	0.58	Perc. 5	50.0	0.63	Perc. 5	65.0	0.80
Perc. 10	60.0	0.65	Perc. 10	50.0	0.69	Perc. 10	65.0	0.80
Perc. 25	69.0	0.80	Perc. 25	70.0	0.80	Perc. 25	70.0	0.84
Perc. 50	80.0	0.87	Perc. 50	80.0	0.92	Perc. 50	80.0	0.92
Perc. 75	80.0	0.92	Perc. 75	90.0	1.00	Perc. 75	90.0	1.00
Perc .90	95.0	1.00	Perc .90	100.0	1.00	Perc .90	90.0	1.00
Perc. 95	100.0	1.00	Perc. 95	100.0	1.00	Perc. 95	90.0	1.00

S1 Table (continued). Mean, standard deviation, and percentiles scores of EQ-5D-5L visual analogue scale (VAS) and utility score of the subgroups by residence, gender, age, and education level

Urban, Male, 17-30 years, Low education (N=24)			Urban, Male, 17-30 years, Middle education (N=66)			Urban, Male, 17-30 years, High education (N=23)		
	VAS	**Utility**		**VAS**	**Utility**		**VAS**	**Utility**
Mean	75.3	0.93	Mean	82.8	0.92	Mean	80.3	0.86
SD	13.6	0.08	SD	12.2	0.11	SD	15.2	0.17
Perc. 5	50.0	0.78	Perc. 5	60.0	0.69	Perc. 5	55.0	0.71
Perc. 10	60.0	0.84	Perc. 10	70.0	0.78	Perc. 10	70.0	0.71
Perc. 25	65.0	0.87	Perc. 25	80.0	0.87	Perc. 25	70.0	0.84
Perc. 50	79.5	0.92	Perc. 50	85.0	0.92	Perc. 50	80.0	0.91
Perc. 75	80.0	1.00	Perc. 75	90.0	1.00	Perc. 75	95.0	0.92
Perc .90	90.0	1.00	Perc .90	95.0	1.00	Perc .90	98.0	1.00
Perc. 95	100.0	1.00	Perc. 95	100.0	1.00	Perc. 95	100.0	1.00

Urban, Male, 31-50 years, Low education (N=31)			Urban, Male, 31-50 years, Middle education (N=67)			Urban, Male, 31-50 years, High education (N= 17)		
	VAS	**Utility**		**VAS**	**Utility**		**VAS**	**Utility**
Mean	78.4	0.95	Mean	79.9	0.93	Mean	80.0	0.93
SD	16.1	0.05	SD	11.8	0.08	SD	9.7	0.08
Perc. 5	50.0	0.87	Perc. 5	60.0	0.80	Perc. 5	70.0	0.82
Perc. 10	50.0	0.91	Perc. 10	65.0	0.84	Perc. 10	70.0	0.83
Perc. 25	70.0	0.91	Perc. 25	70.0	0.84	Perc. 25	70.0	0.84
Perc. 50	80.0	1.00	Perc. 50	80.0	1.00	Perc. 50	80.0	0.92
Perc. 75	90.0	1.00	Perc. 75	90.0	1.00	Perc. 75	90.0	1.00
Perc .90	95.0	1.00	Perc .90	95.0	1.00	Perc .90	95.0	1.00
Perc. 95	100.0	1.00	Perc. 95	95.0	1.00	Perc. 95	95.0	1.00

Urban, Male, >50 years, Low education (N=16)			Urban, Male, >50 years, Middle education (N=26)			Urban, Male, >50 years, High education (N=7)		
	VAS	**Utility**		**VAS**	**Utility**		**VAS**	**Utility**
Mean	69.2	0.87	Mean	81.0	0.95	Mean	82.9	0.97
SD	14.8	0.12	SD	11.1	0.09	SD	16.0	0.05
Perc. 5	40.0	0.53	Perc. 5	65.0	0.72	Perc. 5	50.0	0.88
Perc. 10	50.0	0.74	Perc. 10	70.0	0.80	Perc. 10	50.0	0.88
Perc. 25	60.0	0.83	Perc. 25	70.0	0.92	Perc. 25	80.0	0.92
Perc. 50	70.0	0.86	Perc. 50	80.0	1.00	Perc. 50	90.0	1.00
Perc. 75	80.0	0.96	Perc. 75	90.0	1.00	Perc. 75	90.0	1.00
Perc .90	90.0	1.00	Perc .90	100.0	1.00	Perc .90	100.0	1.00
Perc. 95	100.0	1.00	Perc. 95	100.0	1.00	Perc. 95	100.0	1.00

Perc: Percentile
**: Low education means primary school and below, middle education means high school, and high education is college/university*

S2 Table. Mean, standard deviation, and percentiles scores of WHOQOL-BREF dimensions score of the subgroups by residence, gender, age, and education level

Rural, Female, 17-30 years, Low education* (N=28)					Rural, Female, 17-30 years, Middle education (N=55)				
	Physical	Psycho-logical	Social	Environ-ment		Physical	Psycho-logical	Social	Environ-ment
Mean	66.2	67.7	60.4	57.9	Mean	69.4	65.4	59.7	56.9
SD	10.0	11.9	14.5	14.1	SD	8.9	11.8	11.2	11.7
Perc. 5	50.0	50.0	41.7	40.6	Perc. 5	57.1	41.7	41.7	34.4
Perc. 10	53.6	50.0	50.0	46.9	Perc. 10	57.1	50.0	41.7	43.8
Perc. 25	58.9	60.4	50.0	53.1	Perc. 25	64.3	58.3	50.0	50.0
Perc. 50	64.3	66.7	58.3	59.4	Perc. 50	67.9	66.7	58.3	56.3
Perc. 75	71.4	75.0	75.0	65.6	Perc. 75	75.0	70.8	66.7	65.6
Perc .90	78.6	83.3	83.3	78.1	Perc .90	82.1	79.2	75.0	75.0
Perc. 95	85.7	83.3	83.3	84.4	Perc. 95	82.1	87.5	75.0	75.0

Rural, Female, 17-30 years, High education (N=15)					Rural, Female, 31-50 years, Low education (N=41)				
	Physical	Psycho-logical	Social	Environ-ment		Physical	Psycho-logical	Social	Environ-ment
Mean	69.3	68.1	68.9	67.5	Mean	66.8	63.2	63.0	54.4
SD	8.1	14.1	12.0	9.1	SD	12.6	13.6	14.8	13.2
Perc. 5	53.6	50.0	50.0	56.3	Perc. 5	50.0	45.8	33.3	31.3
Perc. 10	57.1	50.0	50.0	56.3	Perc. 10	53.6	50.0	50.0	34.4
Perc. 25	64.3	54.2	66.7	59.4	Perc. 25	60.7	54.2	50.0	43.8
Perc. 50	71.4	66.7	66.7	68.8	Perc. 50	64.3	58.3	66.7	53.1
Perc. 75	78.6	79.2	75.0	71.9	Perc. 75	71.4	66.7	75.0	62.5
Perc .90	78.6	87.5	91.7	75.0	Perc .90	82.1	79.2	75.0	68.8
Perc. 95	78.6	91.7	91.7	90.6	Perc. 95	85.7	87.5	83.3	71.9

Rural, Female, 31-50 years, Middle education (N=50)					Rural, Female, 31-50 years, High education (N=15)				
	Physical	Psycho-logical	Social	Environ-ment		Physical	Psycho-logical	Social	Environ-ment
Mean	67.9	65.8	63.1	57.4	Mean	71.9	71.4	68.2	64.2
SD	11.3	12.9	11.2	10.7	SD	9.3	7.0	9.7	6.9
Perc. 5	50.0	45.8	50.0	37.5	Perc. 5	60.7	58.3	50.0	53.1
Perc. 10	53.6	50.0	50.0	46.9	Perc. 10	60.7	58.3	50.0	53.1
Perc. 25	60.7	58.3	50.0	50.0	Perc. 25	60.7	66.7	58.3	59.4
Perc. 50	67.9	66.7	58.3	56.3	Perc. 50	71.4	70.8	75.0	65.6
Perc. 75	75.0	75.0	75.0	62.5	Perc. 75	78.6	75.0	75.0	68.8
Perc .90	78.6	79.2	75.0	73.4	Perc .90	82.1	79.2	75.0	75.0
Perc. 95	89.3	91.7	75.0	75.0	Perc. 95	89.3	83.3	83.3	75.0

S2 Table (continued). Mean, standard deviation, and percentiles scores of WHOQOL-BREF dimensions score of the subgroups by residence, gender, age, and education level

Rural, Female, >50 years, Low education (N=22)					**Rural, Female, >50 years, Middle education (N=23)**				
	Physical	**Psycho-logical**	**Social**	**Environ-ment**		**Physical**	**Psycho-logical**	**Social**	**Environ-ment**
Mean	67.7	67.4	56.9	54.5	Mean	66.6	64.5	59.4	62.2
SD	11.0	12.6	19.2	17.9	SD	12.5	11.5	11.3	11.8
Perc. 5	50.0	50.0	25.0	37.5	Perc. 5	46.4	41.7	50.0	43.8
Perc. 10	57.1	54.2	25.0	37.5	Perc. 10	50.0	50.0	50.0	46.9
Perc. 25	64.3	66.7	50.0	46.9	Perc. 25	57.1	58.3	50.0	56.3
Perc. 50	67.9	66.7	58.3	53.1	Perc. 50	67.9	66.7	58.3	60.9
Perc. 75	78.6	75.0	66.7	65.6	Perc. 75	75.0	70.8	66.7	68.8
Perc .90	85.7	79.2	75.0	75.0	Perc .90	82.1	75.0	75.0	78.1
Perc. 95	85.7	95.8	83.3	81.3	Perc. 95	85.7	75.0	75.0	81.3

Rural, Female, >50 years, High education (N=7)					**Rural, Male, 17-30 years, Low education (N=31)**				
	Physical	**Psycho-logical**	**Social**	**Environ-ment**		**Physical**	**Psycho-logical**	**Social**	**Environ-ment**
Mean	64.3	69.4	63.9	56.8	Mean	71.8	66.4	59.7	55.3
SD	9.3	10.4	11.4	13.2	SD	11.8	14.1	12.6	15.0
Perc. 5	50.0	54.2	50.0	37.5	Perc. 5	50.0	50.0	50.0	40.6
Perc. 10	50.0	54.2	50.0	37.5	Perc. 10	57.1	50.0	50.0	40.6
Perc. 25	60.7	62.5	50.0	50.0	Perc. 25	64.3	54.2	50.0	43.8
Perc. 50	64.3	75.0	66.7	62.5	Perc. 50	71.4	64.6	54.2	53.1
Perc. 75	78.6	79.2	75.0	68.8	Perc. 75	78.6	79.2	75.0	65.6
Perc .90	82.1	83.3	75.0	71.9	Perc .90	87.5	89.6	75.0	82.8
Perc. 95	82.1	83.3	75.0	71.9	Perc. 95	92.9	91.7	83.3	84.4

Rural, Male, 17-30 years, Middle education (N=53)					**Rural, Male, 17-30 years, High education (N=16)**				
	Physical	**Psycho-logical**	**Social**	**Environ-ment**		**Physical**	**Psycho-logical**	**Social**	**Environ-ment**
Mean	72.0	70.3	67.9	60.2	Mean	70.1	71.4	67.7	65.2
SD	9.5	13.3	14.1	12.9	SD	9.8	12.6	11.3	13.7
Perc. 5	53.6	45.8	41.7	37.5	Perc. 5	46.4	37.5	33.3	31.3
Perc. 10	57.1	54.2	50.0	43.8	Perc. 10	60.7	54.2	58.3	50.0
Perc. 25	67.9	62.5	58.3	50.0	Perc. 25	66.1	68.8	66.7	62.5
Perc. 50	75.0	70.8	66.7	59.4	Perc. 50	69.6	72.9	66.7	65.6
Perc. 75	78.6	79.2	75.0	68.8	Perc. 75	76.8	79.2	75.0	73.4
Perc .90	82.1	87.5	83.3	75.0	Perc .90	82.1	83.3	75.0	81.3
Perc. 95	85.7	91.7	91.7	81.3	Perc. 95	85.7	87.5	83.3	87.5

S2 Table (continued). Mean, standard deviation, and percentiles scores of WHOQOL-BREF dimensions score of the subgroups by residence, gender, age, and education level

Rural, Male, 31-50 years, Low education (N=40)					Rural, Male, 31-50 years, Middle education (N=50)				
	Physical	Psycho-logical	Social	Environ-ment		Physical	Psycho-logical	Social	Environ-ment
Mean	73.4	68.5	60.7	57.4	Mean	68.6	67.2	62.4	54.0
SD	12.3	13.1	14.7	14.2	SD	11.2	10.5	12.2	11.2
Perc. 5	50.0	50.0	41.7	37.5	Perc. 5	50.0	54.2	50.0	37.5
Perc. 10	57.1	50.0	41.7	40.6	Perc. 10	53.6	56.3	50.0	40.6
Perc. 25	67.9	54.2	50.0	43.8	Perc. 25	64.3	58.3	50.0	46.9
Perc. 50	75.0	66.7	58.3	59.4	Perc. 50	71.4	66.7	62.5	51.6
Perc. 75	82.1	79.2	75.0	65.6	Perc. 75	78.6	75.0	75.0	62.5
Perc .90	89.3	83.3	75.0	78.1	Perc .90	80.4	81.3	75.0	71.9
Perc. 95	92.9	87.5	83.3	84.4	Perc. 95	82.1	87.5	75.0	75.0

Rural, Male, 31-50 years, High education (N=15)					Rural, Male, >50 years, Low education (N=22)				
	Physical	Psycho-logical	Social	Environ-ment		Physical	Psycho-logical	Social	Environ-ment
Mean	75.9	75.3	71.9	66.8	Mean	61.6	59.0	53.3	49.2
SD	12.4	13.1	16.6	12.5	SD	11.0	11.5	11.0	14.9
Perc. 5	50.0	54.2	50.0	50.0	Perc. 5	50.0	50.0	41.7	28.1
Perc. 10	60.7	58.3	50.0	53.1	Perc. 10	50.0	50.0	41.7	37.5
Perc. 25	67.9	66.7	58.3	56.3	Perc. 25	50.0	50.0	50.0	40.6
Perc. 50	75.0	75.0	66.7	65.6	Perc. 50	60.7	58.3	50.0	48.4
Perc. 75	85.7	83.3	83.3	78.1	Perc. 75	71.4	66.7	58.3	62.5
Perc .90	92.9	95.8	100.0	87.5	Perc .90	75.0	75.0	75.0	65.6
Perc. 95	96.4	100.0	100.0	90.6	Perc. 95	78.6	79.2	75.0	65.6

Rural, Male, >50 years, Middle education (N=17)					Rural, Male, >50 years, High education (N=7)				
	Physical	Psycho-logical	Social	Environ-ment		Physical	Psycho-logical	Social	Environ-ment
Mean	63.2	68.8	66.7	56.5	Mean	64.9	67.4	56.9	57.8
SD	14.0	12.3	15.2	9.0	SD	13.3	9.7	6.3	6.2
Perc. 5	39.3	41.7	41.7	37.5	Perc. 5	42.9	54.2	50.0	50.0
Perc. 10	42.9	50.0	50.0	43.8	Perc. 10	42.9	54.2	50.0	50.0
Perc. 25	50.0	62.5	58.3	53.1	Perc. 25	60.7	62.5	50.0	50.0
Perc. 50	71.4	70.8	66.7	56.3	Perc. 50	64.3	66.7	58.3	59.4
Perc. 75	75.0	79.2	75.0	62.5	Perc. 75	78.6	70.8	66.7	62.5
Perc .90	78.6	79.2	83.3	68.8	Perc .90	78.6	83.3	66.7	62.5
Perc. 95	78.6	83.3	100.0	71.9	Perc. 95	78.6	83.3	66.7	62.5

S2 Table (continued). Mean, standard deviation, and percentiles scores of WHOQOL-BREF dimensions score of the subgroups by residence, gender, age, and education level

Urban, Female, 17-30 years, Low education (N=33)					Urban, Female, 17-30 years, Middle education (N=57)				
	Physical	Psycho-logical	Social	Environ-ment		Physical	Psycho-logical	Social	Environ-ment
Mean	68.7	63.7	57.5	57.5	Mean	68.3	65.5	62.2	59.4
SD	11.1	14.7	10.6	12.3	SD	11.0	13.2	16.5	13.8
Perc. 5	50.0	37.5	50.0	34.4	Perc. 5	53.6	45.8	33.3	40.6
Perc. 10	53.6	50.0	50.0	43.8	Perc. 10	53.6	54.2	41.7	43.8
Perc. 25	60.7	54.2	50.0	46.9	Perc. 25	60.7	58.3	50.0	53.1
Perc. 50	71.4	62.5	50.0	59.4	Perc. 50	67.9	66.7	58.3	59.4
Perc. 75	78.6	66.7	66.7	62.5	Perc. 75	75.0	70.8	75.0	65.6
Perc .90	78.6	83.3	75.0	71.9	Perc .90	82.1	83.3	83.3	75.0
Perc. 95	85.7	91.7	75.0	81.3	Perc. 95	89.3	91.7	91.7	93.8

Urban, Female, 17-30 years, High education (N=18)					Urban, Female, 31-50 years, Low education (N=32)				
	Physical	Psycho-logical	Social	Environ-ment		Physical	Psycho-logical	Social	Environ-ment
Mean	65.9	65.4	61.3	60.8	Mean	66.8	59.7	59.6	53.4
SD	14.6	10.7	15.1	15.6	SD	12.0	12.0	13.5	10.6
Perc. 5	35.7	37.5	33.3	34.4	Perc. 5	42.9	41.7	33.3	37.5
Perc. 10	39.3	54.2	41.7	43.8	Perc. 10	50.0	45.8	41.7	43.8
Perc. 25	57.1	62.5	50.0	46.9	Perc. 25	58.9	50.0	50.0	46.9
Perc. 50	67.9	66.7	62.5	62.5	Perc. 50	67.9	58.3	58.3	53.1
Perc. 75	78.6	70.8	66.7	71.9	Perc. 75	75.0	66.7	66.7	59.4
Perc .90	85.7	70.8	83.3	75.0	Perc .90	78.6	75.0	75.0	68.8
Perc. 95	85.7	83.3	91.7	84.4	Perc. 95	82.1	79.2	75.0	71.9

Urban, Female, 31-50 years, Middle education (N=62)					Urban, Female, 31-50 years, High education (N=18)				
	Physical	Psycho-logical	Social	Environ-ment		Physical	Psycho-logical	Social	Environ-ment
Mean	69.8	66.3	64.5	58.8	Mean	73.0	68.2	66.2	66.2
SD	10.4	12.6	13.1	13.9	SD	12.0	9.2	13.4	12.8
Perc. 5	53.6	45.8	50.0	34.4	Perc. 5	42.9	54.2	41.7	40.6
Perc. 10	57.1	50.0	50.0	43.8	Perc. 10	57.1	54.2	50.0	43.8
Perc. 25	60.7	54.2	50.0	50.0	Perc. 25	67.9	58.3	50.0	56.3
Perc. 50	67.9	66.7	66.7	56.3	Perc. 50	71.4	70.8	75.0	67.2
Perc. 75	75.0	75.0	75.0	65.6	Perc. 75	82.1	75.0	75.0	78.1
Perc .90	82.1	79.2	75.0	78.1	Perc .90	89.3	83.3	83.3	87.5
Perc. 95	85.7	83.3	83.3	81.3	Perc. 95	92.9	87.5	83.3	90.6

S2 Table (continued). Mean, standard deviation, and percentiles scores of WHOQOL-BREF dimensions score of the subgroups by residence, gender, age, and education level

Urban, Female, >50 years, Low education (N=20)					Urban, Female, >50 years, Middle education (N=25)				
	Physical	Psycho-logical	Social	Environ-ment		Physical	Psycho-logical	Social	Environ-ment
Mean	65.6	62.5	59.7	59.4	Mean	66.0	65.9	61.2	58.8
SD	12.4	12.7	12.2	10.5	SD	12.1	10.7	10.2	11.7
Perc. 5	48.2	41.7	41.7	46.9	Perc. 5	46.4	50.0	50.0	40.6
Perc. 10	50.0	45.8	45.8	46.9	Perc. 10	50.0	50.0	50.0	46.9
Perc. 25	55.4	54.2	50.0	50.0	Perc. 25	58.9	58.3	50.0	50.0
Perc. 50	67.9	62.5	62.5	59.4	Perc. 50	67.9	70.8	62.5	59.4
Perc. 75	75.0	70.8	66.7	65.6	Perc. 75	75.0	70.8	66.7	67.2
Perc .90	82.1	75.0	75.0	73.4	Perc .90	82.1	75.0	75.0	75.0
Perc. 95	87.5	83.3	83.3	79.7	Perc. 95	85.7	79.2	75.0	75.0

Urban, Female, >50 years, High education (N=7)					Urban, Male, 17-30 years, Low education (N=24)				
	Physical	Psycho-logical	Social	Environ-ment		Physical	Psycho-logical	Social	Environ-ment
Mean	64.8	64.9	60.7	64.3	Mean	70.5	64.9	61.6	59.9
SD	10.8	17.5	16.5	15.3	SD	13.7	13.1	15.2	12.3
Perc. 5	46.4	41.7	50.0	50.0	Perc. 5	53.6	50.0	41.7	46.9
Perc. 10	46.4	41.7	50.0	50.0	Perc. 10	53.6	50.0	50.0	46.9
Perc. 25	57.1	54.2	50.0	50.0	Perc. 25	64.3	54.2	50.0	50.0
Perc. 50	64.3	58.3	50.0	59.4	Perc. 50	73.2	64.6	58.3	60.9
Perc. 75	75.0	79.2	75.0	81.3	Perc. 75	78.6	72.9	75.0	67.2
Perc .90	78.6	91.7	91.7	87.5	Perc .90	89.3	83.3	83.3	75.0
Perc. 95	78.6	91.7	91.7	87.5	Perc. 95	92.9	91.7	83.3	78.1

Urban, Male, 17-30 years, Middle education (N=66)					Urban, Male, 17-30 years, High education (N=23)				
	Physical	Psycho-logical	Social	Environ-ment		Physical	Psycho-logical	Social	Environ-ment
Mean	71.7	70.1	65.8	59.2	Mean	71.4	64.7	68.1	64.1
SD	12.3	13.9	16.9	14.4	SD	10.9	15.7	11.1	12.9
Perc. 5	50.0	45.8	41.7	34.4	Perc. 5	53.6	33.3	50.0	40.6
Perc. 10	57.1	50.0	41.7	40.6	Perc. 10	57.1	41.7	58.3	40.6
Perc. 25	60.7	58.3	50.0	50.0	Perc. 25	64.3	54.2	58.3	59.4
Perc. 50	71.4	75.0	66.7	56.3	Perc. 50	71.4	66.7	66.7	65.6
Perc. 75	78.6	79.2	75.0	68.8	Perc. 75	78.6	75.0	75.0	75.0
Perc .90	85.7	87.5	91.7	78.1	Perc .90	85.7	79.2	83.3	78.1
Perc. 95	96.4	87.5	91.7	81.3	Perc. 95	85.7	83.3	83.3	81.3

S2 Table (continued). Mean, standard deviation, and percentiles scores of WHOQOL-BREF dimensions score of the subgroups by residence, gender, age, and education level

Urban, Male, 31-50 years, Low education (N=31)					Urban, Male, 31-50 years, Middle education (N=67)				
	Physical	Psycho-logical	Social	Environ-ment		Physical	Psycho-logical	Social	Environ-ment
Mean	72.9	72.4	65.2	61.2	Mean	70.0	67.3	67.1	58.8
SD	12.3	15.7	17.9	16.7	SD	10.9	12.8	16.9	13.9
Perc. 5	53.6	50.0	41.7	37.5	Perc. 5	57.1	45.8	41.7	34.4
Perc. 10	53.6	58.3	50.0	46.9	Perc. 10	57.1	54.2	50.0	40.6
Perc. 25	64.3	66.7	58.3	50.0	Perc. 25	64.3	58.3	58.3	50.0
Perc. 50	75.0	79.2	66.7	62.5	Perc. 50	67.9	66.7	66.7	59.4
Perc. 75	82.1	79.2	75.0	71.9	Perc. 75	78.6	75.0	83.3	71.9
Perc .90	89.3	87.5	83.3	78.1	Perc .90	85.7	83.3	91.7	78.1
Perc. 95	92.9	91.7	91.7	81.3	Perc. 95	92.9	87.5	91.7	81.3

Urban, Male, 31-50 years, High education (N=17)					Urban, Male, >50 years, Low education (N=16)				
	Physical	Psycho-logical	Social	Environ-ment		Physical	Psycho-logical	Social	Environ-ment
Mean	67.2	66.4	63.7	57.7	Mean	75.0	72.5	68.3	67.7
SD	14.0	13.1	17.4	16.4	SD	11.5	13.5	14.8	16.8
Perc. 5	50.0	37.5	50.0	34.4	Perc. 5	53.6	41.7	41.7	28.1
Perc. 10	53.6	50.0	50.0	37.5	Perc. 10	60.7	58.3	50.0	50.0
Perc. 25	57.1	58.3	50.0	50.0	Perc. 25	69.6	62.5	54.2	56.3
Perc. 50	60.7	70.8	58.3	53.1	Perc. 50	71.4	70.8	75.0	68.8
Perc. 75	75.0	79.2	75.0	62.5	Perc. 75	82.1	79.2	75.0	82.8
Perc .90	96.4	83.3	100.0	84.4	Perc .90	85.7	91.7	83.3	84.4
Perc. 95	96.4	83.3	100.0	90.6	Perc. 95	100.0	95.8	100.0	90.6

Urban, Male, >50 years, Middle education (N=26)					Urban, Male, >50 years, High education (N=7)				
	Physical	Psycho-logical	Social	Environ-ment		Physical	Psycho-logical	Social	Environ-ment
Mean	68.2	66.3	63.3	55.8	Mean	65.8	60.7	53.6	47.8
SD	9.5	8.7	12.5	9.0	SD	7.7	7.2	17.9	10.5
Perc. 5	50.0	54.2	41.7	40.6	Perc. 5	53.6	50.0	25.0	34.4
Perc. 10	53.6	54.2	50.0	40.6	Perc. 10	53.6	50.0	25.0	34.4
Perc. 25	60.7	54.2	50.0	46.9	Perc. 25	60.7	54.2	41.7	40.6
Perc. 50	67.9	64.6	62.5	53.1	Perc. 50	64.3	62.5	50.0	43.8
Perc. 75	75.0	75.0	75.0	62.5	Perc. 75	75.0	66.7	75.0	56.3
Perc .90	78.6	75.0	75.0	68.8	Perc .90	75.0	70.8	75.0	65.6
Perc. 95	82.1	75.0	75.0	68.8	Perc. 95	75.0	70.8	75.0	65.6

Perc: Percentile
**: Low education, means primary school and below, middle education means high school, and high education is college/university*

CHAPTER 6

Living in uncertainty due to floods and pollution: the health status and quality of life of people living on an unhealthy riverbank

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Abstract

BACKGROUND: People living on the banks of polluted rivers with yearly flooding lived in impoverished and physically unhealthy circumstances. However, they were reluctant to move or be relocated to other locations where better living conditions were available. This study aimed to investigate the health status, quality of life (QoL), happiness, and life satisfaction of the people who were living on the banks of one of the main rivers in Jakarta, Indonesia, the Ciliwung.

METHODS: Respondents were 17 years and older and recruited from the Bukit Duri community (n=204). Three comparison samples comprised: i) a socio-demographically matched control group, not living on the river bank (n=204); ii) inhabitants of Jakarta (n=305), and iii) the Indonesian general population (n=1041). Health status and QoL were measured utilizing EQ-5D-5L, WHOQOL-BREF, the Happiness Scale, and the Life Satisfaction Index. A visual analogue scale question concerning respondents' financial situations was added. MANOVA and multivariate regression analysis were used to analyze the differences between the Ciliwung respondents and the three comparison groups.

RESULTS: The Ciliwung respondents reported lower physical QoL on WHOQOL-BREF and less personal happiness than the matched controls but rated their health (EQ-5D-5L) and life satisfaction better than the matched controls. Similar results were obtained by comparison with the Jakarta inhabitants and the general population. Bukit Duri inhabitants also perceived themselves as being in a better financial situation than the three comparison groups even though their incomes were lower.

CONCLUSIONS: The recent relocation to a better environment with better housing might improve the former Ciliwung inhabitants' quality of life and happiness, but not necessarily their perceived health, satisfaction with life, and financial situations.

KEYWORDS: quality of life; health status; happiness; life satisfaction; water pollution; Indonesia

Background

Many people in the developing world live in places that are characterized by unhealthy living circumstances. This is the case in the downstream areas of many rivers in Southeast Asia, where waste from the factories and people of the upper and lower parts of the river is accumulating, causing water pollution and house flooding: e.g. the Mekong and Red River Deltas in Cambodia and Vietnam, Manila bay, and the Mae Klong river in Thailand [1-6]. The Ciliwung river in Jakarta on the island of Java in Indonesia is an example of such a situation. The river is the largest among 13 rivers flowing through Jakarta, at approximately 130 km in length, with a catchment area of 390 square km. The Ciliwung river is heavily polluted with heavy metal concentrations such as lead (Pb) and zinc (Zn) [6-8], nitrate (NO3), human enteric viruses, and Escherichia coli [9, 10]. Moreover, it is frequently flooded, with its yearly peak occurring in January and February. When the floods hit, higher contaminations of viruses and bacterial indicators are found in the floodwaters [11].

Notwithstanding these circumstances, at the time of this study, many people still lived next to the Ciliwung. Living in such a place with high health risks, inadequate infrastructure, unreliable water and electricity supplies, and regular floods, was often perceived by the inhabitants as an acceptably safe and normal part of everyday life [12, 13]. People used the river water for washing and defecating. The children played and swum with their playmates. The houses had bad sanitation and were overcrowded; cats and mice could be found frequently [14, 15]. Evidently, such living conditions were accompanied by increased risks of different diseases, such as fecal-oral contagion, infectious diseases, skin complaints, and diarrhea. Despite the conditions, the inhabitants were reluctant to move or to be relocated by the government to other parts of Jakarta where better living conditions were available. This apparent contradiction raises questions concerning their subjective health and quality of life, including life satisfaction and happiness.

As elsewhere, government plans have been implemented in Jakarta to improve the state of such rivers in order to prevent pollution and flooding. For the later evaluation of the impact of these plans upon the lives of the people involved, knowledge of their health status and quality of life is required. Hence the aims of the present investigation were: 1) to obtain data on the health status and quality of life of people living on the Ciliwung riverbank, and 2) to compare these features with those of: i) a matched control group consisting of people with similar demographic characteristics, ii) inhabitants of Jakarta in general, and iii) the norm scores for the general population of Indonesia. The comparison groups were chosen to identify: i) the potential contribution of the target group's specific living circumstances to their health status

and quality of life; ii) how the group's results on these features compared to those of (a) the overall inhabitants of their metropolitan city Jakarta, and b) the Indonesian people in general.

Methods

Respondents

We conducted the survey in Bukit Duri, an administrative urban village of South Jakarta city directly adjacent to the Ciliwung river. The population of Bukit Duri in 2015 consisted of 9233 families encompassing 32679 subjects [16]. Of these families, approximately 400 lived by the Ciliwung. The inclusion criteria for this group, which will be referred to as 'Ciliwung' in this manuscript, were the following: i) living by the Ciliwung river, ii) aged 17 years or more, iii) an adequate command of the Indonesian language Bahasa Indonesia. The interviewers were introduced by members of the non-profit organization 'Ciliwung Merdeka', which operates in the area. As no formal street plan existed, nor any detailed information about the number of inhabitants per house, respondents were invited after knocking on each door. Because of this sampling approach, it was difficult to count non-responders, as more than one person could have been living in a household. We were able to interview 204 respondents.

The data for the three comparison groups: the Indonesian general population (which will be referred to as 'general population'), Jakarta sample ('Jakarta'), and a comparable matched control group ('matched control') were selected from our larger study which focused upon the Indonesian general population, in which several questionnaires were tested in a face-to-face setting at the home/office of the interviewer or the homes of the subjects [17]. This larger study implemented a multi-stage stratified quota sampling procedure to ensure the sample's representativeness of the Indonesian general population, resulting in 1041 respondents being interviewed in the final analysis. The sample was similar to the Indonesian population with respect to location (urban/rural), gender, age, level of education, religion, and ethnicity [17]. For Jakarta as a comparison group, all respondents from the larger study who lived in Jakarta were included (n=305). For the control group, we matched every respondent from the Ciliwung group with a respondent from the general population group with respect to their gender, age group, level of education, and monthly income. When there was more than one match for a respondent from of the Ciliwung population, a subject was randomly chosen from the possible matches.

Procedure

The study was approved by the Health Research Ethics Committee, YARSI University, Jakarta. We hired four final year bachelors' degree students at the YARSI University Faculty of Psychology as interviewers. All interviewers were trained by two of the authors at a half-day workshop concerned with the research project itself, the questionnaires, and the interview technique. The interviews were held at the homes of the respondents. Before they participated in the study, the interviewers asked the respondents to read and sign informed consent forms. Respondents were encouraged to read the questionnaire by themselves, but if they had difficulty in reading: i.e. if they were illiterate, had low education levels, or eyesight problems, the interviewers would help them by reading aloud an item and asking them to indicate the answer in the questionnaire. Each respondent received a mug specifically designed for the study as a token of appreciation.

Measures

Background and demographic characteristics of each respondent were obtained utilizing a questionnaire including questions about the respondent's gender, age, ethnicity, education, religion, income, and marital status.

The health status of the respondents was measured by the official EQ-5D-5L Bahasa Indonesia version provided by the EuroQol Group. This translation of EQ-5D-5L was produced using a standardized translation protocol [18] and has proven to be valid and reliable in many countries [19-22] including in Indonesian population samples [23, 24]. The EQ-5D-5L is a generic HRQOL instrument which consists of two parts: i) five dimensions (mobility, self-care, usual activities, pain/discomfort, anxiety/depression), each of which can take one of five responses (no problems, slight problems, moderate problems, severe problems, and unable/extreme problems), and ii) the EQ Visual Analogue Scale (EQ-VAS), which records the respondent's self-rated health on a 20 cm vertical visual analogue scale with endpoints labelled "the best health you can imagine'' and "the worst health you can imagine" [25].

Quality of life was measured by the Indonesian version of WHOQOL-BREF, which is an abbreviated 26-item version of WHOQOL-100 that assesses four major domains: physical, psychological, social relationships, and environment. Each item is rated using a 5-point Likert scale with varied wording on each scale depending on the item (for example 1 = very dissatisfied to 5 = very satisfied). The scores are then transformed into a linear scale between 0 and 100, with 0 being the least favorable quality of life and 100 being the most favorable [26, 27]. The WHOQOL-BREF has been proved valid in a variety of contexts, and across many health conditions in many countries [28-32], including in Indonesia [33]. In line with the manual of the English version of WHOQOL-BREF [27], we chose to apply a time-frame of four weeks, and our

version was acknowledged by the WHO as the revised official Bahasa Indonesia version. We used the self-administered paper-based WHOQOL-BREF for this study. The Indonesian version of WHOQOL-BREF is available and has been proven as a valid and reliable questionnaire to be used in Indonesia [33].

In addition, we measured the respondents' personal happiness and life satisfaction. Personal happiness was assessed with the Happiness Thermometer, an 11-point scale for the assessment of happiness: during today, over the past month, and for life as a whole. The scale was graphically represented by 11 smileys presented horizontally, ranging from 0, represented by a 'sad smiley', to 5, represented by a neutral smiley, to 10, represented by a happy smiley. A similar measure showed good test-retest reliability, significant convergent validity coefficients, and the ability to distinguish small differences in happiness [34-36]. For this study's sample, the internal consistency of the Happiness Thermometer scale was 0.78.

Life satisfaction was assessed with Cantril's Self-Anchoring Striving Scale [37]. Participants were presented an 11-step vertical ladder, where the bottom step was marked with 0, the worst life possible, and the last step with 10, the best possible life. Participants were asked to assess satisfaction with their life at three time-points: now, five years ago, and five years from now. This measure is frequently used in surveys such as the Gallup World Poll [38]. The internal consistency of the Cantril's Self-Anchoring Striving Scale in the present sample was 0.74.

Finally, we were interested in how the people of Ciliwung, who lived in a poor area of Jakarta, perceived their family's financial situation given their relatively low incomes. We asked the following question: "We would like to know how you perceive your family's financial situation. On the scale below, which number is the best reflection of your family's financial situation now?" Then a 10-points horizontal VAS scale ranging from 0 ('the poorest you can imagine') to 10 ('the richest you can imagine') was presented for the respondents to choose.

The cultural adaptation of the questionnaires was conducted following guidelines from Guillemin [39] which consist of forward translation, backward translation, committee review, and pre-testing. The EQ-5D-5L and WHOQOL-BREF were available in Bahasa Indonesia versions, provided by the EuroQol Group and World Health Organization, respectively. The Happiness Thermometer and Cantril's Self-Anchoring Striving Scale were translated into Bahasa Indonesia by two native Indonesian speakers, backward translated into English by a native English speaker, and the study team held a meeting to check on the equivalence of the two translations. A pilot study of 46 inhabitants of Ciliwung was conducted to test the feasibility of the questionnaires and revision was subsequently undertaken based on the respondents' input. The inclusion of the family's financial situation scale was based on this pilot study.

Analysis

The demographic characteristics were described as percentages within the subgroups in each sample: i.e. gender, age group, education level, ethnicity, religion, monthly income and marital status. For the self-reported health profile obtained from EQ-5D-5L, we calculated the percentages of respondents for each level of each dimension. We then combined level 2 (slight problems) through to level 5 (unable/extreme problems) into 'any problems' and presented this along with level 1 (no problems). The proportions of the Ciliwung and the three comparison groups' respondents who reported any problems were compared using the Chi-square test. The EQ-5D-5L health states were converted into a single index score using the Indonesian value set [17], and EQ-VAS was scored by transforming the 20 cm VAS into a 0-100 scale [40]. Mean and standard deviation were calculated for each different domain of WHOQOL-BREF, and for visual analogue scales of perceived happiness, life satisfaction, and financial situation.

For the comparison between the Ciliwung sample and the three other groups of the domains of each variable: health status (EQ-VAS and index score), quality of life (physical, psychological, social relationships and environment domains from WHOQOL-BREF), personal happiness (today, over the past month, and whole life), life satisfaction (now, five years ago, and five years from now), and financial situation, we applied t-tests if the data was normally distributed or the Wilcoxon rank-sum test if not normally distributed. Normality was tested using the Shapiro-Wilk test. We also applied one-way MANOVA to test the difference between groups across each outcome variable's domains simultaneously: health status, quality of life, happiness, and life satisfaction. The groups - Ciliwung, matched control, Jakarta, general population - served as the predictors. Further multiple linear regression analysis was carried out to evaluate the group differences when controlling for socio-demographic variables: gender, age, education, monthly income, ethnicity, religion, and marital status. Additional multiple linear regression analyses were conducted to evaluate the group differences in the average scores of the three time-points on the Happiness Thermometer and on Cantril's Self-Anchoring Striving Scale when controlling for socio-demographic variables. $P < 0.05$ was considered significant. To determine the magnitude of the differences, we calculated the effect size using Cohen's d and applied the criteria from Cohen for the interpretation: 0.2-0.5 = small, 0.5-0.8 = medium, >0.8 = large difference [41].

Results

Demographic characteristics of respondents

As could be expected, the Ciliwung group did not differ from the matched controls in each of the demographic characteristics (see Table 1). Compared to the general population and Jakarta samples, the Ciliwung group did not differ in age and gender. On the other hand, the group had on average a lower education, monthly income, and percentage of single/divorced persons compared to the general population and Jakarta samples. The majority of the Ciliwung group had a Batavian ethnic and Islam background, with similar percentages to the Jakarta group.

Table 1. Comparison of Demographic Characteristics of Ciliwung sample with matched control group, Jakarta group, Indonesian general population group

Character-istic	Level	Ciliwung N=204		Matched control N=204		Jakarta N=305		General population N=1041	
		n	%	n	%	n	%	n	%
Age	17-30 years	80	39.2	80	39.2	105	34.4	412	39.6
	31-50 years	88	43.1	88	43.1	151	49.5	434	41.7
	> 50 years	36	17.7	36	17.7	49	16.1	195	18.7
Gender	Male	102	50.0	102	50.0	137	44.9	521	50.1
	Female	102	50.0	102	50.0	168	55.1	520	49.9
Level of Education (highest)	Primary school or lower	71	34.8	68	33.3	74	24.3*	334	32.1
	High school	129	63.2	132	64.7	190	62.3	546	52.4*
	College/University	4	2.0	4	2.0	41	13.4*	161	15.5*
Income/ month (Euro)	<500K IDR (<30)	108	52.9	108	52.9	94	30.8*	507	48.7
	500-2500K IDR (30-150)	68	33.3	68	33.3	109	35.8	354	34.0
	2500-5000K IDR (150-300)	26	12.8	26	12.8	79	25.9*	130	12.5
	5000-10000K IDR (300-600)	2	1.0	2	1.0	19	6.2*	40	3.8*
	>10000K IDR (>600)	0	0.0	0	0.0	4	1.3	10	1.0

Table 1 (continued). Comparison of Demographic Characteristics of Ciliwung sample with matched control group, Jakarta group, Indonesian general population group

Characteristic	Level	Ciliwung N=204		Matched control N=204		Jakarta N=305		General population N=1041	
		n	%	n	%	n	%	n	%
Ethnicity	Batavian	99	48.5	34	16.6*	109	35.7*	110	10.6*
	Javanese	55	27.0	81	39.7*	82	26.9	433	41.6*
	Sundanese	39	19.1	34	16.7	8	2.6*	198	19.0
	Sumatran	6	2.9	25	12.3*	64	21.0*	129	12.48
	Other	5	2.5	30	14.7*	42	13.8*	171	16.4*
Religion	Islam	203	99.5	203	99.5*	292	95.7*	911	87.5*
	Christian	1	0.5	1	0.5*	7	2.3	99	9.5*
	Others	0	0.0	0	0.0	6	2.0*	31	3.0*
Marital Status	Married	154	75.5	128	62.7*	196	64.3*	619	59.5*
	Divorced/Single	50	24.5	76	37.3*	109	35.7*	422	40.5*

** difference of proportion between Ciliwung and corresponding groups: control, Jakarta, general population, statistically significant (p-value<0.05)*

Comparison between groups

Table 2 shows that by comparison with the matched control group, the Ciliwung group had significantly lower scores for the physical domain of quality of life (WHOQOL-BREF) and 'feeling happy today'. However, the group scored significantly higher on life satisfaction for all three time points and perceived financial situation. Self-perceived health measured with EQ-5D-5L (EQ-VAS) showed the opposite direction to that measured by WHOQOL-BREF: Ciliwung respondents reported significantly higher (more favorable) scores than the matched control group. Note that most effect sizes were small, except that for the physical domain of WHQOL-BREF, which was moderate.

Compared to the Jakarta respondents, the Ciliwung group reported significantly lower scores on three quality of life domains (physical, social, and environmental), and on personal happiness for all time points. However, the group's scores on their perceived health status (EQ-VAS) and their current and future life satisfaction, were significantly higher than the Jakarta group. The effect sizes were small in all comparisons.

A similar picture was shown when comparing the Ciliwung group and the general population: Ciliwung respondents scored lower on quality of life and happiness, but higher

on health status (VAS), life satisfaction, and perceived financial situation. Most effect sizes were small, with the exception of that for the physical domain of WHQOL-BREF, which was moderate.

Table 2. Health status and quality of life of Ciliwung sample in comparison with groups: matched control, Jakarta, general population

		Ciliwung		Matched controls			Jakarta			General population		
Aspect	**Dimension**	**Mean**	**SD**	**Mean**	**SD**	**ES[a]**	**Mean**	**SD**	**ES**	**Mean**	**SD**	**ES**
Health status	EQ-VAS	81.74	15.39	78.85*	13.24	0.20	77.50*	13.15	0.3	79.41*	14.03	0.16
	Index score	0.91	0.15	0.91	0.11	0.00	0.90	0.12	0.09	0.91	0.11	0.01
Quality of life	Physical	63.31	11.56	69.66*	10.60	0.57	68.77*	11.23	0.48	69.23*	11.50	0.52
	Psychological	64.24	14.86	66.14	13.69	0.13	65.77	12.77	0.11	66.74*	12.89	0.19
	Social	59.48	14.78	62.25	14.9	0.19	63.33*	14.28	0.27	63.13*	14.41	0.25
	Environment	53.62	14.21	55.94	13.88	0.17	58.02*	12.50	0.33	58.49*	13.41	0.36
Happiness	Today	6.75	2.28	7.26*	1.79	0.25	7.31*	2.05	0.26	7.35*	1.84	0.31
	Last month	6.48	2.26	6.90*	1.98	0.20	7.09*	2.14	0.28	7.05*	1.94	0.28
	Whole life	6.94	2.11	7.28	1.73	0.18	7.56*	1.86	0.32	7.37*	1.78	0.23
Life satisfaction	Now	7.01	2.11	6.34*	1.84	0.34	6.51*	1.87	0.26	6.47*	1.89	0.28
	5 years ago	6.20	2.36	5.69*	2.03	0.23	5.88	2.18	0.14	5.79*	2.06	0.19
	5 years later	8.78	1.80	8.24*	1.76	0.31	8.50*	1.58	0.17	8.29*	1.71	0.29
Financial condition	Now	5.70	1.91	4.99*	1.73	0.39	5.45	1.53	0.15	5.23*	1.83	0.25

** differences between Ciliwung mean and means of corresponding groups: matched control, Jakarta, general population, statistically significant (p-value<0.05)*
[a] effect size based on Cohen's d

Exploring health status in more detail, the percentage of Ciliwung respondents who reported 'no problem' on all dimensions of EQ-5D-5L ('11111') was significantly higher than that of the comparison groups, as can be seen in Table 3. When we looked at the proportions of 'any problems' (levels 2-5) reported per dimension, the Ciliwung group had significantly less anxiety/depression than each of the comparison groups. For the other four dimensions, the proportions of 'any problems' were similar.

Table 3. EQ-5D-5L Self-reported health profiles: four group samples (%)

Sample		Mobility		Self-Care		Usual Activity		Pain/Discomfort		Anxiety/Depression		Reported '11111'[a]
	N	No	Any	No	Any	No	Any	No	Any	No	Any	
Ciliwung	204	90.20	9.80	97.06	2.94	90.20	9.80	64.22	35.78	84.31	15.69	55.39
Controls	204	91.67	8.33	98.53	1.47	87.75	12.25	60.78	39.22	68.63	31.37*	44.12*
Jakarta	305	88.52	11.47	98.36	1.64	84.92	15.08	59.67	40.32	63.28	36.72*	37.70*
General	1041	92.03	7.97	98.08	1.92	89.15	10.86	60.61	39.39	66.09	33.91*	43.70*

[a] percentage of respondents who reported no problems (level 1) on all five dimensions of EQ-5D-5L
** difference between proportions of respondents in the specific dimensions between Ciliwung and corresponding group statistically significant (p-value<0.05)*

The MANOVA analysis demonstrated statistically significant differences between the Ciliwung group and the matched control group in quality of life and life satisfaction (Wilks lambda 0.915 and 0.965, respectively), but not in health status and happiness. Further, the Ciliwung group was significantly different from the other groups in each of the outcome variables (Wilks lambda between 0.936 and 0.986), with the exception of health status (where there was no significant difference with the general population).

When controlling for socio-demographic factors: i.e. gender, age, education, monthly income, ethnicity, religion, and marital status (see Table 4), the outcomes were similar overall to those which were uncontrolled (see Table 2). When we averaged the respondents' responses at the three different time points on the happiness and life satisfaction scales, the results were similar to those shown in Table 4: the Ciliwung group was significantly different from the other groups in happiness and life satisfaction scores.

Table 4. Linear multiple regression coefficients for quality of life, health status, happiness, life satisfaction, and financial condition with groups and demographics as independent variables

		Location	Gender[a]	Age	Education[b]		Income[c]		Ethnicity[d]				Religion[e]		Marital status[f]	Constant
		Ciliwung	Male		Middle	High	500-2500K	>2500K	Sundanese	Bataknese	Batavia	Others	Christian	Others	Married	
HEALTH STATUS	**EQ-VAS**															
	vs Control[g]	2.88*	-	-	-	-	-	-	-	-	-	-	-	-	-	78.85*
	vs Jakarta	5.81*	2.94*	-0.11*	-1.48	1.62	-0.64	2.91	-6.31*	-4.84*	-7.22*	-4.23	9.27	-5.48	-1.69	85.45*
	vs General	4.47*	2.26*	-0.10*	2.13*	5.39*	-1.74	1.56	2.18	-3.38*	-5.27*	0.66	-0.12	-6.09*	0.83	80.53*
	Index score															
	vs Control	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	0.912*
	vs Jakarta	0.025*	0.026*	-0.003*	-0.007	-0.004	0.008	0.032	-0.044*	-0.012	-0.029*	-0.016	0.082	0.014	0.029*	0.985*
	vs General	0.010	0.024*	-0.002*	0.001	0.009	-0.001	0.021*	-0.022*	-0.035*	-0.037*	-0.017	0.016	-0.034	0.024*	0.953*
QUALITY OF LIFE	**Physical**															
	vs Control	-6.36*	-	-	-	-	-	-	-	-	-	-	-	-	-	69.66*
	vs Jakarta	-3.84*	2.32*	-0.10*	1.42	0.32	-0.13	2.27	-3.16	3.06	-0.26	0.04	5.12	-3.03	-0.29	69.34*
	vs General	-4.87	1.95	-0.14	0.15	-0.30	0.29	2.46	-3.15*	0.48	-1.60	0.85	1.27	-1.54	0.21	73.18*
	Psychological															
	vs Control	-1.91	-	-	-	-	-	-	-	-	-	-	-	-	-	66.14*
	vs Jakarta	0.24	1.18	-0.14*	-0.08	-3.64	2.75	6.74*	-1.01	2.43	-1.66	0.57	1.96	-6.50	0.71	67.39*
	vs General	-0.85	1.81	-0.11	1.01	0.85	0.40	4.19	-2.70*	0.11	-3.41*	1.20	1.89	-4.25	1.13	68.13*
	Social															
	vs Control	-2.78	-	-	-	-	-	-	-	-	-	-	-	-	-	62.26*
	vs Jakarta	-2.76	1.59	-0.08	1.14	2.23	-0.15	4.28*	-0.42	0.96	0.83	0.30	0.89	1.79	1.83	61.36*
	vs General	-3.07	1.91	-0.11	2.63	3.93	-0.10	2.83	-0.85	1.12	0.40	4.87*	1.08	-5.51*	3.08*	61.23*

QUALITY OF LIFE	**Environmental**															
	vs Control	-2.33	-	-	-	-	-	-	-	-	-	-	-	-	-	55.94*
	vs Jakarta	-2.24	-0.02	-0.08	1.38	1.55	-0.13	5.54*	-1.47	4.17*	1.37	-1.31	0.10	10.26	0.36	56.64*
	vs General	-3.27	-0.42	-0.08	1.29	3.32	-0.51	4.52	-1.98	0.89	0.01	4.35*	1.52	2.73	-0.71	59.60*
HAPPINESS	**Today**															
	vs Control	-0.51*	-	-	-	-	-	-	-	-	-	-	-	-	-	7.26*
	vs Jakarta	-0.30	-0.19	0.00	0.34	-0.03	0.37	0.99*	0.25	0.32	0.01	-0.10	-0.60	0.90	-0.28	6.98*
	vs General	-0.48*	-0.21	-0.01	0.42*	0.52*	-0.24	0.29	0.13	0.22	-0.12	0.26	0.19	-0.53	0.16	7.25*
	Last month															
	vs Control	-0.42*	-	-	-	-	-	-	-	-	-	-	-	-	-	6.90*
	vs Jakarta	-0.53*	-0.14	-0.01	0.08	-0.09	0.28	0.45	0.62	0.58	0.17	0.15	-0.23	0.63	0.29	6.70*
	vs General	-0.50*	-0.10	0.00	0.20	0.49*	-0.26	0.04	0.24	0.35	0.09	0.29	0.52*	-0.25	0.34*	6.69*
	Whole life															
	vs Control	-0.34	-	-	-	-	-	-	-	-	-	-	-	-	-	7.28*
	vs Jakarta	-0.47*	0.05	-0.01	0.34	-0.22	0.08	0.42	0.31	0.65*	0.03	-0.02	0.18	0.77	-0.11	7.27*
	vs General	-0.38*	-0.13	-0.01	0.45*	0.61*	-0.21	0.18	0.07	0.39*	0.05	0.22	0.06	-0.68	0.19	7.11*
LIFE SATISFACTION	**Today**															
	vs Control	0.68*	-	-	-	-	-	-	-	-	-	-	-	-	-	6.34*
	vs Jakarta	0.64*	0.11	-0.01	-0.50*	-0.17	0.11	0.47	-0.06	0.44	-0.11	-0.27	-0.63	0.20	0.10	6.76*
	vs General	0.62*	-0.14	0.00	0.34*	0.44*	-0.35*	0.09	0.51*	0.45*	0.09	0.68*	0.00	-0.25	0.30*	6.02*
	5 years ago															
	vs Control	0.52*	-	-	-	-	-	-	-	-	-	-	-	-	-	5.69*
	vs Jakarta	0.52*	0.17	-0.02*	-0.54*	-0.25	-0.08	0.00	-1.00*	0.52	0.15	-0.18	-1.09	0.32	-0.06	6.81*
	vs General	0.34	-0.06	0.00	0.35*	0.53*	-0.50*	-0.33	0.10	0.39	0.38*	0.29	-0.04	0.09	0.09	5.54*

Table 4 (continued). Linear multiple regression coefficients for quality of life, health status, happiness, life satisfaction, and financial condition with groups and demographics as independent variables

		Location	Gender[a]	Age	Education[b]		Income[c]		Ethnicity[d]				Religion[e]		Marital status[f]	Constant
		Ciliwung	Male		Middle	High	500-2500K	>2500K	Sundanese	Batakkanese	Batavia	Others	Christian	Others	Married	
LIFE SAT.	**5 years later**															
	vs Control	0.54*	-	-	-	-	-	-	-	-	-	-	-	-	-	8.24*
	vs Jakarta	0.43*	-0.10	-0.01	-0.07	0.32	0.35*	0.23	0.21	0.15	0.18	0.54	0.25	-0.80	-0.19	8.54*
	vs General	0.51*	-0.10	-0.01	0.55*	0.63*	-0.23*	-0.07	0.50*	0.45*	0.37*	0.70*	0.09	-0.53	0.07	7.98*
FINANCIAL	**Financial condition**															
	vs Control	0.71*	-	-	-	-	-	-	-	-	-	-	-	-	-	4.99*
	vs Jakarta	0.48*	0.17	0.00	-0.04	0.63	-0.12	0.41	-0.04	0.30	-0.21	-0.36	-0.38	1.19	-0.21	5.48*
	vs General	0.63*	-0.24*	0.00	0.72*	1.16*	0.00	0.57*	0.75*	0.63*	0.21	0.49*	0.00	0.58	0.04	4.46*

** p-value <0.05*
[a] *Female is the reference group*
[b] *Basic education level: primary school and below is the reference group*
[c] *Monthly income less than 500K IDR is the reference group*
[d] *Javanese is the reference group*
[e] *Islam is the reference group*
[f] *Single/divorced is the reference group*
[g] *For comparison between Ciliwung and reference group, univariate linear regression was used*

Discussion

Our findings are the first with respect to the quality of life and health status of people living in uncertainty due to floods, pollution, and possible relocation. These people lived on the banks of the Ciliwung river in Jakarta, Indonesia. A demographically-matched control group was utilized in the study. We found that the Ciliwung respondents reported lower quality of life on the physical domain but experienced higher health status (EQ-VAS) than the matched controls. Further, Ciliwung respondents perceived themselves as less happy but more satisfied with their lives than the controls. Their differences with the Jakarta and general population samples were comparable. In addition, they perceived themselves as richer than people living in Jakarta and the general population, although their actual incomes were lower.

The lower level of physical health in the Ciliwung group was understandable given the unhealthy environment. However, the better health status and life satisfaction compared to the other three groups, illustrated by a higher EQ-VAS score, fewer anxiety/depression problems and higher life satisfaction scores, was surprising considering the living environment, which was highly polluted and often flooded, the lower income, and the smaller houses. This finding also appears contradictory to a number of investigations of health status in general populations, e.g. in Indonesia [42], Singapore [43], Sri Lanka [44], and South Australia [45], where groups with lower education levels and incomes usually reported lower health status. It should be noted that there is no information from these studies on whether or not their general population respondents were living in polluted river areas. Moreover, the Ciliwung group life satisfaction score was higher than the average Indonesian score in the World Happiness Report 2017 published by the United Nations [46]. Notwithstanding this, the people of the Ciliwung group reported themselves as being less happy compared to the three comparison groups, which was more in line with what we expected.

Several investigations reported that people living in poor and regularly flooded areas of Jakarta acknowledged that they faced many problems: e.g. poverty, lack of facilities, space limitations, and regular floods. All these problems put a severe burden on the inhabitants' health, emotional, security, and economic circumstances [13, 47, 48]. However, the present study found positive outcomes in terms of better self-reported health status and life satisfaction regardless of their poor living conditions. Several possible explanations can be identified and are also mentioned in the literature, often based on qualitative research: adaptation, relative comparisons, and social capital. First, the people living on the banks of the Ciliwung river had learned to cope with certain life conditions; they considered the yearly floods as a normal part of everyday life to which they had become accustomed. These people knew what to do during floods, how to protect their belongings, and how to recover after a flood.

As a close community, they developed physical (e.g. raising house levels) and non-physical (a communal work system to minimize the effect of a flood, the re-use of surviving material after a flood) responses to floods, in other words, they became resilient [12, 47-49]. Second, the Ciliwung respondents might have been comparing their life situations with those of their nearest neighbors, with similar low levels of income and life conditions, which might have prevented them from becoming envious, whilst the comparison group respondents might have had a broader range of incomes in their neighborhoods. Third, these people had lived there for generations amongst those they had known for life, often with similar ethnicity and religion. They knew their neighbors, which meant: they could depend upon them in times of distress, they had quick access to formal and informal job opportunities, and support in times of lifecycle events such as marriage, sickness, and death [12, 49]. Moreover, they developed community-based organizations that helped them to organize both formal and informal strategies to cope with the uncertainty of policies concerning eviction and yearly floods [50]. This 'social capital' might have raised their levels of life satisfaction. Some members of the community who succeeded in improving their economic situation and relocated to a middle-class neighborhood returned after a short time because they: (i) missed the strong social cohesion amongst their former neighbors, (ii) realized that the cost of living in their poor former community was cheaper than in their new neighborhood, and (iii) acknowledged the advantage of the strategic location of their previous neighborhood [49].

Several limitations of this study should be considered. First, the data was collected at a time of escalation of tension between the people of Kampung Pulo and the government of Jakarta, i.e. in the area across the river from Bukit Duri, concerning the possibility of relocation to some large blocks of flats provided by the Jakarta government. The plan was to relocate people from Bukit Duri who lived on the riverbank after the relocation of Kampung Pulo was finished. Remarkably, this did not lead to an increased prevalence of reported anxiety or depression compared with the other groups. Indeed, it is also difficult to judge if and how the possibility of relocation in the near future may have had an impact on the respondents' subjective well-being. In the event, a month after completion of the data collection, the inhabitants of Bukit Duri received a final letter from the government announcing the exact date of their relocation, which was realized several months later. Their former homes were demolished in order to improve the river's condition.

Second, respondent recruitment might raise questions about the objectivity/representativeness of the study sample since we asked non-governmental organization officers to introduce us to the community. This might have entailed some bias in terms of interdependent data collection. However, we matched the proportions of the Bukit Duri

population with respect to gender, age, and level of education with a control group. As can be seen in Table 1, we succeeded in constructing a representative sample.

Implications

Our results have some implications for future studies. During the writing of this manuscript, the relocation of the respondents living on the banks of the Ciliwung river in Bukit Duri to large blocks of flats was accomplished by the government of Jakarta. Considering the findings of lower levels of physical health and happiness of the Ciliwung respondents, relocation to a better living environment might be expected to have improved these aspects of their life. However, it would be interesting to follow up whether living in large blocks of flats, which from a distance might be considered as providing better living conditions, would indeed affect health status and life satisfaction in a positive way. Furthermore, it would be interesting to find out if and how these changes: geographic location, living conditions, and dwelling in flats instead of houses, would impact upon the dynamic inter-relationships within the community, their social capital, and community resilience. Future studies combining quantitative and qualitative methods could obtain a comprehensive picture of the effects of relocation on the people involved. A quantitative study could be undertaken by repeating the measurement of HRQOL in the current research population with respect to happiness, life satisfaction, and perceived economic circumstances in their new living environment and to compare these data with the previous data before their relocation. A qualitative study could be accomplished by utilizing in-depth interviews and observations of the respondents, focusing on their experiences of being relocated. Results from the present and future studies could be used by government, local and national, when developing policies related to people living in unhealthy areas, such as on the riverbank of a polluted river.

Conclusion

People living on a polluted and flooding riverbank in a large city showed a lower quality of life, particularly physical, and fewer feelings of happiness, than a comparable group that did not live there. The differences were small overall. Moreover, the people living on the riverbank perceived themselves to be better in terms of health status in general, life satisfaction, and financial situation. Hence the relocation to better housing and an improved environment

might be expected to improve their physical health and quality of life, but not necessarily their satisfaction with life and the perception of their financial circumstances.

Abbreviations

QoL: Quality of life

WHOQOL-BREF: World Health Organization Quality of life BREF

EQ-5D-5L: five-level EuroQol five-dimensional questionnaire

Declarations

Ethics approval and consent to participate

The study was approved by the Health Research Ethics Committee, YARSI University, Jakarta number 008/KEP-UY/BIA/V/2014.

Respondents who participated signed informed consent forms.

Consent for publication

Not applicable

Availability of data and material

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

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

JP, JH, JB, and SS were involved in the conceptualization and the design of the study. FP, TS, and AI carried out the data collection. FP and TS conducted the analyses. JP, JH, and JB were the main consultants in the data analyses. All the authors commented on the final analysis. FP

and TS drafted the first draft of the manuscript, and all the authors revised it. All the authors read and approved the final manuscript.

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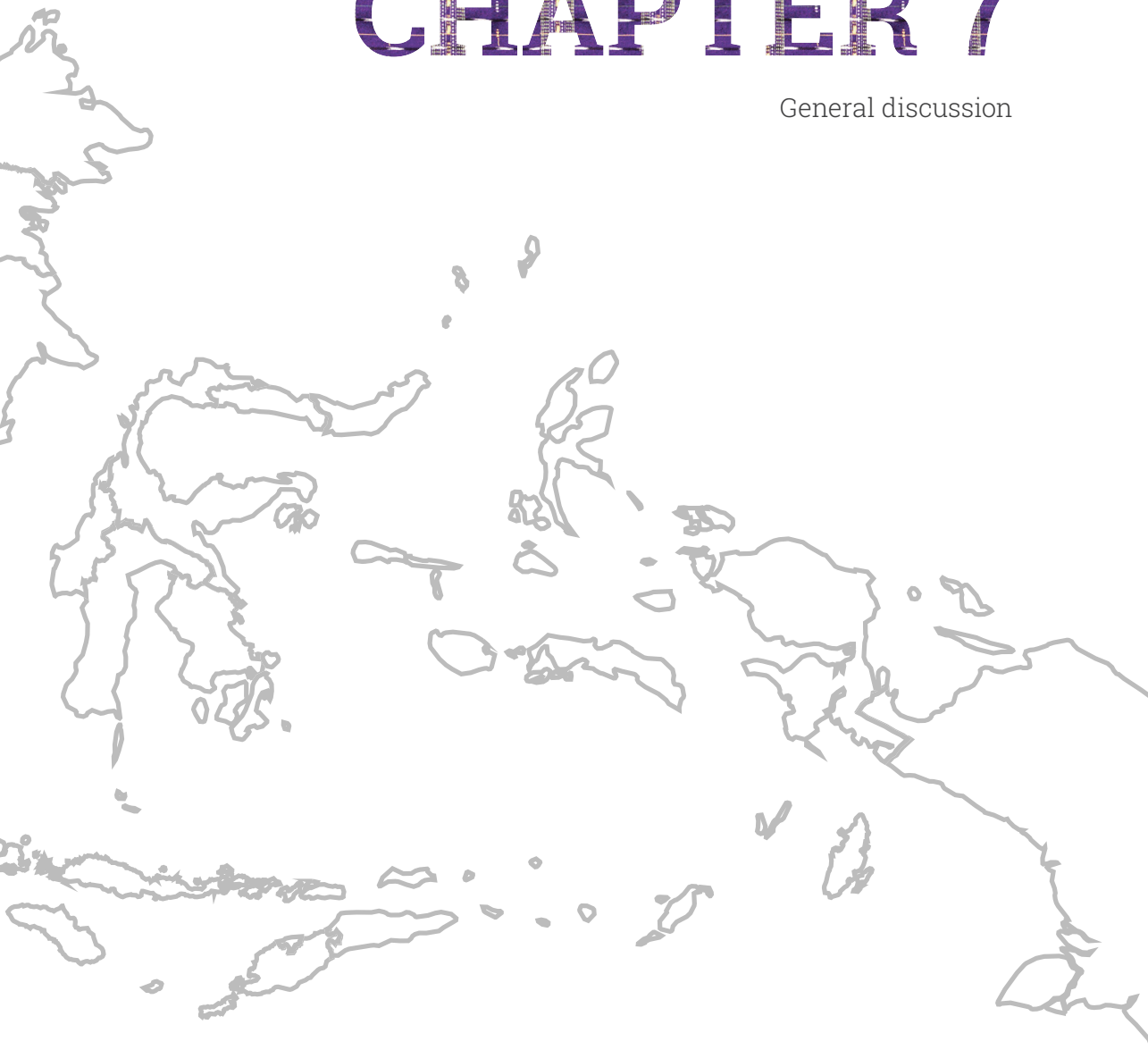
CHAPTER 7

General discussion



Quality of life improvement is one of the main objectives of the Indonesian government. Various programs have been implemented by different ministries, including the Ministry of Health (MoH). One major MoH program is the implementation of a national health insurance scheme for all the Indonesian population. The national health budget allocation would benefit from an evidence-based strategy and the application of economic evaluation. An evidence-based policy is helpful not only for health budget allocation, but also for various other intervention programs such as clean water supply. To measure the effects of these efforts in improving the quality of life of the Indonesian population, objective estimates of health-related quality of life (HRQOL) are needed. However, neither norm scores nor a value set obtained from the Indonesian people are available for internationally accepted HRQOL measures, such as WHOQOL-BREF and EQ-5D-5L.

This thesis sets out to provide valid and reliable EQ-5D-5L and WHOQOL-BREF instruments to be used in Indonesia, including population norms and a national value set for EQ-5D-5L. Data were collected from a representative sample of the Indonesian general population utilizing a standardized data collection procedure and a state-of-the-art quality control tool to ensure the best quality of data. The test-retest reliability of both questionnaires, and two methods of eliciting a population's health preferences: Composite Time-Trade Off (C-TTO) and Discrete Choice Experiments (DCE) were investigated. The use of the questionnaires, their norm scores, and the value set are illustrated in an investigation of the quality of life of people living on the bank of a highly polluted river in Jakarta.

This chapter provides a summary of the main findings, followed by limitations, implications and recommendations for those using HRQOL measures, and directions for future research.

Research Objectives

1. To obtain the values of different EQ-5D-5L health states according to the Indonesian general population in a standardized way.
2. To establish the test-retest reliability of the methods used to obtain the value set: C-TTO and DCE utilizing EQ-VT.
3. To establish the test-retest reliability of two frequently-used HRQOL measures: EQ-5D-5L and WHOQOL-BREF.
4. To obtain population norm scores for EQ-5D-5L and WHOQOL-BREF.
5. To apply these instruments in a specific population: people living on a polluted riverbank.

Objective 1. To obtain the values of different EQ-5D-5L health states according to the Indonesian general population in a standardized way. This thesis reports on the successful collection of the health preferences of the Indonesian general population using EQ-5D-5L and a standardized valuation protocol, namely EuroQol Valuation Technology (EQ-VT), accompanied by a quality control (QC) tool (1-3). Key to this successful outcome was the education, coaching, and retraining of the interviewers after feedback from the QC process. They should be well-trained and adaptive to any problems they might face in the field. (**Chapter 2**). For the interviewers themselves, recruiting suitable respondents was considered to be a major problem. They should thus be allowed to optimize the time of interview, to utilize personal networks, and to use different scripts to explain the goals of the study to obtain respondents' approval to participate. After establishing the values for different EQ-5D-5L health states in a representative sample of the Indonesian population, the C-TTO and DCE data were combined using a Hybrid Model approach to produce the Indonesian EQ-5D-5L value set (**Chapter 4**).

Objective 2. To establish the test-retest reliability of the methods used to obtain the value set: C-TTO and DCE utilizing EQ-VT. The paper on which **chapter 3** is based is the first report of the test-retest reliability of the C-TTO and DCE of the EQ-VT template, the standard protocol for health preference valuation using EQ-5D-5L which has resulted in, to date, seven national value sets (4-10). A strong point of the investigation was that the retest interview was conducted by the same interviewer as the first one. Remarkably, the DCE showed a less favorable test-retest result than C-TTO, given that DCE is usually considered an easier task to complete. Indeed, if the latter is the case, it is unclear why this was not expressed by better test-retest reliability. It might well be that DCE is not as simple as it looks.

Objective 3. To establish the test-retest reliability of two frequently-used HRQOL measures: EQ-5D-5L and WHOQOL-BREF. EQ-5D-5L and WHOQOL-BREF were completed twice by a sample representative of the general population. The descriptive part of EQ-5D-5L and the four domains of the WHOQOL-BREF had high test-retest reliability scores (**Chapter 5**). These results supported the use of the two HRQOL questionnaires in the Indonesian population.

Objective 4. To obtain population norm scores for EQ-5D-5L and WHOQOL-BREF. EQ-5D-5L and WHOQOL-BREF can be used by different parties, e.g. clinicians, researchers, public health experts, and health care workers, for different purposes. In all cases, they most likely need to compare their findings with the general population. Hence, a set of norm scores is warranted (**Chapter 5**). More than 1000 respondents, representative of the national population, completed the two questionnaires and norm scores were derived for the total sample, including the subgroups, with respect to residence, gender, level of education, age, religion, and ethnicity. Since this exercise, the WHOQOL-BREF instrument used in this study has been acknowledged

by the WHOQOL Group office as the official Indonesian version to be used with the Indonesian population.

Objective 5. To apply these instruments in a specific population: people living on a polluted riverbank. The HRQOL of people living on the banks of one of the main rivers in Jakarta, Indonesia (the Ciliwung) was measured using EQ-5D-5L and WHOQOL-BREF. In addition, happiness, life satisfaction, and financial position were investigated. The scores were then compared with those of several groups: viz. 1) a matched control group, 2) Jakarta inhabitants and 3) the Indonesian general population (**Chapter 6**). The results showed that the Ciliwung respondents reported lower physical quality of life and less personal happiness than the controls, but, interestingly, rated their health and life satisfaction better than the controls. The Ciliwung people also perceived themselves as being in a better financial position than the controls even though their incomes were lower. A possible explanation for these contradictory findings is that people had learned to cope with these life conditions in their close community and had become accustomed to their deprived surroundings.

Limitations

The investigation in this thesis has several limitations which require consideration when interpreting the results, of which the most important are mentioned below.

The majority of the respondents interviewed to obtain the population norms and value set were living on Java island. This might raise questions about the representativeness of the study sample since there are five major islands in Indonesia. The reason to focus the data collection on Java island was because it is the most populous island (57% of the population) and the main migration target from all over Indonesia. The diversity of its population in terms of ethnicity helps to fulfil all the categories in the quota sampling in a cost-effective way, leading to a similar distribution of the main demographic characteristics between our sample and that of the Indonesian population. However, it is still unknown whether the results obtained in Java from these migrants would have differed from the values should the interviews have been conducted on their original islands. The future research section below presents a study design which can help overcome this limitation.

The test-retest procedure respondents were those who had limited difficulty with the C-TTO and DCE tasks, resulting in a more highly educated retest population. As the retest population was of a higher educational level, it could be expected that the results would have a bias towards favourable test-retest variations compared with "real-life" valuations which include everyone regardless of their ability to comprehend the tasks.

Another limitation is that the interval time of the second test in the test-retest procedure overlapped with the WHOQOL-BREF's reference period of 4 weeks ("We ask that you think

about your life in the last four weeks.") This might have biased the test-retest result. However, this could be considered as an advantage because it implies that the respondent was, in part, looking back to the same health condition. Thus, concerning the overlap, variation between test-retest results cannot be explained by a change in the respondent's health.

With respect to the respondents who lived on the impoverished riverbank in Jakarta, the data was collected at a time of escalation of tension between the people there and the government of Jakarta concerning the possibility of relocation to large blocks of flats provided by the Jakarta government. The plan was to relocate the people from Bukit Duri who lived on the riverbank after the relocation of the people who lived across the river, namely Kampung Pulo, was completed. How the possibility of relocation in the near future may have had an impact on the respondents' responses to the HRQOL exercise is still unknown.

The contrasting results from the Ciliwung people, who reported lower physical quality of life and less personal happiness compared to the matched controls, but rated their health, life satisfaction, and economic condition better, should be explored thoroughly in a qualitative interview after data collection. Such a qualitative approach could provide clearer answers concerning the underlying reason for these contrasting results.

Implications for users of EQ-5D-5L and WHOQOL-BREF in Indonesia

This thesis has a number of implications for researchers, clinicians, and policymakers who wish to use EQ-5D-5L and WHOQOL-BREF in Indonesia. For three groups of users, it is important to obtain the latest version of the questionnaire.

To obtain the correct version of the questionnaire

The most up-to-date version of the Indonesian EQ-5D-5L will be provided by the EuroQol Office after permission has been acquired to use it. For permission to use EQ-5D-5L in any study, a registration form has to be completed on the EuroQol Group website: http://www.euroqol.org/. User guidelines can also be downloaded from the same website: these provide a thorough explanation of the questionnaire itself, the scoring procedure, organizing data, and presenting the results. The EuroQol Group is not a commercial entity, and for non-commercial users, registration and use of the questionnaire are free of charge.

The same applies to the WHOQOL-BREF: its use is free. The World Health Organization (WHO) Quality of Life Group is the copyright holder of the WHOQOL-BREF questionnaire, together with other WHOQOL instruments such as WHOQOL-HIV and WHOQOL-OLD. To obtain permission to use the WHOQOL-BREF questionnaire, a user-agreement form needs to be completed and submitted to the email address provided on the website: http://www.who.int. After permission is given, the latest version of the questionnaire is received.

Using the questionnaires when respondents have difficulties in reading

The two questionnaires are self-completed, meaning that most respondents should be able to complete the questionnaire by themselves with no difficulty. However, for respondents with difficulties, e.g., if they were illiterate, had low education levels, or had eyesight problems, it was recommended that interviewers help them by reading an item aloud and asking them to indicate the answer in the questionnaire (**Chapter 6**).

Scoring the questionnaires

EQ-5D has a non-standard scoring system, which is often not well understood. The responses provided by respondents for each dimension of EQ-5D-5L describe 'health states'. A 1-digit number expresses the level selected for that specific dimension. Combining a 5-digit number for the 5 dimensions describes the specific health state of the respondent. For example, state '11111' indicates 'no problems on any of the five dimensions', while state '12345' indicates 'no problems with mobility, slight problems with washing or dressing, moderate problems with doing usual activities, severe pain or discomfort and extreme anxiety or depression'. The EQ-5D-5L instrument has 3125 (5^5) unique health states. Each of these health states should be converted into a single index value that can be obtained from the Indonesian value set (**Chapter 4**). For the EQ-VAS, the number provided by the respondents can be used in any required calculation. Note that the single index value is a value from the 'general public' and thus represents a value from the 'societal perspective' for the health state of the patient. The EQ-VAS provides value from the patient themselves: the patient perspective.

WHOQOL-BREF uses the classical scoring system. Each domain of the WHOQOL-BREF: physical, psychological, social, and environmental, consists of several items. Each domain score obtained from averaging the respondents' responses to the items belongs to the same domain. For example, the social domain score is obtained from the average of responses to item numbers 20, 21, and 22. The responses to the first two items are the score for overall quality of life and general health, respectively (11).

Using the population norms

Chapter 5 provides the population norm scores for the two questionnaires. For EQ-5D-5L: EQ-VAS and index value, and for WHOQOL-BREF: the four domains, the overall quality of life and general health norm scores, were presented. These norm scores were stratified in respect of residence, gender, level of education, and age. Hence, this enables researchers to compare the HRQOL data they have measured with the same demographic characteristics as in the general population.

Clinicians

Using the HRQOL measures in clinical practices

In addition to researchers, clinicians might also wish to use EQ-5D-5L and the WHOQOL-BREF. Collecting the HRQOL data at multiple time points enables an individual patient's progress to be followed over time, to inform upon whether the care plan goals of the patient are being achieved, and at the aggregate level could inform clinicians or health service providers concerning their clinical interventions from the patients' point of view.

Analyzing the data

Given that EQ-5D-5L has only five dimensions and only one question per dimension, it could well be that the health problem of the patient is not captured within the five dimensions of the EQ-5D-5L. In those cases, EQ-VAS becomes useful as an alternative. For instance, it can pick up problems related to low energy. Ch**apter 5** gave several examples of such findings. Evidently, WHOQOL-BREF is also an alternative, and will probably prove more sensitive in the higher regions of quality of life. Indeed, since WHOQOL-BREF measures four broad domains of HRQOL - physical, psychological, social and environmental - using 26 questions, the information obtained is more comprehensive than from EQ-5D. This information, together with other measures, e.g. disease-specific HRQOL measures, can be used to make decisions with respect to the best care choices for patients. The downside of such an approach is that WHOQOL-BREF is a much longer questionnaire than EQ-5D-5L. The choice between EQ-5D and WHOQOL-BREF in routine use in clinical practice is thus a trade-off between logistics and sensitivity.

When comparing the measurement of the same patient over time, the 'Paretian Classification of Health Change' introduced by Devlin et al. (12) can be useful. In short, an EQ-5D-5L health state (e.g. post treatment or care) is considered to be 'better' than another health state (e.g. baseline) if it is better on at least one dimension and is no worse on any other dimension. An EQ-5D-5L health state is considered to be 'worse' than another health state if it is worse on at least one dimension and is no better on any other dimension. This approach delivers the following possible results: better, worse, stable (unchanged), mixed.

The use in clinical practice of quality of life questionnaires, such as WHOQOL-BREF, EQ-5D-5L, or indeed any other HRQOL instrument can improve the communication between patient and clinicians. This can be achieved by asking patients to complete such questionnaires before their consultations, preferably using an electronic device or online form that can instantly produce domain scores and indicate their relative position with respect to the general population scores displaying the same sociodemographic characteristics such as gender and age. The clinician can then use the results during the meeting with the patient to discuss issues that are less observable (e.g. social relationships) or are of a more diffuse

and long-term nature (e.g. energy and fatigue) than might usually be addressed in a regular consultation (13-17).

Policymakers

For the utilization of health care budgets, evidence-based policy making is highly critical. One way to achieve this is by health technology assessment (HTA) or economic evaluation (18). One type of study in economic evaluation is cost-utility analysis (CUA), which can be used to evaluate HRQOL outcomes and to compare costs and outcomes between different healthcare programs in terms of cost per quality-adjusted life years (QALYs). A QALY is a measure of the health state of a person or group in which the benefits, in terms of length of life, are adjusted to reflect the quality of life. One QALY is equal to one year of life in full health. It is calculated by estimating the years of life remaining for a patient following a particular treatment or intervention and weighting each year with a quality-of-life score (on a 0 to 1 scale). This quality of life score is obtained by using multi-attribute utility instruments (MAUs). The EQ-5D instrument is one of the most-used MAUs in the world, and several national HTA organizations, e.g., the United Kingdom, the Netherlands, and Thailand, have recommended EQ-5D as the preferred method for deriving utilities for CUA (19-21). Since this thesis now makes the national Indonesian value set of EQ-5D-5L available **(Chapter 4)**, HTA studies in Indonesia could utilize the national value set instead of those of other countries which might not match the characteristics and values of the Indonesian population.

Future research directions

Psychometric properties of EQ-5D-5L and WHOQOL-BREF in different patient groups

This thesis investigates the test-retest reliability of EQ-5D-5L and WHOQOL-BREF in a general healthy population. The results have shown that the two questionnaires have good reproducibility. Furthermore, the two seem to be able to differentiate between different socio-demographic subsamples, for instance between male and female, lower and higher education, and lower and higher income. This indicates their validity for use in Indonesia. However, published studies concerning the psychometric properties of the two questionnaires, e.g., validity, reliability, discriminatory power, and responsiveness, in patient groups in Indonesia, are rare. One example is a study that validated EQ-5D-5L in Indonesian human papillomavirus (HPV)-related cancer patients which found that EQ-5D-5L has good construct validity and test-retest reliability (22). Another study validated WHOQOL-BREF in Indonesian elderly samples and found that it showed excellent discriminant validity, construct validity and good internal consistency (23). A recent study by Setyowibowo et al., (24) found differences in HRQOL, measured by EQ-5D-5L and WHOQOL-BREF, between patients with breast cancer-

symptomology and controls, in the predicted direction. Further investigation concerning the psychometric properties of the two questionnaires in different patient populations, followed by the HRQOL of the respective patient groups, is needed in the near future.

Health preference comparison between areas of Indonesia: an east - west study

As stated in the limitations section, one main limitation of the thesis is that the majority of the respondents interviewed was living on Java Island. One way to investigate whether location is indeed an issue in valuing health in Indonesia would be to sample values for health states at different places/islands in the archipelago. It is planned to conduct an extended valuation study where a group of well-trained interviewers will be sent to different areas of Indonesia to collect data. Data collection will be carried out in the western part of Indonesia, e.g. Aceh or North Sumatera province, the central part, e.g. Borneo and Sulawesi island, and in the eastern part, e.g. West Papua or Papua province. Similar quota sampling will be implemented in respect of residence, gender, age, and level of education. Comparison of data from the different areas and the current value set would indicate any differences in health states valuation. In addition, any differences in HRQOL between these areas would also become apparent.

Follow-up HRQOL measurement of the Ciliwung respondents

Some of the respondents living on the banks of the Ciliwung river in Jakarta have been relocated to large blocks of flats provided by the Jakarta government. A follow-up measurement of their HRQOL, happiness, life satisfaction, and perceived economic circumstances, which then compared these scores with their previous data before relocation, would indicate any differences that most likely could be attributed to the relocation to better housing and an improved environment.

HRQOL measures for the Indonesian youth population

An EQ-5D version for the youth population aged 7-16, EQ-5D-Y, has been validated in several countries (25-28). However, an Indonesian version of EQ-5D-Y does not yet exist. By having a validated Indonesian version of EQ-5D-Y, the health status of younger patient and citizens groups in Indonesia could be estimated and compared in order to set priorities for health care. Furthermore, a validated EQ-5D-Y is needed for the many upcoming (cost-) effectiveness studies. Another internationally-accepted HRQOL questionnaire for youth population is the PedsQL, a generic multidimensional questionnaire that measures HRQOL on four domains: physical, emotional, social, and school (29). The validity, reliability, and responsiveness of EQ-5D-Y and PedsQL in Indonesian pediatric patient populations: e.g. cancer, asthma, and malnutrition, and in the healthy population, will be assessed.

For children or adolescents who are mentally or physically incapable of reporting their HRQOL, proxy versions of EQ-5D-Y and PedsQL are available. Validation of this proxy version will be undertaken by asking the caregiver (the proxy): parent(s) and/or physician, to rate the child's/ adolescent's health-related quality of life in their (the proxy's) opinion.

Conclusion

This thesis aimed to provide information on the psychometric properties, population norms, and value sets of two internationally-accepted HRQOL measures, EQ-5D-5L and WHOQOL-BREF, based on the Indonesian general population, and to apply the two measures in a population who lived on a highly polluted riverbank. The availability of the EQ-5D-5L and WHOQOL-BREF population norms and value sets enabled these two questionnaires to be used by Indonesian researchers in their investigations, by clinicians in their daily practice, and by policymakers in the decision-making process, to obtain HRQOL values for the population sample they measured and, where required, to compare their scores with the scores of the samples from the general population with similar demographic characteristics.

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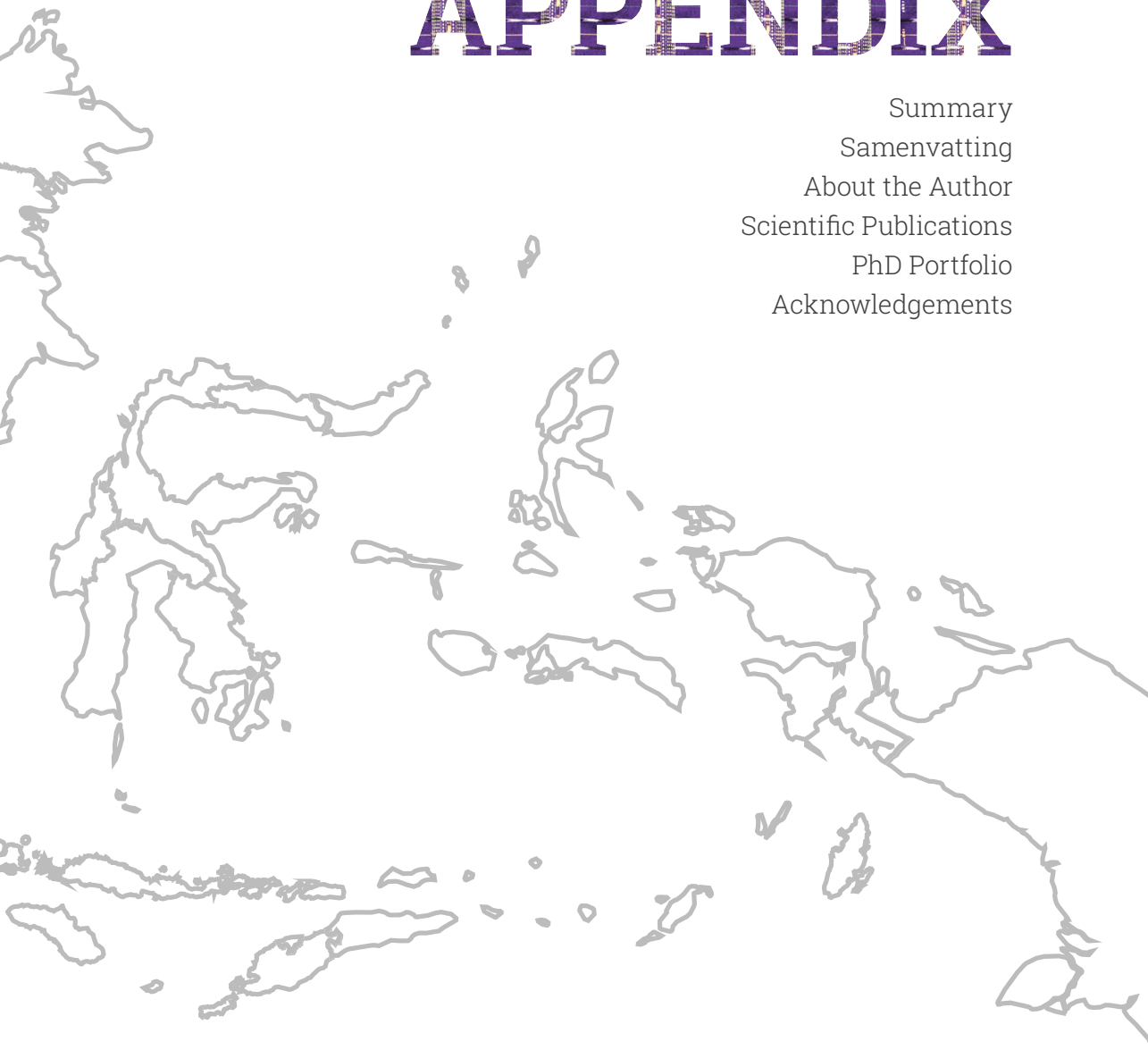
APPENDIX



Summary

Chapter 1 introduces the topic of health-related quality of life (HRQOL) measurement and its application in Indonesia. Although the economy of Indonesia continues to grow, the health budget cannot keep up with the increasing needs for better health care. Hence, help for rational priority setting in health policy is warranted, such as that provided by health technology assessment (HTA) and economic evaluations. HTA and economic evaluations require objective estimates of HRQOL. To date, several internationally-accepted HRQOL measures, such as WHOQOL-BREF and EQ-5D-5L, have begun to be used in several investigations in Indonesia. There is only limited information regarding their psychometric properties when used in Indonesia, whilst national Indonesian population norms and a value set are absent. To fulfill these needs, the aims of this thesis were to investigate the psychometric properties and provide norm scores and value sets for the WHOQOL-BREF and EQ-5D-5L in Indonesia, using a large, representative sample of the general population. The two questionnaires and their norm scores were also used to investigate the quality of life of people living on the bank of the polluted Ciliwung river in Jakarta.

The objectives of this thesis were:

1. To obtain the values (utilities) of different EQ-5D-5L health states according to the Indonesian general population using a standardized method: the EQ-VT.
2. To establish the test-retest reliability of the methods used to obtain the value set: C-TTO and DCE utilizing EQ-VT.
3. To establish the test-retest reliability of two frequently-used HRQOL measures, namely the EQ-5D-5L and WHOQOL-BREF.
4. To obtain population norm scores for EQ-5D-5L and WHOQOL-BREF.
5. To apply these instruments in a specific population: people living on a polluted riverbank.

Chapter 2 describes the problems encountered during the valuation data collection and how the utilization of a quality control (QC) report and subsequent retraining of interviewers improved the interviewers' performance and the quality of the data collected. The interviewers were asked about problems they encountered during data collection, difficulties faced by respondents in completing the interviews according to the interviewers, and the solutions implemented by the interviewers to solve those problems. In addition, the data collected from the first 98 respondents were analyzed based on the QC indicators, such as the number of TTO steps and time used to explain the example, explanation of the worse-than-dead element of the example, and minimal time to complete the interview. The quality of the data from the first 98 respondents was then compared to the quality of the data obtained from the

subsequent 168 respondents. From the thematic analysis of the interviewers' answers using NVivo, it was shown that they encountered problems in recruiting respondents, conducting the interviews, and overcoming technical difficulties. Solutions to the recruitment problems were: optimization of the time of the interview, the use of broader social networks, and the use of different scripts to explain the goals of the project to respondents. Solutions applied to help respondents during the interview were: developing the technical and personal skills of the interviewers and stimulating the respondents' thought processes. To solve the technical difficulties, the interviewers were stimulated to rely on themselves to find solutions or obtain help from other sources, such as the EuroQol office. Analysis of the first 98 respondents showed considerable problems in data quality according to several quality indicators. The retraining program and subsequent feedback based on the QC tool were then implemented. Data from the subsequent 168 interviews were judged as of good quality.

In **Chapter 3**, the test–retest reliability of the two techniques used in the EuroQol valuation protocol (EQ-VT), the Composite Time Trade-Off (C-TTO) and Discrete Choice Experiments (DCE), was investigated. 226 respondents completed the C-TTO and DCE twice, within a 10 day to 2 months interval, at each time by the same interviewer. The results showed that for C-TTO, 82 of 86 (95.3%) of health states and 155 of 226 (68.6%) of the respondents had no significant mean value differences between test and retest. For DCE, 72.5% of responses were identical. The DCE retest showed a different pattern concerning the relative importance of the dimensions, while the C-TTO remained the same. The Hybrid model, where C-TTO and DCE data were combined, showed no different pattern of relative importance of the 5 EQ dimensions between test and retest. It can be concluded that C-TTO as a value elicitation technique is stable over time, while for DCE the relative values of the 5 dimensions shift. When both data are combined, the resulting Hybrid model is stable.

For EQ-5D-5L to be suitable for use in economic evaluations or HTA, a societal-based value set is needed. **Chapter 4** provides the procedure to obtain such value set, including different modelling approaches. 1054 respondents aged 17 years and over were recruited from the Indonesian general population, using a multi-stage stratified quota method with respect to residence, gender, age, level of education, religion, and ethnicity. Two elicitation technique, C-TTO and DCE, were applied. To estimate the value set, a hybrid regression model combining C-TTO and DCE data was used. In the value set, the maximum value was 1.000 for the health state with no problems in all dimensions (health state '11111'), followed by the health state '11112' with value 0.921. The minimum value was -0.865 for the worst state ('55555'). Preference values were most affected by the mobility dimension and least by the pain/discomfort dimension.

Chapter 5 presents two results that support the use of EQ-5D-5L and WHOQOL-BREF in Indonesia: the test-retest reliability of the questionnaires and population norms. From the

same Indonesian general population sample that was interviewed for the EQ-5D-5L value set, the norm data for both instruments were calculated. For the test-retest evaluations, a sub-sample of 206 respondents completed both instruments twice. The results showed that EQ-5D-5L displays almost perfect agreement between test and retest (Gwet's AC: 0.85-0.99 and percentage agreement: 90-99%) regarding the five dimensions. However, the reproducibility of EQ-VAS and index scores were considered poor (ICC: 0.45 and 0.37 respectively). For WHOQOL-BREF, ICCs of the four domains were between 0.70 and 0.79, which indicated moderate to good reproducibility. For EQ-5D-5L norm scores, female and older respondents showed lower EQ-index scores, whilst rural, younger, and higher-educated respondents showed higher EQ-VAS scores. In most of the WHOQOL-BREF domains, being male, younger, higher-educated, and having a high-income was associated with the highest scores. These norm scores are useful for researchers and clinicians in Indonesia who can now compare their findings with those of the Indonesian general population.

Chapter 6 presents an investigation of HRQOL in a sample of people living on the banks of a polluted river in Jakarta, Indonesia, the Ciliwung. 204 respondents 17 years and older completed EQ-5D-5L, WHOQOL-BREF, the Happiness Scale, and the Life Satisfaction Index. A visual analogue scale question concerning the respondents' perception of their financial circumstances was added. Their scores were then compared to three samples: i) a socio-demographically matched control group, not living on the river bank (n=204); ii) inhabitants of Jakarta (n=305); and iii) the Indonesian general population (n=1041). The Ciliwung respondents reported lower physical quality of life on WHOQOL-BREF and less personal happiness than the matched controls. Interestingly, they rated their health, reported on EQ-5D-5L, and life satisfaction better than the matched controls. Similar results were obtained in comparison with the Jakarta inhabitants and the general population. In addition, the Ciliwung respondents also perceived themselves as being in better financial circumstances than the three comparison groups, even though their incomes were lower.

Chapter 7 consists of a general discussion of the main findings of the studies presented in the thesis. It discusses the findings with respect to psychometric properties, norm scores, and the valuation set for Indonesia. In addition, it reviews the application of the two questionnaires in a sample of people living on the bank of a polluted river in Jakarta. Based on the findings of this thesis, recommendations and implications for researchers, clinicians, and policymakers are outlined.

Recommendations for future research are: i) to obtain the psychometric properties of EQ-5D-5L and WHOQOL-BREF in different patient groups, ii) to obtain and compare health preferences between different areas of Indonesia, iii) to provide valid and reliable HRQOL measures, their norm scores, and value sets with respect to the Indonesian populations

of children and adolescents, and iv) to follow up the HRQOL measurement of the Ciliwung respondents after relocation.

Summarizing, EQ-5D-5L and WHOQOL-BREF are now validated and reliable HRQOL measures in Indonesia. The Indonesian national value set and population norms are now available for different stakeholders, such as researchers, clinicians, and policymakers.

Samenvatting

Hoofdstuk 1 introduceert de toepassing van gezondheid gerelateerde kwaliteit van leven metingen in Indonesië. Hoewel de economie van Indonesië een langdurige groei kent, kan het gezondheidszorgbudget geen gelijke tred houden met de toegenomen behoefte aan zorg. Daarom is een rationele prioritering in de gezondheidszorg noodzakelijk, zoals die gegeven wordt door *Health Technology Assessment* (HTA) en economische evaluaties. Voor HTA en economische evaluaties zijn objectieve gezondheid gerelateerde kwaliteit van leven metingen noodzakelijk. In Indonesië is een begin gemaakt met de toepassing van verschillende internationaal geaccepteerde kwaliteit van leven metingen, zoals de WHOQOL-BREF en de EQ-5D-5L. Helaas is er maar weinig informatie over de psychometrische eigenschappen van die vragenlijsten bij het gebruik in Indonesië, en ontbreken er Indonesische normwaarden en *value sets* (utiliteiten). Om deze reden is de doelstelling van dit proefschrift om de psychometrische eigenschappen van de genoemde vragenlijsten te onderzoeken en de norm scores en de *value set* vast te stellen, middels een groot representatief onderzoek onder de algemene populatie in Indonesië. De twee vragenlijsten en hun norm scores werden ook gebruikt om de kwaliteit van leven te meten van de bewoners aan de Ciliwung in Jakarta.

De doelstellingen van dit proefschrift waren:

1. Het verkrijgen van waarden (utiliteiten) voor de verschillende EQ-5D-5L gezondheidstoestanden van de algemene populatie in Indonesië middels een internationaal gestandaardiseerde onderzoeksmethode: de EQ-VT.
2. Het vaststellen van de test-hertest betrouwbaarheid van de methoden die gebruikt worden om de value sets te verkrijgen: C-TTO en DCE, beide vastgesteld met de EQ-VT.
3. Het vaststellen van de test-hertest betrouwbaarheid van twee veelgebruikte gezondheids-gerelateerde kwaliteit van leven vragenlijsten, namelijk de EQ-5D-5L en WHOQOL-BREF.
4. Het verkrijgen van normscores van de algemene populatie voor de EQ-5D-5L en WHOQOL-BREF.
5. Het toepassen van deze instrumenten in een specifieke populatie: de oeverbewoners van een vervuilde rivier.

Hoofdstuk 2 beschrijft de problemen tijdens het verzamelen van de Indonesische *value sets* voor de EQ-5D-5L. Daarnaast beschrijft hoofdstuk 2 hoe de toepassing van een kwaliteits-controle en de daaropvolgende extra training van de interviewers, de kwaliteit van de verzamelde data verbeterde. Aan de interviewers is gevraagd welke problemen ze tegenkwamen

tijdens de dataverzameling; welke problemen de respondenten volgens de interviewers hadden tijdens het interview, en de oplossingen die de interviewers daar vervolgens voor aandroegen. In aanvulling hierop werden de data van de eerste 98 respondenten geanalyseerd op basis van de kwaliteitscontrole indicatoren, zoals het aantal TTO stappen en de tijd gebruikt bij het voorbeeld, de uitleg over het lager-dan-dood-aspect van het voorbeeld, en de tijd die nodig was om het interview af te ronden. De kwaliteit van de data van de eerste 98 respondenten werd daarna vergeleken met de kwaliteit van de data verzameld door de daarop volgende 168 respondenten. Vanuit de thematische analyse van de antwoorden van de interviewers met behulp van 'NVivo', bleek dat de interviewers problemen hadden bij het rekruteren van respondenten, het afnemen van het interview, en het oplossen van IT-problemen. Oplossingen voor de rekruteringsproblemen waren: het optimaliseren van het tijdstip van het interview, het gebruik van grotere sociale netwerken, en het gebruik van verschillende *scripts* bij het uitleggen van het doel van het onderzoek aan de respondenten. Oplossingen die werden toegepast om respondenten te helpen tijdens het interview waren: het ontwikkelen van de technische en sociale vaardigheden van de interviewers en het stimuleren van het denkproces van de respondenten. Voor het oplossen van de technische (IT-)problemen werden de interviewers gestimuleerd om meer met eigen oplossing te komen, of hulp te vragen aan anderen, zoals aan het EuroQol Bureau. De data van de eerste 98 respondenten liet bij verschillen kwaliteitsindicatoren substantiële problemen zien wat betreft de kwaliteit van de data. Daaropvolgend werd een extra trainingsprogramma gegeven aan de interviewers, en de feedback gebaseerd op de kwaliteitscontrole indicatoren werd met hen gedeeld. De data die daarna werd verzameld (168 interviews), werd beoordeeld als van goede kwaliteit.

In **Hoofdstuk 3** is de test–hertest betrouwbaarheid van de twee technieken zoals gebruikt in het EuroQol waarderingsprotocol (EQ-VT) onderzocht namelijk: de Composite Time Trade-Off (C-TTO) en de Discrete Choice Experiments (DCE). 226 respondenten vulden de C-TTO en DCE twee keer in, met een interval variërend van 10 dagen tot 2 maanden en met steeds met dezelfde interviewer. De resultaten lieten zien dat bij C-TTO, 82 van de 86 (95.3%) gezondheidstoestanden en 155 van de 226 (68.6%) van de respondenten, geen significant verschil vertoonde in gemiddelde waarderingen tussen test en re-test. Bij DCE was 72.5% van de antwoorden identiek. The DCE re-test data liet een verschillend patroon wat betreft het relatieve belang van de 5 EQ dimensies, terwijl dat bij C-TTO gelijk bleef. Het hybride model, waarin C-TTO and DCE data gecombineerd werden, liet geen verschillen zien tussen test en re-test. Hier uit werd de conclusie getrokken dat C-TTO als waarderingsmethode stabiel is over de tijd, in vergelijking met DCE waarbij de relatieve waardes van de dimensies kunnen verschuiven. Wanneer beide data werden gecombineerd, was het resulterende hybride model stabiel.

Om de EQ-5D-5L toepasbaar te maken in economische evaluaties of HTA, is een maat-

schappelijke waardenset (*value set*) nodig. **Hoofdstuk 4** beschrijft de procedure om zo'n *value set* te verkrijgen, inclusief verschillende manieren van modelleren. 1054 respondenten in de leeftijd van 17 jaar en ouder werden gerekruteerd vanuit de algemene Indonesische bevolking, op de basis van een quota gestratificeerde selectie met aandacht voor woonplaats, geslacht, leeftijd, onderwijsniveau, religie en etniciteit. Er werden waarderingsmethoden toegepast: en wel C-TTO and DCE. Om de *value set* te schatten, werd een hybride regressiemodel gebruikt, waarin C-TTO en DCE data werden gecombineerd. De meeste zelfgerapporteerde gezondheidsproblemen werden waargenomen in de dimensie 'pijn en andere klachten' (39.7%) en het minste aantal in de dimensie zelfzorg (1.9%). Binnen de *value set* was de maximale waarde 1.000 voor de gezondheidstoestand zonder problemen in elke dimensie (gezondheidstoestand '11111'), gevolgd door gezondheidstoestand '11112' met de waarde 0.921. De minimale waarde was -0.865 voor de slechtste toestand ('55555'). De waarden werden het meeste beïnvloed door de dimensie "mobiliteit" en het minst door de dimensie "pijn/ongemak".

Hoofdstuk 5 presenteert twee resultaten, die het gebruik van de EQ-5D-5L en WHOQOL-BREF in Indonesië ondersteunen: de test-hertest betrouwbaarheid van de vragenlijsten en de populatienormen. Met behulp van dezelfde selectie uit de Indonesische algemene bevolking die was geïnterviewd voor de EQ-5D-5L *value set*, werden de normdata voor beide vragenlijsten berekend. Voor de test-hertest evaluaties, vulde een subgroep van 206 respondenten beide vragenlijsten twee keer in. De resultaten lieten zien dat de EQ-5D-5L een bijna perfecte overeenkomst liet zien tussen test en hertest betreffende de vijf dimensies: Gwet's AC = 0.85-0.99 en een 90-99% overeenstemming. Daartegenover werden de reproduceerbaarheid van EQ-VAS en de index scores beschouwd als zwak (ICC: respectievelijk 0.45 en 0.37). Voor de WHOQOL-BREF, bedroegen de ICCs van de vier domeinen tussen 0.70 en 0.79, wat wijst op gemiddelde tot goede reproduceerbaarheid. Bij de EQ-5D-5L lieten vrouwelijke en oudere repsondenten lagere EQ-index scores zien, terwijl jongere, hogeropgeleide respondenten en respondenten op het platteland hogere EQ-VAS scores rapporteerden. Voor de meeste domeinen binnen WHOQOL-BREF gold dat man zijn, jong zijn, hoger opgeleid en het hebben van een hoog inkomen geassocieerd is met de hoogste scores. Deze normscores kunnen nuttig zijn voor onderzoekers en clinici in Indonesië die nu hun bevindingen kunnen vergelijken met die van de Indonesische algemene bevolking.

Hoofdstuk 6 presenteert een onderzoek naar gezondheids-gerelateerde kwaliteit van leven van oeverbewoners van een vervuilde rivier in Jakarta; de Ciliwung. 204 respondenten van 17 jaar en ouder completeerden de EQ-5D-5L, de WHOQOL-BREF, de Happiness Scale, en de Life Satisfaction Index. Daarna werd een visuele analogie schaal voorgelegd betreffende de perceptie over de financiële omstandigheden. De responsen werden vergeleken met drie controlegroepen: i) een sociaal-demografisch gematchte controlegroep van inwoners die niet op

de oevers van de rivier woonden (n=204); ii) inwoners van Jakarta (n=305); en iii) de algemene Indonesische bevolking. De oeverbewoners van de Ciliwung rapporteerden een lagere fysieke kwaliteit van leven op de WHOQOL-BREF en minder persoonlijk geluk dan de gematchte controlegroep. Opvallend was dat de oeverbewoners een betere gezondheid (EQ-5D-5L) en meer tevredenheid met het leven rapporteerden dan hun gematchte controlegroepen. Soortgelijke resultaten werden verkregen in vergelijking met de inwoners van Jakarta en de algemene bevolking. Daarnaast gaven kenden de oeverbewoners van de Ciliwung rivier zichzelf betere financiële omstandigheden toe dan de drie controlegroepen, ook al was hun inkomen lager.

Hoofdstuk 7 bevat een algemene discussie van de belangrijkste vindingen van de studies die in dit proefschrift gepresenteerd zijn. Het bespreekt de bevindingen over de psychometrische eigenschappen, de normscores, en de *value set* voor Indonesië. Verder beschouwt het de toepassing van twee vragenlijsten bij de oeverbewoners van een vervuilde rivier in Jakarta. Op basis van deze bevindingen worden aanbevelingen en implicaties voor onderzoekers, clinici en beleidsmakers geschetst.

Aanbevelingen voor toekomstig onderzoek zijn: i) het beschrijven van de psychometrische eigenschappen van EQ-5D-5L en WHOQOL-BREF in verschillende patiëntengroepen, ii) het verkrijgen en vergelijken van *value sets* van verschillende gebieden van Indonesië, iii) het beschikbaar maken van valide en betrouwbare gezondheidsgerelateerde kwaliteit van leven meetmethodes, hun normscores en *value sets* voor de Inonesische bevolkingsgroepen voor zowel kinderen en adolescenten en iv) het vervolgen van het kwaliteit van leven onderzoek bij de oeverbewoners van de Ciliwung nadat zij verhuisd zijn.

Samenvattend kan gesteld worden dat de EQ-5D-5L en de WHOQOL-BREF inmiddels gevalideerde en betrouwbare gezondheidsgerelateerde kwaliteit van leven meetmethodes zijn in Indonesië. De Indonesische nationale *value set* en bevolkingsnormen zijn vanaf heden beschikbaar voor de verschillende belanghebbenden, zoals onderzoekers, clinici en beleidsmakers.

About the Author

Fredrick Dermawan Purba was born on 26th February 1981 in Medan, North Sumatra, Indonesia. After finishing high school in Medan in 1999, he began studying psychology at Padjadjaran University in Jatinangor. He finished his Bachelor's degree in 2004 and then spent a year working on different projects for a variety of psychological service bureaus in Bandung. In 2005, he commenced his education in the Master of Psychology program, specialization adult clinical psychology, at Padjadjaran University while at the same time joining the teaching staff on the faculty. In 2009 he finished the Master's program and officially become a therapist, having obtained a clinical licence. He continued working on the teaching staff in the Department of Developmental Psychology and conducted psychological counselling in the faculty office. In 2014, Professor Jan Passchier arranged a PhD position at Erasmus MC involving a number of HRQOL projects in Indonesia. During his PhD study, he followed the Master in Health Sciences specialization in Public Health, at the Netherlands Institute of Health Science (NIHES), Erasmus MC, and completed this second Master's degree in 2016. Under the supervision of Professor Jan van Busschbach, he became involved in activities related to the EuroQol Group. In addition to the validation and valuation of EQ-5D-5L in Indonesia, he organized several congresses in Indonesia about this subject, presented papers and posters at around ten international conferences, and collaborated internationally with other researchers to conduct and publish EQ-5D related studies, notably helping the EQ-5D valuation study in the Philippines as trainer and author. In 2015, together with Jan Passchier and Jan van Busschbach, he inaugurated a research group named 'Quality of Life Measurement and its Application in the Republic of Indonesia (QOLMARI)' and serves as its secretary. To widen his professional network, he became a member of the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) and the International Society for Quality of Life Research (ISOQOL).

Scientific Publications

In this thesis

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Arifin, B., Idrus, L.R., van Asselt, A.I.D., **Purba, F. D.**, Perwitasari, D.A., Atthobari, J., Cao, Q., Krabbe, P.F.M., Postma, M.J. (2018). Association between patient characteristics and EQ-5D-based utility measures in Indonesian type 2 diabetes mellitus outpatients (under review)

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PhD Portfolio

PhD student name	Fredrick Dermawan Purba
Place of PhD training	Erasmus University Medical Centre. Department of Psychiatry, section Medical Psychology and Psychotherapy Additional education was done at the Netherlands Institute of Health Science (NIHES) and resulted in an additional Master of Science in Health Sciences, specialization in Public Health.
PhD period	2014-2018
Promotors	Prof. Jan J.V. Busschbach, Prof Jan Passchier, Prof Sawitri Sadarjoen
Co-promotors	Dr Joke Hunfeld, Dr Aulia Iskandarsyah

1. PhD training	**Year**	**Workload (Hours/ECTS)**
General courses		
- Principles of Research in Medicine and Epidemiology	2014	0.7
- Introduction to Public Health	2014	0.7
- Methods of Public Health Research	2014	0.7
- Methods of Health Services Research	2014	0.7
- Primary and Secondary Prevention Research	2014	0.7
- Social Epidemiology	2014	0.7
- English Language	2014	0.7
- Study Design	2014	4.3
- Biostatistical Methods I: Basic Principles	2014	5.7
- Biostatistical Methods II: Classical Regression Models	2014	4.3
- Public Health Research Methods	2014	5.7
- Courses for Quantitative Researcher	2014	1.4
- International Comparison of Health Care Systems	2014	1.4
- Quality of Life Measurement	2016	0.9
- Patient Preferences in Delivery of Health Care	2016	5.0
- Repeated Measurements in Clinical Studies	2016	1.4
- Causal Inference	2016	0.7
- Joint Model for Longitudinal and Survival Data	2016	0.7
- Health Services: Research and Practices	2016	0.9
- From Problem to Solution in Public Health	2016	1.1
- Public Health in Low and Middle-Income Countries	2016	3.0
- Logistic Regression	2016	1.4

1. PhD training (continued)	Year	Workload (Hours/ECTS)
- Research Integrity	2016	0.3
- Site Visit to the Municipal Health Service Rotterdam	2016	0.3
- Research Proposal	2016	2.5
- Integration module	2016	0.3
- Research Period	2016	28.7
- Oral research Presentation	2016	1.4
Seminars and workshops		
- PubMed and EndNote workshops	2014	
International Presentations		
- 32nd EuroQol Plenary Meeting in Krakow, Poland, EuroQol: paper presentation	2015	
- EQ-5D Symposium for Policy Makers and HTA Practitioners in Asia (Singapore): oral presentation	2016	
- 7th ISPOR Asia-Pacific Conference: poster presentation	2016	
- National Symposium: A Big Step Forwards for Health Policy in Indonesia: initiator and oral presentation	2016	
- 33rd EuroQol Plenary Meeting: poster presentation	2016	
- 9th The lowlands Health Economists' Study Group (lola-HESG) conference: paper presentation	2017	
- 15th European Congress of Psychology: oral presentation	2017	
- 34th EuroQol Plenary Meeting, EuroQol: poster presentation	2017	
- 24th Annual Conference of International Society for Quality of Life Research (ISOQOL): poster presentation	2017	
Reviewing Papers		
- Review 6 manuscripts for Health and Quality of Life Outcomes journal	2016-2018	
- Review 3 manuscripts for Quality of Life Research journal	2016-2018	
- Review 2 manuscripts for Value in Health journal	2018	
- Review 1 manuscript for the European Journal of Health Economics	2017	

1. PhD training (continued)	Year
- Review 3 manuscripts for Plos ONE journal	2017-2018
- Review 1 manuscript for Archives of Gerontology and Geriatrics journal	2017

2. Education	
Training the principal investigators and interviewers of the Philippine EQ-5D-5L valuation study team	2017

3. **Professional organizations**	
- Founding member and secretary of the Quality of Life Measurement and its Application in the Republic of Indonesia (QOLMARI)	2015-now
- International Society for Pharmacoeconomics and Outcomes Research (ISPOR)	2016-now
- International Society for Quality of Life Research (ISOQOL)	2017-now

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