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 are used to measure HRQOL across all kinds of respondents. The latter are 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 in 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 at 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 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 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%).

**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).

**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 Tables 3–7. 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
Table 1. General socio-demographics of the study respondents*

| 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                      | -               |

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
This data is also presented, with some slight differences, in Purba et al [26]

https://doi.org/10.1371/journal.pone.0197098.t001
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.

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

| EQ-5D-5L       |            |            |            |            |            |
|----------------|------------|------------|------------|------------|------------|
| Dimension      | Agreement coefficient<sup>a</sup> | Percentage Agreement | ICC Non<sup>b</sup> | ICC Trans<sup>c</sup> | CCC<sup>d</sup> |
| 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<sup>a</sup> | 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          |            |            | Social    | 0.70 | 0.70 |
| Environmental   |            |            | Environmental | 0.72 | 0.72 |

<sup>a</sup> Gwet’s Agreement Coefficient  
<sup>b</sup> Data is not transformed  
<sup>c</sup> Data is transformed: log, squared, and cubic and the results presented following the order of transformation  
<sup>d</sup> Lin’s concordance correlation coefficients

https://doi.org/10.1371/journal.pone.0197098.t002

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 indicates 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).

https://doi.org/10.1371/journal.pone.0197098.g001
Table 8 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.
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, education level, religion, ethnicity and monthly income 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 9. 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 9 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 WHO-QOL-BREF dimensions score of the subgroups stratified by residence, gender, age, and education level of this table can be found in the S2 Table.

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

Table 7. EQ-5D-5L self-reported health profiles in anxiety/depression dimension in the total population sample and sub-samples by residence, gender, age, education level, religion, ethnicity and monthly income (%).

| Socio-demographic | ANXIETY/DEPRESSION |
|-------------------|--------------------|
|                   | 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

https://doi.org/10.1371/journal.pone.0197098.t007
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%.

https://doi.org/10.1371/journal.pone.0197098.g002

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

https://doi.org/10.1371/journal.pone.0197098.g003
Another limitation is that the interval time of the second test is intersect with the WHO-QOL-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.

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.

### Table 8. Mean scores and SD of EQ-5D-3L 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        |
| 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                | 80.30  | 12.19       | 0.91   | 0.11        |

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

https://doi.org/10.1371/journal.pone.0197098.t008
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 estimation of quality of life in the general population, one might consider to use 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 general population, despite of 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. (DOCX)
S2 Table. Population norm of the WHQOL-BREF domains stratified by subgroups. (DOCX)

Acknowledgments
The Dutch and Indonesian non-profit organization ‘Van Deventer-Maas Stichting (VDMS)’ and the ‘Indonesia Bhadra Utama (IBU) Foundation’ respectively, helped us with the data collection. Any errors or omissions are the responsibility of the authors only.

Author Contributions
Conceptualization: Joke A. M. Hunfeld, Jan Passchier, Jan J. V. Busschbach.
Formal analysis: Fredrick Dermawan Purba.
Funding acquisition: Joke A. M. Hunfeld, Jan Passchier, Jan J. V. Busschbach.
Investigation: Fredrick Dermawan Purba, Titi Sahidah Fitriana.
Methodology: Joke A. M. Hunfeld, Jan Passchier, Jan J. V. Busschbach.
Project administration: Fredrick Dermawan Purba, Aulia Iskandarsyah, Titi Sahidah Fitriana.
Resources: Fredrick Dermawan Purba, Aulia Iskandarsyah, Titi Sahidah Fitriana, Sawitri S. Sadarjoen, Jan Passchier, Jan J. V. Busschbach.
Supervision: Joke A. M. Hunfeld, Jan Passchier, Jan J. V. Busschbach.
Writing – original draft: Fredrick Dermawan Purba.
Writing – review & editing: Fredrick Dermawan Purba, Joke A. M. Hunfeld, Aulia Iskandarsyah, Titi Sahidah Fitriana, Sawitri S. Sadarjoen, Jan Passchier, Jan J. V. Busschbach.

References
1. Drummond M, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW. Methods for the Economic Evaluation of Health Care Programmes (Fourth edition). Oxford: Oxford University Press; 2015.
2. Patrick DL, Deyo RA. Generic and disease-specific measures in assessing health status and quality of life. Med Care. 1989; 27(3 Suppl):S217–32. PMID: 2646490.
3. Herdman M, Gudex C, Lloyd A, Janssen M, Kind P, Parkin D, et al. Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). Qual Life Res. 2011; 20(10):1727–36. Epub 2011/04/12. https://doi.org/10.1007/s11136-011-9903-x PMID: 21479777; PubMed Central PMCID: PMCPMC3220807.
4. Brooks R. EuroQol: the current state of play. Health Policy. 1996; 37(1):53–72. PMID: 10158943.
5. The WHOQOL Group. Development of the World Health Organization WHOQOL-BREF quality of life assessment. Psychol Med. 1998; 28(3):551–8. PMID: 9626712.
6. Skevington SM, Lotfy M, O’Connell KA. The World Health Organization’s WHOQOL-BREF quality of life assessment: psychometric properties and results of the international field trial. A report from the WHOQOL group. Qual Life Res. 2004; 13(2):299–310. Epub 2004/04/17. https://doi.org/10.1023/B:QURE.0000018486.19160.00 PMID: 15085922.
7. de Willigge Gv, Wiersma D, Nienhuis FJ, Jennen JA. Changes in quality of life in chronic psychiatric patients: A comparison between EuroQol (EQ-5D) and WHOQOL. Qual Life Res. 2005; 14(2):441–51. https://doi.org/10.1007/s11136-004-0689-y PMID: 15892433.
8. Hanestad BR, Rustoen T, Knudsen O Jr., Lerdal A, Wahl AK. Psychometric properties of the WHO-QOL-BREF questionnaire for the Norwegian general population. J Nurs Meas. 2004; 12(2):147–59. PMID: 16092712.
9. Kunz S. Psychometric properties of the EQ-5D in a study of people with mild to moderate dementia. Qual Life Res. 2010; 19(3):425–34. https://doi.org/10.1007/s11136-010-9600-1 PMID: 20500008.
10. Tran BX, Ohinmaa A, Nguyen LT. Quality of life profile and psychometric properties of the EQ-5D-5L in HIV/AIDS patients. Health Qual Life Outcomes. 2012; 10:132. https://doi.org/10.1186/1477-7525-10-132 PMID: 23116130.
11. Hunger M, Sabariego C, Stollenwerk B, Ciez A, Leidl R. Validity, reliability and responsiveness of the EQ-5D in German stroke patients undergoing rehabilitation. Qual Life Res. 2012; 21(7):1205–16. https://doi.org/10.1007/s11136-012-0331-3 PMID: 22864570.
12. Kim TH, Jo MW, Lee SI, Kim SH, Chung SM. Psychometric properties of the EQ-5D-5L in the general population of South Korea. Qual Life Res. 2013; 22(8):2245–53. https://doi.org/10.1007/s11136-012-0331-3 PMID: 23224560.
13. Janssen MF, Pickard AS, Golicki D, Gudex C, Niewada M, Scalone L, et al. Measurement properties of the EQ-5D-5L compared to the EQ-5D-3L across eight patient groups: a multi-country study. Qual Life Res. 2013; 22(7):1717–27. https://doi.org/10.1007/s11136-012-0322-4 PMID: 23184421.
14. Setiawan D, Dusafi tri A, Galistiani GF, van Asselt AD, Postma MJ. Health-Related Quality of Life of Patients with HPV-Related Cancers in Indonesia. Value in Health Regional Issues. 2018; 15:63–9. https://doi.org/10.1016/j.vhri.2017.07.016 PMID: 29474181.
15. Salim OC, Sudharma NI, Rina K, Kusumaratna RK, Hidayat A. Validity and reliability of World Health Organization Quality of Life-BREF to assess the quality of life in the elderly (in Bahasa Indonesia). Univ Med. 2007; 26:27–38.
16. Sitaresmi MN, Moster S, Gundy CM, Sutaryo Veerman AJ. Health-related quality of life assessment in Indonesian childhood acute lymphoblastic leukemia. Health Qual Life Outcomes. 2008; 6:96. https://doi.org/10.1186/1477-7525-6-96 PMID: 18992169.
20. Handajani YS, Djoerban Z, Irawan H. Quality of life people living with HIV/AIDS: outpatient in Kramat 128 Hospital Jakarta. Acta Med Indones. 2012; 44(4):310–6. PMID: 23314972.

21. Iskandar S, van Crevel R, Hidayat T, Siregar IM, Achmad TH, van der Ven AJ, et al. Severity of psychiatric and physical problems is associated with lower quality of life in methadone patients in Indonesia. Am J Addict. 2013; 22(5):425–31. https://doi.org/10.1111/j.1521-0391.2013.00334.x PMID: 23952886.

22. Endarti D, Riewpaiboon A, Thavorncharoensap M, Praditsittikorn N, Hutubessy R, Kristina SA. Evaluation of Health-Related Quality of Life among Patients with Cervical Cancer in Indonesia. Asian Pac J Cancer Prev. 2015; 16(8):3345–50. PMID: 25921142.

23. Shafie AA, Gupta V, Baabbad R, Hammerbye E, Home P. An analysis of the short- and long-term cost-effectiveness of starting biphasic insulin aspart 30 in insulin-naive people with poorly controlled type 2 diabetes. Diabetes Res Clin Pract. 2014; 106(2):319–27. https://doi.org/10.1016/j.diabres.2014.08.024 PMID: 25305133.

24. Home P, Baik SH, Galvez GG, Malek R, Nikolajsen A. An analysis of the cost-effectiveness of starting insulin detemir in insulin-naive people with type 2 diabetes. J Med Econ. 2015; 18(3):230–40. https://doi.org/10.3111/13696998.2014.985788 PMID: 25407031.

25. Gupta V, Baabbad R, Hammerbye E, Nikolajsen A, Shafie AA. An analysis of the cost-effectiveness of switching from biphasic human insulin 30, insulin glargine, or neutral protamine Hagedorn to biphasic insulin aspart 30 in people with type 2 diabetes. J Med Econ. 2015; 18(4):263–72. https://doi.org/10.3111/13696998.2014.991791 PMID: 25426701.

26. Purba FD, Hunfeld JAM, Iskandarsyah A, Fitriana TS, Sadarjoen SS, Ramos-Goni JM, et al. The Indonesian EQ-5D-5L Value Set. Pharmacoeconomics. 2017; 35(11):1153–65. https://doi.org/10.1007/s40273-017-0538-9 PMID: 28695543.

27. Badan Pusat Statistik. Statistik 70 Tahun Indonesia Merdeka Jakarta Badan Pusat Statistik; 2015 [November 3, 2015]. Available from: http://bps.go.id/index.php/publikasi/1053.

28. Rabin R, Gudex C, Selai C, Herdman M. From translation to version management: a history and review of methods for the cultural adaptation of the EuroQol five-dimensional questionnaire. Value Health. 2014; 17(1):70–6. https://doi.org/10.1016/j.jval.2013.10.006 PMID: 24438719.

29. The WHOQOL Group. WHOQOL-BREF Introduction, Administration, Scoring And Generic Version of The Assessment1996 May 9, 2014. Available from: http://www.who.int/mental_health/media/en/76.pdf.

30. Gwet KL. Computing inter-rater reliability and its variance in the presence of high agreement. Br J Math Stat Psychol. 2008; 61(Pt 1):29–48. https://doi.org/10.1348/000711006X126600 PMID: 18482474.

31. Wongpakaran N, Wongpakaran T, Wedding D, Gwet KL. A comparison of Cohen’s Kappa and Gwet’s AC1 when calculating inter-rater reliability coefficients: a study conducted with personality disorder samples. BMC Med Res Methodol. 2013; 13(1):61. https://doi.org/10.1186/1471-2288-13-61 PMID: 23627889.

32. Koo TK, Li MY. A Guideline of Selecting and Reporting Intraclass Correlation Coefficients for Reliability Research. J Chiropr Med. 2016; 15(2):155–63. https://doi.org/10.1016/j.jcm.2016.02.012 PMID: 27330520.

33. McCaffrey N, Kaambwa B, Currow DC, Ratcliffe J. Health-related quality of life measured using the EQ-5D-5L: South Australian population norms. Health Qual Life Outcomes. 2016; 14(1):133. https://doi.org/10.1186/s12955-016-0537-0 PMID: 27644755.

34. Shiroiwa T, Fukuda T, Ikeda S, Igarashi A, Noto S, Saito S, et al. Japanese population norms for preference-based measures: EQ-5D-3L, EQ-5D-5L, and SF-6D. Qual Life Res. 2016; 25(3):707–19. https://doi.org/10.1007/s11136-015-1108-2 PMID: 26303761.

35. Golicki D, Niewada M. EQ-5D-5L Polish population norms. Arch Med Sci. 2015; 13(1):191–200. https://doi.org/10.5114/aoms.2015.52126 PMID: 28144271.

36. Koh D, Abdullah AM, Wang P, Lin N, Luo N. Validation of Brunei’s Malay EQ-5D Questionnaire in Patients with Type 2 Diabetes. PLoS One. 2016; 11(11):e0165555. https://doi.org/10.1371/journal.pone.0165555 PMID: 27835652.

37. Pattanaphe saj J, Thavorncharoensap M. Measurement properties of the EQ-5D-5L compared to EQ-5D-3L in the Thai diabetes patients. Health Qual Life Outcomes. 2015; 13:14. https://doi.org/10.1186/s12955-014-0203-3 PMID: 2590017.

38. Sakthong P, Sonsa-Ardjit N, Sukarnjanaset P, Munpan W. Psychometric properties of the EQ-5D-5L in Thai patients with chronic diseases. Qual Life Res. 2015. https://doi.org/10.1007/s11136-015-1038-z PMID: 26048348.

39. Jia YX, Cui FQ, Li L, Zhang DL, Zhang GM, Wang FZ, et al. Comparison between the EQ-5D-5L and the EQ-5D-3L in patients with hepatitis B. Qual Life Res. 2014; 23(8):2355–63. https://doi.org/10.1007/s11136-014-0670-3 PMID: 24627090.
40. Garcia-Gordillo MA, Adsuar JC, Olivares PR. Normative values of EQ-5D-5L: in a Spanish representative population sample from Spanish Health Survey, 2011. Qual Life Res. 2016; 25(5):1313–21. https://doi.org/10.1007/s11136-015-1164-7 PMID: 26482825.

41. Hinz A, Kohlmann T, Stobel-Richter Y, Zenger M, Braehler E. The quality of life questionnaire EQ-5D-5L: psychometric properties and normative values for the general German population. Qual Life Res. 2014; 23(2):443–7. Epub 2013/08/08. https://doi.org/10.1007/s11136-013-0498-2 PMID: 23921597.

42. Scitovsky T. The joyless economy: An inquiry into human satisfaction and consumer dissatisfaction. 1976.

43. Noerholm V, Groenvold M, Watt T, Bjorner JB, Rasmussen NA, Bech P. Quality of life in the Danish general population—normative data and validity of WHOQOL-BREF using Rasch and item response theory models. Qual Life Res. 2004; 13(2):531–40. https://doi.org/10.1023/B:QURE.0000018485.05372.d6 PMID: 15085925.

44. Cruz LN, Polanczyk CA, Camey SA, Hoffmann JF, Fleck MP. Quality of life in Brazil: normative values for the WHOQOL-bref in a southern general population sample. Qual Life Res. 2011; 20(7):1123–9. https://doi.org/10.1007/s11136-011-9845-3 PMID: 21279448.

45. Hawthorne G, Herman H, Murphy B. Interpreting the WHOQOL-Bréf: Preliminary Population Norms and Effect Sizes. Social Indicators Research. 2006; 77(1):37–59. https://doi.org/10.1007/s11205-005-5552-1