

Validation of the WEMWBS among adolescents

Title

Validation of two versions of the Warwick-Edinburgh Mental Well-Being Scale in Norwegian adolescents

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Validation of two versions of the Warwick-Edinburgh Mental Well-Being Scale among Norwegian adolescents

Abstract

Aim: This study aimed to examine the psychometric properties of the original 14-item version of the Warwick-Edinburgh Mental Well-Being Scale (WEMWBS) and the short 7-item version (SWEMWBS) to validate these scales for use among Norwegian adolescents.

Method: Cross-sectional data were collected by distributing questionnaires among students in five upper secondary schools in Norway with a net sample of $n = 1814$. Exploratory and confirmatory factor analyses (CFA) and a reliability analysis were conducted and possible floor and ceiling effects were examined to evaluate the scales. A correlation analysis was conducted to examine criterion-related validity. **Results:** The preliminary exploratory factor analysis gave strong indications of a one-dimensional solution for both versions of the scale. Furthermore, both scales showed high internal consistency (Cronbach's $\alpha = .93$ for the WEMWBS and $\alpha = .88$ for the SWEMWBS). The SWEMWBS showed the best fit in the CFA and a strong correlation with the WEMWBS ($r = .94$). The score distributions of both scales indicated the possibility of a small ceiling effect. Both scales showed high correlations with related constructs in the expected direction. **Conclusion: In our study, based on the CFA results and the high correlation between the original scale and the short length, the SWEMWBS was found to be most suitable for use among Norwegian adolescents.**

Keywords: *mental health, wellbeing, WEMWBS, SWEMWBS, adolescence, Norway.*

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Introduction

Adolescence is a period of upheaval that introduces many new life changes and challenges, when individuals encounter opportunities related to choices in education, work, love life and self-development. Therefore, adolescence constitutes an important time when a solid foundation for good mental health can be built^{1,2}. Early mental health problems can lead to problems later in life; thus, developing good mental health in childhood and adolescence is crucial. Although most adolescents have good mental health, self-reported mental health problems have increased both internationally³ and in several national representative studies in Norway^{4,5}. In 1996, 12% of Norwegian adolescents reported having mental health problems, and this percentage increased to 19% in 2005⁴. Poor physical and mental health and difficulties with education and job attainment are the most important observed long-term consequences of early mental health problems^{2,6}. Thus, having good mental health is an important resource that helps individuals develop and maintain a good quality of life, contribute to their communities, and live healthy and productive lives^{7,8}.

In recent years, the focus on the mental health of adolescents has increased^{1,4,7}. The World Health Organization (WHO) definition of mental health⁸ emphasizes the importance of mental wellbeing, which can be referred to as a “positive and sustainable mental state that allows individuals to thrive and flourish”⁹. The hedonic and eudaimonic perspectives have been the two major theoretical approaches to mental wellbeing. The hedonic perspective focuses on happiness, while the eudaimonic perspective focuses on to which extent an individual is fully functioning¹⁰.

Despite a great deal of research on mental health, previous studies have mainly focused on mental health problems and disorders in adolescence⁹. Research on mental wellbeing, especially with regard to validated instruments for adolescents, has been lacking^{11,12}. Such instruments are important for evaluating public health-related interventions aimed at

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promoting adolescents' mental health. According to a recent systematic review of instruments measuring mental wellbeing¹³, only a few short scales are developed to cover the broad concept of mental wellbeing.

Therefore, we have chosen to use the Warwick-Edinburgh Mental Well-Being Scale (WEMWBS), a short scale covering both hedonic and eudaimonic aspects of mental wellbeing¹¹. Based on the Affectometer 2, academic literature and nine focus group interviews, an expert panel developed the WEMWBS in 2006. In the development of the scale, psychometric testing was conducted using data from 354 students in Scotland, as well as two representative Scottish population-based datasets of 1749 respondents¹¹. The scale was found to measure a single construct with high internal consistency for both adults and adolescents in the United Kingdom^{9, 11}. The WEMWBS consists of 14 items covering the main concepts associated with positive mental health: positive affect, satisfying interpersonal relationships, and positive functioning^{11, 14}. However, the scale was abbreviated into the 7-item short WEMWBS (SWEMWBS), due to indications of item redundancy and scaling properties¹². The correlation between the two scales was found to be high ($r = .95$)¹².

However, the SWEMWBS represents a narrower view of mental wellbeing; most of the items cover psychological and eudaimonic wellbeing, and few items cover hedonic wellbeing or affect¹². Although many studies have used both the (S)WEMWBS (this abbreviation includes both scales) in several countries¹⁵, to the best of our knowledge, the Norwegian versions have only been validated and compared for use among adults^{16, 17}. Smith et al.¹⁶ recommends future studies to validate the scales in other populations.

The current study aimed to validate the (S)WEMWBS in a sample of Norwegian adolescents between 15 and 21 years old. More precisely, the (S)WEMWBS were evaluated for factorial validity to test whether they measured a single construct and to assess which of the scales showed the best model fit with the data. The psychometric properties of these

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scales were assessed with reliability and correlation analyses, and the distributions of the (S)WEMWBS were examined for possible floor and ceiling effects.

Method

Participants

The schools in the study are five out of ten schools (8 public and 2 private) in one of the largest cities in Norway. One of the schools is private, while four of the schools are public. Although the schools only represent two out of four districts in this city, all districts are rather similar in socio-demographic terms. The schools represent both urban and rural environments, with a wide variety of both vocational and academic study tracks, which is also typical of Norwegian upper secondary schools. The number of students at each school ranged from 260 to 1087. In total, 2087 questionnaires were completed, and 58 were left blank, resulting in a response rate of 97.3%. Some students younger than 16 years old lacked the required parental consent, resulting in the exclusion of 169 respondents. In addition, 11 questionnaires were excluded because only background information was provided; 19 respondents older than 21 years and 74 respondents of an unknown age were also excluded. The age range was 15–21, and the net sample size was 1814 respondents with an equal gender distribution.

Procedure

The study was approved by the Regional Committee for Medical and Health Research Ethics in central Norway (REK midt 2014/1996). The data were collected in September 2016. Letters and a video available on the school's e-learning platform provided students with general information about the study. All first-year students aged 15–16 years old received an informational letter that included a consent form to be completed by the parents of students

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younger than 16 years of age. Older students provided their consent by completing the questionnaire. The students were informed that their participation was voluntary and anonymous and that the information provided would be kept confidential. Teachers were responsible for administering the questionnaires during a 45-minute classroom session of their choice over a three-week period. Prior to handing out the questionnaires, the teachers read aloud a letter provided by the researchers with practical information regarding the adolescents' participation. The students who chose not to participate in the survey were permitted to do other schoolwork.

Measures

Background variables

Gender, age, study track, parents' education and family income were used as background variables to describe the sample.

Mental wellbeing

The WEMWBS was used to measure mental wellbeing^{11, 12}. The short version (SWEMWBS) includes seven of the 14 items covered in the WEMWBS. Our study used a Norwegian translation of the English version by Smith et al.¹⁶. The respondents were asked how they had felt about 14 positively worded statements over the past two weeks. The response categories ranged from 1 = *none of the time* to 5 = *all of the time*, where higher scale scores indicated higher levels of mental wellbeing. In accordance with previous studies, the (S)WEMWBS were estimated as the sum of the individual item scores^{9, 11, 17}. For the SWEMWBS, the sum score was weighted to optimise the psychometric properties⁹. The WEMWBS score ranged from 14-70, while the SWEMWBS score ranged from 7-35.

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Related constructs

To evaluate criterion-related validity, we used the following scales: the Hopkins Symptom Checklist (HSCL-10) to assess symptoms of anxiety and depression¹⁸, the Satisfaction with Life Scale (SWLS)¹⁹, the Rosenberg Self-Esteem Scale (RSES)²⁰, and the General Self-Efficacy Scale (GSE)²¹. These scales measure concepts that are expected to relate to mental wellbeing and represent both positive (satisfaction with life, self-esteem and self-efficacy) and negative aspects (symptoms of anxiety and depression) of mental health. All scales have been validated for use among adolescents²²⁻²⁵, and they had high internal consistency in the current study (Cronbach's $\alpha > .88$). The scales used in the correlation analyses were constructed as the mean scores of the items because the mean scales preserve the original item-scale range and make addressing missing information easier²⁶.

Statistical analyses

Factorial validity was examined using principal component analysis (PCA) with oblique rotation and confirmatory factor analyses (CFA) to test whether the scale measured a single construct and to evaluate which of the two scales had the better model fit. The following fit indices were employed in the CFA: the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI), which were considered adequate if $> .90$ (preferably $> .95$); the Root Mean Squared Error of Approximation (RMSEA) with a cut-off value of $< .08$ (preferably $< .05$)²⁷, and the Standardized Root Mean Squared Residual (SRMR), which was acceptable if $< .10$ ²⁶. Modification indices (MIs) were used to identify potential improvements in the model fit and has been utilized in previous studies^{11, 16, 17}. Factor loadings of $> .55$ were considered good, while $.30$ was set as the minimum value to be included in the analysis²⁸. The sample sizes in the CFA and the PCA were $n = 1643$ (WEMWBS) and $n = 1679$ (SWEMWBS) after listwise deletion.

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Respondents who provided the same response for all items in the scales were noted. Floor and ceiling effects in the (S)WEMWBS were examined in histograms of their distributions. Floor and ceiling effects could indicate the extent to which the scale was able to discriminate at the extremes of the latent variable. Reliability was estimated using composite reliability (CR) and Cronbach's α , with values above .70 indicating satisfactory internal consistency²⁹. Criterion-related validity was evaluated by correlating (S)WEMWBS with related scales using Pearson's r .

Descriptive analyses and principal component factoring were conducted in SPSS version 24.0 and CFA were conducted in STATA version 14.2 (stata.com).

Results

Descriptive statistics

The mean age of the students was 17 (SD = 1.1). Table 1 provides a more complete description of the sample. A total of 7.4% and 9.4% had missing information for at least one item in the SWEMWBS and the WEMWBS respectively. Missing information ranged from 4.3% (item 5, had energy to spare) to 5.7% (item 12, feeling loved) in the WEMWBS. Hence, missing information was rather evenly distribution across the items. The mean score on the WEMWBS was $M = 50.2$ (SD = 9.8) ($n = 1643$), similar to a previous study ($M = 48.8$)⁹. The mean score on the SWEMWBS was $M = 24.9$ (SD = 5) ($n = 1679$).

(Insert Table I approx. here)

Dimensionality

The WEMWBS was subject to PCA. A two-dimensional factor structure was suggested by Kaiser's criterion. The first factor had an eigenvalue of 7.26 with an explained variance of 52%. By contrast, the second factor had an eigenvalue barely above 1.0, with an explained

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variance of 7% and the scree plot indicated a single construct. Factor loadings varied from .38–.88 on factor 1 and .36–.85 on factor 2. Four items showed loadings on the second factor (items 4, 9, 12 and 13); three of these items were indicators of relatedness. Item 13, feeling interested in new things, had loadings of equal size on both factors. When forcing a one-factor solution, the loadings varied from .59 to .80, which is quite satisfactory²⁸.

(Insert Table II approx. here)

Dimensionality was further evaluated using CFA. The first two models were based on the WEMWBS, while the last two models were based the SWEMWBS (Table 2). Model 1 showed a poor model fit with the existing data, with a high significant χ^2 value; however, this value is strongly affected by the large sample sizes²⁷. The RMSEA and the SRMR were above the acceptable limits, and the CFI and the TLI were below the recommended threshold values. The standardized factor loadings ranged from .53 to .80. The modification indices indicated that the model fit would be improved by adding covariance between the error terms for items 1 and 2 (MI = 153), between those for items 8 and 10 (MI = 342), and between those for items 9 and 12 (MI = 200). In model 2, covariance between the error terms for items 8 and 10 was added. The model fit was still unsatisfactory – with a highly significant χ^2 value and the RMSEA and the SRMR above the recommended threshold values, although the CFI and the TLI showed adequate values.

In model 3, when evaluating the SWEMWBS, the standardized factor loadings ranged from .63 to .79. As for model 1, the model fit was not satisfactory. MI indicated that the model fit would be improved by adding a covariance between the error term for items 1 and 2 (MI = 189). In model 4, this covariance was added. The fit indices showed acceptable and improved model fit compared with those of the previous models. The χ^2 value was statistically significant, and the RMSEA was just adequate. The factor loadings for models 2 and 4 are presented in Table 3.

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(Insert Table III approx. here)

Same response answering

A total of 188 respondents (10.4%) chose the same response category for all 14 items of the WEMWBS. This result indicated satisfactory variance in the responses for the (S)WEMWBS. Same response answering was most frequently found for categories four and five.

Floor and ceiling effects

The distribution for the (S)WEMWBS showed little evidence of floor effects (Figure 1). The score distributions for the scales indicated a tendency towards a small ceiling effect. The ceiling effect was explained by same response answering on category 5. The same response answering may be due to a high value on the latent dimension, or be an expression of a response set. If the former is true, the scales possibly do not discriminate well enough among adolescents with high levels of wellbeing.

(Insert Figure I approx. here)

Reliability and criterion-related validity

Based on Cronbach's α and composite reliability, internal consistency was satisfactory for both scales ($\alpha = .93$, CR = .92 for the WEMWBS, and $\alpha = .88$, CR = .86 for the SWEMWBS) (Table 2).

The correlation between the mental wellbeing scales was high ($r = .94$). The correlations between each mental wellbeing scale and related scales were of equal size or slightly weaker for SWEMWBS. The latter showed a negative and statistically significant correlation with symptoms of anxiety and depression ($r = -.55$) and positive and statistically

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significant correlations with life satisfaction ($r = .64$), self-esteem ($r = .66$) and self-efficacy ($r = .65$).

(Insert Table IV approx. here)

Discussion

After comparing and validating the psychometric properties of the (S)WEMWBS for use among Norwegian adolescents, we found that the short version (SWEMWBS) was more feasible than the original version (WEMWBS). When exploring the *dimensionality* of the WEMWBS, exploratory factor analysis (PCA) showed support for a one-factor solution, which is in line with previous research^{9, 11, 17}. However, the results of the CFA showed that the WEMWBS had a poor model fit with the data, which is similar to the findings of two previous studies^{16, 17}, where they used several correlated error terms to obtain a satisfactory model fit. Although Tennant et al.¹¹ found the WEMWBS to be unidimensional with an acceptable fit with the data in the CFA after adding covariance between some of the items, they also suggested that the scale may have some redundancy due to high value of Cronbach's α . In our study, the SWEMWBS showed an acceptable model fit with the data when adding one covariance between two error terms of item 1 and 2; one of the covariances added in Smith et al.¹⁶.

The SWEMWBS was found to be preferable to the WEMWBS because of its better overall model fit in the CFA and because it had seven items relative to the 14 items for the WEMWBS. Theoretically, the SWEMWBS represents a restricted view of mental wellbeing, as few items cover the hedonic approach or affect¹². However, the near perfect correlation between the two versions of the mental wellbeing scale may indicate that the SWEMWBS covers the same elements as the WEMWBS. Although the two dimensions are theoretically

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different, the respondents' patterns of answers indicate that they do not perceive this distinction.

The results revealed signs of a possible small *ceiling effect* in both scales, which may indicate that the scales do not discriminate well enough for the highest levels of mental wellbeing. In contrast to our findings, those of Tennant et al.¹¹ for both adults and students showed no signs of ceiling effects in the WEMWBS.

Most of the adolescents reported a high level of mental wellbeing, which is line with previous research conducted in the United Kingdom⁹. Haver et al.¹⁷ also found a high level of reported wellbeing (SWEMWBS) in both Norwegian and Swedish samples of adults. However, in their study, the mean age of the respondents was 40 years old hotel managers, making their sample incomparable to the adolescent sample in our study. The high mean scores in the current study may also be influenced by the positively worded items and the adolescents' responses in what they thought was the desired direction. This may also have contributed to the small ceiling effects.

Criterion-related validity was supported by statistically significant and positive correlations between the (S)WEMWBS and satisfaction with life, self-esteem, self-efficacy and mental wellbeing, which is in line with past research^{11, 17}. In addition, a statistically significant negative correlation was found between mental wellbeing and symptoms of anxiety and depression.

A major strength of the study is the large and representative sample size, and the high response rate. A limitation of the study is the lack of control for the potential social desirability bias, since no measure of this response set was included in the questionnaire.

In conclusion, the SWEMWBS had the best model fit with the data in the CFA, a high correlation with the original version, and a short length, making it more appropriate for use among Norwegian adolescents than the WEMWBS. We therefore recommend utilizing the

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SWEMWBS for Norwegian adolescents. However, future research is needed to evaluate measurement invariance in adolescent mental wellbeing by gender and age. Evaluating the scale's sensitivity for change is important in order to use the scale in public health-related interventions aimed at promoting mental health in adolescence.

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Declaration of conflicts of interest

The authors have no conflicts of interest to declare.

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Table I

Description of the sample (n=1814)

Variables	<i>n</i>	%
Gender		
Male	871	48.3
Female	934	51.7
Missing	9	
Age		
15-16	738	40.7
17	479	26.4
18	449	24.8
19	106	5.8
20-21	42	2.3
Study track		
Vocational	511	28.8
General	1266	71.2
Missing	37	
Parents education		
One or both parents with a master degree	626	65.5
Lower than a master degree and missing	1188	34.5
Family income		
Poor	110	6.2
Neither poor nor good	40	22.8
Good	1263	71
Missing	35	

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Table II

Confirmatory factor analyses and internal consistency of the mental wellbeing scales^a

Model	χ^2	df	RMSEA	CFI	TLI	SRMR	α	CR
WEMWBS							.93	.92
1	1408.35***	77	.10	.89	.87	.05		
2 ^b	1073.53***	76	.09	.92	.90	.04		
SWEMWBS							.88	.86
3	292.13***	14	.11	.95	.92	.04		
4 ^c	108.16***	13	.07	.98	.97	.02		

^a CFA of WEMWBS n=1643 and CFA of SWEMWBS n=1679, listwise deletion. ^b Includes one covariance

between the error terms for items 8 and 10. ^c Includes one covariance between the error terms for items 1 and 2.

* $p < .05$. ** $p < .01$. *** $p < .001$.

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Table III

Factor loadings of the mental well-being scales

Items	Wording	Model 2 (WEMWBS) ^a		Model 4 (SWEMWBS) ^b	
		Unstand. ^c	Stand. ^d	Unstand. ^c	Stand. ^d
1	I've been feeling optimistic about the future	1 (fixed)	0.63	1 (fixed)	.59
2	I've been feeling useful	1.04	0.77	1.07	.73
3	I've been feeling relaxed	1.00	0.55	1.05	.65
6	I've been dealing with problems well	1.01	0.76	1.15	.80
7	I've been thinking clearly	1.09	0.77	1.24	.81
9	I've been feeling close to other people	0.98	0.67	0.99	.63
11	I've been able to make up my own mind about things	0.98	0.72	1.01	.74
4	I've been interested in other people	0.74	0.55		
5	I've had energy to spare	1.02	0.69		
8	I've been feeling good about myself	1.23	0.76		
10	I've been feeling confident	1.24	0.77		
12	I've been feeling loved	0.95	0.56		
13	I've been interested in new things	0.99	0.61		
14	I've been feeling cheerful	0.90	0.71		

^a n= 1643, listwise deletion. ^b n= 1679, listwise deletion. ^c Unstand.: unstandardized factor loadings.

^d Stand.: standardized factor loadings.

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Table IV

Correlations of the mental well-being scales with related constructs

Scales ^a	WEMWBS		SWEMWBS	
	r	n	r	n
Anxiety and depression symptoms	-.60***	1636	-.55***	1670
Satisfaction with life	.68***	1569	.64***	1601
Self-esteem	.70***	1554	.66***	1587
Self-efficacy	.66***	1543	.65***	1573

^a Anxiety and depression is assessed by HSCL-10, satisfaction with life is assessed by SWLS, self-esteem is assessed by RSES, and self-efficacy is assessed by GSE.

* $p < .05$. ** $p < .01$. *** $p < .001$.

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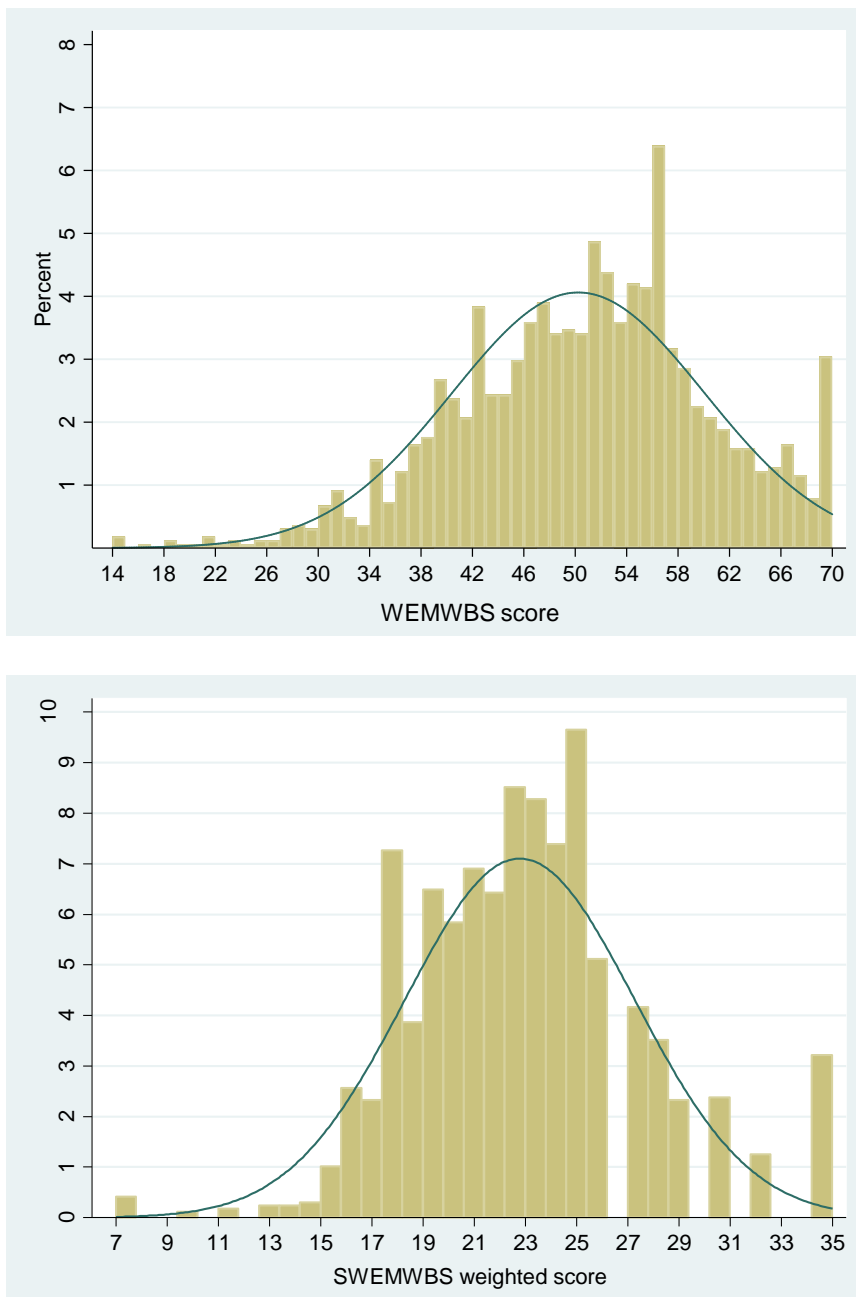


Figure I. Distributions of the mental wellbeing scales.

WEMWBS score n=1643, listwise deletion and SWEMWBS score n=1679, listwise deletion.