Original Article

Normative Data for the Singapore English and Chinese SF-36 Version 2 Health Survey

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Abstract

Introduction: The aim of this study is to report normative data for the Short-Form 36 version 2 (SF-36v2) for assessing health-related quality of life, in the Singapore general population. Materials and Methods: Data for English and Chinese-speaking participants of the Singapore Prospective Study Programme were analysed. The SF-36v2 scores were norm-based with the English-speaking Singapore general population as reference and reported by age (in decades), gender and ethnicity as well as for the 5 most prevalent chronic medical conditions. Scores were reported separately for the English and Chinese language versions. Results: A total of 6151 English-speaking (61.5% Chinese and 19.2% Malay) and 1194 Chinese-speaking participants provided complete data. Mean (SD) age of all participants was 49.6 (12.58) years with 52.4% being women. In both languages, women reported lower scores than men on all scales. Among the chronic medical conditions, stroke had the largest impact on all English SF-36v2 scales and on 3 Chinese SF-36v2 scales (role-physical, general health and social functioning). Conclusion: We have provided detailed normative data for the Singapore English and Chinese SF-36v2, which would be valuable in furthering HRQoL research in Singapore and possibly the region.

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Key words: Health-related quality of life, Health status, Mental well-being, Social well-being

Introduction

Health-related Quality of Life (HRQoL) measures are increasingly being incorporated into clinical research and practice as a tool to understand, from the patients' perspective, the impact of a disease on their physical, mental and social well-being. The Medical Outcomes Short-Form 36 (SF-36) Questionnaire is arguably the most commonly used generic profile-based HRQoL measure, with translations in over 120 languages across more than 40 countries.[1]

The SF-36 version 2 (SF-36v2) was developed to overcome some of the deficiencies in the original version (henceforth referred to as version 1, v1).[1] Revisions to the SF-36v1 may be summarised as (i) simpler instructions and improved layout for questions and answers to improve clarity, (ii) improved phrasing of some items to provide greater comparability with translations and cultural adaptations widely-used in the United States (US) and in other countries, and (iii) revision of response options from dichotomous to 5-level response choices for the role physical and role emotional items to improve sensitivity, and from 6-level to 5-level response choices for the vitality and mental health items for simplification.[1]

The normative data of the SF-36v1 for the Singaporean general population were previously reported[2] and have since been used in clinical research in Singapore, including a 2-year prospective longitudinal study to evaluate health outcomes in osteoarthritis patients after total knee replacement[3] and several cross-sectional studies evaluating HRQoL in thyroid cancer survivors,[4] chronic hepatitis B infections[5] and stroke survivors.[6] The purpose of this paper is to report the normative data for the SF-36v2 in the Singapore general population, in the hope that this will similarly be useful for clinical research in Singapore.

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Materials and Methods

Study Design and Participants

Data for this Institutional Review Board-approved study were collected as part of the Singapore Prospective Study Programme (SP2). SP2 is a cross-sectional study that involves a follow-up of 10,747 participants from 4 previous cross-sectional surveys (from 1982 to 1998). Participants were invited to participate in this follow-up examination conducted between 2004 and 2007, where HRQoL data including the SF-36v2 were collected for the first time. Written informed consent was obtained from all participants prior to commencing the study.

Detailed sample selection methods for the original studies have been described elsewhere and include the Thyroid and Heart Study (1982 to 1984),[7] the National Health Survey (1992),[8] the National University of Singapore Heart Study (1993 to 1995)[9] and the National Health Survey (1998).[8] Briefly, all studies were a random sample of participants from the Singapore population, with disproportionate sampling stratified by ethnicity to increase the number of minority ethnic participants (Malays and Asian Indians). Using the unique National Registration Identity Card numbers, the Ministry of Home Affairs provided current addresses and phone numbers of participants. Participants were then contacted by either mail or telephone to obtain an appointment for trained field interviewers to administer questionnaires at the participant's home. Three home visits were made on 3 different times of the day, including at least 1 weekend and 1 weekday, before a participant was deemed non-contactable. All interviewed participants were subsequently invited to attend a clinical examination for additional tests and collection of biological specimens, shortly after the home visit.

Data Collection

Interviewers collected data on medical history, demographic and lifestyle (alcohol intake, smoking) factors using a pre-tested questionnaire. Participants were classified as being Chinese, Malay or Asian Indian according to self-report. Age was calculated based on self-reported date of birth. History of chronic diseases was captured by self-report and a few of these were confirmed by laboratory data. Participants were asked whether they had ever been told that they had hypertension, diabetes mellitus or high cholesterol. History of coronary heart disease was defined as a positive response to any of the 3 questions 'Has your doctor ever told you that you have blockage of the arteries to your heart?' or 'Have you had ever had a heart attack?' or 'Have you ever had angioplasty-ballooning or heart bypass operation procedures?' Participants were also asked whether they had ever been told by a physician that they had a cerebrovascular accident (i.e. stroke). Information on other chronic diseases (lung disease, cancer, musculoskeletal illness and mental illness) was also captured using a checklist. The presence of hypertension was defined as systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mm Hg or history of hypertension. The presence of diabetes mellitus was defined as patients with a fasting glucose level ≥7.0 mmol l-1 or with a known history of diabetes mellitus or those currently taking antidiabetic medications. Participants were classified as having dyslipidaemia if they have met any of the following two criteria: participant answered 'yes' to the question 'Are you taking any medication for high cholesterol?'; fasting total cholesterol 6.2 mmol l-1 or more; low-density lipoprotein cholesterol 4.1 mmol l-1 or more; high-density lipoprotein cholesterol less than 1.0 mmol l-1; or fasting triglyceride 2.3 mmol l-1 or more using National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) clinical cutoff points for lipid parameters.[10] For the health examination, participants were examined in the morning after a 10-hour overnight fast. Details of health examination, blood draw, sample preparation and biochemical analyses were previously published.[11]

Short-Form 36 Health Survey Version 2 (SF-36v2)

The SF-36v2 is an improvement over the original version and is a generic HRQoL instrument comprising 36 items measuring 8 domains, namely, physical functioning (PF), role-physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role-emotional (RE) and mental health (MH), with higher scores reflecting better perceived health.[1] The SF-36v2 uses norm-based scoring algorithms (T-score transformation with mean of 50 and standard deviation of 10) for all 8 scales. For example, an individual with a score of 40 on the PF indicates that he or she had worse PF by one standard deviation compared to the general population. Two summary scores, physical component summary (PCS) and mental component summary (MCS), may be computed on the basis of the 8 domain scores using regression weights derived from principal component factor analysis with varimax rotation. The reliability and validity of the SF-36v2 in Singapore were reported separately.[12]

Statistical Analyses

Data were first entered into an Excel spreadsheet (Microsoft Corporation) and subsequently converted to Stata format using StatTransfer (Circle Systems). Individual SF-36v2 items were recoded, summed and transformed, with missing values imputed as recommended in the SF-36v2 user manual.[13] The reference group used in norm-based scoring is the English-speaking Singapore general population rather than the US general population. Participants with missing scale scores were excluded listwise from analysis.

Study participants analysed were classified into subgroups stratified by age (in decades, starting from 21 years), gender (men and women) and ethnicity (Chinese/ Malay/ Indians). In addition, we classified participants into groups with and without a specific chronic medical condition. Due to the large number of chronic medical conditions captured in this study, we limited the reporting of SF-36v2 scores to the 5 most prevalent chronic medical conditions.

In Singapore, the SF-36v2 is available in English, Chinese, Malay and Tamil. In this study, we have analysed the data for only the English and Chinese language versions of the SF-36v2 due to the small number of study participants who completed the survey in Malay and Tamil (n = 227). Data were analysed separately for the English and Chinese language surveys. As participants who completed the English SF-36v2 (multi-ethnic) were clearly different from those who completed the Chinese SF-36v2 (Chinese only), we did not perform any statistical tests of comparisons between the 2 groups of participants. However, we did compare the characteristics of English- and Chinese-speaking Chinese. All data analyses were performed using Stata version 10 (StataCorp LP).

Results

Characteristics of Study Participants

Out of 10,747 participants available for follow-up, complete data for 7345 participants (68.3%) were eventually analysed, among whom, 6151 completed the SF-36v2 in English while 1194 completed the SF-36v2 in Chinese.In all, 2580 participants did not return for clinic examination and were excluded when computing the normative data for selected chronic medical conditions. This was because we would like to use a combination of self-reported and laboratory confirmed data for chronic medical conditions. Reasons for exclusion of other participants are detailed in Figure 1. In the analysed sample of 7345 participants, the mean (SD) age of participants was 49.6 (12.58) years, 3848 (52.4%) were women, 4974 (67.7 %) were Chinese and 1182 (16.1 %) were Malay. Distribution of participant characteristics by language is given in Table 1. Chinese SF-36v2 scores were computed with reference to the English-speaking Singapore population and are generally lower compared to the English SF-36v2 although the differences were small (range of score differences: 1.03 to 2.53). Compared to Chinese-speaking Chinese, English-speaking Chinese participants were younger on average (mean (SD) age, years 55.6 (11.16) vs 47.8 (12.58), P <0.001), more likely to be men, have lower prevalence of chronic medical conditions and higher SF-36v2 scores (Table 1). Among the English speakers, Indians were significantly older with mean (SD) age for Chinese, Malays and Indians being 47.8 years (12.58), 47.9 years (12.37) and 50.9 years (12.07), respectively. The distribution of overall English and Chinese SF-36v2 scale scores are given in Figures 2 and 3, respectively.

SF-36v2 Norms for Singapore

The English SF-36v2 norms stratified by age, gender and ethnicity are summarised in Table 2. In general, women reported lower scores than men on all scales and across the 3 ethnicities. At the same time, Indians generally reported lower scores on all scales. English-speaking Chinese

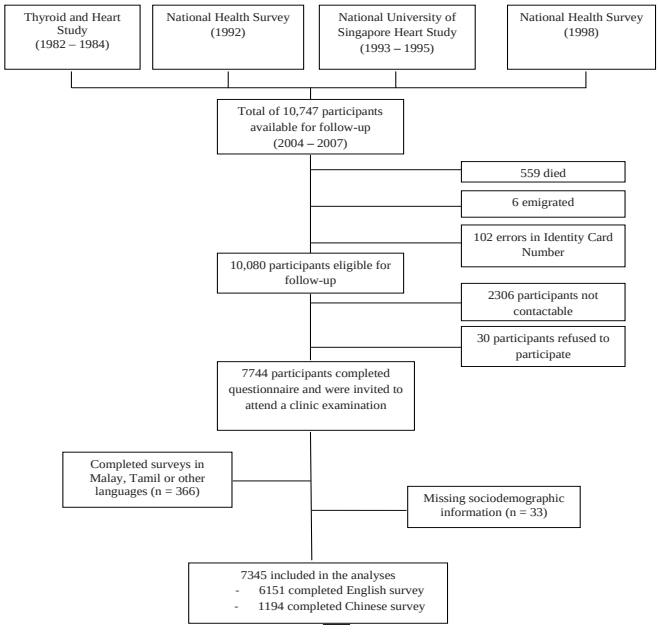

Fig. 1. Flow chart of study participants.

Table 1. Characteristics of Study Participant by Survey Language

	Completed English SF-36v2					Completed Chinese SF-36v2	
	All (n = 6151)	**Chinese (n = 3780)**	**Malay (n = 1182)**	**Indian (n = 1189)**	***P* value (among ethnic groups)**	**(n = 1194)**	***P* value (between English and Chinese-speaking ethnic Chinese)**
Mean (SD) Age, years	48.4 (12.51)	47.8 (12.58)	47.9 (12.37)	50.9 (12.07)	<0.001	55.6 (11.16)	<0.001
Age, years, n (%)							
≤40	1592 (25.9)	1090 (28.8)	294 (24.9)	208 (17.5)	<0.001	79 (6.6)	<0.001
41 to 50	2028 (33.0)	1204 (31.9)	430 (36.4)	394 (33.1)		318 (26.6)	
51 to 60	1485 (24.1)	856 (22.6)	278 (23.5)	351 (29.5)		396 (33.2)	
>60	1046 (17.0)	630 (16.7)	180 (15.2)	236 (19.9)		401 (33.6)	
Women, n (%)	3162 (51.4)	1941 (51.4)	598 (50.6)	623 (52.4)	0.675	686 (57.5)	<0.001
Five most prevalent chronic medical conditions, n (%)							
Dyslipidaemia	1783 (29.0)	937 (24.8)	382 (32.3)	464 (39.0)	<0.001	373 (31.2)	<0.001
Hypertension	1593 (25.9)	926 (24.5)	315 (26.7)	352 (29.6)	<0.001	400 (33.5)	<0.001
Diabetes mellitus	634 (10.3)	242 (6.4)	153 (12.9)	239 (20.1)	<0.001	142 (11.9)	<0.001
Coronary heart disease	175 (2.8)	75 (2.0)	23 (2.0)	77 (6.5)	<0.001	32 (2.7)	0.150
Stroke	87 (1.4)	38 (1.0)	10 (0.9)	39 (3.3)	<0.001	29 (2.4)	<0.001
Mean (SD) SF-36v2 Norm-based Scores*							
Physical Functioning	50 (10)	51.09 (9.10)	49.61 (10.24)	46.94 (11.69)	<0.001	48.81 (9.89)	<0.001
Role-Physical	50 (10)	51.08 (8.94)	49.17 (10.33)	47.38 (12.07)	<0.001	48.26 (10.40)	<0.001
Bodily Pain	50 (10)	52.09 (9.14)	49.49 (9.92)	47.04 (11.90)	<0.001	48.97 (10.56)	<0.001
General Health	50 (10)	50.18 (9.74)	50.42 (10.07)	49.01 (10.65)	>0.001	47.51 (11.73)	<0.001
Vitality	50 (10)	50.01 (9.98)	50.70 (9.25)	49.27 (10.71)	<0.001	47.47 (10.75)	<0.001
Social Functioning	50 (10)	50.84 (9.12)	49.66 (10.26)	47.67 (11.85)	<0.001	48.78 (10.10)	<0.001
Role-Emotional	50 (10)	50.75 (9.16)	49.76 (9.94)	47.87 (12.09)	<0.001	48.70 (10.53)	<0.001
Mental Health	50 (10)	50.23 (9.64)	50.76 (9.63)	48.51 (11.28)	<0.001	47.78 (10.76)	<0.001

*The reference population is the multi-ethnic English-speaking Singapore general population.

men aged 21 to 40 years reported the lowest mean (SD) VT scores of 49.86 (10.52) compared to Chinese men of other ages (range, 51.50 to 52.41). A different trend was observed among English-speaking Malay and Indian men, with those aged 60 years and older reporting the lowest VT scores compared to other ages (Table 2). Among English-speaking women, there was a clear trend of decreasing PF with increasing age in all ethnicities (Table 2) with the differences across age categories being largest among the English-speaking Indian women where the difference in mean PF scores for participants 21 to 40 years old and those older than 60 years was 10.6. Interestingly, on several scales, the differences in SF-36v2 scores between men and women were generally smaller among Chinese compared to Malays and Indians. For example, the difference in BP scores between Chinese men and women, between Malay men and women and between Indian men and women were 1.58, 2.37 and 4.56, respectively. The Chinese SF-36v2 norms stratified by age and gender are summarised in Table 3. Chinese-speaking women reported lower scores than Chinese-speaking men on all SF-36v2 scales.

SF-36v2 Scores in Participants with Diabetes, Hypertension, Dyslipidaemia, Coronary Heart Disease or Stroke

Dyslipidaemia (29.0%), hypertension (25.9%), diabetes mellitus (10.3%), coronary heart disease (2.8%) and stroke (1.4%) were the 5 most prevalent chronic medical conditions among English-speaking participants in this study. The same 5 conditions were most prevalent among Chinese-speaking study participants except that hypertension (33.5%) was more prevalent than dyslipidaemia (31.2%). SF-36v2 norms for participants with and without these chronic medical conditions for the English and Chinese surveys are summarised in Tables 4 and 5, respectively. Among English-speaking participants, those with stroke reported the lowest SF-36v2 scores on all scales compared to participants with other chronic medical conditions. The score difference among the chronic medical conditions was largest (14.19) for the PF scale where mean (SD) PF scores was highest at 48.52 (10.72) for participants with dyslipidaemia and lowest at 34.33 (16.77) for participants with stroke. Among Chinese-speaking participants, those

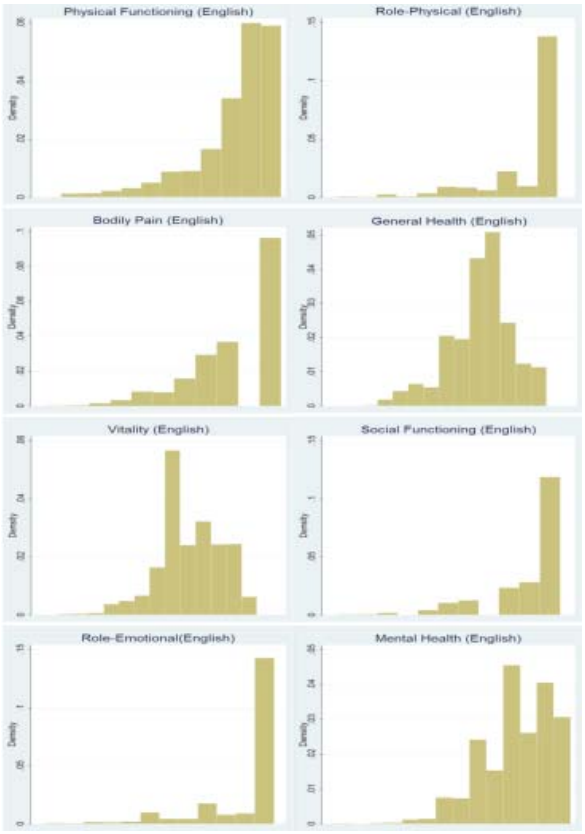

Fig. 2. Distribution of English (Singapore) SF-36v2 norm-based scores by scales.

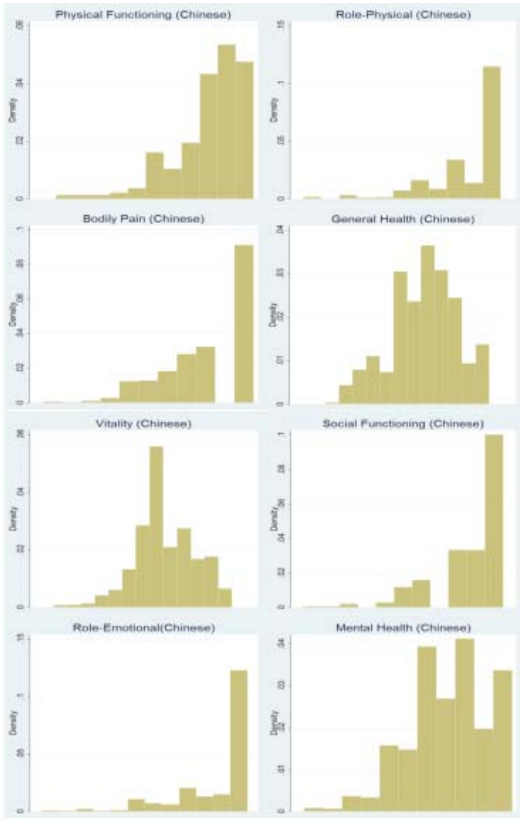

Fig. 3. Distribution of Chinese (Singapore) SF-36v2 norm-based scores by scales.

with coronary heart disease (n = 32) reported the lowest scores on 4 of 8 scales (PF, BP, RE and MH) whereas those with stroke (n = 29) reported the lowest scores on the remaining 4 scales (RP, GH, VT and SF). Chinese-speaking participants with diabetes mellitus reported the lowest scores on GH.

Discussion

This paper presents the normative data for the SF-36v2, an update from our earlier publication on the SF-36v1.[2] To facilitate comparison with the earlier paper, we have organised the results as similarly as possible, i.e. stratified by age, gender and ethnicity in the English-speaking group and by age and gender in the Chinese-speaking group. However, the age categories were organised differently because there were very few Chinese-speaking individuals who are aged 21 to 40 years. In the earlier paper, age categories were 21 to 30, 31 to 40, 41 to 50 and ≥51. Hence, age-specific comparison between the 2 papers can only be made for the other 2 categories (41 to 50 years and 51 years and above). The resulting sample is similar in age characteristics with the Singapore general population. Percent population aged 20 to 64 was 87.1% in the Singapore general population compared with 86.5% in our sample. Percent population aged 65 years and older was 12.9% in the Singapore general population compared with 13.5% in our sample. However, the resulting sample is a slight over representation of Malays and substantial over representation of Indians. The percentage of Chinese, Malays and Indians in the Singapore general population and in the sample were 74.1%, 13.4% and 9.2% versus 67.7%, 16.1% and 16.2%, respectively.

We observed that Indians generally reported lower scores on all scales. This might be because the Indians were older, had a higher proportion of women and had higher prevalence of chronic medical conditions compared to Chinese and Malays. We have also presented the SF-36v2 scores for the 5 most common chronic medical conditions observed in this set of data. Unlike our previously reported study of the SF-36v1 which used self-reported chronic medical condition data, the present study used a combination of laboratory tests and self-reports in defining the presence of chronic medical conditions. As may be expected, SF-36v2

Table 2. Mean (SD) English (Singapore) SF-36v2 Norms by Age, Gender and Ethnicity (n = 6151)

	All	Males					Females				
Age group, years		**21 – 40**	**41 – 50**	**51 – 60**	**≥60**	**All**	**21 – 40**	**41 – 50**	**51 – 60**	**≥60**	**All**
Chinese	**n = 3780**	**n = 512**	**n = 597**	**n = 416**	**n = 314**	**n = 1839**	**n = 578**	**n = 607**	**n = 440**	**n = 316**	**n = 1941**
PF	51.49 (8.97)	54.16 (7.61)	53.68 (7.59)	52.82 (7.76)	48.24 (10.91)	52.69 (8.54)	53.32 (7.02)	51.72 (7.77)	49.10 (9.29)	44.02 (11.55)	50.35 (9.21)
RP	51.57 (8.72)	52.01 (8.56)	53.07 (7.00)	52.17 (8.34)	49.55 (10.89)	51.97 (8.58)	52.20 (7.52)	52.29 (7.63)	51.33 (9.03)	47.09 (11.43)	51.20 (8.84)
BP	51.40 (8.98)	52.38 (8.99)	52.43 (8.06)	52.14 (8.53)	51.59 (8.85)	52.21 (8.57)	51.67 (8.95)	50.93 (9.04)	50.25 (9.16)	48.70 (10.20)	50.63 (9.29)
GH	50.53 (9.37)	51.50 (9.14)	51.53 (8.67)	51.67 (8.98)	49.03 (10.02)	51.13 (9.15)	51.46 (8.59)	51.32 (8.67)	48.99 (9.95)	45.99 (10.91)	49.97 (9.55)
VT	50.42 (9.81)	49.86 (10.52)	51.50 (8.76)	52.41 (9.01)	51.76 (9.54)	51.29 (9.51)	48.60 (10.50)	50.68 (9.54)	50.38 (9.72)	48.29 (10.11)	49.60 (10.02)
SF	51.18 (9.01)	50.59 (9.56)	52.22 (7.84)	51.75 (8.43)	50.94 (9.57)	51.44 (8.80)	50.65 (9.20)	51.69 (8.44)	51.87 (8.82)	48.67 (10.68)	50.93 (9.21)
RE	51.12 (8.95)	50.62 (9.36)	52.10 (7.49)	52.01 (8.15)	50.61 (10.19)	51.41 (8.70)	50.21 (9.15)	51.59 (8.26)	51.92 (8.61)	49.03 (11.12)	50.84 (9.17)
MH	50.60 (9.42)	48.87 (10.35)	50.80 (8.97)	51.80 (8.87)	53.38 (8.68)	50.93 (9.43)	49.01 (10.25)	50.65 (9.36)	51.38 (8.65)	50.45 (8.66)	50.29 (9.41)
Malay	**n = 1182**	**n = 137**	**n = 214**	**n = 148**	**n = 85**	**n = 584**	**n = 157**	**n = 216**	**n = 130**	**n = 95**	**n = 598**
PF	50.03 (10.09)	53.94 (8.34)	52.56 (9.63)	52.03 (7.46)	46.84 (11.44)	51.92 (9.37)	50.27 (9.63)	49.33 (9.08)	46.40 (10.65)	44.57 (12.79)	48.18 (10.42)
RP	49.71 (10.07)	51.26 (8.86)	50.82 (9.16)	50.58 (9.29)	49.33 (10.78)	50.65 (9.37)	48.85 (10.88)	49.34 (9.52)	48.39 (11.29)	48.01 (11.75)	48.79 (10.64)
BP	49.83 (9.74)	51.99 (8.67)	51.11 (9.34)	50.88 (8.77)	49.56 (9.30)	51.03 (9.05)	49.93 (9.87)	49.42 (10.15)	47.52 (10.33)	46.40 (10.62)	48.66 (10.25)
GH	50.76 (9.71)	54.03 (7.63)	52.65 (8.69)	51.60 (10.09)	47.42 (10.82)	51.95 (9.38)	51.13 (9.38)	50.25 (9.14)	48.41 (10.82)	47.18 (10.52)	49.59 (9.89)
VT	51.09 (9.09)	53.22 (8.74)	52.41 (8.32)	52.57 (8.77)	50.28 (8.95)	52.33 (8.65)	49.86 (9.32)	49.98 (8.89)	50.11 (10.06)	49.40 (9.49)	49.89 (9.34)
SF	50.02 (10.14)	51.23 (9.15)	51.11 (9.19)	49.88 (10.52)	50.03 (10.53)	50.67 (9.73)	49.00 (10.06)	49.74 (10.10)	49.75 (10.33)	48.70 (12.32)	48.38 (10.50)
RE	50.15 (9.72)	50.87 (9.30)	50.81 (9.15)	50.36 (9.27)	50.94 (9.40)	50.73 (9.23)	48.64 (11.70)	49.82 (9.48)	49.65 (9.51)	50.54 (9.74)	49.59 (10.15)
MH	51.12 (9.42)	52.28 (8.77)	51.25 (9.23)	52.29 (8.92)	53.53 (8.37)	52.09 (8.93)	49.03 (10.79)	49.31 (10.41)	50.71 (9.72)	52.07 (8.57)	50.17 (9.78)
Indian	**n = 1189**	**n = 88**	**n = 192**	**n = 161**	**n = 125**	**n = 566**	**n = 120**	**n = 202**	**n = 190**	**n = 111**	**n = 623**
PF	47.40 (11.52)	52.46 (8.80)	51.13 (10.11)	49.47 (10.99)	44.44 (12.27)	49.39 (11.03)	49.79 (10.24)	47.95 (10.69)	44.17 (11.28)	39.19 (12.44)	45.59 (11.67)
RP	47.96 (11.77)	49.49 (11.92)	50.60 (9.36)	49.87 (10.62)	44.81 (14.24)	48.94 (11.53)	49.91 (9.91)	49.20 (11.33)	46.59 (11.21)	40.97 (13.85)	47.07 (11.92)
BP	47.42 (11.69)	51.51 (9.49)	49.94 (10.52)	49.65 (11.19)	48.59 (10.60)	49.81 (10.59)	48.53 (11.98)	46.83 (11.74)	43.41 (11.85)	41.94 (12.72)	45.25 (12.21)
GH	49.40 (10.25)	53.05 (10.14)	50.90 (9.87)	49.92 (10.62)	47.29 (11.42)	50.16 (10.61)	51.28 (8.60)	50.62 (8.81)	47.97 (10.42)	43.76 (10.14)	48.72 (9.87)
VT	49.69 (10.52)	51.75 (10.32)	52.74 (9.00)	51.45 (9.96)	50.27 (11.73)	51.67 (10.15)	49.41 (9.96)	49.71 (10.48)	46.75 (10.71)	44.90 (10.13)	47.89 (10.54)
SF	48.04 (11.71)	49.12 (11.07)	49.38 (11.05)	49.03 (11.05)	48.19 (12.31)	48.98 (11.32)	48.77 (11.44)	48.52 (11.68)	46.80 (11.59)	43.73 (13.21)	47.19 (12.00)
RE	48.30 (11.81)	49.51 (11.13)	50.23 (9.60)	49.56 (10.31)	47.64 (13.16)	49.36 (10.92)	48.43 (11.02)	49.13 (11.13)	46.60 (13.33)	44.18 (14.20)	47.34 (12.50)
MH	48.92 (11.03)	49.02 (11.37)	49.85 (10.41)	50.70 (11.61)	51.21 (9.56)	50.26 (10.74)	48.12 (10.29)	48.88 (10.88)	46.72 (11.68)	46.74 (11.52)	47.69 (11.15)

PF: Physical functioning; RP: Role-physical; BP: Bodily pain; GH: General health; VT: Vitality; SF: Social Functioning; RE: Role-emotional; MH: Mental health

Table 3. Mean (SD) Chinese (Singapore) SF-36v2 Norms by Age and Gender (n = 1194)

		Males					Females				
Age group, years	**All**	**21 – 40**	**41 – 50**	**51 – 60**	**≥60**	**All**	**21 – 40**	**41 – 50**	**51 – 60**	**>60**	**All**
	n = 1194	**n = 32**	**n = 119**	**n = 171**	**n = 186**	**n = 508**	**n = 47**	**n = 199**	**n = 225**	**n = 215**	**n = 686**
PF		55.55 (3.82)	54.35 (5.76)	51.55 (6.73)	46.68 (11.09)		52.64 (7.00)	50.56 (7.77)	49.47 (7.52)	41.26 (12.60)	
RP		51.60 (8.27)	52.07 (7.73)	50.56 (7.75)	45.30 (12.71)		51.36 (8.03)	49.59 (9.06)	48.43 (9.14)	44.29 (12.42)	
BP		52.12 (11.71)	51.24 (9.48)	49.96 (10.12)	49.50 (10.87)		52.23 (7.99)	49.50 (10.14)	47.43 (10.65)	46.40 (11.14)	
GH		52.57 (10.76)	51.62 (9.27)	47.93 (11.31)	46.44 (13.07)		48.93 (9.01)	47.79 (11.08)	47.53 (11.40)	44.46 (12.75)	
VT		49.56 (13.44)	50.39 (9.58)	48.21 (10.46)	47.01 (10.93)		46.99 (10.94)	47.25 (10.39)	46.80 (10.67)	46.36 (11.15)	
SF		50.81 (10.46)	52.77 (7.29)	49.80 (8.08)	47.18 (11.15)		51.05 (8.05)	50.10 (8.77)	49.19 (9.29)	44.73 (12.52)	
RE		51.05 (9.09)	51.13 (8.08)	50.23 (8.47)	46.11 (12.64)		50.86 (7.92)	49.07 (10.33)	48.51 (10.52)	47.41 (11.50)	
MH		49.02 (12.48)	49.20 (10.57)	46.47 (10.50)	48.36 (11.08)		45.05 (11.14)	46.73 (10.20)	47.98 (10.66)	48.70 (10.89)	

PF: Physical functioning; RP: Role-physical; BP: Bodily pain; GH: General health; VT: Vitality; SF: Social Functioning; RE: Role-emotional; MH: Mental health

Table 4. English (Singapore) SF-36v2 Norms in Study Participants with and Without the Stated Chronic Medical Conditions

Chronic medical conditions		**Mean (SD) SF-36v2 Norm-based Scores**							
		PF	**RP**	**BP**	**GH**	**VT**	**SF**	**RE**	**MH**
Dyslipidaemia	Y (n = 1783)	48.52 (10.72)	48.78 (11.08)	48.77 (10.50)	49.01 (10.68)	50.33 (9.98)	49.32 (10.42)	49.46 (10.55)	50.55 (9.79)
	N (n = 2546)	50.69 (9.60)	50.46 (9.18)	49.92 (9.82)	51.25 (9.31)	50.32 (10.06)	50.33 (9.60)	49.86 (9.76)	49.90 (10.09)
Hypertension	Y (n = 1593)	48.43 (10.76)	48.99 (10.72)	48.92 (10.37)	49.34 (10.25)	50.77 (9.94)	49.98 (9.84)	49.50 (10.58)	50.88 (9.87)
	N (n = 2520)	51.21 (9.07)	50.61 (9.11)	49.88 (9.85)	51.64 (9.21)	50.38 (9.99)	50.12 (9.77)	49.87 (9.67)	49.80 (10.02)
Diabetes mellitus	Y (n = 634)	45.62 (11.93)	46.41 (12.56)	47.40 (11.50)	45.41 (11.65)	48.47 (10.53)	47.45 (11.75)	48.03 (11.79)	49.86 (10.74)
	N (n = 3678)	50.60 (9.50)	50.41 (9.18)	49.83 (9.81)	51.14 (9.47)	50.63 (9.92)	50.33 (9.53)	50.01 (9.70)	50.19 (9.88)
Coronary heart disease	Y (n = 175)	43.70 (13.04)	43.23 (14.55)	45.98 (12.11)	43.74 (12.63)	47.56 (10.84)	44.74 (13.89)	46.19 (13.43)	49.07 (10.47)
	N (n = 5968)	50.19 (9.83)	50.20 (9.76)	50.13 (9.91)	50.18 (9.85)	50.08 (9.98)	50.15 (9.83)	50.11 (9.87)	50.02 (9.99)
Stroke	Y (n = 87)	34.33 (16.77)	36.83 (17.19)	42.82 (13.35)	42.56 (13.61)	44.58 (14.02)	39.97 (16.74)	41.61 (17.09)	47.29 (13.71)
	N (n = 6064)	50.22 (9.69)	50.19 (9.73)	50.10 (9.91)	50.11 (9.90)	50.08 (9.91)	50.14 (9.80)	50.12 (9.81)	50.04 (9.93)

PF: Physical functioning; RP: Role-physical; BP: Bodily pain; GH: General health; VT: Vitality; SF: Social Functioning; RE: Role-emotional; MH: Mental health; Y: With stated chronic medical conditions; N: Without stated chronic medical conditions

Table 5. Chinese (Singapore) SF-36v2 Norms in Study Participants with and Without the Stated Chronic Medical Conditions

Chronic medical conditions		Mean (SD) SF-36v2 Norm-based Scores							
		PF	RP	BP	GH	VT	SF	RE	MH
Dyslipidaemia	Y (n = 373)	46.49 (11.08)	45.40 (11.86)	45.98 (11.42)	45.51 (12.35)	46.37 (11.53)	46.59 (11.37)	46.29 (12.15)	46.81 (11.66)
	N (n = 484)	50.72 (8.68)	49.23 (9.35)	49.63 (10.29)	49.74 (10.63)	48.70 (10.42)	50.13 (8.77)	48.70 (10.16)	48.49 (10.24)
Hypertension	Y (n = 400)	47.45 (10.56)	46.75 (11.13)	47.11 (11.19)	47.56 (11.36)	47.57 (11.05)	47.63 (10.82)	46.77 (11.54)	47.64 (11.85)
	N (n = 402)	51.30 (8.25)	49.22 (9.30)	48.97 (10.61)	49.89 (10.86)	48.68 (10.93)	50.16 (8.82)	48.91 (9.92)	48.35 (9.97)
Diabetes mellitus	Y (n = 142)	41.87 (12.85)	42.81 (13.25)	45.56 (10.55)	40.71 (13.63)	44.04 (11.34)	43.90 (12.32)	44.97 (13.59)	47.28 (11.54)
	N (n = 711)	50.31 (8.77)	48.59 (9.80)	48.53 (10.88)	49.43 (10.74)	48.58 (10.79)	49.43 (9.55)	48.32 (10.27)	48.02 (10.78)
Coronary heart disease	Y (n = 32)	41.36 (11.83)	39.46 (14.53)	42.99 (12.00)	41.72 (12.02)	45.62 (8.87)	43.63 (11.69)	40.50 (14.20)	44.30 (10.90)
	N (n = 1161)	49.03 (9.75)	48.53 (10.13)	49.15 (10.47)	47.67 (11.69)	47.54 (10.78)	48.92 (10.02)	48.96 (10.27)	47.87 (10.74)
Stroke	Y (n = 29)	41.42 (15.36)	39.16 (15.32)	45.20 (12.72)	40.05 (16.20)	41.60 (11.36)	39.04 (13.34)	42.59 (16.48)	45.91 (11.50)
	N (n = 1165)	49.00 (9.65)	48.49 (10.15)	49.06 (10.49)	47.69 (11.55)	47.62 (10.69)	49.03 (9.89)	48.85 (10.30)	47.82 (10.74)

PF: Physical functioning; RP: Role-physical; BP: Bodily pain; GH: General health; VT: Vitality; SF: Social Functioning; RE: Role-emotional; MH: Mental health; Y: With stated chronic medical conditions; N: Without stated chronic medical conditions

scores were lower among patients with a specific chronic medical condition compared to those without the chronic medical condition.

We noted that the impact of chronic medical conditions on SF-36v2 scores differed among Chinese and English-speaking participants. This could be due to 3 reasons: (i) differences in sociodemographic variables among English and Chinese-speaking participants, (ii) differences in the prevalence of chronic medical conditions among English and Chinese-speaking participants, (iii) language effect due to the use of different language versions of the SF-36v2. As the equivalence of the English and Chinese SF-36v1 has been previously shown,[2] it is unlikely that the differences were due to the different language versions. However, this remains to be explored in a separate study.

Normative data such as those presented here for the Singapore population by age, gender, ethnicity and chronic medical conditions are important for the meaningful interpretation of results in studies using the SF-36v2 in Singapore in several ways. First, they allow the computation of the expected SF-36v2 scores for Singaporeans adjusted for age, gender, ethnicity and survey language. This would facilitate the interpretation of the SF-36v2 scores obtained in clinical research or routine use with that for the general Singapore population. By observing how the scores for patients involved in clinical trials differ from the general population, this will allow for establishment of external validity. Second, they facilitate interpretation of the SF-36v2 scores by allowing users to know how their study sample fared compared to the general population of a specific medical condition. For example, if a diabetes mellitus (DM) patient presenting in the clinic reported a PF score of 40, the clinician would know that this patient has a PF score that is one standard deviation below the general DM population in Singapore (mean (SD) PF score: 49.35 (9.70)). Third, they allow identification of specific SF-36v2 domains that are affected by a specific medical condition, thus providing guidance for targeted intervention. For example, English-speaking participants with stroke had the greatest impairment on PF, which is more than one SD below the population norm, compared to other scales. Mean (SD) norm-based scores for SF-36v2 scales among stroke patients were: PF – 34.33 (16.77), RP – 36.83 (17.19), BP – 42.82 (13.35), GH – 42.56 (13.61), VT – 44.58 (14.02), SF – 39.97 (16.74), RE – 41.61 (17.09) and MH – 47.29 (13.71). Note, however, that this comparison across the scales can be done only after the scores were converted to norm-based scoring, which would take into account the arbitrary differences in the ceiling and floor effects for the various SF-36v2 scales.[12] This represents an important advantage of SF-36v2 over SF-36v1.

We recognise that this study is not without its limitations. First, as the presence of chronic medical conditions were based on a combination of laboratory and self-reported

data, participants who did not return for follow-up clinic examination were excluded from the normative data of participants with chronic medical conditions. This resulted in a reduction of available data points as 2580 participants did not return for the clinic examination (24.7%). In our earlier paper,[11] we noted that participants who returned for clinic examination were more likely to report better PF, GH, VT and MH, worse BP and RE and similar RP and SF scores. However, as the use of laboratory and self-reported data is more accurate than the use of self-reported data alone, this may represent a pragmatic compromise. In a separate analysis (results available upon request), we computed the norm-based scores using self-reported data alone. The number of participants with self-reported dyslipidaemia, hypertension and diabetes mellitus were fewer than number of participants with these conditions defined by a combination of self-reported and laboratory data. This means that self-reporting underestimated the prevalence of these medical conditions. The definition of coronary heart disease and stroke were based on self-reports only. The general trend was that norm-based scores were lower if medical conditions were determined based on self-reports only. That is, awareness of dyslipidaemia, hypertension and diabetes mellitus was associated with poorer HRQoL. We have made this similar observation in an occupational population in Thailand.[14] However, none of the differences exceeded the clinically important difference of 5 points.

Second, in this study, the SF-36v2 was interviewer-administered. Given that there are documented differences between scores obtained through self- and interviewer-administration,[15] this needs to be borne in mind when comparing scores obtained using a mode of administration other than interviewer-administration. The use of interviewer-administration in this study was necessary so that participants with poor literacy could be included, which has the advantage of providing a more representative assessment of the population as illiterate participants are not excluded.

Third, by combining the 21 to 30 years and 31 to 40 years categories, and by using a combination of laboratory and self-reported data to define chronic medical conditions, we have limited our abilities to directly compare the findings of this study (conducted from 2004 to 2007) with the earlier study (conducted from 1998 to 1999) using the SF-36v1. Nevertheless, direct comparison of the 2 studies is not the main intent of this paper and is probably not meaningful as real changes in population HRQoL may have occurred over the 5 years since the previous study was conducted. Furthermore, the SF-36v2 has now superseded the SF-36v1.

Conclusion

In this paper, we have provided detailed normative data for users of the English (Singapore) and Chinese (Singapore) SF-36v2, which would be valuable in furthering research in HRQoL in Singapore and possibly the region, particularly in countries without population reference values.

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