

**Normative profile of health-related quality of life for Hong Kong general population
using preference-based instrument EQ-5D-5L**

Running Title: Hong Kong Chinese EQ-5D-5L Population Norms

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Introduction

To date, there are many different instruments for measuring Health-Related Quality of Life (HRQoL), including EuroQol 5-dimension (EQ-5D), Health Utilities Index (HUI) (1), and the Short-form 6-dimension (SF-6D) (2). The EQ-5D is a generic multi-attribute utility instruments that provides a preference-based measure of health status. It was developed by the EuroQol Group (3) and is globally used to measure health-related quality of life (HRQoL) for clinical and economic assessment. Among the different types of HRQoL measures, a profile-based measure (e.g., SF-36 and SF-12) is one of the many where an individual health profile is calculated with weighted sums of the scaled scores (4). While a preference-based measure (e.g., EQ-5D, SF-6D and HUI-3) enables each subject's self-classified information to be converted into a single index (utility value), and are a preferred method as they can be easily computed by applying scoring rules that reflect the relative importance of each dimension of health states, enabling comparisons between different populations and predictions of health outcomes (5). There is an increasing number of studies have been conducted to explore how to evaluate HRQoL around the world (6-12). Thus, the reference values for HRQoL in specific jurisdictions are very important for the interpretation of health status, as they reflect the norms of one population in the health system and provides a meaningful anchor to another group of individuals for comparison, such as comparing the health status of a patient group with that of the general population. Moreover, these reference values not only determines whether a group or individual scores are below or above the average for that specific population (13) but also enable international comparisons. According to the National Institute for Health and Care Excellence (NICE) guidelines (7), the EQ-5D is a recommended tool for estimating quality-adjusted life years (QALYs) using utility values for evaluating cost-effectiveness analyses of the intervention programmes.

The descriptive system of the EQ-5D comprises five dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. In the past decade, value sets for the 3-level version (EQ-5D-3L) have been established and widely used in many countries. However,

several studies reported ceiling effects and low discriminatory power of the 3L version and criticised its feasibility with missing values (14). The existence of a ceiling effect not only presents in the general population as expected but also in different patient groups (15). The 5-level EQ-5D version (EQ-5D-5L) is an updated version of the original EQ-5D-3L with five levels (no problems, slight problems, moderate problems, severe problems and extreme problems) for each dimension. It defines 3125 possible health states to improve the instrument properties, such as increasing discriminative capacity and reducing ceiling effects (3), compared to the EQ-5D-3L, which only describes 243 health states. The EQ-5D-5L is available in more than 130 languages and in various modes of administration (16). The valuation study using the EQ-5D-3L was conducted in 24 countries (17) based on social and cultural differences and value sets for the EQ-5D-5L are now available in more than 10 jurisdictions including Spain (18), Australia (19), Germany (20), Poland (21), Canada (22), England (23), Japan (24), Korea (25), The Netherlands (26), Uruguay (27), China (28), Indonesia (29) and more recently, Hong Kong (30, 31).

Hong Kong (HK) is a legacy of the British Colony and was returned to China as a special administrative region of China in 1997. HK has a different health system with different cultural, demographic and socio-economic characteristics than other provinces of China (32). The population in HK is approximately 7.4 million (33) and approximately 94% of its people are Chinese (34). Self-report HRQoL has become increasingly popular as an outcome assessment, and it has recently been adopted for evaluation in clinical practice (35, 36) and the effectiveness of treatments/interventions (37, 38). The Hospital Authority (HA) is a statutory body managing all 42 public hospitals in HK, and it embarked on the first benchmark patient experience survey on inpatient service in 2010, for which the EQ-5D was included as a measure of health outcomes (39). To gather a proactive collection of feedback from patients with different disease and health needs, the patient experience survey on specialist outpatient and accident and emergency services were followed in 2014 (40) and 2016 (41), respectively.

The collection of self-reported health statuses using the validated Chinese version of the EQ-5D-5L (EQ-5D-5L HK) (42), therefore, enables measurement of HRQoL among patients with chronic diseases (43) and correlations with patient engagement in hospital settings (44). However, to date, there is only one published article mentioning population norms for the HK Chinese population using the SF-6D instrument (45). There are no existing population norms using the EQ-5D from the HK general population. This study, therefore, aimed to establish a normative profile of HRQoL for HK Chinese residents aged 18 years and above using the preference-based measure, EQ-5D-5L HK, stratified by sex, age and educational levels. It also explored the relationships between HRQoL and other socio-economic factors, such as long-term conditions and disability, mental illness and chronic diseases in the HK population.

Methods

Study design

The current study was conducted using the data derived from the valuation study of the preference-based health index using the EQ-5D-5L in the HK (30). These preferences (utilities) are measured on a scale from 0 to 1 where full health is anchored at one and death at zero. A negative value is obtained when the health state is worse than death. It was a cross-sectional, population-based, face-to face survey using the locally validated EQ-5D-5L HK and was conducted between June 2014 and October 2015 in the HK general population. Sampling was performed using the stratified quota method in which the sample quota was assigned according to HK population structure (age, sex and education level).

Data collection

A representative sample in terms of age, sex, and highest educational attainment was recruited across 18 geographical districts in HK. The survey included Cantonese-speaking HK residents aged 18 and above in both public and private housing estates. Face-to-face interviews were conducted by a team of 6 trained and experienced interviewers with the aid of computer-based valuation software (The EuroQol Valuation Technology, EQ-VT) (46). In

addition, respondents were asked to report their own health status using the EQ-5D-5L descriptive system, the EQ-VAS, and their socio-economic information including age, sex, marital status, educational level, and experience with serious illness, including whether it was a longstanding health condition such as a disability, mental illness and/or chronic disease.

All participants were informed of their rights, any possible risks/benefits were explained and information about the purpose of the study and details of the research procedures were given before starting the interview. Written informed consent was also obtained from each of the participants at this stage. The participants were allowed to withdraw from the study at any point. All data were kept confidential and anonymous.

Measurements

EQ-5D-5L HK

The culturally validated HK Chinese version of the EQ-5D-5L instrument (EQ-5D-5L HK) consists of self-reported health on a five-dimension descriptive system and self-reported overall health using the EuroQol Visual Analogue Scale (EQ-VAS) (42). The descriptive system comprises the dimensions of Mobility (MO), Self-Care (SC), Usual Activities (UA), Pain/Discomfort (PD) and Anxiety/Depression (AD), and each dimension has five response levels describing the level of severity: (1) no problem, (2) slight problems, (3) moderate problems, (4) severe problems, and (5) extreme problems. There are 3,125 possible health states defined by combining each level on each dimension, ranging from the best possible states “11111” as “full health” to “55555” as “the worst health”. The EQ-VAS is the self-reported overall health perception of the respondents. It records the respondent’s self-rated health on a vertical scale from 0 (the worst health) to 100 (the best health) scale where the respondents picture their health status on the interview day.

Socio-economic Characteristics

The socio-economic characteristics of the respondents were collected in the interviews. The items included age, sex, educational attainment, marital status, employment, housing, having children and receiving any allowance from the government (i.e., Comprehensive Social Security Assistance (CSSA), old age allowance, disability allowance, etc.). The participants were also asked to report whether themselves, their family members or someone they knew had experienced serious illnesses and whether the subjects themselves had any longstanding health conditions such as a disability, mental illness or chronic disease. In traditional Chinese culture, it is expected that family members take care of each other in HK, and caring for the sick and elderly is an unavoidable responsibility. Therefore, a person who has experienced serious illnesses, and in particular their family members, have an impact on their underlying health status in HK, which provides a distinct normative evaluation of health in HK compared to other jurisdictions. In addition, they were asked to rate how satisfied they were with their life on a scale of 0 - 10, where 0 is not satisfied at all and 10 is completely satisfied.

Statistical analysis

The utility score of EQ-5D was derived using the established HK value set (30) by weighting each respondent's self-report health status to a single preference-based health index (utility scores). Data analysis was performed using IBM SPSS Statistics version 24 and Stata version 13.0. Descriptive summary statistics were estimated for the percentage of people reporting any problem on each EQ-5D-5L dimension or the EQ-VAS scores, the top 10 most frequently reported EQ-5D-5L health statuses and self-reported life satisfaction. However, due to rounding, the total percentage of distribution may not be possible to add up to 100. The normative profiles of the HK health index were described (mean, standard deviation, and 25th, 50th, 75th percentile) according to the stratified respondents' characteristics included age groups, sex and education level. Mean-difference tests were conducted to calculate the differences between age groups. To explore the relationships among potential covariates (socio-economic characteristics and health conditions) and the HK health index, a

multivariable homoscedastic Tobit regression model was employed for the analysis. EQ-5D utility scores usually show a severe ceiling effect, with most participants rating themselves in full health with a utility score of 1.0, and therefore the data could be interpreted as being bounded or censored at 1.0. This nature of the EQ-5D score distribution could produce biased and inconsistent estimation when using OLS regression (47). Thus, the Tobit model was suggested as an appropriate alternative tool to handle censored variables in econometrics research (48). Statistical significance was considered if the p-value was <0.05 .

Results

Background Characteristics

A total of 1,033 HK residents aged 18 and above responded to the study recruitment, and 19 respondents either dropped out from the interview or gave incomplete responses, leaving 1,014 respondents who participated in this study. Table 1 shows the background characteristics of the respondents included demographics (gender and age), socio-economic characteristics (highest education attainment, marital status, employment status, living status, had any children, receiving any government allowance and self-reported living satisfaction), and health conditions (experience with serious illness and self-report longstanding health conditions) and a comparison with the structure of general HK population (33, 49). They were 59% female with an age distribution of 16% aged 18-24, 17% aged 25-34, 17% aged 35-44, 12% aged 45-54, 22% aged 55-64, and 16% aged 65 and above. For the socio-economic characteristics, the majority of the respondents (81%) attended secondary school / sub-degree or above, and around half of them were married (58%) and were in paid employment (43%). The majority of them (93%) lived with family, and 63% of them had children. Approximately 14% of the respondents received at least one allowance from the local government. In addition, approximately 77% of respondents rated their life satisfaction 7 or above (out of a score of 0-10). In all of health conditions, 70% of respondents had experienced severe illness, either to the self (26%), relatives (39%) or caring for others (49%). For the self-reported health status, around one-third of the participants (30%) reported that they had at least one

longstanding health condition, and approximately 90% of them were diagnosed more than 6 months prior to participation in the study. The most common self-report longstanding health conditions were having hypertension (19%, 192 respondents) and diabetes (8%, 80 respondents). The study sample was overall reasonably representative of the local population in terms of gender, educational attainment and marital status. However, the sample had fewer respondents from the 45-54 age group and those in paid employment than the general HK population.

HK Chinese EQ-5D-5L Normative Profile

Table 2 shows the distribution of self-reported descriptive EQ-5D-5L and overall health VAS of the sample by different age groups. Around half of the participants (46%) reported no problems in all domains. The highest proportion of participants reported problems in Pain/ Discomfort (41%), followed by Anxiety/ Depression (26%), Mobility (12%) and Usual Activities (9%), while the lowest percentage reported problems in Self-care (1%). The mean (standard deviation (SD)) of the VAS was 82.7 (11.8) for the overall sample. Regarding the five descriptive dimensions, the population seemed to experience greater problems in the dimension of pain/ discomfort, especially in 55-64 age group. Interestingly, younger age groups (age 18-24 and age 25-54) experienced greater problems with anxiety/depression.

The mean health index value, using the EQ-5D-5L HK value set, for the general population in Hong Kong was 0.92 (SD 0.12), with values ranging from 0.02 to 1.00, which was left-skewed to “Full Health” status (i.e., utility index at 1.00) (Figure 1). The EQ-VAS score (Figure 2) was ranged from 25 to 100, which was also left-skewed to “the best health you can imagine” (i.e., EQ-VAS score of 100). The top 10 most frequently reported EQ-5D-5L health states out of the 3,125 possible health states mainly settled around level 1 (no problem) and 2 (slight problem). The ten health states included “11111” (46%), “11121” (18%), “11112” (9%), “11122” (8%), “21121” (3%), “21111” (2%), “11221” (2%), “21122” (2%), “21222” (1%), “11212” (1%). These health states represented the majority (91%) of the participants.

Table 3 shows the mean values for the EQ-5D-5L index scores by age group, gender and educational level. Generally, elder people had lower index values in males and females than the young groups, however, they were not significant at $P < 0.05$. In addition, educational level seemed to be another factor affecting the mean values where persons with lower educational level had roughly lower index values, particularly in the 25-34 age group.

Health Index by Socio-economic Characteristics and Health Conditions

Table 4 shows the means and standard errors (SE) of the EQ-5D-5L health index and different background characteristics (i.e., demographics, socio-economics characteristics and health conditions). After adjusting for the demographics, the results revealed that some of the socio-economics characteristics and health condition were significantly ($P < 0.05$) correlated with the health index. For the socio-economic characteristics, persons with higher educational attainment and those who reported higher life satisfaction had significantly higher health index ($P < 0.05$). However, persons who received government allowance had significantly ($P < 0.05$) lower health index than those not receiving the allowance. In addition, persons who experienced serious illness also had significantly lower health indexes ($P < 0.05$).

Discussion

This study reports the first population norm of HRQoL for Chinese residents aged 18 years and above that was derived based on a representative sample (1,014 respondents) in HK using the preference-based value set of EQ-5D-5L HK (30, 42). In the study, around half of the participants (46%) reported no problems in all health domains. The results are in line with the findings of the normative values estimated by EQ-5D-5L in other populations such as the USA (44%) (27), Australia (43%) (19), Portugal (47%) (50), UK (48%) (51) and Germany (48%) (20), but lower than in China (54%) (52) and Spain (62.4%) (18) and higher than in Poland (39%) (21). The proportion of “no problem” responses for each dimension (mobility, self-care, usual activities, pain/discomfort and anxiety/depression) were 88.3% (mobility), 98.5% (self-

care), 91.4% (usual activities), 59.5% (pain/discomfort) and 74.0% (anxiety/depression). The findings showed that our population experienced fewer problems in self-care and usual activities, but greater problems in pain/ discomfort and anxiety/ depression. The pattern was similar to the EQ-5D-5L population studies in other countries such as China, Australia, Poland and Germany.(19-21, 52) For the mobility health status, our population reported more problems than in China (52), fewer problems than in Australia, Poland and Germany (19-21), and a similar number of problems as the Spanish population (18). Interestingly, our younger population reported more problems with anxiety/ depression, but the proportion declined with age, which was similar to China population (52). However, the pattern was completely different from prior studies in some countries such as Vietnam (53), Australia (19), Spain (18) and Poland (21).

No previous normative study using the EQ-5D-3L in HK was performed to determine if there was improvement in the ceiling effect by increasing the levels of responses in the EQ-5D-5L, but reductions were shown in other countries (10,20,24,50). However, it was still high when compared to the Short-form (SF-6D) instrument in the local population (45). The mean health index in the HK Chinese population was 0.92, which was slightly higher than the norms reported for Portugal (0.89) and Poland (0.89) (21, 50) but lower than in the USA (0.97) (27). Scores were similar to the populations in Australia (0.91) and Vietnam (0.91) (19, 53) but lower than the population in China (0.96) (52). However, a direct comparison of the cross-country utility scores is not recommended because each jurisdiction has a different demographic structure, societal values and health system, which all could have an impacted perceived utility in the five dimensions of the EQ-5D-5L (17). Furthermore, the index derived from the EQ-5D-5L in the local population was higher than the norms derived from different versions of the Short-form instrument (45). Undoubtedly, utility valuations from different instruments cannot be directly compared due to the differences between utility scale effects, variation in the descriptive systems and the preferences of the people interviewed (54).

In previous studies, the normative profile by sex, age and educational level were shown to provide important reference information. In this study, although only educational level showed significant effects on people's HRQoL, which is inconsistent with other findings in Asia, we should not neglect that sex and age might play an important role in the evaluation of people's HRQoL. There was a clear trend that EQ-5D utility score decreased with increasing age, which was consistent with studies reported in Singapore and Japan (55, 56). These normative values can be used to compare health profiles of patients with specific conditions of the same age and/or gender and to identify disease burden in particular patient populations (3). In addition, the normative profile fully represents the societal preferences of the Chinese adult population in HK. Thus, the estimated EQ-5D-5L norms could be used as baseline to enable the comparisons of the treatment effectiveness of pre- and post- intervention in healthcare evaluation. It also could be used to evaluate the healthcare burden on a given disease and compare it with different adjacent countries. Moreover, the population norms could be used to conduct the economic evaluation to determine policy formulation and on resource allocation. In addition, additional local research is also required to assess the responsiveness over time for time trend analysis.

In this study, the mean health index decreased with increasing age, and females reported slightly worse health status than males. However, no significant differences between different age groups or sexes were identified in multivariate analysis after controlling for all socio-economic characteristics and health conditions in the study. The results were different from prior studies in some countries, in which they found that elder groups and females were significantly more likely to have lower health indexes than the others in multivariate analysis (19, 55, 57). Our findings revealed that people with higher educational attainment and life satisfaction reported a significantly higher health index. However, individuals who received a government allowance, had experienced serious illness had a significantly lower health index in the HK general population, which was consistent with previous studies (19, 53).

One of the strengths of this study is that it covered a large, representative sample of the adult population in HK through quota sampling by age, gender and educational attainment over 3 geographical areas of HK: Hong Kong Island, Kowloon and New Territories. However, a limitation of our study is that only the land-based, non-institutional population in HK was covered. Those who lived in institutions (i.e., hospitals, old age homes or nursing care homes) and persons living on board vessels were not involved in the study. These individuals who may have significantly different health indexes. This limitation might have introduced some bias in our estimations and implies that people with more/severe health problems might be underestimated in the study. Nevertheless, this group only makes up 1% of the HK population (58) and further studies are suggested to confirm differences and supplement the current findings in the local population.

Conclusion

This is the first study to provide normative profiles of HRQoL for HK Chinese residents aged 18 years and above that are derived using the EQ-5D-5L HK measure and its preference-based weights stratified by sex, age, and education levels. Since a health index is different from profile-based measures and is shaped by societal context and health systems, the HK normative data can be used as a reference that enables health evaluation and comparisons of different healthcare interventions with similar socio-economic characteristics in the local population. Thus, it enables local policy-makers to formulate health care policy and planning in HK to maximise efficiency in allocating limited health resources.

Reference

1. Torrance GW, Feeny DH, Furlong WJ, Barr RD, Zhang Y, Wang Q. Multiattribute utility function for a comprehensive health status classification system: Health utilities index mark 2. *Medical Care*.1996; 34(7): 702–722.
2. Brazier J, Roberts J, Deverill M. The estimation of a preference-based measure of health from the SF-36. *Journal of Health Economics*. 2002; 21(2): 271–292.
3. Devlin NJ, Brooks R. EQ-5D and the EuroQol Group: Past, Present and Future. *Appl Health Econ Health Policy*. 2017; 15: 127-37.
4. Luo N, Wang P, Fu AZ, Johnson JA, Coons SJ. Preference-based SF-6D scores derived from the SF-36 and SF-12 have different discriminative power in a population health survey. *Medical Care*. 2012; 50: 627-632.
5. Clarke PM, Hayes AJ, Glasziou PG, Scott R, Simes J, Keech AC. Using the EQ-5D index score as a predictor of outcomes in patients with type 2 diabetes. *Medical Care*. 2009; 47: 61-68.
6. Kind P, Brooks RG, Rabin R. EQ-5D concepts and methods: a developmental history. Dordrecht, Springer, 2005.
7. National Institute for Health and Care Excellence. Guide to the methods of technology appraisal. London: National Institute for Health and Care Excellence, 2013.
8. Szende A, Oppe M, Devlin N. EQ-5D value sets: inventory, comparative review and user guide. EuroQol Group Monographs: Dordrecht, Springer, 2007.
9. Xie F, Gaebel K, Perampaladas K, et al. Comparing EQ-5D valuation studies: a systematic review and methodological reporting checklist. *Med Decis Making*. 2014; 34: 8-20.
10. Janssen MF, Lubetkin EI, Sekhobo JP, et al. The use of the EQ-5D preference-based health status measure in adults with Type 2 diabetes mellitus. *Diabet Med*. 2011; 28: 395-413.
11. Pickard AS, Wilke CT, Lin HW, et al. Health utilities using the EQ-5D in studies of cancer. *Pharmacoeconomics*. 2007; 25: 365-84.

12. Brazier J, Connell J, Papaioannou D, et al. A systematic review, psychometric analysis and qualitative assessment of generic preference-based measures of health in mental health populations and the estimation of mapping functions from widely used specific measures. *Health Technol Assess.* 2014; 18: vii-viii, xiii-xxv, 1-188.
13. Hopman WM, Towheed T, Anastassiades T, et al. Canadian normative data for the SF-36 health survey. Canadian Multicentre Osteoporosis Study Research Group. *CMAJ.* 2000; 163: 265-71.
14. 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: 1717-1727.
15. Ferreira PL, Ferreira LN, Pereira LN. How consistent are health utility values? *Qual Life Res.* 2008; 17: 1031-1042.
16. EuroQol. EQ-5D. Rotterdam, The Netherlands: EuroQol, 2018.
17. Szende A, Janssen B, Cabases J. Self-reported population health: an international perspective based on EQ-5D. Dordrecht, Springer, 2014.
18. 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: 1313-21.
19. McCaffrey N, Kaambwa B, Currow DC, et al. Health-related quality of life measured using the EQ-5D-5L: South Australian population norms. *Health Qual Life Outcomes.* 2016; 14: 133.
20. Hinz A, Kohlmann T, Stobel-Richter Y, et al. The quality of life questionnaire EQ-5D-5L: psychometric properties and normative values for the general German population. *Qual Life Res.* 2014; 23: 443-7.
21. Golicki D, Niewada M. EQ-5D-5L Polish population norms. *Arch Med Sci.* 2017; 13: 191-200.
22. Xie F, Pullenayegum E, Gaebel K, et al. A Time Trade-off-derived Value Set of the EQ-5D-5L for Canada. *Med Care.* 2016; 54: 98-105.

23. Devlin NJ, Shah KK, Feng Y, et al. Valuing health-related quality of life: An EQ-5D-5L value set for England. *Health Econ.* 2017; 27: 7-22.
24. Shiroywa T, Ikeda S, Noto S, et al. Comparison of Value Set Based on DCE and/or TTO Data: Scoring for EQ-5D-5L Health States in Japan. *Value Health.* 2016; 19: 648-54.
25. Kim SH, Ahn J, Ock M, et al. The EQ-5D-5L valuation study in Korea. *Qual Life Res.* 2016; 25: 1845-52.
26. Versteegh MM, Vermeulen KM, Evers SAA, et al. Dutch Tariff for the Five-Level Version of EQ-5D. *Value Health.* 2016; 19: 343-52.
27. Augustovski F, Rey-Ares L, Irazola V, et al. An EQ-5D-5L value set based on Uruguayan population preferences. *Qual Life Res.* 2016; 25: 323-33.
28. Luo N, Liu G, Li M, et al. Estimating an EQ-5D-5L Value Set for China. *Value Health.* 2017; 20: 662-69.
29. Purba FD, Hunfeld JAM, Iskandarsyah A, et al. The Indonesian EQ-5D-5L Value Set. *Pharmacoeconomics.* 2017; 35: 1153-65.
30. Wong ELY, Ramos-Goni JM, Cheung AWL, et al. Assessing the Use of a Feedback Module to Model EQ-5D-5L Health States Values in Hong Kong. *Patient.* 2018; 11: 235-47.
31. Wong ELY, Shah K, Cheung AWL, et al. Evaluation of Split Version and Feedback Module on the Improvement of Time Trade-Off Data. *Value Health.* 2018; 21: 732-41.
32. Kong X, Yang Y, Gao J, Guan J, Liu Y, Wang R, et al. Overview of the health care system in Hong Kong and its referential significance to mainland China. *Journal of the Chinese Medical Association.* 2015; 78(10): 569–573.
<https://doi.org/10.1016/j.jcma.2015.02.006>
33. Census and Statistics Department, The Government of the Hong Kong Special Administrative Region. 2016 Population By-census - Summary Results. 2017.

34. Census and Statistics Department, The Government of the Hong Kong Special Administrative Region. 2011 Population Census - Thematic Report: Ethnic Minorities. 2012.
35. Ho JC, Chang AM, Yan BP, et al. Dabigatran compared with warfarin for stroke prevention with atrial fibrillation: experience in Hong Kong. *Clin Cardiol*. 2012; 35: E40-5.
36. Cheung PWH, Wong CKH, Lau ST, et al. Responsiveness of the EuroQoL 5-dimension (EQ-5D) in adolescent idiopathic scoliosis. *Eur Spine J*. 2018; 27: 278-85.
37. Dienstknecht T, Luring C, Tingart M, et al. Total hip arthroplasty through the mini-incision (Micro-hip) approach versus the standard transgluteal (Bauer) approach: a prospective, randomised study. *J Orthop Surg (Hong Kong)*. 2014; 22: 168-72.
38. Yoon DH, Bin SI, Chan SK, et al. Effectiveness and tolerability of transdermal buprenorphine patches: a multicenter, prospective, open-label study in Asian patients with moderate to severe chronic musculoskeletal pain. *BMC Musculoskelet Disord*. 2017; 18: 337.
39. Wong ELY, Coulter A, Cheung AWL, et al. Patient experiences with public hospital care: first benchmark survey in Hong Kong. *Hong Kong Med J*. 2012; 18: 371-80.
40. Hong Kong Hospital Authority. Patient Experience and Satisfaction Survey on Specialist Outpatient Service 2014. 2015.
41. Hong Kong Hospital Authority. Patient Experience and Satisfaction Survey on Accident and Emergency Service 2016. 2017.
42. Wong ELY, Yeoh EK, Bernhard S, et al. Validation and valuation of the preference-based health index using EQ-5D-5L in the Hong Kong population. *Value in Health*, 2015.
43. Xu RH, Cheung AWL, Wong ELY. Examining the health-related quality of life using EQ-5D-5L in patients with four kinds of chronic diseases from specialist outpatient clinics in Hong Kong SAR, China. *Patient Prefer Adherence*. 2017; 11: 1565-72.

44. Xu RH, Cheung AWL, Wong ELY. The relationship between shared decision-making and health-related quality of life among patients in Hong Kong SAR, China. *Int J Qual Health Care*. 2017; 29: 534-40.
45. Wong CKH, Mulhern B, Cheng GHL, Lam CLK. SF-6D population norms for the Hong Kong Chinese general population. *Quality of Life Research*. 2018; 27:2349–2359.
46. Oppe M, Devlin NJ, van Hout B, et al. A program of methodological research to arrive at the new international EQ-5D-5L valuation protocol. *Value Health*. 2014; 17: 445-53.
47. Rowen D, Brazier J, Roberts J. Mapping SF-36 onto the EQ-5D index: how reliable is the relationship? *Health and Quality of Life Outcomes*. 2009; 7: 27. <https://doi.org/10.1186/1477-7525-7-27>
48. Austin PC, Escobar M, Kopec JA. The use of the Tobit model for analyzing measures of health status. *Qual Life Res*. 2000;9(8):901-10.
49. Census and Statistics Department, The Government of the Hong Kong Special Administrative Region. 2011 Population Census - Main Report. Census and Statistics Department. 2012.
50. Ferreira LN, Ferreira PL, Ribeiro FP, et al. Comparing the performance of the EQ-5D-3L and the EQ-5D-5L in young Portuguese adults. *Health Qual Life Outcomes*. 2016; 14: 89.
51. Feng Y, Devlin N, Herdman M. Assessing the health of the general population in England: how do the three- and five-level versions of EQ-5D compare? *Health Qual Life Outcomes*. 2015; 13: 171.
52. Yang Z, Busschbach J, Liu G and Luo N. EQ-5D-5L norms for the urban Chinese population in China. Yang et al. *Health and Quality of Life Outcomes*. 2018; 16:210. DOI: doi.org/10.1186/s12955-018-1036-2
53. Nguyen LH, Tran BX, Hoang Le QN, et al. Quality of life profile of general Vietnamese population using EQ-5D-5L. *Health Qual Life Outcomes*. 2017; 15: 199.

54. Richardson J, Lezzi A, Khan MA. Why do multi-attribute utility instruments produce different utilities: the relative importance of the descriptive systems, scale and 'micro-utility' effects. *Qual Life Res.* 2015; 24:2045–2053. DOI 10.1007/s11136-015-0926-6
55. Abdin E, Subramaniam M, Vaingankar JA, Luo N, Chong SA (2013). Measuring health-related quality of life among adults in Singapore: population norms for the EQ-5D. *Quality of Life Research.* 2013; 22(10): 2983–2991. Doi: 10.1007/s11136-013-0405-x
56. Shirowa T, Fukuda T, Ikeda S, Igarashi A, Noto S, Saito S, Shimosuma K. (2016). Japanese population norms for preference-based measures: EQ-5D-3L, EQ-5D-5L, and SF-6D. *Quality of Life Research.* 2016; 25(3): 707–719. Doi: 10.1007/s11136-015-1108-2
57. Abdin E, Subramaniam M, Vaingankar JA, et al. Population norms for the EQ-5D index scores using Singapore preference weights. *Qual Life Res.* 2015; 24: 1545-53.
58. Census and Statistics Department, The Government of the Hong Kong Special Administrative Region. *Hong Kong Annual Digest of Statistics.* 2017.