

The reliability and validity of the Chinese Short Warwick-Edinburgh Mental Well-being Scale in the general population of Hong Kong

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Abstract

Purpose To evaluate the reliability and validity of the 7-item Chinese short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS) in Hong Kong Chinese.

Methods Under “A Jockey Club Initiative for a Harmonious Society” project, a random telephone survey was conducted in 2017 on 1,331 Hong Kong Chinese residents aged ≥ 18 . A confirmatory factor analysis (CFA) was conducted to test the factorial validity. The Spearman correlations of the SWEMWBS with other scales including the 12-item short form health survey (SF-12), family well-being, self-rated health, the global happiness item (GHI), subjective happiness scale (SHS), and patient health questionnaire-4 (PHQ-4), were used to evaluate the convergent and divergent validity. Known-group validity was also assessed. We calculated congeneric reliability based on standardized factor loadings and error variances. Two-week test-retest reliability was assessed in 100 randomly selected respondents using intraclass correlation coefficient (ICC).

Results Among the weighted sample, 55.9% were female and 72.9% were 25 to 64 years old. The CFA indicated good validity of the SWEMWBS. The SWEMWBS had moderate correlations with SHS, SF-12 mental component, PHQ-4 and GHI, but a weak correlation with SF-12 physical component. Older respondents, those with higher education level, married, working, with higher household income reported higher level of well-being. The congeneric reliability of the SWEMWBS was 0.85. Moderate to good test-retest reliability was observed (ICC 0.70, 95% CI 0.55 to 0.80).

Conclusion The Chinese SWEMWBS showed good validity and reliability for measuring wellbeing in the general population of Hong Kong.

Keywords: mental health; well-being; reliability; validity

Introduction

The World Health Organization (WHO) declared that health is “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”[1]. Recently, positive mental health has been increasingly recognized, shifting the focus to prevention, strength and well-being [2,3]. Well-being is a multidimensional construct, with measures of life satisfaction, quality of life and happiness being used interchangeably [4,5]. Well-being has two perspectives: hedonic well-being covers both the cognitive judgment of life satisfaction and affective emotions and moods [6,7], while eudaimonic well-being focuses on psychological functioning and self-realization [7,8]. A variety of instruments with one to hundreds of items have been used to measure well-being [9,10].

The 14-item Warwick-Edinburgh Mental Well-being Scale (WEMWBS) is a population-based measure that broadly assesses affective-emotional aspects, cognitive-evaluative dimensions and psychological functioning [11]. The understanding of mental health and well-being may vary with cultures and beliefs. One study suggested that the WEMWBS was acceptable across different cultural groups, after comparing its performance among groups of English-speaking, Chinese and Pakistani adults living in the UK [12]. The qualitative data pointed to the possibility of the misinterpretation of one item, “I’ve been feeling interested in other people”, among some members of the Chinese community. This item was not included in the 7-item short WEMWBS (SWEMWBS), and the latter is more preferable for monitoring mental well-being in large-scale population studies given its robust measurement properties and brevity [13,14]. The SWEMWBS has been validated in deaf British sign language users [15], Norwegian and Swedish adults [16], Norwegian adolescents [17], people with schizophrenia, depression and anxiety spectrum disorders in Singapore [18], and hospitalized patients with mental illness in Hong Kong [19]. The SWEMWBS was developed to support mental health promotion programs and has the advantage of a low ceiling effect in population samples. However, the validity and reliability of the SWEMWBS in the general population of Hong Kong is unknown. Previous studies have identified that the SWEMWBS items can be loaded on one factor using a principal component analysis [15-17,19] and confirmatory factor analysis [16-18]. A confirmatory factor analysis is typically used in scale development [20], but it has yet to be conducted for the Chinese version of the SWEMWBS. Therefore, we evaluated the validity and reliability of the SWEMWBS in a general Chinese population (92.0% being Chinese) in Hong Kong using multiple methods, including tests of factorial validity, convergent and divergent validity, known-group validity, congeneric reliability, and test-retest reliability, and identified how the SWEMWBS scores differed by demographic characteristics.

Methods

Participants

Under the project entitled “A Jockey Club Initiative for a Harmonious Society” (short title: “FAMILY Project”) to promote family health, happiness and harmony (3Hs) in Hong Kong (<http://www.family.org.hk>), the Family and Health Information Trends Survey (FHInTS) was a periodic, territory-wide telephone survey on family health, health information use and other aspects [21]. The present and latest survey was conducted in 2016/2017. All interviews were conducted by trained interviewers of the Public Opinion Programme, the University of Hong Kong. Cantonese-speaking respondents aged 18 or above were eligible. Landline and mobile telephone numbers were randomly generated using known prefixes assigned by the Office of the Communications Authority. All data were collected by interviewers using a Web-based Computer Assisted Telephone Interview (Web-CATI) system invented in-house by the research team, which allowed real-time data capture and consolidation. Invalid telephone numbers were eliminated. For the mobile numbers, owners were selected if they had not been interviewed in previous FHInTS surveys. For the landline numbers, the person with the next soonest birthday who was eligible and present in the household was selected. The response rate was 68.9%, which was calculated as the number of successful cases divided by the total number of successful, incomplete and refusal cases. Of 1,331 respondents recruited, 100 were randomly selected to complete a retest of the SWEMWBS after two weeks. Verbal informed consents was obtained from each respondent. Ethical approval was granted by the Institutional Review Board of the University of Hong Kong / Hospital Authority Hong Kong West Cluster.

Measures

Translation of the English SWEMWBS into Chinese followed the standard forward-step, backward-step, and pretest-step method [22]. The SWEMWBS was first translated into Chinese by a bilingual researcher from the project team, and then back into English by another bilingual researcher iteratively until a consensus was achieved (Appendix in Supplementary File). The SWEMWBS uses a 5-point Likert scale (1 none of the time, 2 rarely, 3 some of the time, 4 often, 5 all of the time). The raw score is calculated by summing all seven items with a range of 7 to 35, and higher scores indicate a higher level of well-being [13].

The 12-item Short Form Health Survey (SF-12) measures general health, physical functioning, role-physical, role-emotional, mental health, bodily pain, vitality and social functioning in the past four weeks. The physical and

mental component scores range from 0 to 100 with higher scores indicating better functioning. The SF-12 has been translated and validated for use in Hong Kong Chinese [23].

Family well-being [24] was measured as a composite score of 3 items by asking the respondents “How harmonious/ happy/ healthy do you think your family is?”, which was used in our previous study [25]. Respondents rated each item from 0 (not at all harmonious/ happy/ healthy) to 10 (very harmonious/ happy/ healthy), resulting in a total score of 0-30, with higher scores indicating better family well-being.

Self-rated physical health (SRH) was measured by asking the respondents “In general, would you say your physical health is?” [26,27]. Responses included “excellent”, “very good”, “good”, “fair” and “poor”, and were scored from 1 to 5, correspondingly.

The Global Happiness Item (GHI) is a single item of general happiness, which was measured by asking the respondents “In general, would you say you are happy or not happy?”, with response scores of 1 to 4 corresponding to “very happy”, “happy”, “not very happy” and “not happy at all” [28,29]. This simple subjective measurement of happiness is concordant with other more objective measures of wellbeing and was used in our previous study [30].

The 4-item Subjective Happiness Scale (SHS) assesses an individual’s overall happiness [31]. The response format is a 7-point Likert-type scale. The mean score is computed with the 4th item reverse coded. Higher scores indicate higher levels of happiness. The reliability and validity of the Chinese SHS has been evaluated in the general population [32].

The 4-item Patient Health Questionnaire-4 (PHQ-4) combines the PHQ-2 with the 2-item Generalized Anxiety Disorder scale to measure depression and anxiety in a brief instrument [33]. The response format is a 4-point Likert-type scale. The composite score ranges from 0 to 12, with higher scores indicating higher levels of depression and anxiety.

Data analysis

Skewness < 2 and kurtosis < 7 were used to evaluate the normal distribution of the sum score of the SWEMWBS [34]. Floor or ceiling effects were considered to be present if more than 15% of the respondents achieved the lowest or highest possible score [35]. The characteristics of the raw data were weighted using a random iterative method [36,37] according to provisional figures obtained from the Hong Kong Census and Statistics Department on the sex-age distribution of the Hong Kong population at the end of 2015 and the educational attainment (highest level

attended) distribution from the 2011 census. All analyses were conducted using SPSS 25.0 (IBM Corp, Armonk, NY, USA) if unspecified. A *p* value of less than 0.05 was considered statistically significant.

Factorial validity

A confirmatory factor analysis (CFA) was conducted using lavaan version 0.6-2 in R version 3.5.3 to test the one factor model of the SWEMWBS [38]. The factor loadings were also reported. The diagonally weighted least squares (DWLS) was used as the estimator, which has been suggested to be less biased [39]. Chi-squared test, root mean square error of approximation (RMSEA) (< 0.08 acceptable, < 0.05 excellent), standardized root mean square residual (SRMR) (< 0.08 acceptable), comparative fit index (CFI) (> 0.90 acceptable, > 0.95 excellent), and incremental fit indices (NFI) (> 0.90 acceptable) were used to assess the model fit [40].

Convergent and divergent validity

Spearman's correlation coefficients were used to assess the relationships between the SWEMWBS and the SF-12, family well-being, SRH, the GHI, the SHS, and the PHQ-4. The coefficients were classified as weak (coefficient 0.10 - 0.39), moderate (0.40 - 0.69), strong (0.70 - 0.89) or very strong (0.90 - 1.00) [41-43]. We hypothesized that SWEMWBS would have a positive correlation with the SF-12, family well-being and the SHS, and a negative correlation with SRH, the GHI and the PHQ-4. It was expected that the correlation between the SWEMWBS and the SF-12 mental component would be stronger than that with the SF-12 physical component, which would indicate a divergent validity. The statistical test of the correlation difference was evaluated by the cocor package in R [44].

Known-group validity

Differences in the SWEMWBS by sex were tested using an independent t-test. Analysis of variance (ANOVA) and post-hoc tests were used to test the differences in the SWEMWBS according to demographic characteristics. The level of well-being was expected to be higher among people with older age, higher education or a higher household income, but similar by sex [14].

Congeneric reliability

We calculated the congeneric reliability (composite reliability) coefficient based on standardized factor loadings and error variances [45,46]. Congeneric reliability should have a value of at least 0.6 [47]. The corrected item-total

correlation was the correlation between the score of a specific item and the overall score, with a value of > 0.4 indicating good consistency [48].

Test-retest reliability

Intraclass correlation coefficient (ICC) estimates and their 95% confidence intervals (CI), calculated based on an absolute agreement 2-way mixed-effects model, were used to determine the test-retest reliability [49]. Reliability was classified as poor (ICC <0.5), moderate (0.5 - 0.75), good (0.75 - 0.9), or excellent (> 0.90) [49].

Results

Demographics

Among the weighted sample of 1,322 participants, which differed from the unweighted sample size due to rounding (Table 1), 55.9% were female, 72.9% were aged 25 to 64 years, 76.8% had secondary or lower education, 59.5% were married or cohabitated, 47.2% were working, and 64.2% had a monthly household income of HK\$ 20,000 or higher (1 US\$=7.8 HK\$).

[Insert Table 1 here]

Approximately 98% (1,306 / 1,311) of the total sample provided complete SWEMWBS data. The SWEMWBS raw scores had a normal distribution (mean = 25.5, SD = 4.96; skewness: -0.42; kurtosis: 0.45). The percentages of the lowest score (score 7) and highest score (score 35) were 0.2% and 4.2% respectively, which indicated no floor or ceiling effect.

Factorial validity

Figure 1 shows the factor loadings of the seven items (0.62 to 0.73). The Chi-squared test statistic was 30.82 (df = 14, $p = 0.006$). The RMSEA was 0.03, which showed an excellent model fit. The CFI and NFI were 0.995 and 0.991 respectively, both indicating a good model fit. The SRMR was 0.037 (< 0.08), also indicating a good model fit.

[Insert Figure 1 here]

Convergent and divergent validity

Table 2 shows significant correlations between the SWEMWBS and the other scales. Positive correlations were found between the SWEMWBS and the SF-12, family well-being, and the SHS, indicating that people with better

well-being have better quality of life, better family well-being and a higher level of subjective happiness. Negative correlations were found between the SWEMWBS and self-rated health and the PHQ-4, showing that people with better well-being have a better physical condition and lower levels of anxiety and depression. Moderate correlations were found between the SWEMWBS and the SHS ($\rho = 0.53$), SF-12 mental component ($\rho = 0.48$), PHQ-4 ($\rho = -0.47$) and GHI ($\rho = -0.41$). The correlations between the SWEMWBS and the SF-12 physical component, family well-being, and SRH were expectedly weak ($\rho = 0.15, 0.37$ and -0.32 , respectively). The strong correlation of the SWEMWBS with the SF-12 mental component and weak correlation with the physical component indicated its divergent validity (difference of $\rho = 0.33, 0.23$ to $0.43, p < 0.001$).

[Insert Table 2 here]

Known-group validity

Table 3 shows no difference in the SWEMWBS raw score by sex. Respondents aged 18-24 years had the lowest level of well-being compared to the other age groups, as did those with primary or lower education. Respondents who had never been married reported a lower level of well-being than those who were married or widowed. Full-time students and people who were not working had a lower level of well-being compared to people who were working. Respondents who had a lower household income reported a lower level of well-being compared to those with a higher household income and people with an unstable household income.

[Insert Table 3 here]

Congeneric reliability

The congeneric reliability coefficient was 0.85. The corrected item-total correlation was high, with Spearman's rank correlation coefficients ranging from 0.56 (item 6) to 0.67 (item 4) (**Table 4**).

[Insert Table 4 here]

Test-retest reliability

The Intraclass correlation coefficient between the test and retest scores of the SWEMWBS was 0.70 (95% CI 0.55 to 0.80, $p < 0.001$) (**Table 5**), suggesting moderate to good reliability.

[Insert Table 5 here]

Discussion

Our study showed that the Chinese version of the SWEMWBS is valid and reliable for Hong Kong Chinese. The sum score of the SWEMWBS showed no ceiling effect. A Chi-squared test of the CFA indicated a rejection of the model, which is typical when large samples are used [40]. However, the RMSEA, CFI, NFI and SRMR all indicated a good model fit. The congeneric reliability of the present Chinese SWEMWBS is high (0.85). However, we did not use Cronbach's alpha, which was reported for both the previously translated version among hospitalized patients with mental illness in Hong Kong (0.89) and the English version (0.89 in the student sample and 0.91 in the population sample) [11,19]. Our test-retest results indicated moderate to good reliability of the SWEMWBS (0.70, 0.55 to 0.80) which was also similar to the previous Chinese version (0.68) [19].

Our results demonstrated that the SWEMWBS had moderate to good test-retest reliability with an overall ICC of 0.70. The ICCs of some specific items, such as “feeling useful” and “able to make up my own mind about things” were smaller than the other items, probably because these items were less stable and more sensitive to change. As the sample size of the test-retest was not very large, the stability or responsiveness of the scale needs to be further explored.

We found moderate correlations between the SWEMWBS and subjective and global happiness, the SF-12 mental component, depression and anxiety. The correlations between the SWEMWBS and the SF-12 physical component, family well-being, and self-rated health were weak. These findings can be explained by the definition of well-being, including the hedonic perspective focusing on the subjective experience of happiness and life satisfaction, and the eudaimonic perspective focusing on psychological functioning [7]. The results were in line with our hypothesis and previous findings that the SWEMWBS has moderate correlations with the happiness index and psychological morbidity, but lower correlations with measurements of overall health [14].

Well-being was correlated with several demographic factors, including age, education level, marital status, occupation, and household income. We found no sex difference in well-being which was consistent with the validation of the English [14], Swedish and Norwegian versions [16], as well as a large-scale study of well-being by different measurements [50]. Respondents aged 18-24 years, with primary or lower education, who had never been married, who were students or not working, or who had a lower household income reported a lower level of well-being. The differences in age, education, and income that we found were consistent with the norms for the English version of the SWEMWBS [14].

Our study had some limitations as the enrolled subjects might not be fully representative of the general population. The unweighted sample had higher proportions of females and elderly people compared to those of the general population [51]. In addition, we are uncertain about the effects of different survey methods (telephone vs face-to-face) on the results. However, the SWEMWBS includes general questions about feelings of optimism, usefulness, and relationships, which are not sensitive topics. Thus we believe that the interview method would not lead to large differences. Finally, the scale's responsiveness for detecting changes over time has not been assessed, e.g. after an intervention or community-based program.

Conclusion

Multiple methods were used to test the reliability and validity of the SWEMWBS. The SWEMWBS showed good validity and reliability for the general Chinese population of Hong Kong. Given the brevity, multiple dimensions, and acceptable validity of the SWEMWBS, population-based research may adopt the SWEMWBS as a simple measurement of well-being.

Conflict of interest The authors declare that they have no conflicts of interest.

Ethical approval This study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of the University of Hong Kong / Hospital Authority Hong Kong West Cluster.

Informed consent Informed consent was obtained from each individual participant included in this study.

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Table 1. Characteristics of the participants

Demographics	n (%)	n (%)
	Unweighted	Weighted ^a
Sex		
Male	486 (36.5)	583 (44.1)
Female	845 (63.5)	739 (55.9)
Age, years		
18-24	135 (10.1)	114 (8.6)
25-34	86 (6.5)	245 (18.5)
35-44	101 (7.6)	231 (17.5)
45-54	196 (14.7)	257 (19.4)
55-64	290 (21.8)	231 (17.5)
65 or above	523 (39.3)	245 (18.5)
Education		
Primary or below	306 (23.0)	299 (22.6)
Secondary / Diploma	675 (50.7)	717 (54.2)
Degree or above	350 (26.3)	306 (23.2)
Marital status		
Never been married	277 (20.8)	389 (29.4)
Cohabitated	9 (0.7)	10 (0.8)
Married	828 (62.2)	776 (58.7)
Divorced / Separated	53 (4.0)	51 (3.9)
Widowed	164 (12.3)	96 (7.3)
Occupation		
Working	419 (31.5)	624 (47.2)
Out of work	40 (3.0)	81 (6.2)
Housekeeper	244 (18.3)	229 (17.4)
Full-time student	90 (6.8)	82 (6.2)
Retired	538 (40.4)	306 (23.1)
Household income (1 US\$=7.8 HK\$)		
Below 20,000 HK\$	522 (39.2)	428 (32.4)
20,000 HK\$ or above	759 (57.0)	853 (64.5)
Unstable	50 (3.8)	41 (3.1)
Total	1331 (100.0)	1322 (100.0)

Note. ^a weighted by sex, age and education. The difference of sample size in weighted and unweighted data was due to rounding.

Table 2. The correlation of different measures with the 7-item Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS)

Measures	Score range	Mean (SD)	Spearman Coefficients ρ
SF12 PCS (n=636)	0-100 ^a	45.96 (9.20)	0.15**
SF12 MCS (n=636)	0-100 ^a	48.39 (10.14)	0.48**
Family well-being (n=1,316)	0-10 ^b	7.44 (1.64)	0.37**
SRH (n=1,331)	1-5 ^c	3.37 (0.98)	-0.32**
GHI (n=1,323)	1-4 ^d	1.98 (0.57)	-0.41**
SHS (n=1,306)	1-7 ^e	5.12 (1.05)	0.53**
PHQ-4 (n=1,327)	0-12 ^f	5.86 (2.27)	-0.47**

Note. PCS: Short Form Health Survey Physical Component Score; MCS: Short Form Health Survey Mental Component Score; SRH: Self-rated Health. GHI: Global Happiness Item. SHS: Subjective Happiness Scale. PHQ-4: Patient Health Questionnaire. Coefficients ** $p < 0.001$. ^a higher scores indicate better quality of life. ^b higher scores indicate better family well-being. ^c higher scores indicate worse self-rated health. ^d higher scores indicate lower level of happiness. ^e higher scores indicate higher level of subjective happiness. ^f higher scores indicate higher level of anxiety and depression.

Table 3. The 7-item Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS) score of participants with different demographic characteristics

Demographics	n	Mean (SD)	Mean difference (95%CI)
Sex			
Male	472	25.57 (5.05)	Reference
Female	834	25.51 (4.91)	-0.05 (-0.61, 0.51)
Age, years			
18-24	135	23.07 (4.31)	Reference
25-34	85	24.87 (4.33)	1.80 (0.48, 3.13)**
35-44	101	25.83 (4.09)	2.77 (1.50, 4.03)**
45-54	195	25.65 (4.52)	2.58 (1.51, 3.66)**
55-64	286	26.14 (4.47)	3.07 (2.07, 4.07)**
65 or above	504	25.85 (5.58)	2.79 (1.86, 3.72)**
Education			
Primary or below	300	24.94 (5.62)	Reference
Secondary / Diploma	658	25.65 (4.84)	0.71 (0.04, 1.39)*
Degree or above	348	25.82 (4.53)	0.89 (0.12, 1.65)*
Marital status			
Never been married	274	23.91 (4.62)	Reference
Cohabitated	9	25.00 (6.65)	1.09 (-2.15, 4.34)
Married	810	26.07 (4.85)	2.16 (1.49, 2.83)**
Divorced / Separated	53	25.09 (5.10)	1.19 (-0.25, 2.63)
Widowed	160	25.78 (5.35)	1.88 (0.92, 2.83)**
Occupation			
Working	415	25.60 (4.28)	Reference
Out of work	38	23.39 (4.88)	-2.20 (-3.83, -0.57)**
Housekeeper	240	25.23 (4.86)	0.36 (-1.14, 0.42)
Full-time student	90	23.07 (4.39)	-2.53 (-3.64, -1.41)**
Retired	523	26.20 (5.41)	0.60 (-0.03, 1.23)
Household income (1 US\$=7.8 HK\$)			
Below 20,000 HK\$	505	24.97 (5.34)	Reference
20,000 HK\$ or above	753	25.85 (4.67)	0.88 (0.32, 1.44)**
Unstable	48	26.50 (4.71)	1.53 (0.07, 3.00)*

* $p < 0.05$, ** $p < 0.01$.

Table 4. Item-total statistics for the 7-item Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS)

(N=1,306)

Items	Mean \pm standard deviation	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Squared multiple correlation	Cronbach's alpha if item deleted
1. Feeling optimistic about the future	3.43 \pm 1.09	22.10	18.10	0.57	0.35	0.83
2. Feeling useful	3.66 \pm 1.04	21.87	18.18	0.60	0.36	0.83
3. Feeling relaxed	3.57 \pm 0.99	21.96	18.40	0.62	0.39	0.83
4. Dealing with problems well	3.62 \pm 0.91	21.91	18.54	0.67	0.48	0.82
5. Thinking clearly	3.74 \pm 0.91	21.79	18.69	0.64	0.46	0.82
6. Feeling close to other people	3.75 \pm 0.97	21.78	18.92	0.56	0.32	0.84
7. Able to make up my own mind about things	3.75 \pm 0.93	21.78	18.76	0.62	0.43	0.83

Table 5. Intraclass correlation coefficient between initial test and retest (n=100) for the 7-item Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS)

Items	ICC	95% CI	<i>p</i> value
1. Feeling optimistic about the future	0.69	0.53, 0.79	<0.001
2. Feeling useful	0.34	0.02, 0.56	0.021
3. Feeling relaxed	0.65	0.49, 0.77	<0.001
4. Dealing with problems well	0.50	0.26, 0.66	<0.001
5. Thinking clearly	0.51	0.26, 0.67	<0.001
6. Feeling close to other people	0.59	0.40, 0.73	<0.001
7. Able to make up my own mind about things	0.42	0.13, 0.61	0.004
Total score	0.70	0.55, 0.80	<0.001

Note. ICC: Intraclass Correlation Coefficient.

Figure 1. Factor loadings of Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS) from confirmatory factor analysis

