NHS Health Scotland

Warwick-Edinburgh Mental Well-being Scale (WEMWBS)

User guide – Version 2

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THE UNIVERSITY OF WARWICK

WARWICK MEDICAL SCHOOL

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Audience

It is anticipated that the audience for this user guide includes researchers and practitioners who are familiar with the use of scales in evaluations. This user guide does not seek to answer questions relating to what to consider for evaluation purposes. For this, the following should be referred to in the first instance:

- WEMWBS practitioner-based user guide, *Using WEMWBS to measure the impact of your work on mental wellbeing: A practice-based user guide*, at www2.warwick.ac.uk/fac/med/research/platform/wemwbs/researchers/userguide/wemwbs_practice_based_user_guide.pdf
- other WEMWBS user guides available at www2.warwick.ac.uk/fac/med/research/platform/wemwbs/researchers/userguide/

The following Mental Health Improvement Evaluation Guides (2005) from NHS Health Scotland provide general information, which will also be of use:

- Guide 1: Evidence-based practice www.healthscotland.com/documents/457.aspx
- Guide 2: Measuring success www.healthscotland.com/documents/458.aspx
- Guide 3: Getting results www.healthscotland.com/documents/459.aspx
- Guide 4: Making an impact www.healthscotland.com/documents/460.aspx
- Guide 5: Selecting scales to assess mental wellbeing in adults www.healthscotland.com/documents/2403.aspx

Update revisions

This is an updated version of the original user guide (version 1, 2008, by Professor Stewart-Brown and Dr Janmohamed, edited by Dr Parkinson).[1] There will be no further updates. For new information about WEMWBS, see the website www2.warwick.ac.uk/fac/med/research/platform/wemwbs

Summary

The Warwick–Edinburgh Mental Well-being Scale (WEMWBS) was developed in 2006 by researchers from the universities of Warwick and Edinburgh, with funding provided by NHS Health Scotland, to enable the measurement of mental wellbeing in adults (individuals aged 16 and above) in the UK (see www.healthscotland.com/scotlands-health/population/Measuring-positive-mental-health.aspx). It derives from a model of mental wellbeing that is more than the absence of mental illness, and involves both feeling good and functioning well.

WEMWBS is a 14-item scale covering subjective wellbeing and psychological functioning, in which all items are worded positively and address aspects of positive mental health. The scale is scored by summing the response to each item answered on a 1 to 5 Likert scale. The minimum scale score is 14 and the maximum is 70. WEMWBS was initially validated for use in the UK with those aged 16 and above, involving surveys in both student and general population samples, and focus groups. It has now been widely validated in different populations and languages other than English.

Scores derived from the student and population samples showed a single underlying factor, interpreted to be mental wellbeing, with low levels of social desirability bias and expected moderate correlations with other scales of wellbeing. Scores for individuals were stable over a one-week period.

People participating in studies of face validity have found the scale clear, unambiguous and easy to complete. They volunteered the opinion that the scale measured mental wellbeing.

Population scores on WEMWBS approximate to a normal distribution, with few studies showing ceiling or floor effects, making the scale suitable for monitoring mental wellbeing in population samples. The scale is not designed to identify or screen for individuals with high or low mental wellbeing. However, a number of different cut points (for example, using quintiles and standard deviation) have been used in epidemiological analyses to identify probably very well and probably unwell groups in order to investigate correlates and determinants of mental wellbeing.

The Scottish population mean score obtained during validation was 50.7 with a 95% confidence interval of 50.3 to 51.1, in a combined national dataset comprising the *Health Education Population Survey* 2006 (wave 12) and the *Well? What do you think?* 2006 survey. Since 2008, WEMWBS has been included in the *Scottish Health Survey* where the population mean score for Scotland has varied between 50.0 and 49.7 over the period 2008 to 2013, with a mean score of 50.0 in both 2008 and 2013. For England, WEMWBS has been included in the *Health Survey for England* since 2010, and the population mean score has varied from 50.9 in 2010 to 51.6 in 2011 and 52.4 in 2012.

In general population samples, a U-shaped relationship is found for age, with mean WEMWBS scores lower in middle age and highest in the 65 to 74 year age group. Small, non-significant differences are found for sex, with male

scores slightly higher than those for females. Low WEMWBS scores have been consistently associated with low socio-economic status, but the relationship between socio-economic status and high WEMWBS scores is different and is being further investigated. Collection of WEMWBS scores in many surveys and cohort studies is now enabling the association and predictive power of other socio-demographic, lifestyle and social capital factors with mental wellbeing, to be identified. These factors include marital status, household income, economic activity, fruit and vegetable consumption, and supportive relationships.

Research on WEMWBS has shown that:

- WEMWBS is sensitive to change
- a short 7-item version, the Short Warwick–Edinburgh Mental Well-being Scale (SWEMWBS), better meets the scaling properties of the Rasch model
- WEMWBS is suitable for use at a population level for those aged 13 years and above
- WEMWBS can be used in English-speaking ethnic minority populations in the UK
- WEMWBS is valid in a number of other languages.

Both WEMWBS and SWEMWBS have continued to be widely used in national and local surveys, and for evaluation of the impact of public mental health initiatives.

As a short and psychometrically robust scale, with little or nothing in the way of ceiling or floor effects in population samples, both WEMWBS and SWEMWBS are suitable for monitoring mental wellbeing at a population level. WEMWBS is also suitable for measuring change due to interventions or programmes.

Both WEMWBS and SWEMWBS are freely available, but prospective users should seek permission to use the scales. This is obtained by registering to use the copyrighted scale by completing the online registration form on the University of Warwick WEMWBS webpage at www2.warwick.ac.uk/fac/med/research/platform/wemwbs/researchers/register/ If the scale is reproduced, it must remain unaltered and include the copyright statement that appears with it (see Appendix i, v and vii). Information on developments and new research can be found at www2.warwick.ac.uk/fac/med/research/platform/wemwbs

Contents

Abbreviations

BIDR	Balanced Inventory of Desirable Responding
BMI	Body mass index
CAPI	Computer-assisted personal-interviewing
CASI	Computer-assisted self-interviewing
CES-D	Centre for Epidemiological Studies Depression Scale
CI	Confidence interval
COPD	Chronic obstructive pulmonary disease
EPDS	Edinburgh Post Natal Depression Scale
FAS	Family Affluence Scale
HEPS	Health Education Population Survey
GHQ 12	General Health Questionnaire 12
MHC-SF	Mental Health Continuum-Short Form
ROC	Receiver operating characteristic
SALSUS	Scottish Schools Adolescent Lifestyle and Substance Use Survey
SDQ	Strengths and Difficulties Questionnaire
SIMD	Scottish Index of Multiple Deprivation
SOA	Single Outcome Agreement
SWEMWBS	Short Warwick–Edinburgh Mental Well-being Scale
Well?	Well? What do you think? survey
WEMWBS	Warwick–Edinburgh Mental Well-being Scale
WHO-5	WHO-Five Well-being Index

1. Introduction

Practitioners of mental health promotion and public mental health have, for many years, recognised the need to focus their efforts on improving mental health as well as preventing mental illness. Due to confusion relating to the use of the term 'mental health' to describe services for people with mental illness, terms such as positive mental health and mental wellbeing have been adopted to define the aims of such initiatives. These terms – positive mental health and mental wellbeing – are seen as synonymous and are used interchangeably in this user guide.

Public mental health has been hampered by a lack of valid instruments suitable for measuring positive mental health in the general population. Monitoring and evaluation have had to be undertaken using instruments designed primarily to detect mental illness. There are two problems with such an approach. First, mental illness measures tend to have significant ceiling effects in general population samples, meaning that people with only moderately good mental health can achieve the highest possible score. As a result, these measures cannot show improvements in mental health in the healthier portion of the population distribution. Second, participants who are involved in the evaluation of interventions to promote mental health may develop the erroneous impression that the interventions are designed only to help people with mental health problems and, in this way, the evaluation can affect the impact of interventions.

To overcome these problems, NHS Health Scotland commissioned the development of the Warwick–Edinburgh Mental Well-being Scale (WEMWBS) as part of the Mental Health Indicators Programme.[a]

This user guide is for those who want to use WEMWBS for monitoring and research purposes, as well as for evaluations. Those who require information on what to consider for evaluation are referred to the NHS Health Scotland Evaluation Guides in the first instance (www.healthscotland.com/mental-health-publications.aspx). For full details on the development of WEMWBS, see www.healthscotland.com/scotlands-health/population/Measuring-positive-mental-health.aspx and for its current use, research and latest developments, see www2.warwick.ac.uk/fac/med/research/platform/wemwbs

Ceiling and floor effects – these occur when many people score the maximum or minimum score on a scale. Improvements or deteriorations in the assessed variable being measured cannot therefore be identified. For example, significant ceiling effects on a mental health scale used in a general population sample may mean that people who possess only moderately good mental health can achieve the highest possible score. As a result, the instrument cannot show improvements in mental health in the healthier portion of the population distribution.

[a] NHS Health Scotland was commissioned by the Scottish Government's National Programme for Improving Mental Health and Well-being (www.wellscotland.info) to establish a core set of national, sustainable mental health and wellbeing indicators for adults in Scotland (www.healthscotland.com/scotlands-health/population/mental-health-indicators.aspx).

2. A word about mental wellbeing

A necessary starting point for the development of a new instrument is a clear understanding of the concept that it is designed to measure. In the past, there has been considerable discussion and debate about the nature of positive mental health and wellbeing. Recently, a reasonable level of consensus has emerged among both academics and the public.

Mental wellbeing is now largely accepted as covering two perspectives: (1) the subjective experience of happiness (affect) and life satisfaction (the hedonic perspective); and (2) positive psychological functioning, good relationships with others and self-realisation (the eudaimonic perspective). The latter includes the capacity for self-development, autonomy, self-acceptance and competence. These two perspectives are described in the popular literature as feeling good and functioning well. Those wanting to understand more about this subject are referred to the large literature, clearly described in Ryan and Deci (2001).[2]

There has been some discussion in the academic literature as to whether mental wellbeing and mental illness represent two ends of a single spectrum (single continuum model) or two separate dimensions (two continua or dual continua model). The two continua model allows for the possibility that people who have a diagnosis of a mental illness can experience mental wellbeing. It reflects the finding that analysis of instruments covering both positive and negative mental health often suggests two correlated, but independent, underlying factors. Possible explanations for these findings include issues relating to how psychiatric conditions are defined, the fluctuating nature of mental illness, and individuals' interpretations and responses to positively and negatively worded items on mental health measurement scales.

Mental wellbeing derives from psychological functioning, which includes the ability to develop and maintain mutually beneficial relationships, and from levels of happiness and contentment with life, usually measured as life satisfaction. Psychological functioning includes the ability to maintain a sense of autonomy, agency, self-acceptance, self-esteem, personal growth and purpose in life. Mental wellbeing is more than the outcome of treating or preventing mental illness.

Mental illness is a term used to encompass all mental disorders – these are illnesses that affect mood, emotions, and the ability to function effectively and appropriately.

Hedonic perspective of wellbeing focuses on the subjective experience of happiness (affect) and life satisfaction.

Eudaimonic perspective of wellbeing focuses on psychological functioning, good relationships with others and self-realisation. This is the development of human potential that, when realised, results in positive functioning in life, and covers a wide range of cognitive aspects of mental health.

3. What is WEMWBS and how was it developed?

WEMWBS comprises 14 items that relate to an individual's state of mental wellbeing in the previous two weeks (see Appendix i). Responses are made on a five-point scale ranging from 'none of the time' to 'all of the time'. Each item is worded positively and, together, they cover most, but not all, attributes of mental wellbeing including both hedonic and eudaimonic perspectives. Areas not covered include spirituality or purpose in life. These were deemed to extend beyond the general population's current understanding of mental wellbeing and their inclusion was thought likely to increase non-response.

WEMWBS aims to measure mental wellbeing itself and not the determinants of mental wellbeing, which include resilience, skills in relationships, conflict management and problem solving, as well as social acceptance, respect, equality and social justice.

WEMWBS was developed through research that was conducted at Warwick and Edinburgh universities for NHS Health Scotland.[b] The starting point for the research was a pre-existing scale called Affectometer 2, developed in the 1980s in New Zealand.[3] Affectometer 2 consists of 20 statements and 20 adjectives relating to mental health, in which positive and negative items are balanced. It proved to have a broad measure of intuitive appeal to practitioners and researchers working in this area in the UK. While it had been used in a number of countries, there was no UK validation of the scale and so this validation was conducted as the first step in this research project.

Validation of Affectometer 2 in both population and student samples suggested that, while it performed adequately, it was longer than it needed to be and subject to an unacceptable level of bias due to 'desirable responding' (respondents answering in a way they thought was likely to be 'approved of').[4, 5] A focus group study involving participants from a wide range of socio-economic backgrounds found that although, in general, the scale was viewed favourably, some of the items were considered to be 'difficult', and in spite of the balance of positive and negative items, the instrument was viewed predominantly as a measure of mental illness.[4]

A multidisciplinary research advisory group, familiar with epidemiological research and the academic literature relating to concepts of mental wellbeing, reviewed these results (Appendix ii). The research team drafted a set of items derived partly from Affectometer 2, but taking into account the findings of the qualitative focus group research relating to difficult and potentially redundant items, while at all times referring to current literature on mental wellbeing. Working iteratively with the advisory group, this new scale was refined to the 14-item WEMWBS.[4]

[b] See www.healthscotland.com/scotlands-health/population/Measuring-positive-mental-health.aspx for information on the development of WEMWBS and associated historical reports.

4. How has WEMWBS been validated?

Table 1 lists whether or not the psychometric tests involved in validating a scale have been performed on WEMWBS and, if so, the sample(s) used. Details of the results are given on the following pages.

Table 1: Psychometric testing of WEMWBS in the UK

Psychometric test	Tested	Sample
Confirmatory factor analysis	✓	Student population samples Scottish general adult population samples School children aged 13-16 years
Construct validity	✓	Student population samples Scottish general adult population samples School children aged 13-16 years
Internal consistency	✓	Student population samples Scottish general adult population samples School children aged 13-16 years
Test-retest reliability	✓	Student population samples School children aged 13-16 years
Response bias	✓	Student population samples
Face (or content) validity	✓	WEMWBS research advisory group Focus groups with people from a wide range of socio-economic backgrounds School children aged 13-16 years
Criterion validity	x	'Gold standard' measure to assess WEMWBS against does not currently exist
Rasch analysis	✓	Scottish general adult population sample
Sensitivity to change	✓	Variety of samples in intervention studies carried out in the UK
Cross-cultural validity	✓	English-speaking adults from Pakistan and Chinese populations in England Translated versions: Arabic, Bangla, Dutch French, German, Greek, Hindi, Italian, Japanese, Lithuanian, Norwegian, Portuguese, Spanish, Urdu and Welsh. Some of these translated versions have been validated quantitatively with psychometric tests, and qualitatively with focus groups

5. Original validation of WEMWBS – adults (16 years+)

Validation was originally performed in the UK with those aged 16 and above in student samples recruited at the universities of Warwick and Edinburgh in 2006, and subsequently discussed by two focus groups in Scotland and England.[4, 6] WEMWBS was then included in two national Scottish population surveys in 2006, allowing validation using population data.

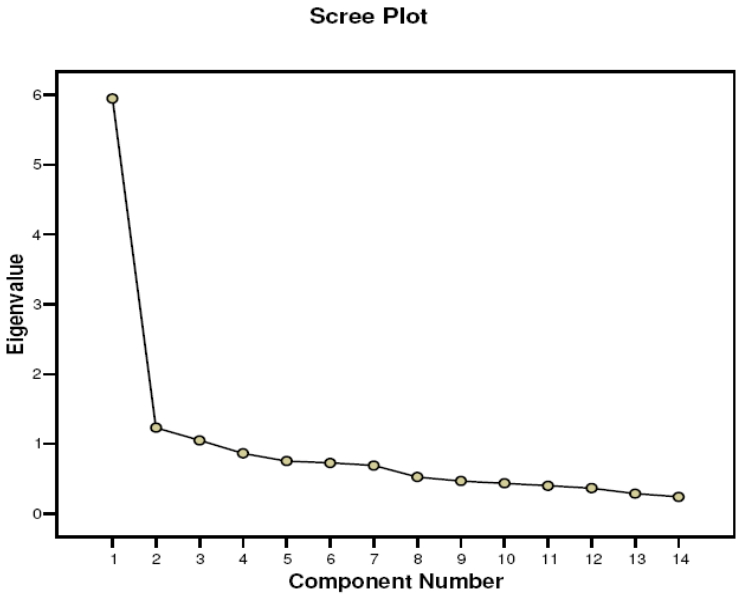
5.1 Student populations (n = 348)

Principal components factor analysis
The main aims in conducting this analysis were:

- to determine whether the number of items in the scale could be reduced
- to determine the relationships between items.

The test considers how much variance is added by each factor the scale considers. The variance that each additional factor contributes is expressed by eigenvalues. A scree plot of eigenvalues against component numbers can be used to illustrate the amount of variance that a single factor contributes.

Figure 1: WEMWBS scree plot for student samples (n = 348)



The principal components factor analysis confirmed a single underlying factor to the scale, shown in the sharp 'elbow' of the scree plot. This underlying factor is interpreted to be mental wellbeing.

Construct validity
This considers the extent to which there are logical relationships between the scale and other scales or factors (such as age or sex) known to affect the concept being measured. It is assessed by correlations between the scale under review and other scales measuring similar concepts (convergent validity) or different concepts (divergent validity), and by determining statistically significant differences in scale scores between different groups.

For validation of WEMWBS, this was assessed by testing correlations between WEMWBS and other scales that measure aspects of mental health, as well as scales that measure general health and emotional intelligence (Appendix iii), and also the extent to which it follows anticipated patterns for age and sex (Table 2).

Table 2: Correlation of WEMWBS to other scales

Scale	n	Correlation with WEMWBS$^{\alpha}$
WHO-Five Well-being Index	79	0.77**
Short Depression Happiness Scale	71	0.76**
Positive and Negative Affect Scale – Positive Subscale	63	0.73*
Positive and Negative Affect Scale – Negative Subscale	63	-0.55**
Satisfaction With Life Scale	79	0.72**
Global Life Satisfaction Scale	77	0.55**
Scale of Psychological Well-being	63	0.73**
EQ-5D Thermometer	72	0.42**
Emotional Intelligence Scale	67	0.51**

$^{\alpha}$ Pearson's correlation coefficient
* significant at 0.05 level
** significant at 0.01 level

Correlations were moderately high between WEMWBS and the: Scale of Psychological Well-being; Satisfaction with Life Scale; Short Depression Happiness Scale; Positive and Negative Affect Scale – Positive Subscale; and the WHO-Five Well-being Index. These results were similar to those found between Affectometer 2 and these scales, which is as expected given that Affectometer 2 was the starting point for research on WEMWBS. These results indicate that WEMWBS covers both hedonic and eudaimonic aspects of mental wellbeing.

WEMWBS showed moderate to low correlations with the EQ-5D Thermometer (a measure of overall physical and emotional health) and the Emotional Intelligence Scale (a measure of the ability to accurately assess one's own and others' emotions). This is expected because these two scales measure concepts that are separate from, but not unrelated to, positive mental health.

Internal consistency
This considers whether the scale describes a consistent underlying theme – in this case, it considers the extent to which the items included in WEMWBS are focused on assessing mental wellbeing. Scores range from 0 to 1 and are measured by Cronbach's alpha coefficient. The higher the coefficient, the more highly correlated the items in the scale. A coefficient of 0.7 to 0.8 is ideal[7] and higher coefficients may suggest that some degree of item redundancy exists in the scale.

Cronbach's alpha coefficient = 0.89 (n = 348)

This high coefficient suggests that, while there is a good level of internal consistency, there may be scope to reduce even further the number of items

in the scale (analyses have subsequently been undertaken to explore the potential for a shortened scale, see section 10).

Test-retest reliability

This considers the stability of responses over a period of time. Test-retest reliability is determined by calculating the correlation between two sets of scores for the same group of people who repeat the test after a set period of time. For WEMWBS, the time period was one week.

Correlation$^{\alpha}$ = 0.83 after one week (n = 124)

$^{\alpha}$ Intra-class correlation coefficient

The test-retest reliability score was high for WEMWBS after one week. This suggests that the transient fluctuations that a person may experience from one day to the next are not reflected in the scores, and these scores remain robust over a short period of time.

Response bias

This considers the extent to which an individual may tailor his or her responses in order to be perceived in a certain light, a phenomenon known as 'impression management'. It also considers the extent to which an individual remains unaware of their true state of mental wellbeing, known as 'self-deception bias'. These two aspects of social desirability responding are measured using the Balanced Inventory of Desirable Responding (BIDR).

Correlations between the two subscales of the BIDR and WEMWBS, and between the two subscales and other mental health scales including Affectometer 2, are shown in Table 3.

Table 3: Correlation of WEMWBS to BIDR$^{\alpha}$

Scale	n	Impression management	Self-deception
WEMWBS	115	0.18*	0.35**
Affectometer 2	115	-0.25**	0.55**
WHO-Five Well-being Index	62	-0.39**	-0.20
Positive and Negative Affect Scale – Positive Subscale	52	0.02	0.50**
Positive and Negative Affect Scale – Negative Subscale	51	0.03	-0.16
Satisfaction With Life Scale	62	0.34**	0.40**
Global Life Satisfaction Scale	62	0.26*	0.13

$^{\alpha}$ Pearson's correlation coefficient

* significant at 0.05 level

** significant at 0.01 level

WEMWBS showed a low correlation with both subscales of the BIDR. This contrasts with Affectometer 2, where self-deception bias was a major disadvantage of the scale. WEMWBS also performed better than three comparison mental health scales on impression management, and better than two on self-deception.

These findings suggest that both impression management and self-deception response biases, while still an issue (as they are with all mental health scales), are acceptable for monitoring and evaluation purposes at the group/population level.

5.2 Focus groups

Face validity
Face validity assesses whether the items in the scale are suitable for the overall concept being measured. For WEMWBS, this was tested in two focus groups with members of the general population in England and Scotland, selected on the basis of socio-economic background, age and sex. Groups included mental health service users and non-users. Individuals were asked to complete WEMWBS and discuss their impressions of the scale. The aim of these investigations was to test what people thought WEMWBS was designed to measure and to determine its user-friendliness. Participants were asked to identify any items that they thought irrelevant or confusing. Results of these focus group discussions suggested that WEMWBS was clear, user-friendly and unambiguous. Unlike Affectometer 2, no suggestions were made to modify the scale or to clarify it in any way. Importantly, participants recognised that WEMWBS measured positive mental health rather than mental illness.

5.3 Scottish population samples (n = 1,749)

WEMWBS was included in the autumn wave of the Scottish *Health Education Population Survey* (HEPS) 2006 (wave 12), which collected data from a random sample of the Scottish population aged 16 to 74 years on a wide range of aspects of health and health-related lifestyles.[8] It was also included in the population survey *Well? What do you think?* (Well?) 2006, which was conducted on a random sample of the Scottish population aged 16 and above and collected data on public attitudes to mental health, mental wellbeing and mental health problems.[9]

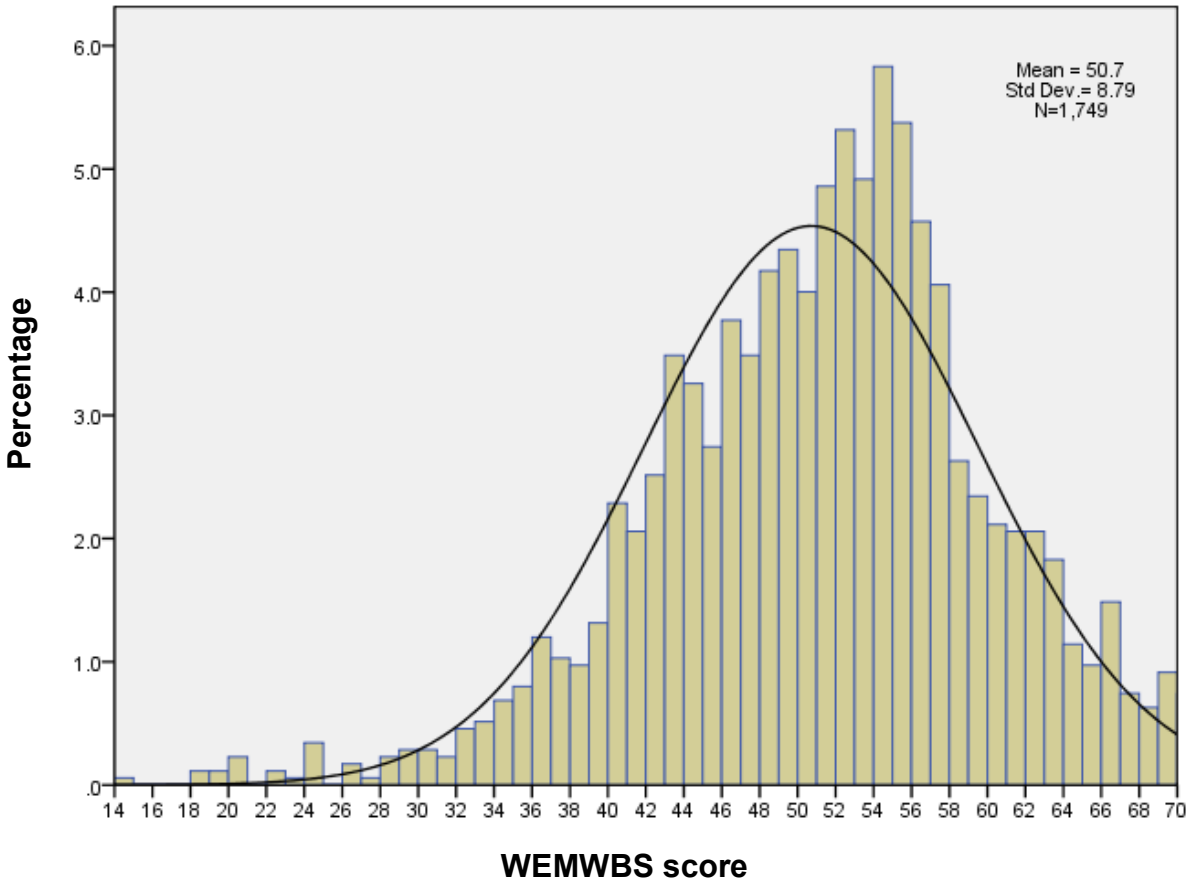
Analysis of combined data from these two population surveys (n = 2,075 for the combined dataset, with complete WEMWBS scores for n = 1,749 and complete General Health Questionnaire 12 (GHQ 12) scores for n = 1,239) has confirmed the findings of the student validation, with analyses showing:[6]

- verification of a pre-hypothesised single underlying factor (n = 1,749)
- Cronbach's alpha = 0.91 (n = 1,749), again indicating that while there is a good level of internal consistency, there may be scope to reduce the number of items in the scale even further
- good performance against accepted criteria, discriminating population groups largely as expected and in a way consistent with other population surveys (see section 8 and Appendix iv)
- significant moderate negative correlation to the GHQ 12 (see section 7).

6. Distribution of WEMWBS scores

In both the student and population samples, WEMWBS scores followed a roughly normal distribution with only a slight left-skew (Figure 2). WEMWBS can be used to calculate mean scores for different groups of people, or for the same people at different time periods.[c] Mean scores can be compared using standard deviations and 95% confidence intervals.

Figure 2: Distribution of WEMWBS scores for the combined HEPS (wave 12) and Well? 2006 survey dataset (n = 1,749)



Because population scores on WEMWBS approximate to a normal distribution, with few studies showing ceiling or floor effects, WEMWBS can be expected to capture the full spectrum of positive mental health. This makes the scale suitable for monitoring mental wellbeing trends over time in population samples, and for monitoring and evaluating the effect of mental health-promoting programmes or interventions.

WEMWBS is not designed to identify or screen for individuals with either low or high mental wellbeing. Cut points to enable such screening activity have not been developed in the way that they have for mental illness measures (see section 7).

[c] Mean scores should be used if the data collected are normally distributed, and median scores if the data are not. WEMWBS scores followed a roughly normal distribution with a slight left-skew. As the distribution is so close to normal, it is considered appropriate to use mean scores, although some statisticians may decide that median scores should be used.

Epidemiologists studying the correlates and determinants of mental wellbeing using WEMWBS have, however, used a variety of cut points to define population groups with varying levels of mental wellbeing. These include (i) dividing the population into quintiles on the basis of WEMWBS scores, and (ii) categorising the population according to the extent of their standard deviation from the mean (see section 20).[9, 10] All these are valid approaches for the purposes of such analyses, and the best approach will depend on the population under study and the purpose of the investigation.

7. Comparison between WEMWBS scores and scores on measures of mental illness

General Health Questionnaire 12

The HEPS 2007 survey included the GHQ 12 measure alongside WEMWBS, allowing the two to be compared in the same group of people. Each item in GHQ 12 has four response options. It can be scored either as 1 to 4 (continuous scoring) or recoded so that the first two options score 0 and the last two score 1 (dichotomous scoring).

Figure 3a shows the distribution of GHQ 12 scores, scored 1 to 4 for each item thus giving a continuous range of scores from 12 to 48. WEMWBS showed a significant negative correlation with continuous GHQ 12 scores in this population (Spearman's rank correlation coefficient r = -0.662, p <0.01), which persisted when the dichotomous scoring method was used (Spearman's rank correlation coefficient r = -0.536, p < 0.01). This correlation with GHQ 12 (scored 1 to 4) is also illustrated in the scatter plot shown in Figure 3b.

Figure 3a: Distribution of GHQ 12 scores for the HEPS 2007 dataset (n = 1,741)

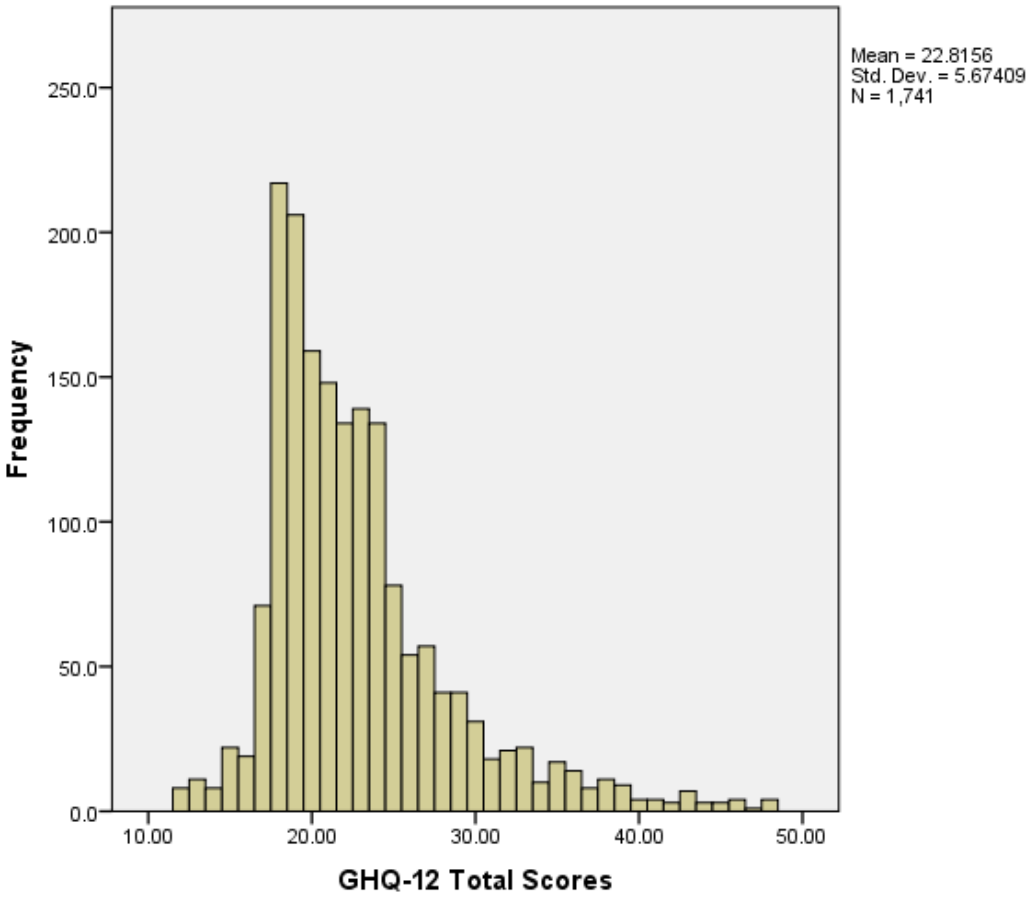
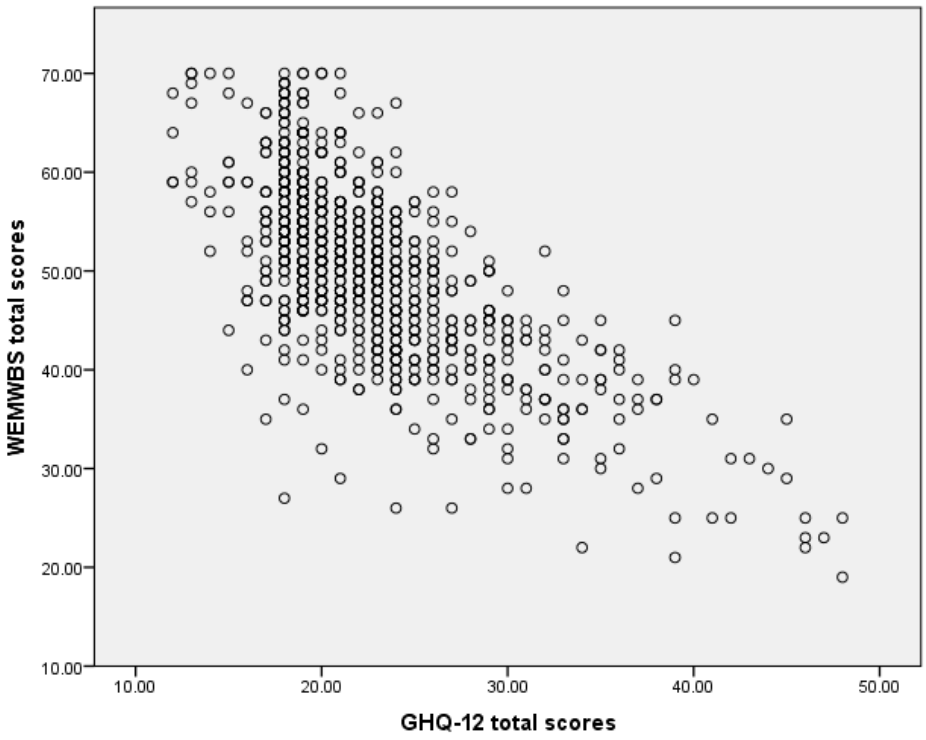
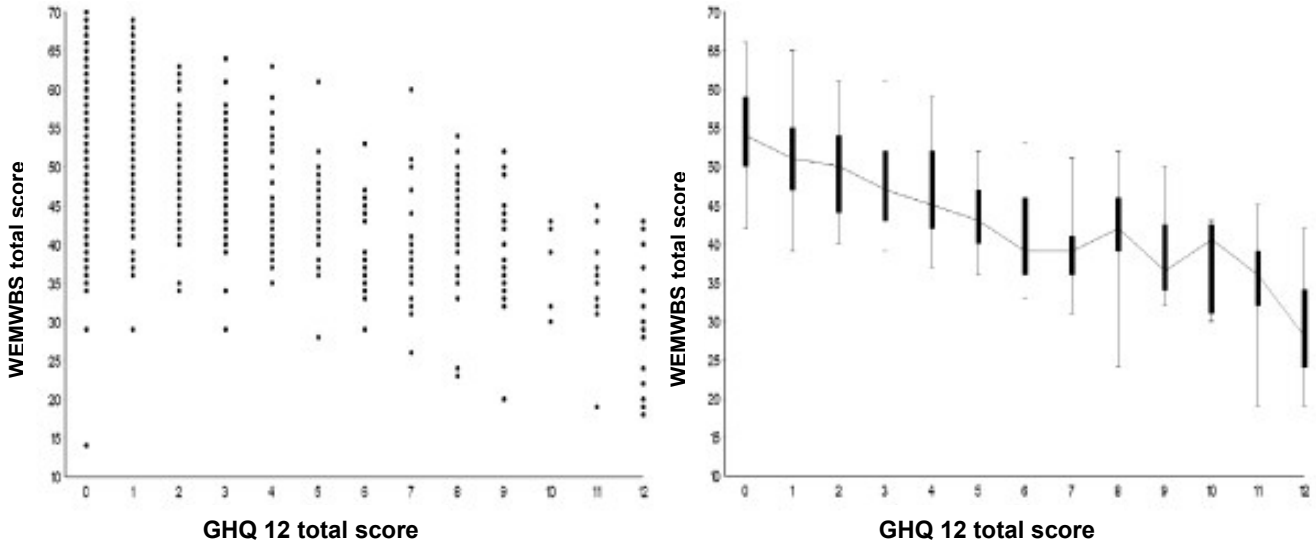


Figure 3b: Scatter plot of WEMWBS and GHQ 12 scores for the HEPS 2007 dataset (n = 1,741)



The relationship between WEMWBS and GHQ 12 was also explored in the dataset used for the original validation of WEMWBS, a combination of the HEPS 2006 (wave 12) and Well? 2006 survey datasets, using the dichotomous scoring method (Figure 4).[6]

Figure 4: WEMWBS score vs. GHQ 12 score, scatter plot and box and 90% confidence interval whisker plot for the combined HEPS (wave 12) and Well? 2006 survey dataset (n = 1,239)



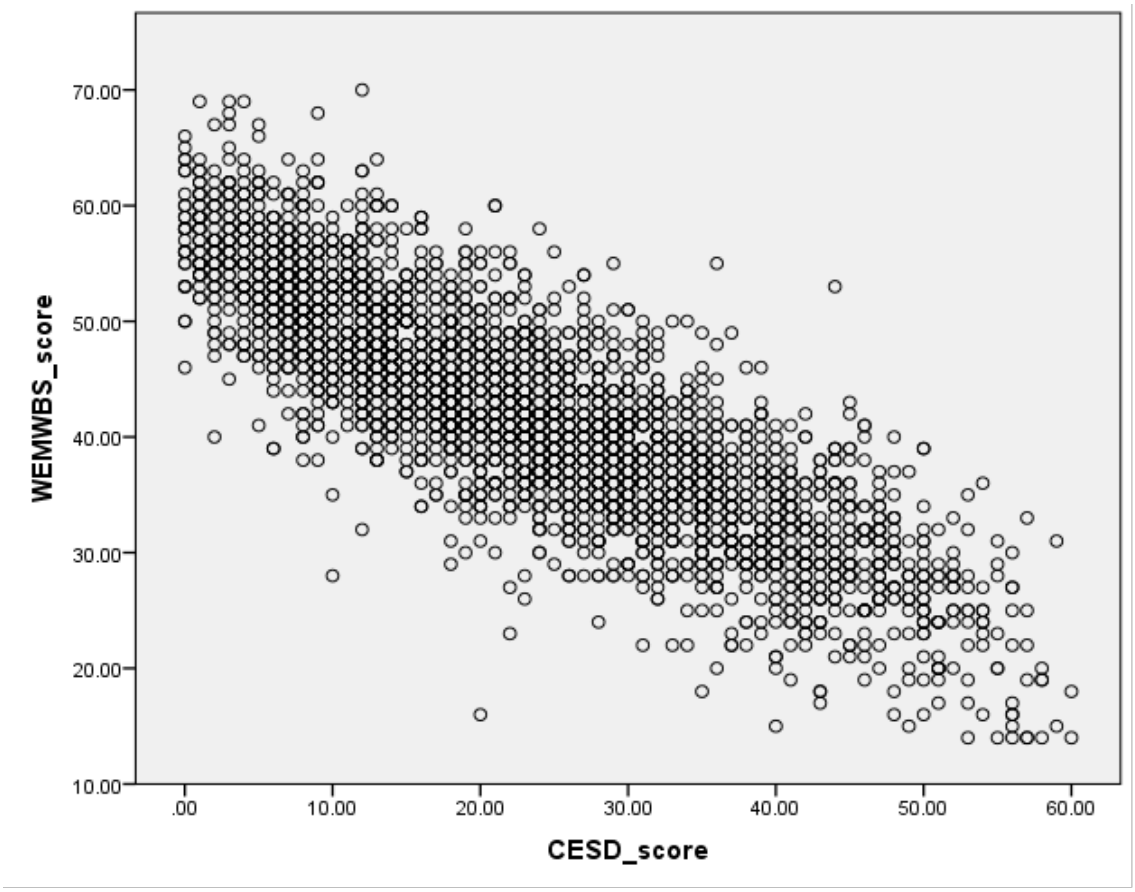
These results indicate that respondents for a certain GHQ 12 score can have a wide range of WEMWBS scores, although lower WEMWBS scores tend to

be associated with higher GHQ 12 scores. The two scales are therefore not simply the inverse of each other and are measuring different things.

Centre for Epidemiological Studies Depression Scale

The Centre for Epidemiological Studies Depression Scale (CES-D) is a clinically validated measure of depression for use in population samples, and scores can range from 0 to 60 with a score of 16 or over indicative of depression. More than 3,000 participants in a randomised controlled trial of an internet-based cognitive behaviour therapy intervention completed CES-D and WEMWBS at the same time. The correlation between these two measures (both approximately normally distributed) was high (Pearson's correlation coefficient r = -0.84) (Figure 5).[11] (www2.warwick.ac.uk/fac/med/research/platform/wemwbs/development/papers/donatella_bianco-thesis.pdf)

Figure 5: Scatter plot of WEMWBS scores and CES-D scores



This high correlation suggested that it might be appropriate to investigate cut points on WEMWBS corresponding to clinical cut points on the CES-D using receiver operating characteristic (ROC) curves. Using the cut point of 16 on the CES-D, indicating probable psychological distress, a WEMWBS score of ≤44 gives a sensitivity and specificity of >80%. Using the cut point of 26 on the CES-D, indicating probable major depression, a WEMWBS score of ≤40 gives a sensitivity and specificity of more than 80% for depression as defined by the CES-D.

Edinburgh Post Natal Depression Scale

A similar exercise has been undertaken with the Edinburgh Post Natal Depression Scale (EPDS) in a sample of 200 mothers delivering in Sheffield. The distribution of scores on the EPDS is negatively skewed, and the overall correlation with WEMWBS was closer to that with the GHQ 12 than with the more normally distributed CES-D (Spearman correlation coefficient r = -0.64).[12] (www2.warwick.ac.uk/fac/med/research/platform/wemwbs/development/papers/margherita_dissertation.pdf)

Scores on the EPDS range from 0 to 30, with higher scores indicating more distress. Different EPDS cut points for identifying postnatal depression have been recommended for screening women in the postnatal period. Using ROC analysis, an EPDS cut point of 9.5, suggesting possible depression, corresponds to a WEMWBS score of 48 (sensitivity 80%, specificity 82%), and a cut point of 12.5, indicating probable depression, corresponds to a WEMWBS score of up to 45.

Sensitivity of 80% means that 20% of people who have depression will be missed. As measured by either the EPDS or the CES-D, by using a cut off for WEMWBS of 45 or 40 respectively, 20% of depressed people would be missed.

So can WEMWBS be used to measure mental illness?

WEMWBS was developed as a measure of mental wellbeing not a measure of mental illness. There is a school of thought that suggests that these are correlated, but independent components, of mental health (the dual continua model). The moderate correlation with both GHQ 12 and the EPDS is consistent with this model. The high correlation with the CES-D, however, suggests a single continuum in which the level of correlation between WEMWBS and measures of mental illness depends on the psychometric properties of the different instruments, rather than a difference in the underlying constructs.

While WEMWBS is not recommended for screening for depression or for mental illness, due to the fact that it does not do this as efficiently as measures designed for this purpose, these results with the CES-D indicate that people with a WEMWBS score of ≤40 could be at high risk of major depression and should be advised to seek help. Those with scores between 41 and 45 should be considered in high risk of psychological distress and increased risk of depression.

8. Variation across demographic and social groups

Analysis of data from population surveys has also provided population norms for WEMWBS across different socio-demographic groups. Tables 4a and 4b show mean WEMWBS scores, along with the lower and upper 95% confidence intervals and the number of responses on which these estimates are based, for Scotland and England, respectively (Appendix iv shows the same analysis for Scotland but for median scores, and also contains significance p values for Table 4a).

Combined HEPS (wave 12) and Well? 2006 survey dataset[6] (n = 1,749)
The original validation of WEMWBS explored variation of scores across demographic groups in this dataset. In this large dataset, small differences reach statistical significance (meaning that the differences are likely to reflect real differences in the population) (Table 4a). Significant differences in mental wellbeing were found for each of the five categories of 'self-perceived health status', ranging from very good to very poor. For tenure, those living in rented accommodation were found to have significantly lower mental wellbeing scores compared with those who either own their homes outright or own with a mortgage. Those who were unemployed had significantly lower mental wellbeing scores than those who were in work or studying, although no significant differences were found between those who were retired compared to each of the other four employment categories. For marital status, those who were married or living as a couple had significantly higher mental wellbeing than those who were categorised as single or as widowed/divorced/separated. No real pattern was found for mental wellbeing with respect to gross household income per annum or terminal education age. There were no significant differences found either for chief income earner social grade, gender or age, although there appears to be a trend towards lower mental wellbeing for lower social grades and a U-shaped relationship for age.

Table 4a: WEMWBS mean scores across demographic groups: Scottish population sample combined HEPS (wave 12) and Well? 2006 survey dataset

Variable		n	Mean (95% CI)
Total		1,749	50.7 (50.3-51.1)
Sex			
	Male	783	51.3 (50.6-51.9)
	Female	966	50.3 (49.7-50.8)
Age in years			
	16-24	176	51.7 (50.6-52.8)
	25-34	245	50.1 (49.1-51.1)
	35-44	353	49.7 (48.8-50.7)
	45-54	306	49.5 (48.4-50.5)
	55-64	334	51.4 (50.4-52.4)
	65-74	274	52.4 (51.3-53.4)
	75+	61	51.2 (48.9-53.4)
Tenure			
	Own outright	523	52.3 (51.5-53.0)
	Own with a mortgage	705	51.1 (50.5-51.7)
	Rent	519	48.6 (47.8-49.4)

Self-perceived health status		
Very good	563	53.8 (53.1-54.5)
Good	753	50.9 (50.4-51.9)
Fair	319	47.6 (46.6-48.6)
Poor	84	43.5 (41.3-45.6)
Very poor	29	40.9 (37.1-44.6)
Employment status		
In work	968	51.4 (50.9-51.9)
Student	82	51.8 (50.2-53.4)
Retired	465	50.6 (49.8-51.4)
Unemployed	154	48.4 (47.0-49.8)
Other	79	46.1 (43.5-48.8)
Marital status		
Single	188	49.4 (48.2-50.7)
Married/living as a couple	418	51.7 (50.9-52.5)
Widowed/divorced/separated	155	47.8 (46.1-49.5)
Gross household income, £/pa		
<5,000	55	48.3 (46.0-50.6)
5,000-14,999	198	48.3 (46.9-49.7)
15,000-29,999	180	52.3 (51.1-53.5)
30,000+	173	50.6 (49.3-51.8)
Terminal education age		
<16	228	50.7 (49.5-51.9)
16-18	355	49.2 (48.2-50.2)
19+	181	51.8 (50.7-52.9)
Chief income earner social grade		
A	38	52.7 (49.5-55.9)
B	84	50.68 (48.8-52.5)
C1	217	51.5 (50.5-52.6)
C2	193	51.0 (49.8-52.2)
D	101	49.5 (47.7-51.3)
E	124	46.8 (45.0-48.7)

95% CI = 95% confidence interval of the mean

Similar results have been found in other population surveys carried out in Scotland and England, but there are also some differences, some of which may be due to the larger sample size and thus greater statistical significance.

Scottish Health Survey, 2012 and 2013 combined dataset[13] (n = 9,709)
The *Scottish Health Survey* topic report on mental health and wellbeing has subsequently analysed factors significantly associated with low mental wellbeing among a larger sample of adults (aged 16 years and above) in Scotland, and used logistic regression to assess correlations controlling for confounding demographic and health-related factors (see www.gov.scot/Resource/0046/00469088.pdf).

Mental wellbeing was significantly associated with age, with mean scores high in the youngest adult age groups (50.1 and 50.2 for ages 16 to 24 and 25 to 34 years, respectively), dropping among adults aged 45 to 54 years (48.9), rising to a peak between ages 65 and 74 years (51.1), and then dropping off again among the oldest group of 75 years+ (49.5). Scores were higher among

men than women across all age groups. WEMWBS scores were lowest for adults who were separated (45.8), while those married/civil partnership or living as married had the highest mean scores (51.2 and 50.4, respectively).

Assessment by the Scottish Index of Multiple Deprivation (SIMD) showed that the mean score in the least deprived quintile was 51.8, declining across the quintiles to a mean score of 47.2 in the most deprived. WEMWBS scores by household income were highest among those in the highest income quintile (51.7) and fell across the quintiles to the lowest income quintile (46.3). Adults who were permanently unable to work scored considerably lower (39.6) compared to those in employment or government training (51.1), full-time education (50.6) or retired (50.6).[d] Those in rented accommodation also scored considerably lower than those with a mortgage or owning their own home (47.8 vs. 50.8 and 51.2, respectively). Finally, scores increased with educational qualification level from 46.4 among those with no formal educational qualifications, to 51.9 among those with a degree or higher.

In regression models, age, marital status and household income remained significant predictors of poor mental wellbeing.[e] Economic activity also remained statistically significant after controlling for other independent variables. This was the factor most strongly associated with low mental wellbeing, in particular the group of adults who were permanently unable to work.[f] However, deprivation, home ownership and household type were not significant in the logistic regression models.[g]

Health conditions were also looked at. Mean WEMWBS scores varied considerably between adults with and without doctor-diagnosed conditions (categorised as: high blood pressure; diabetes; angina, heart attack or stroke; asthma; and chronic obstructive pulmonary disease (COPD)). In each case, the mean score was significantly lower among those who had been diagnosed with one (or more) of these conditions, compared to those who had not. COPD was also a significant predictor of low mental wellbeing after controlling for other factors.[h]

Health Survey for England, 2010 and 2011 combined dataset (n = 13,983)
The age distribution of mental wellbeing was similar, with a slight drop in the age groups 35 to 55 years and a peak at ages 65 to 74 years, and there were no significant gender differences (Table 4b). Housing tenure showed the same trend, with homeowners having higher wellbeing scores. Those who left full-time education aged 19 or older also had higher wellbeing scores. Employment status showed job seekers and people who are permanently

[d] Due to the considerable differences in the age distribution within each group, for example, with very few individuals retired below the age of 40, it was not possible to robustly age-standardise these results, so differences observed in mean scores could, in part, reflect different age profiles.
[e] Due to colinearity with other explanatory factors, which have a stronger association with mental wellbeing, education was not included in regression models.
[f] These results may partially reflect the effect of unemployment on mental wellbeing; they may be confounded by those who are unable to take up work as a result of poor mental health.
[g] While not significant in the regression model, the prevalence of some of the most significant risk factors for low mental wellbeing remains highest in deprived areas.
[h] Cardiovascular conditions (grouped together) and asthma were not included in final regression models due to their strong relationship with other included predictors.

unable to work because of long-term sickness as having very low WEMWBS scores. Those at home looking after a family also had lower scores than those at work. People who were married or living as a couple had higher wellbeing scores than those who were single, divorced or widowed.

Table 4b WEMWBS scores by demographic groups: *Health Survey for England*, 2010 and 2011 combined

Variable		n	Mean (95% CI)
Total		13,983	51.3 (51.1-51.4)
Sex			
	Male	6,145	51.5 (51.2-51.7)
	Female	7,838	51.1 (50.9-51.3)
Age in years			
	16-24	1,453	51.3 (50.9-51.7)
	25-34	2,086	51.4 (51.1-51.8)
	35-44	2,525	50.6 (50.2-50.9)
	45-54	2,523	50.4 (50.0-50.8)
	55-64	2,332	51.8 (51.5-52.2)
	65-74	1,752	52.7 (52.3-53.1)
	75+	1,312	50.9 (50.4-51.4)
Housing tenure			
	Own outright	4,514	52.3 (52.0-52.5)
	Own with a mortgage	5,366	51.7 (51.5-51.9)
	Rent	3,869	49.4 (49.1-49.7)
Terminal education age			
	15 or under	3,125	50.4 (50.0-50.7)
	16-18	6,385	50.8 (50.6-51.0)
	19 and over	3,745	52.6 (52.3-52.8)
	Not finished yet	723	52.2 (51.6-52.8)
Employment status			
	In work	8,923	51.8 (51.6-51.9)
	Student	256	52.0 (51.0-53.0)
	Retired	3,496	51.9 (51.6-52.2)
	Looking for paid work	255	48.1 (46.9-49.4)
	Permanently unable to work because of long-term sickness	451	41.2 (40.1-42.3)
	Looking after home or family	453	48.0 (47.0-49.0)
Marital status			
	Single	3,816	50.3 (50.1-50.6)
	Married/living as a couple	7,384	52.1 (51.9-52.3)
	Divorced	1,326	50.0 (49.5-50.6)
	Widowed	1,004	50.7 (50.1-51.3)
Equivalised household income, £/pa quintiles			
Lowest	<=11,143	1,787	48.2 (47.7-48.7)
Second lowest	11,144-19,091	2,228	50.4 (50.0-50.8)
Middle	19,092-29,167	2,346	51.4 (51.0-51.7)
Second highest	29,168-45,139	2,567	52.2 (51.9-52.5)
Highest	>45,139	2,586	53.1 (52.8-53.4)

95% CI = 95% confidence interval of the mean

Analysis of the 2011 survey data showed mental wellbeing to be generally lower among people with the health conditions covered in the survey (cardiovascular disease, diabetes, hypertension, chronic pain) www.hscic.gov.uk/catalogue/PUB09300/HSE2011-All-Chapters.pdf, while analysis of the 2010 survey data showed a very strong association between WEMWBS scores and self-reported general health www.hscic.gov.uk/catalogue/PUB03023/heal-surv-eng-2010-resp-heal-ch7-well.pdf In this 2010 survey data, WEMWBS scores were also lower among those who had been diagnosed with high blood pressure compared with those who had never been diagnosed.

Associations between WEMWBS and socio-demographic factors have also been explored in the *Health Survey for England* 2010 and 2011 combined dataset using a different study design in which associations with both high and low mental wellbeing were independently compared with middle-range mental wellbeing.[10] Analyses showed that associations with low mental wellbeing mirrored those from studies of mental illness, but associations with high mental wellbeing followed a different pattern. There was no correlation between high mental wellbeing and educational achievement and the correlation with income level was restricted to only one quintile group. Employment was only associated in so far as retired populations had higher mental wellbeing. This latter approach suggests that different perspectives may be required in promoting mental health as opposed to preventing mental illness.

9. Variation with lifestyles and social capital

The epidemiological and social associations of mental wellbeing as measured by WEMWBS, were initially explored through regression analyses of the 2006/7 HEPS (n = 1,834) and Well? 2006 survey (n = 1,216) datasets.

Mental wellbeing was found to be strongly associated with healthy eating, assessed in terms of fruit and vegetable and oily fish consumption, but not with smoking or physical activity. Healthy eating variables were more strongly associated with mental wellbeing than the presence of long-standing illness or employment status. Neither alcohol consumption in the 'safe drinking' range, nor sugar consumption were associated with mental wellbeing.

People's 'satisfaction with the neighbourhood' in which they lived, their level of 'support in a personal crisis', their 'contact with friends and relatives', and their acceptance for personal 'disclosure about mental health problems' were all independently associated with mental wellbeing. These variables were more strongly associated with mental wellbeing than long-standing illness or unemployment.

The results of these studies are suggestive of a significant role for both fruit and vegetable consumption, and supportive relationships in the generation of mental wellbeing. However, the cross-sectional nature of the datasets and the relatively crude definition of some key variables in these surveys made it important that the results were validated in other studies.

Further analyses have subsequently been undertaken on large, national survey datasets, and some consensus is appearing:

Scottish Health Survey

The results with regard to fruit and vegetable consumption have since been confirmed in other studies, for example, Blanchflower *et al* using combined *Scottish Health Survey* 2008 and 2009 data (n = 12,667),[14] and also using *Health Survey for England* combined 2010 and 2011 data, see the next subsection *Health Survey for England*.[15]

The *Scottish Health Survey* topic report on mental health and wellbeing, which analysed factors significantly associated with low mental wellbeing (noted in section 8), also assessed lifestyle and social capital factors among adults in a 2012 and 2013 combined dataset (n = 9,709)[13] (see www.gov.scot/Resource/0046/00469088.pdf). These analyses found that higher WEMWBS mean scores were associated with those adults who met the recommended physical activity guidelines, and with those adults who ate the recommended number of portions of fruit and vegetables a day. Scores were significantly lower among non-drinkers than among drinkers, and those with possible alcohol dependence[i] had significantly poorer mental wellbeing than those without. Current smokers also had significantly lower WEMWBS scores than both ex-smokers and those who had never smoked. With body mass index (BMI) categories, WEMWBS mean scores were lowest in those in the underweight group, then fluctuated for men with increasing BMI, while the

[i] Assessed by the Alcohol Use Disorders Identification Test (AUDIT).

highest WEMWBS score occurred in the healthy weight group for women and then reduced with BMI.

In multivariate logistic regression models, physical activity levels, possible alcohol dependence, smoking, and fruit and vegetable consumption were significantly associated with mental wellbeing, indicating that they are all significant predictors of mental wellbeing after controlling for other independent factors. However, obesity was not a significant factor.

For social capital-related factors, mental wellbeing mean scores were lower among adults who provide unpaid care, with lower scores as hours of care provided increase. However, carers who provide a small amount of care showed a higher mean WEMWBS score than non-carers; this may be related to the beneficial effect that volunteering may have on mental wellbeing. Adults who perceived local crime to be a lot more than it was two years ago had a lower mean WEMWBS score than those who either thought it about the same, a little more, or a little less. In addition, adults who never eat meals together in the household also scored lower than those who eat together three or more times in a week.

Unpaid caring was found to be a significant predictor of low mental wellbeing after controlling for other related factors in logistic regression models, with results generally stronger among women.[j]

Health Survey for England
Associations between WEMWBS and lifestyle were also explored in the *Health Survey for England* using a combined 2010 and 2011 dataset (n = 13,983).[15] In this study, both high and low mental wellbeing were independently compared with middle-range mental wellbeing and included logistic regression analyses.

Analyses showed the strongest associations to be between fruit and vegetable consumption and smoking, after controlling for socio-economic variables. Alcohol intake and obesity were associated with low, but not high, mental wellbeing.[k]

Overall
Analyses of survey data are starting to indicate which lifestyle and social capital factors are associated with/predictors of mental wellbeing as assessed by WEMWBS. Longitudinal studies are, however, needed to further explore these associations and gain some insights into likely causality.

[j] Eating together was not included in the final multivariate logistic regression models.
[k] Physical activity was not included in the analyses because data on this lifestyle factor was not collected in the survey.

10. The scaling properties of WEMWBS – Rasch analysis and SWEMWBS

Data from HEPS 2006 (wave 12) have been used to establish the extent to which WEMWBS fits the Rasch model.[16] This statistical procedure provides a more robust interpretation of the internal construct validity of ordinal scales[l] and is used to determine how the intervals in an ordinal scale relate to one another. This analysis permits an answer to the following question: "Is a score of 60 twice as good as a score of 30?". A good fit to the Rasch model indicates that the scale has good scaling properties. This means that a mean score of, for example, 44 can be taken to be twice as good as a mean score of 22. Rasch analysis can also be used to determine potential item redundancy in a scale, and to assess whether a reduction in the number of scale items may be appropriate.

Rasch analysis was developed to test examination questions and scores. As such, it assumes a hierarchy of items in terms of difficulty of response. The items in WEMWBS were not intended to be hierarchical; so there is no reason to suppose that people will always, for example, find it more difficult to be optimistic than to deal with problems well.

Data from 779 respondents (aged 16 to 74 years, mean of 41.9 years) was used to test WEMWBS from the perspective of this model. Initial fit to model expectations was poor. Analysis showed that seven of the original 14 items of WEMWBS conform to Rasch model expectations (Table 5). This 7-item scale is called SWEMWBS (Short Warwick–Edinburgh Mental Well-being Scale) (Appendix v). The correlation between WEMWBS and SWEMWBS is high at 0.954, and the internal consistency reliability (based on the Person Separation Index)[m] of SWEMWBS was 0.845 compared to 0.906 for WEMWBS. Both of these suggest strong internal consistency, with that of WEMWBS perhaps stronger than necessary.

Table 5: Short Warwick–Edinburgh Mental Well-being Scale (SWEMWBS)

Item number from WEMWBS	Statement
Item 1	I've been feeling optimistic about the future
Item 2	I've been feeling useful
Item 3	I've been feeling relaxed
Item 6	I've been dealing with problems well
Item 7	I've been thinking clearly
Item 9	I've been feeling close to other people
Item 11	I've been able to make up my own mind about things

Given fit to the Rasch model, i.e. Rasch compatibility, strict uni-dimensionality, and being largely free of item bias, SWEMWBS has more robust scaling properties than WEMWBS. SWEMWBS thus provides an interval scale

[l] The internal scaling properties of WEMWBS were tested using internal construct validity in the form of confirmatory factor analysis. Results were consistent with a single underlying construct.

[m] Equivalent to Cronbach's alpha.

estimate of mental wellbeing, with higher scores within an item reflecting greater overall mental wellbeing. Robust measurement properties, combined with brevity, can make SWEMWBS preferable to WEMWBS at present for monitoring mental wellbeing in populations where robust interval scale measurement is important, and where space constraints (response burden) are an issue. SWEMWBS is more complicated to score and it is very important that it is scored correctly in order for comparisons to be made across different studies. To facilitate this, a raw score to interval scale transformation of SWEMWBS scores has been developed for use in parametric procedures (see section 17 and www2.warwick.ac.uk/fac/med/research/platform/wemwbs/researchers/guidance/).

However, in terms of face validity, SWEMWBS presents a more restricted view of mental wellbeing than the 14-item WEMWBS. It therefore offers a slightly different perspective on mental wellbeing, although the scores from the two scales are highly correlated. With most items representing aspects of psychological and eudaimonic wellbeing, and few covering hedonic wellbeing or affect, SWEMWBS relates more to functioning than to feeling. Given that the assumption of item hierarchy does not apply to WEMWBS items, lack of fit with the Rasch model does not, of itself, suggest that the 14-item WEMWBS is not a sound measure of mental wellbeing.[n]

The main advantage of the 7-item scale is that it is shorter and can be transformed so that it can be used as an interval scale for psychometric analysis. Where face validity is an issue, there remain arguments for continuing to collect data on the full 14-item WEMWBS. Responses to mental wellbeing scales may change as knowledge and self-awareness increase at population level. There are, therefore, arguments for continuing to gather data on the 14-item scale (given the 7-item scale is embedded) to examine measurement of mental wellbeing at the ordinal level, to explore item bias in different samples, and to further analyse potential dimensionality.

[n] It remains true that the majority of scales commonly used to measure mental health in trials and population surveys have not been shown to meet the strict criteria associated with additive conjoint measurement as operationalised through the Rasch model.

11. Sensitivity to change

The sensitivity to change of WEMWBS has been assessed in a range of studies, including lifestyle change programmes, parenting programmes, internet-based cognitive behavioural therapy programmes, and many others.

WEMWBS has proved sensitive to change at both the group and individual level. At group level, in keeping with other studies, changes of half a standard deviation or more proved likely to be important.[17]

As mental wellbeing is not a disease and therefore not 'clinical', the concept of 'clinically important difference' does not apply. The more relevant assessment is whether a change on WEMWBS is recognisable by the respondent as of importance. Assessments can be made of the importance of change at the individual level using statistical methods. Investigations suggest that a change of three or more points is likely to be recognisable to an individual, but different statistical methods provide estimates ranging from three points to eight points.

The importance of a change of three or more points has been corroborated in a further study that examined score changes on WEMWBS compared to the gold standard of clinical assessment of change in the context of a counselling service (see www2.warwick.ac.uk/fac/med/research/platform/wemwbs/development/papers/margerita_aucc_analysis_3.pdf). Any clinical improvement was associated with improvement in WEMWBS score. However, significant correlation between the level of improvement on WEMWBS and the level of improvement clinically was only evident at three points and above. Below a three-point change, the extent of change in WEMWBS was not correlated with change as assessed clinically.

The sensitivity to change of SWEMWBS has not, to date, been assessed in this way.

12. Value of use with individuals and in a clinical setting

Although developed for use as a population-based measure of mental wellbeing, WEMWBS has utility at the individual level as:

- a qualitative tool to open up discussion about a person's mental wellbeing
- in the context of projects and programmes to enable self-reflection as a prelude to involvement with health-enhancing activities
- an aid to offering clinical advice.

In relation to the latter, while not designed as a clinical tool or to monitor mental wellbeing at individual level, WEMWBS is being used by some investigators who report that it can be valuable in this context. If used in this manner, an improvement or deterioration of three or more points can be suggested as important (see section 11).

WEMWBS has been used for self-assessment on various apps and public access websites where scores are interpreted to offer clinical advice based on the cut points identified in section 7. It is important that such self-assessment sites include warnings that anyone concerned about a deterioration in their mental health should consult their doctor.

13. Cross-cultural validation and translation of WEMWBS and SWEMWBS

In spite of differences in the way mental health is viewed, WEMWBS and SWEMWBS perform well from a quantitative point of view in different cultural groups. From a qualitative point of view, different cultural groups also find the instrument acceptable, understand the items, and enjoy filling in the questionnaire. Some individual items provoke discussion in minority populations, for example, the item representing autonomy carries a different meaning with regard to mental health in some groups. Some concepts of importance to mental health in some minority groups, for example, 'peace of mind' and 'doing one's duty towards others' are not represented in WEMWBS. While items reflecting relationships are featured in the scale, the pre-eminent importance of social harmony in the family and community, found among some cultural groups, is not.

It is important that WEMWBS is validated before use in different cultural and ethnic groups, but validations undertaken to date suggest that the scale is robust across a wide range of cultures. A cross-cultural validation of the English version of WEMWBS has been carried out among English-speaking adults of Chinese and Pakistani family background resident in England.[18]

WEMWBS has also been translated into a number of languages and some of these translated versions have been validated both psychometrically and qualitatively. Some of the translated versions are available to download from www2.warwick.ac.uk/fac/med/research/platform/wemwbs/researchers/languages/

The following translations have undergone back-translations, have been validated psychometrically, and are available to download: Dutch, French, German, Greek, Italian, Japanese and Spanish. The validation of the Spanish version in a large population sample has been published.[19]

Back-translations and statistical analysis of versions in Arabic, Bangla and Urdu have also been completed and are being prepared for publication, while Hindi, Lithuanian, Norwegian, Portuguese and Welsh versions have undergone back-translations and are available to download.

SWEMWBS, in turn, has been translated into Icelandic and cross-culturally validated. Versions of SWEMWBS translated into Chinese, Danish and Finnish are also available to download from the website.

For up-to-date information on the availability of translated versions, refer to www2.warwick.ac.uk/fac/med/research/platform/wemwbs/researchers/languages/

If you are interested in translating WEMWBS into another language not mentioned or shown on the website, please refer to the guidelines on the website and other aids to assist with translation and back-translation. See also section 14 and Appendix vi.

14. Undertaking translation of WEMWBS and SWEMWBS

Research to develop further versions of (S)WEMWBS in languages other than English, for use in non-English-speaking countries and with UK respondents who do not have English as their first language or who do not feel confident in their use of English, are welcomed. In the first instance, reference should be made to the website at the University of Warwick http://www2.warwick.ac.uk/fac/med/research/platform/wemwbs/researchers/languages/ in order to ascertain whether an approved non-English version is available. If it is, it can be downloaded. If a version in the required language is not available and you wish to develop a translated scale, we encourage you to do so.

Terms and conditions relating to the translation of (S)WEMWBS and the use of translated versions are provided in Appendix vi and at www2.warwick.ac.uk/fac/med/research/platform/wemwbs/researchers/languages/translation_of_swemwbs_into_other_languages_and_using_translated_versions_2.pdf The University of Warwick (Professor Sarah Stewart-Brown Sarah.Stewart-Brown@warwick.ac.uk) will approve translated versions, providing that evidence is presented showing that standard guidance/guidelines for translating scales have been followed. Use of unapproved translations of (S)WEMWBS is not permitted.

Standard guidance/guidelines

The cross-cultural adaptation of health scales is very challenging. The aim of the process is to achieve language versions that are conceptually equivalent (i.e. carrying the same meaning) in different countries/cultures rather than merely linguistically equivalent (i.e. the substitution of a word in one language into a word that is literally the same in another language). Fortunately, several guidelines for producing translated versions have been developed. Those produced by Beaton *et al* (2000) are particularly helpful.[20] In brief, the following is required:

- The original scale is independently translated by at least two people who are native speakers in the new language, one of whom knows about the instrument and the concept under investigation and one of whom does not (stage 1).
- These translations are synthesised by the two translators with a recording observer, using consensus to resolve disagreements (stage 2).
- The agreed translated version (stage 2) is back-translated into the original language by at least two native speakers blind to the original version (stage 3).
- An expert committee compares the back-translations with the original version in English and will either pass the translation as fit for purpose and continue with field testing (stage 4), or will refer their comments back to the translators. The translators will either repeat the process of back-translation and review or make a small change for acceptance, depending on the severity of the discrepancy. When this process is

completed, the pre-final version so produced can be field tested (stage 4).

- A small sample (30-40) of participants in the target setting completes the pre-final version of the questionnaire, and is subsequently interviewed to assess question comprehension and interpretation (cognitive testing) (stage 5). This normally involves focus groups to discuss what participants have understood by the questions.

If possible, a sixth stage, psychometric testing, should be added. This would entail the conduct of empirical studies to assess the scale's reliability (e.g. internal consistency, test-retest), validity (e.g. face, content, construct, criterion) and responsiveness to change.

Alternative (similar, but not identical) guidelines have been developed by several other authors, including Hunt and Bhopal (2004),[21] Guillemin *et al* (1993) [22] and the World Health Organization.

Two useful documents to aid in translation of WEMWBS have been produced, namely:

- a description of common difficulties in translation of WEMWBS questions (www2.warwick.ac.uk/fac/med/research/platform/wemwbs/researchers/languages/frequent_issues_in_translation.pdf)
- a template for the committee to record its comments on back-translations of each question (available at www2.warwick.ac.uk/fac/med/research/platform/wemwbs/researchers/languages/).

15. Validation of WEMWBS with secondary school children aged 13 to 16

The Warwick–Edinburgh Mental Well-being Scale Acceptability and Validation in English and Scottish Secondary School Students Project (The WAVES Project) was undertaken by Warwick and Edinburgh universities between March 2008 and February 2009.[23, 24] This aimed to establish the validity, reliability and acceptability of WEMWBS in teenage students in two secondary school year groups, aged 13 to 14 and 15 to 16 years, in six schools across two cities, one in Scotland and one in England.

Distribution of WEMWBS scores

A total of 1,650 teenagers completed the questionnaire with an overall response rate of 80.8%. WEMWBS scores covered the full range of possible scores (14 to 70) showing a normal distribution with no ceiling or floor effects, and very few missing items (Figure 6). The mean was 48.8 (standard deviation 8.6). Scores for boys were, on average, 1.8 points higher than for girls (Figure 7), although in multiple regression this gender difference was not significant at the 5% level.

Figure 6: Unadjusted WEMWBS scores overall (n = 1,517)

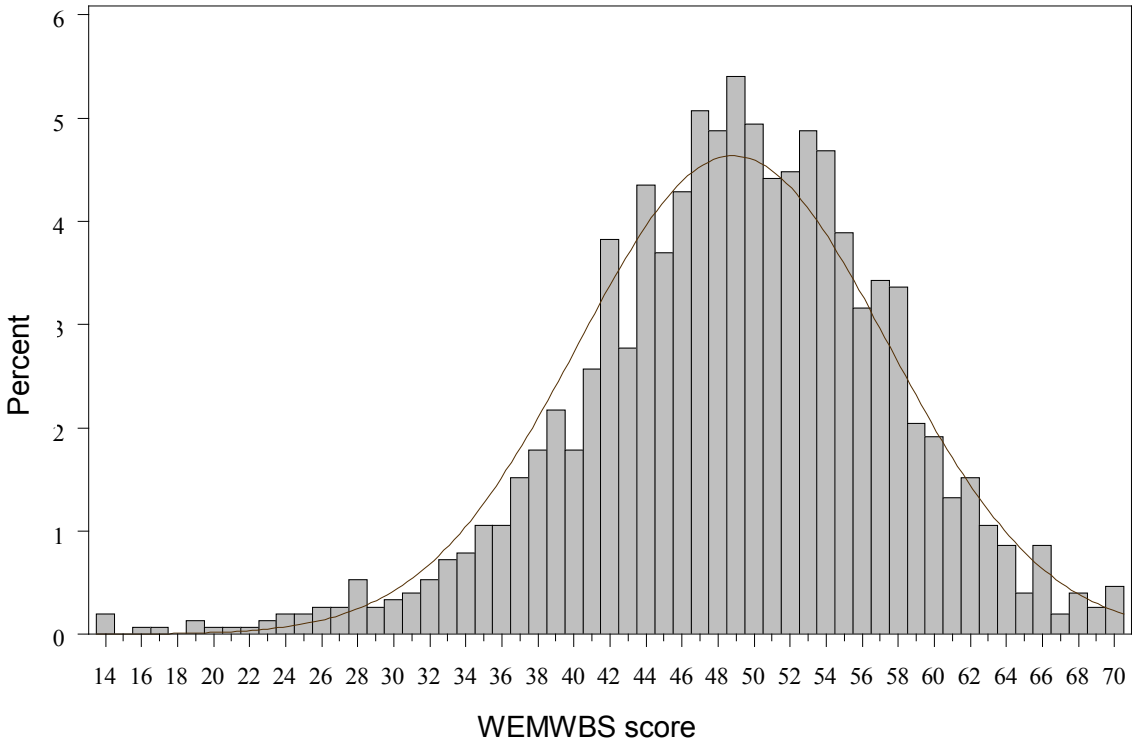
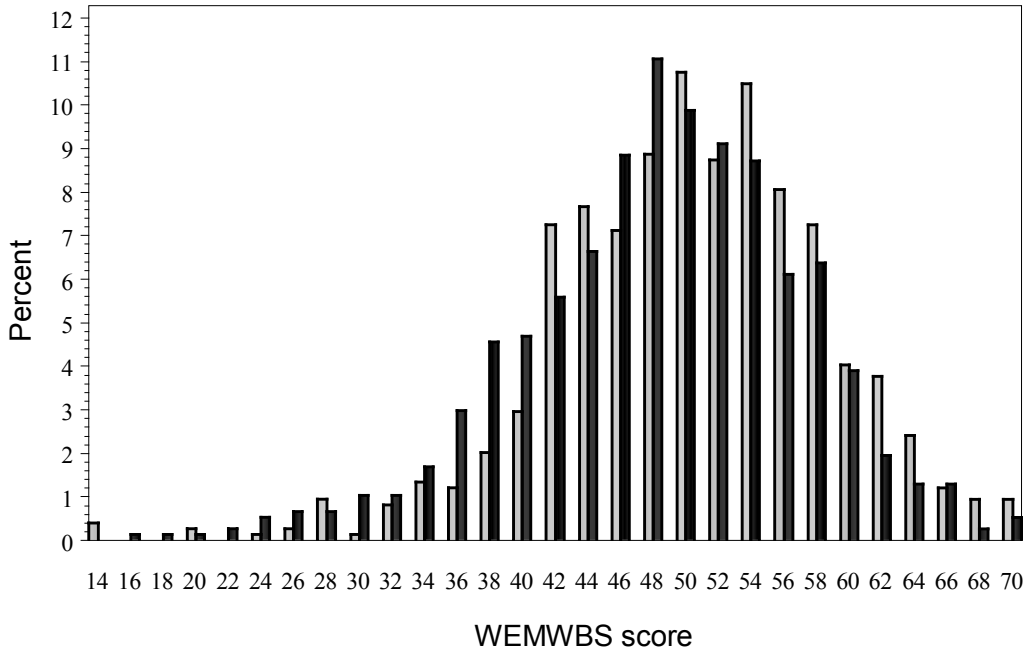


Figure 7: Unadjusted WEMWBS scores by gender (boys: grey; girls: black) (n = 1,517)



Construct validity

This was assessed by testing correlations between WEMWBS and comparator scales that measure aspects of both mental wellbeing and mental health problems (for assessment of convergent and discriminant construct validity, respectively), as well as scales that measure physical health. Socio-demographic details, including family affluence, were also obtained.

Both convergent and discriminant measures of construct validity gave values as predicted (Table 6). Strong and significant positive correlations were found between WEMWBS and measures of mental wellbeing (Mental Health Continuum-Short Form (MHC-SF); the psychological wellbeing domain of the Kidscreen-27; and WHO-Five Well-being Index (1998 version) (WHO-5)). Strong and significant negative correlations were found between WEMWBS and measures of mental health problems (Strengths and Difficulties Questionnaire (SDQ); and the GHQ 12).

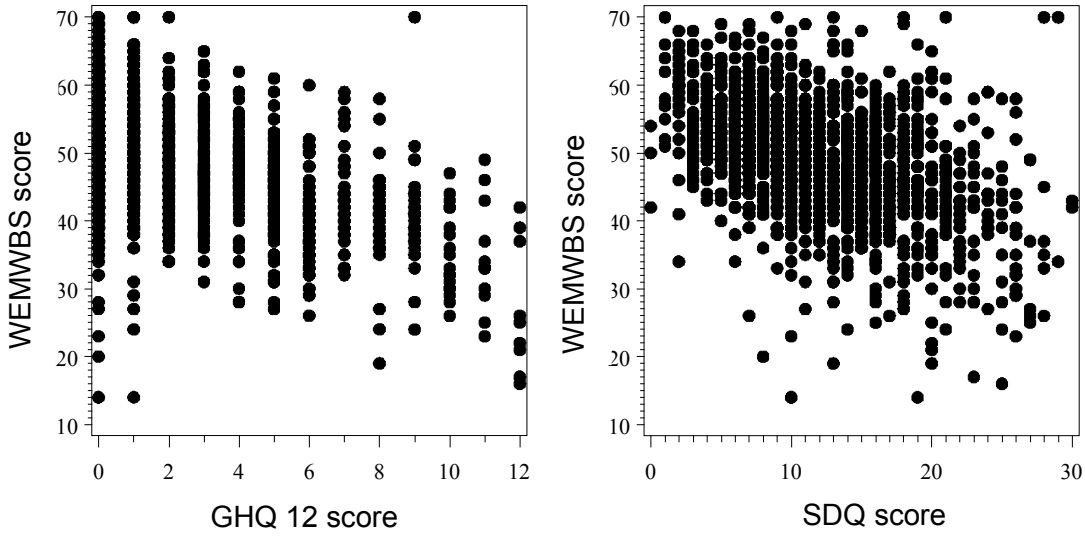
Table 6: Spearman's rank correlation coefficients with 95% confidence intervals for WEMWBS with other scales

Scale		n	Correlation	95% CI		p-value
GHQ 12	Scores	1,479	-0.45	-0.49	-0.40	<0.001
	Likert	1,479	-0.52	-0.56	-0.47	<0.001
WHO-5		1,508	0.57	0.53	0.61	<0.001
SDQ	Total	1,509	-0.44	-0.49	-0.40	<0.001
MHC-SF	Total score	1,396	0.65	0.62	0.69	<0.001

Scale		n	Correlation	95% CI		p-value
MHC-SF	Categorical scores (languishing, moderately mentally healthy or flourishing)	1,396	0.57	0.53	0.61	<0.001
Kidscreen-27	Physical wellbeing	1,499	0.43	0.39	0.47	<0.001
	Psychological wellbeing	1,486	0.59	0.55	0.62	<0.001
	Autonomy and parent relations	1,484	0.46	0.42	0.50	<0.001
	Social support and peers	1,492	0.38	0.33	0.42	<0.001
	School environment	1,489	0.51	0.46	0.55	<0.001

As with adult WEMWBS scores and GHQ 12 scores, a scatter plot shows that respondents scoring the same on the GHQ 12 had a wide range of WEMWBS scores, so although lower WEMWBS scores tend to be associated with higher GHQ 12 scores, one is not simply the inverse of the other (Figure 8). This is also the case with the SDQ.

Figure 8: WEMWBS score vs. GHQ 12 score (n = 1479) and SDQ total score, scatter plot (n = 1,509)



Internal consistency

There were strong internal positive correlations between WEMWBS items and a high internal consistency.

Cronbach's alpha coefficient = 0.87 (95% CI [0.85; 0.88], n = 1,517)

This high Cronbach's alpha indicates good consistency of the scale between items (internal consistency). It also suggests that there may be some item redundancy and, as in adults, it may be possible to reduce the length of the scale, although this was not formally investigated.

Confirmatory factor analysis
Confirmatory factor analysis confirmed the pre-hypothesised one-factor structure of WEMWBS (n = 1,517).

The confirmatory factor analysis, together with the internal consistency results, means that the scale is likely to be a homogeneous measure of one underlying construct – in this case, mental wellbeing.

Test-retest reliability
The correlation between tests and retests for WEMWBS, between 7 and 14 days after initial administration of the questionnaire, was slightly lower than anticipated, indicating a moderate rather than a strong correlation.

Intra-class correlation coefficient = 0.66 (95% CI [0.59; 0.72], n = 212)

The large sample size and response rate mean it is unlikely that this finding of a moderate correlation is a chance one. The finding, based as it is on correlations between scores at the individual level, may mean that WEMWBS in teenagers is subject to fluctuation at this individual level, although findings are stable at the population level for which the scale is intended.

Variations across demographic and social groups
There were no strong associations between WEMWBS score and either age or gender in this group of teenagers (after adjustment for gender and family affluence or age and family affluence, respectively), although there were significant associations with both the Family Affluence Scale (FAS) score (an assessment of relative family affluence), after adjustment for gender and age, and the physical health dimension of the Kidscreen-27. Repeating all tests of validity and internal consistency, separately among those aged 14 years and under and those aged over 14 years, showed no difference by age. The strong psychometric properties of WEMWBS were replicated in both age groups. There were no independent effects of school, once socio-demographic differences (age, gender and family affluence) had been taken into account.

Face validity
This was undertaken in 12 single-sex focus/discussion groups (three boys' groups and three girls' groups in each city) selected from both age groups. Individuals completed WEMWBS with subsequent discussions covering acceptability and comprehensibility of WEMWBS. In all, 80 students took part.

The overall underlying construct of WEMWBS was understood by the majority of the teenagers. Most of the focus group participants felt that the scale was of a suitable length and that the response categories were understandable. However, while the overall length of the scale was acceptable, it was felt that there was some redundancy that could be removed through the amalgamation

of items, and some participants made suggestions for additional items to be added to the scale.

Several focus group participants found some of the individual words or terms either difficult to understand or open to misinterpretation, and some items as a whole were considered vague or unclear, for example, some students were not clear what the item 'interested in other people' meant. The school setting for administration of the scale also tended to confuse some participants, thus restricting the intended scope of the mental wellbeing construct.

Conclusions

WEMWBS is suitable for use at a population level to measure mental wellbeing for those aged 13 years and above. Because of the more moderate test-retest findings and the qualitative results, it is recommend that it should not be used in small-scale studies of teenagers aged 13 to 15 years with samples of less than 100.[o]

While performing well psychometrically for teenagers aged 13 to 16 years, the qualitative findings for WEMWBS suggest that face validity could be improved.[p] In addition, the findings suggest that individual levels of mental wellbeing may fluctuate in teenagers. An improved understanding of fluctuation in levels of both eudaimonic and hedonic constructs of mental wellbeing in this age group is needed. While the length of the scale was acceptable, it may be possible to shorten it.

Qualitative findings suggested that the school setting for administration of the scale might confuse some participants who may be more likely to relate items concretely to the school context, thus restricting the intended, more global, scope of the mental wellbeing construct. When WEMWBS is introduced to teenagers in a school environment, it is therefore important to emphasise its holistic nature.

[o] WEMWBS has since been included in the *Scottish Schools Adolescent Lifestyle and Substance Use Survey* (SALSUS) for S2 and S4 school children (ages 13 and 15) since 2010, and the *Scottish Health Survey* for 13 to 15 year olds from 2012 (it was included in this survey for those aged 16 and above from 2008).

[p] Note, most assessments of scales and measures do not include an in-depth, concurrent qualitative investigation, and it is possible that many other scales in common use with children and young people, if assessed in the same rigorous, qualitative way, might reveal similar issues with face validity.

16. UK population norms

With the continued use of WEMWBS, norms are becoming available for different populations and can be monitored over time. Key UK population norms are shown in Table 7 for WEMWBS and Table 8 for SWEMWBS.

Table 7: Key UK population norms – WEMWBS

Population – survey source	Year	Group		Mean score*
Scottish adults *Scottish Health Survey* (ages 16 years+)	2008	All		50.0 (8.52)
		Men		50.2 (8.55)
		Women		49.7 (8.48)
	2009	All		49.7 (8.27)
		Men		49.9 (8.02)
		Women		49.7 (8.51)
	2010	All		49.9 (8.54)
		Men		50.2 (8.37)
		Women		49.6 (8.67)
	2011	All		49.9 (8.36)
		Men		50.2 (8.35)
		Women		49.7 (8.37)
	2012	All		49.9 (8.50)
		Men		50.4 (8.34)
		Women		49.4 (8.63)
	2013	All		50.0 (8.65)
		Men		50.3 (8.56)
		Women		49.7 (8.70)
English adults *Health Survey for England* (ages 16 years+)	2010	All		50.9 (0.11)
		Men		51.1 (0.17)
		Women		50.7 (0.15)
	2011	All		51.6 (0.1)
		Men		51.8 (0.16)
		Women		51.4 (0.14)
	2012	All		52.3 (0.16)
		Men		52.5 (0.22)
		Women		52.2 (0.20)
Scottish children *Scottish Schools Adolescent Lifestyle and Substance Use Survey* (SALSUS) (S2 and S4 school children, ages ~13 and ~15 years)	2010	S2	All	50.4 (50.3-50.6)
			Boys	50.9 (50.7-51.1)
			Girls	49.9 (49.7-50.1)
		S4	All	49.7 (49.5-49.8)
			Boys	50.8 (50.6-51.0)
			Girls	48.5 (48.3-48.7)
	2013	S2	All	50
			Boys	51
			Girls	49
		S4	All	48
			Boys	50
			Girls	45

* Mean score shown with:
- standard deviation for *Scottish Health Survey*
- standard error of the mean for *Health Survey for England*
- 95% confidence interval for SALSUS

Table 8: Key UK population norms – SWEMWBS

Population – survey source	Year	Group	Mean score*
English adults *Health Survey for England* (ages 16 years+)	2011	All	23.6 (23.5-23.7)
		Men	23.7 (23.6-23.8)
		Women	23.5 (23.4-23.7)

* Mean score on transformed scale, shown with 95% confidence interval

17. Using WEMWBS and SWEMWBS

WEMWBS and SWEMWBS are free to use but prospective users should seek permission to use the scale. This is obtained by registering to use the copyrighted scale by completing the online registration form on the University of Warwick WEMWBS webpage at www2.warwick.ac.uk/fac/med/research/platform/wemwbs (click 'Register to Use WEMWBS'). In this way, a record can be kept on the database held at Warwick University of the way WEMWBS is being used, offering the opportunity to gather data for further analysis from projects where this is appropriate and possible. If the scale is reproduced, it must remain unaltered and include the copyright statement that appears with it (see Appendix i, v and vii).

WEMWBS

Data collection

To date, WEMWBS has been administered in a self-completion format. This has been either via CASI (computer-assisted self-interviewing) whereby respondents are invited to enter their responses directly into the CAPI (computer-assisted personal-interviewing) machine (Well? survey and HEPS),[6] or by the self-completion of paper formats of the scale (student samples and focus groups).[4] It has also been used online. WEMWBS can be assumed to be robust using any of these methods.

WEMWBS has not been tested in interview situations where an interviewer reads out the items to respondents and fills in their responses for them. We do not therefore know whether WEMWBS is robust in these situations.

Scoring

Each of the 14-item responses in WEMWBS are scored from 1 (none of the time) to 5 (all of the time), and a total scale score is calculated by summing the 14 individual item scores (Table 9). The minimum score is 14 and the maximum is 70.

Table 9: Example: Scoring of WEMWBS – with responses highlighted in green

Statements	None of the time	Rarely	Some of the time	Often	All of the time
I've been feeling optimistic about the future	1	2	3	4	5
I've been feeling useful	1	2	3	4	5
I've been feeling relaxed	1	2	3	4	5
I've been feeling interested in other people	1	2	3	4	5
I've had energy to spare	1	2	3	4	5
I've been dealing with problems well	1	2	3	4	5
I've been thinking clearly	1	2	3	4	5
I've been feeling good about myself	1	2	3	4	5
I've been feeling close to other people	1	2	3	4	5
I've been feeling confident	1	2	3	4	5

I've been able to make up my own mind about things	1	2	3	4	5
I've been feeling loved	1	2	3	4	5
I've been interested in new things	1	2	3	4	5
I've been feeling cheerful	1	2	3	4	5
Scores	0	0	4 x 3 = 12	4 x 4 = 16	6 x 5 = 30

Total score = 0 + 0 + 12 + 16 + 30 = 58

Presenting the results

WEMWBS results should be presented as a mean score for the population of interest, with either a standard deviation or 95% confidence interval. The latter two both provide a measure of variance of the scores in the population studied (either as a whole or for sub-groups within it). The range of scores within a sample can also be presented. Scores will vary between 14 and 70.

Interpreting the results and sample size

Table 7 (section 16) shows UK population norms, and that these vary according to the population group studied. The mean score for the population under study can be compared with these population norms to assess whether the level of mental wellbeing is above or below these levels.

Differences between the scores of different groups, or between the scores of the same group of people at two points in time, for example, before and after an intervention, need to be tested statistically using the Student's t-Test or equivalent, to assess how likely the differences are to have arisen by chance. At any given level of difference, results are more likely to be significant if the groups being compared are large, and less likely if the groups are small.

A sample size calculation can be carried out to make precise estimates, if statistical support is available. However, as a rule of thumb, studies need to include at least 50 people with evaluation data at two points in time, or 50 people in each group if two groups are going to be compared. Table 10 gives examples of the required sample size (per group) based on the difference in mean scores of two groups that could be detected, using a power of 0.8, a significance level of 0.05, and a population sample combined HEPS (wave 12) and Well? 2006 survey dataset (n = 1,749), and *Health Survey for England* 2010 and 2011 combined dataset (n = 13,983).

Table 10: Examples of sample size estimates per group required to detect a difference of +/- 2, 3 or 5 points in WEMWBS

Difference in WEMWBS score		
± 2 points	**± 3 points**	**± 5 points**
300	135	50

The implication of sample estimates is that when working with samples that are too small, it is possible to miss a difference that is important. Further discussion is provided in section 20.

Dealing with missing data

In the WEMWBS validation, HEPS and Well? survey responders were deleted if they were not full-responders (i.e. they did not answer all items of WEMWBS). This harsh method was appropriate as the vast majority of responders were full-responders and thus loss of sample size was minimal. However, it may be too harsh an approach to adopt in other surveys.

Views differ on how to deal with missing data and none of the possible methods have been assessed for WEMWBS. The problem of missing data in multi-item scales is curiously under-discussed in the methodological literature. Some researchers use estimation to 'fill in' missing values, thus retaining their original sample size. The following, which have been suggested in the literature, are noted as alternative methods to deleting respondents who are not full-responders:

- calculating the mean value of responses to items that a respondent has answered, and then using that mean score as the score for those questions that the respondent did not answer
- using the midpoint of the range of possible responses
- using the mean response for the particular item from all respondents.

However, using estimations to fill in missing values should only be done in situations where at least a certain proportion of items are answered. If less than this proportion has been answered, the respondent's score should be set to missing. Researchers do not agree on what the proportion should be. For WEMWBS, it can be anticipated that estimations for more than three missing items are unlikely to be robust. In such cases, WEMWBS scores should therefore not be calculated and should be set as missing. It will also be important to check the 'randomness' of the missing data to ensure that certain items are not being systematically missed. Overall, however, when dealing with missing WEMWBS data, it is important to note that the effect of using estimations for WEMWBS scores has not been tested.

SWEMWBS

Scoring

SWEMWBS is more complicated to score and it is very important that it is scored correctly in order for comparisons to be made across different studies.

SWEMWBS is scored by transforming the scores according to a raw score to metric score conversion table (Table 11).[16] A linear transformation of the raw score from SWEMWBS can be used with confidence in parametric analyses, given appropriate distribution. The translation is also only valid when the data are complete, i.e. there are no missing values.

Table 11: Raw score to metric score conversion table for SWEMWBS

Raw score	Metric score
7	7.00
8	9.51
9	11.25
10	12.40
11	13.33

12	14.08
13	14.75
14	15.32
15	15.84
16	16.36
17	16.88
18	17.43
19	17.98
20	18.59
21	19.25
22	19.98
23	20.73
24	21.54
25	22.35
26	23.21
27	24.11
28	25.03
29	26.02
30	27.03
31	28.13
32	29.31
33	30.70
34	32.55
35	35.00

18. Current usage of WEMWBS and SWEMWBS

WEMWBS is currently being used in numerous surveys and intervention studies. In 2014, there were a total of 422 new registrations to use WEMWBS. Examples of the use of WEMWBS and SWEMWBS include:

Surveys in the UK

Scotland

- *Scottish Health Survey* from 2008 for adults (aged 16 years and above) and from 2012 for children (aged 13 to 15 years)
- Scottish Prison Service 2007 Annual Prison Survey
- HEPS (waves 12, 13 and 14) 2006 and 2007 (8-item version, wave 14)
- Well? 2006, 2008 and 2010 surveys
- SALSUS from 2010
- All Scottish Government cross-sectional surveys from January 2012 as part of a set of core questions included in all these surveys (SWEMWBS) (www.gov.scot/Topics/Statistics/About/SurveyHarm)

England

- *Health Survey for England* 2010, 2011, 2012 for adults (aged 16 years and above)

UK

- British Social Attitudes Survey 2007
- Understanding Society (panel study) wave 1 2009/10, wave 4 2012/13 and planned for waves 7 and 10 (SWEMWBS)
- National Childhood Development Study 2008 sweep
- The Royal College of Veterinary Surgeons postal survey of members from 2006

Regional

- NHS Grampian population surveys
- South Lanarkshire Council large-scale quality of life survey (SWEMWBS), and also used by NHS Lanarkshire (SWEMWBS) and North Lanarkshire Council (SWEMWBS)
- North West mental wellbeing survey 2009, 2012/13 (SWEMWBS)
- Coventry, Bolton, Dundee, Aberdeen, Guernsey and Nottingham regional household surveys

International use

- European Social Survey
- Iceland: large population survey and translation
- Spain: large population survey in Catalonia
- Australia: several surveys of the population in Western Australia by researchers at the University of Western Australia, and a large survey for the HABITAT project at the University of Queensland, Australia, Human Movement Studies
- USA: several studies in different states such as Arizona, California, Nebraska, New England and South Carolina

- Portugal: project to improve the mental health and wellbeing of the Viana do Castelo population; Câmara Municipal de Viana do Castelo (CMVC), Viana do Castelo, North of Portugal
- Czech Republic: pilot study to see whether the scale is appropriate in the Czech Republic environment
- Ireland: survey of lifestyle and wellbeing among students and other studies in Southern Ireland
- South Africa: cross-sectional survey of mental wellbeing
- Pakistan: studies by psychology and medical students in various universities in Pakistan
- New Zealand: longitudinal study of health, wellbeing and active ageing
- Zimbabwe: mental wellbeing subsequent to testing HIV positive
- Bangladesh: Bangla translation validation
- Oman: Arabic translation validation

Other studies, too numerous to describe individually, including those by PhD and MSc students, are underway in many other countries, for example: Austria, Canada, China, Denmark, Finland, France, Greece, Hong Kong, India, Italy, Japan, Lithuania, Malaysia, New Zealand, Philippines, Spain, Sri Lanka and Switzerland.

Evaluation of interventions

- before and after evaluations of community participation, music therapy, physical activity, psychological and alternative therapies on mental wellbeing
- assessments of social prescribing projects
- assessment of mental wellbeing among employees
- evaluating the impact of parenting programmes on parents' mental wellbeing in the Parenting Interventions Evaluation of Pathfinders projects
- evaluation of Lottery-funded projects in England
- evaluation of interventions targeting adolescents and older people
- monitoring mental wellbeing among patients attending psychiatric day hospital
- evaluation of interventions provided by NGOs (e.g. Age Concern, RNIB, The Thistle Foundation).

University research projects

- Master’s thesis
- PhDs in conjunction with other outcome measures
- validating new mental wellbeing tools
- evaluating the effectiveness of interventions.

National indicators

Scotland

- Scottish Government’s National Performance Framework to monitor progress of National Outcomes and the ultimate purpose of ‘ creating

a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth' (*Scottish Health Survey* data from 2008)[25] www.gov.scot/About/Performance/scotPerforms/indicators

- Single Outcome Agreement (SOA) local outcome indicators (SWEMWBS) www.improvementservice.org.uk/menu-of-local-outcome-indicators.html
- Scottish adult mental health indicator set (*Scottish Health Survey* data from 2008) www.healthscotland.com/scotlands-health/population/mental-health-indicators-index.aspx
- Scottish children and young people's mental health indicator set (SALSUS from 2010) www.healthscotland.com/scotlands-health/population/mental-health-indicators/children.aspx

England

- English Public Health Outcomes Framework www.gov.uk/government/publications/healthy-lives-healthy-people-improving-outcomes-and-supporting-transparency
- English Mental Health Strategy as an example of an indicator of mental health outcomes for consideration by local commissioners (*Health Survey for England* from 2010) (Department of Health, 2011) www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_124057.pdf
- Department for Environment, Food and Rural Affairs (Defra) indicators of wellbeing, specifically positive mental health, in its original sustainable development indicators set (*Health Survey for England* from 2010)[26] webarchive.nationalarchives.gov.uk/20130402151656/http://archive.defra.gov.uk/sustainable/government/progress/index.htm

UK

- UK Office of National Statistics Wheel of Wellbeing www.neighbourhood.statistics.gov.uk/HTMLDocs/dvc146/wrapper.html

Elsewhere in Europe:

Iceland

- Icelandic national policy contains a SWEMWBS-based target for 2020[27] http://eng.forsaetisraduneyti.is/media/2020/iceland2020.pdf

Europe

- WEMWBS is recommended at national level throughout Europe[28] www.euro.who.int/__data/assets/pdf_file/0004/197113/EHR2012-Eng.pdf?ua=1

19. Further validation research on WEMWBS

Although the basic establishment of WEMWBS is now completed, ongoing research is still required. This includes new primary research but, importantly, also secondary analysis of existing datasets to continue to assess socio-economic and lifestyle correlates of mental wellbeing as measured by WEMWBS.

The further work that is required includes exploring:

- population norms in different populations
- associations between mental wellbeing and other factors; longitudinal datasets will prove to be very powerful in this respect and allow causal relationships to be looked at
- mental wellbeing as a predictor of resilience to disease and longevity
- the evaluation of the sensitivity to change of SWEMWBS
- the extent to which it is appropriate to use WEMWBS to assess mental wellbeing among different ethnic minority populations in the UK
- further cross-cultural validation for use of WEMWBS in countries other than the UK and for non-native English speakers.

For ongoing developments concerning WEMWBS, please refer to www2.warwick.ac.uk/fac/med/research/platform/wemwbs

Further ahead
As further understanding of mental wellbeing develops over the next decade, it is likely that measurement scales will also need to evolve. While WEMWBS fulfils criteria for monitoring mental wellbeing at present, and represents a very significant step forward in terms of other currently available measures, it is likely that it will need to undergo further development in the future.

20. Frequently asked questions about WEMWBS

1. Can WEMWBS be used to evaluate mental wellbeing at the individual level?

WEMWBS was developed for use as a population-based measure of mental wellbeing. Subsequent studies now suggest that WEMWBS does work in terms of measuring change at an individual level, but small changes (<3 points) in score may not be significant. Please refer to section 12.

WEMWBS has not been validated as a screening tool to detect individuals with low mental wellbeing, and its psychometric properties mean that it is unlikely to be an efficient screening tool. Scores of 40 or less, however, put individuals in a high-risk category for mental illness. Please refer to section 7.

2. Could the scale be validated for use with individuals before and after interventions?

WEMWBS was designed as a research tool to be used in populations. However, its responsiveness to change has been evaluated both at the population and the individual level, and at the individual level a change of about three or more points can be considered significant. Please refer to section 11.

There are currently no plans to validate the scale as a screening tool for use with individuals to categorise their individual level of mental wellbeing.

3. Can the questions in WEMWBS be used as triggers for conversations?

Individual questions from WEMWBS can be used as triggers for conversations in the context of qualitative research and to guide focus groups, etc. Please refer to section 12. They have also been used in the context of 'health-promoting projects'. This approach is well received but has not been formally evaluated.

It should be noted that this should not be carried out if the research then includes completion of the scale by the same individuals for evaluation of an intervention. Discussing the individual items and asking for opinions from a group is likely to bias results if individuals are subsequently asked to complete the questionnaire to obtain the mean score for the group.

4. Does adding other questions, for example, demographic description such as age and gender, infringe copyright?

No, this does not infringe copyright and is acceptable. It is envisaged that WEMWBS will frequently be included in the context of a questionnaire containing other questions so that other information about respondents can also be captured. As well as providing general information about the respondents, such data can be used in cross-tabulations with WEMWBS data for wider analysis purposes.

5. Does changing the text size of WEMWBS infringe copyright?

No, this does not infringe copyright and is acceptable as long as no changes to the wording, response categories, or layout of WEMWBS are made.

6. Is it appropriate to provide information such as support contacts for people with low WEMWBS scores?

Providing a supplementary page with information on support contacts is perfectly acceptable, but if such information is provided then it should be available to all those who complete the questionnaire, not just to those with scores deemed to be 'low'.

7. How many people should I study?

This is a technical statistical question. The number in a study or an intervention group determines the size of the difference that can be detected as statistically significant.

It is possible to calculate the number of people needed in a survey or in an intervention study. To do this, four things are required:

- The power of the study (usually 80 to 95%). This is the probability of detecting a real difference when one exists.
- The significance level, usually 0.05 (which gives the corresponding critical value, i.e. 1.96 for significance level 0.05). This is the probability of detecting a difference when one does not exist (false positive).
- The target difference. This is the (minimum) difference you expect to find between the two assessments (i.e. before and after the intervention).
- The standard deviation in the population.

A nomogram can be useful (see Figure 1 in www.pubmedcentral.nih.gov/articlerender.fcgi?artid=137461 and associated text). See also section 17.

Those who are not familiar with sample size calculation are advised to consult a statistician. However, for practical purposes, a sample size of 100 will be adequate for:

- a power of 80% and a significance level of 0.05
- a standard deviation of 8.8 (as found in the combined Scottish population surveys)
- a target difference of five points.

In smaller groups, changes in WEMWBS scores will need to be much larger for these to be statistically significant. It is possible that for groups of very small sizes, changes in WEMWBS scores may never be identified as statistically significant, as such large changes in score would be required.

For further information, the following article is helpful www.pubmedcentral.nih.gov/articlerender.fcgi?artid=137461

8. Can this scale be used with children?

The scale is validated for use with individuals aged 13 to 74 years. Please refer to section 15. There is no evidence for the use of WEMWBS with children below the age of 13 years. It is therefore not recommended that WEMWBS be used with children aged under 13 years. However, the Stirling Children's Wellbeing Scale appears suitable for children aged 8 to 13 years.[29]

9. Can this scale be used with ethnic minority groups in the UK?

Use of this scale in all population groups is encouraged. It has been validated among people with a Chinese and a Pakistani family background living in a city in England.[18] Please refer to section 13. It has not yet been specifically validated with Black or Afro-Caribbean populations.

10. Are there cut-off points for interpretation of WEMWBS scores?

The scale was not developed with a view to categorising the population according to level of mental wellbeing. While this approach is attractive to researchers and policy makers, it goes against the grain of whole population approaches that need to focus on changes in the average of whole population groups. As interest in mental wellbeing is so comparatively recent a phenomenon, we do not yet know what 'optimum' mental wellbeing looks like and any cut-off points we define on the basis of WEMWBS scores would, of necessity, be arbitrary. Those wanting to assess the proportion of a population that suffers from mental health problems should use a scale validated for that purpose, e.g. the GHQ 12 identifies those with a possible psychiatric disorder.

If it is important to present data in a categorical way, for example, for analytical purposes, the best approach, to date, is that used in the analysis of WEMWBS data from the Scottish Government's Well? 2006 survey.[9] Scores were categorised according to the extent of their standard deviation from the mean. A categorical variable was derived for the purposes of the report by dividing the survey population into three groups: (i) those with relatively 'good mental wellbeing' (a WEMWBS score of more than one standard deviation above the mean); (ii) those with 'average mental wellbeing' (a WEMWBS score of within one standard deviation of the mean); and (iii) those with relatively 'poor mental wellbeing' (a WEMWBS score of more than one standard deviation below the mean). This three-fold classification was used as a key analysis variable throughout the report. An alternative approach, which has also been used successfully, is to divide the populations into quintiles based on WEMWBS scores.[10]

11. Can WEMWBS be put on a website or published in a book?

If you are publishing the questionnaire on a website or in a book, permission should be sought and, when reproduced, it should have the following underneath it:

12. Do the numbers (1 to 5) in the boxes for WEMWBS responses influence how people answer the questions?

There is no evidence that the numbers in the boxes affect response, but if you decide to delete the numbers, it should be mentioned in your report because this may affect comparability with other studies. On a website, the numbers

will not normally be there because the options will be buttons rather than boxes.

13. Can WEMWBS be used to measure depression?

The scale is not designed to measure depression, but low scores do relate to depression. Recent studies show that you can define a cut-off point in WEMWBS score that has optimum sensitivity and specificity for depression (as measured by other scales), but wherever you put the cut-off point, you will either miss some people with depression or include people who do not have depression. You would expect this from a scale that is normally distributed and designed to measure wellbeing in the general population. Please refer to section 7.

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Appendix i

The Warwick–Edinburgh Mental Well-being Scale (WEMWBS)

Below are some statements about feelings and thoughts.

Please tick the box that best describes your experience of each over the last 2 weeks

STATEMENTS	None of the time	Rarely	Some of the time	Often	All of the time
I've been feeling optimistic about the future	1	2	3	4	5
I've been feeling useful	1	2	3	4	5
I've been feeling relaxed	1	2	3	4	5
I've been feeling interested in other people	1	2	3	4	5
I've had energy to spare	1	2	3	4	5
I've been dealing with problems well	1	2	3	4	5
I've been thinking clearly	1	2	3	4	5
I've been feeling good about myself	1	2	3	4	5
I've been feeling close to other people	1	2	3	4	5
I've been feeling confident	1	2	3	4	5
I've been able to make up my own mind about things	1	2	3	4	5
I've been feeling loved	1	2	3	4	5
I've been interested in new things	1	2	3	4	5
I've been feeling cheerful	1	2	3	4	5

Warwick–Edinburgh Mental Well-being Scale (WEMWBS)

Appendix ii

WEMWBS advisory group

Prof Glynn Lewis	Department of Psychiatry, University of Bristol
Dr Jane Parkinson	NHS Health Scotland
Prof Jenny Secker	Faculty of Health, Social Care & Education, Anglia Ruskin University
Prof Stephen Stansfeld	Queen Mary University of London
Prof Scott Weich	Warwick Medical School, University of Warwick

Appendix iii

Description of scales used to assess the construct validity of WEMWBS

Scales of affect/feelings	
WHO-Five Well-being Index	5-item scale of statements covering key mental affect states (e.g. I felt cheerful, calm, vigorous and interested) with five response categories. All items positively worded.
Short Depression Happiness Scale	6-item scale with four response categories focused on affect with balanced positive and negative items (e.g. I felt happy, I felt cheerless).
Positive and Negative Affect Scale: - Positive Subscale - Negative Subscale	20-item scale with five response categories comprising a list of positive and negative adjectives covering a wider variety of feelings than is usual in mental health scales (e.g. ashamed, attentive, proud, guilty and excited).

Scales of subjective wellbeing	
Global Life Satisfaction Scale	Single-item scale with four-point response category. 'On the whole are you satisfied with your life?' Most commonly used measure of subjective wellbeing.
Satisfaction with Life Scale	5-item scale with seven response categories. Items cover positive statements, e.g. 'In most ways my life is close to ideal'. The prototype measure of wellbeing.

Psychological functioning	
Scales of Psychological Wellbeing	54-item scale with six response categories assessing psychological functioning with subscales measuring autonomy, self-acceptance, environmental mastery, purpose in life, personal growth, and positive relations with others.

Emotional intelligence	
Emotional Intelligence Scale	33-item scale with five response categories. Consists of statements covering appraisal, expression, regulation of emotion in self and others, and the utilisation of emotions in problem solving.

Psychiatric morbidity	
General Health Questionnaire 12	12-item scale with four response categories. A well-established screening instrument designed to detect possible psychiatric morbidity in the general population. Respondents are asked to respond to questions relating to their recent experience of anxiety, self-confidence, ability to concentrate, decision-making capacity, enjoyment of day-to-day activities, sleep disturbance and stress, etc.

General health	
EQ-5D Thermometer	A measure of health in general where respondents rate their overall health (physical and mental) on a 0-100 scale. Responses to this scale tend to reflect physical more than mental health.

Response bias	
Balanced Inventory of Desirable Responding	40-item scale, split into two subscales. The first subscale measures self-deception (the tendency to exaggerate certain responses or behaviours) and the second subscale measures impression management (the tendency to over-report desirable behaviours and under-report undesirable behaviours).

Appendix iv

WEMWBS median scores across demographic groups: population sample combined HEPS (wave 12) and Well? 2006 survey dataset

Variable		N	Median (95% CI)	p
Total		1749	51 (51-52)	
Sex				
	Male	783	52 (51-52)	<0.05
	Female	966	51 (50-52)	
Age in years				
	16-24	176	53 (52-53)	<0.01[KW]
	25-34	245	51 (50-53)	
	35-44	353	51 (49-52)	
	45-54	306	50 (49-51)	
	55-64	334	52 (51-53)	
	65-74	274	52 (51-54)	
	75+	61	51 (49-54)	
Tenure				
	Own outright	523	52 (52-53)	<0.01[KW]
	Own with a mortgage	705	52 (51-52)	
	Rent	519	50 (49-51)	
Self-perceived health status				
	Very good	563	54 (54-55)	<0.01[J]
	Good	753	51 (51-52)	
	Fair	319	47 (46-49)	
	Poor	84	44 (40-46)	
	Very poor	29	41 (36-47)	
Employment status ^				
	In work	968	52 (51-52)	<0.01[KW]
	Student	82	52 (50-54)	
	Retired	465	51 (50-52)	
	Unemployed	154	49 (47-51)	
	Other	79	46 (43-50)	
Marital status *				
	Single	188	51 (49-53)	<0.01[KW]
	Married/living as a couple	418	52 (51-53)	
	Widowed/divorced/separated	155	49 (46-51)	
Gross household income, £/pa *				
	<5,000	55	48 (44-53)	<0.01[J]
	5,000-14,999	198	49 (47-51)	
	15,000-29,999	180	53 (51-54)	
	30,000+	173	51 (49-53)	
Terminal education age *				
	<16	228	52 (50-53)	<0.05[KW]
	16-18	355	50 (49-51)	
	19+	181	53 (51-54)	
Chief income earner social grade *				
	A	38	55 (51-57)	<0.01[J]
	B	84	50 (48-53)	
	C1	217	51 (50-53)	
	C2	193	53 (51-54)	
	D	101	50 (47-52)	
	E	124	47 (44-51)	

* Tests conducted on a reduced set of individuals. Variable only recorded in the HEPS survey
95% CI = 95% confidence interval of the median
[KW] = p-value generated from a Kruskal-Wallis test

[J] = p-value generated from Jonckheere's tests for ordered alternatives
^ = test conducted excluding the Other category

Appendix v

The Short Warwick–Edinburgh Mental Well-being Scale (SWEMWBS)

Below are some statements about feelings and thoughts.

Please tick the box that best describes your experience of each over the last 2 weeks

STATEMENTS	None of the time	Rarely	Some of the time	Often	All of the time
I've been feeling optimistic about the future	1	2	3	4	5
I've been feeling useful	1	2	3	4	5
I've been feeling relaxed	1	2	3	4	5
I've been dealing with problems well	1	2	3	4	5
I've been thinking clearly	1	2	3	4	5
I've been feeling close to other people	1	2	3	4	5
I've been able to make up my own mind about things	1	2	3	4	5

Short Warwick–Edinburgh Mental Well-being Scale (SWEMWBS)

Appendix vi

Translation of (S)WEMWBS into other languages, and using translated versions

We, NHS Health Scotland, constituted as a Special Health Board for Scotland pursuant to the Health Education Board for Scotland Order 1990 (as amended) and having its headquarters at Meridian Court, 5 Cadogan Street, Glasgow G2 6QE (NHS Health Scotland), The University of Warwick, Kirby Corner Road, Coventry CV4 8UW (University of Warwick), and The University Court of the University of Edinburgh, a charitable body registered in Scotland under registration number SC005336, and having its registered office at Old College, South Bridge, Edinburgh EH8 9YL (The University of Edinburgh), as owners of (S)WEMWBS, welcome efforts to develop versions of (S)WEMWBS in languages other than English, for use in non-English-speaking countries and with UK respondents who do not have English as their first language or who do not feel confident in their use of English. In the first instance, enquiry should be made to the website at the University of Warwick www2.warwick.ac.uk/fac/med/research/platform/wemwbs/researchers/languages/ in order to ascertain whether an approved non-English version is available. If it is, it can be downloaded. If a version in the required language is not available and you wish to develop a translated scale, we encourage you to do so.

This document sets out the terms and conditions relating to the translation of (S)WEMWBS and the use of translated versions. If you translate and/or use a translated version of (S)WEMWBS, and/or provide a translated version of (S)WEMWBS to others, you will be considered to have accepted these terms and conditions. Any translation of (S)WEMWBS and any use of a translated version of (S)WEMWBS that does *not* comply with these terms and conditions may result in all permissions given being revoked.

SWEMWBS is a shortened version of the Warwick–Edinburgh Mental Well-being Scale (WEMWBS). Translations of (S)WEMWBS are permitted provided that the following conditions have been met:

- Prior permission (by email) has been given by The University of Warwick. Permission is sought by contacting Professor Stewart-Brown via the email address Sarah.Stewart-Brown@warwick.ac.uk
- The University of Warwick approves the translated version (Professor Sarah Stewart-Brown Sarah.Stewart-Brown@warwick.ac.uk). The university requires evidence that standard guidance/guidelines have been followed before approving a translated version. Use of unapproved translations of (S)WEMWBS is not permitted. See Annex 1 for information on the standard guidance/guidelines.
- The translated version of (S)WEMWBS must be made available on a non-exclusive basis for use in academic and related research at no cost to the user.

- Copyright in (S)WEMWBS will remain the property of NHS Health Scotland, the University of Warwick and the University of Edinburgh. Copyright in the translated version of (S)WEMWBS will be jointly owned by NHS Health Scotland, the University of Warwick and the University of Edinburgh, and the developer of the translated version (the "Translator"). The Translator shall, subject to compliance with the following terms and conditions, permit third parties to use their translation and shall have full responsibility for the granting and management of such permissions.

The Translator is permitted to license to ***third parties*** the right to use a translation of (S)WEMWBS, and use of a translation of (S)WEMWBS is permitted by a third party provided that:

- Permission must be sought from the Translator prior to use of a translated version of (S)WEMWBS.
- Prior to giving permission for the use of their translated version of (S)WEMWBS, the Translator must obtain information from the prospective user regarding their proposed uses of the translation, and approve those uses. Translators need to be aware of the contexts in which (S)WEMWBS has been validated so that they can advise prospective users appropriately. To date, (S)WEMWBS has been shown to be valid for population surveys, in evaluation studies, and in controlled trials in people aged 13 to 80 years. Sample size calculations for the latter depend on the expected impact of the intervention, but changes in a score of three or more points are commonly observed in before or after evaluations. (S)WEMWBS has not been validated for use in monitoring the progress of individuals.
- The Translator must ensure that any permission given is subject to the requirement on users to provide feedback to the Translator with information regarding how the translated version of (S)WEMWBS has performed, and to supply copies of outputs that report methodological or substantive findings relating to the translated scale. The Translator must ensure that users comply with the above.
- The Translator must maintain a database of use of the translated version of (S)WEMWBS, including details regarding the names and addresses of users, and the purposes to which it is being put, and report such information to The University of Warwick periodically as required.
- The Translator must ensure it is kept informed regarding the performance and use of the translated version, including with regard to any issues that might arise, and report such information to The University of Warwick periodically as required.
- The Translator must only grant non-exclusive free-of-charge licences.
- The Translator must ensure that all licences granted by it include one of the following statements (WEMWBS or SWEMWBS):

Warwick–Edinburgh Mental Well-being Scale (WEMWBS)

Annex 1
Standard guidance/guidelines

The cross-cultural adaptation of health scales is very challenging. The aim of the process is to achieve language versions that are conceptually equivalent (i.e. carrying the same meaning) in different countries/cultures rather than merely linguistically equivalent (i.e. the substitution of a word in one language into a word that is literally the same in another language). Fortunately, several guidelines for producing translated versions have been developed. Those produced by Beaton *et al* (2000) are particularly helpful.[20] In brief, it is required that:

- the original scale is independently translated by at least two people who are native speakers in the new language, one of whom knows about the instrument and the concept under investigation and one of whom does not (stage 1)
- these translations are synthesised by the two translators with a recording observer, using consensus to resolve disagreements (stage 2)
- the agreed translated version (stage 2) is back-translated into the original language by at least two native speakers blind to the original version (stage 3)
- an expert committee consolidates all versions of the questionnaire and develops a pre-final version for field testing (stage 4).
- a small sample (30-40) of participants in the target setting completes the pre-final version of the questionnaire, and is subsequently interviewed to assess question comprehension and interpretation (cognitive testing) (stage 5).

If possible, a sixth stage, psychometric testing, should be added. This would entail the conduct of empirical studies to assess the scale's reliability (e.g. internal consistency, test-retest), validity (e.g. face, content, construct, criterion) and responsiveness to change.

Alternative (similar, but not identical) guidelines have been developed by several other authors, including Hunt and Bhopal (2004),[21] Guillemin *et al* (1993),[22] and the World Health Organization.

Appendix vii

Conditions of using WEMWBS

We welcome the use of WEMWBS. It is free to use but is **copyrighted** to NHS Health Scotland and the universities of Warwick and Edinburgh. **Permission and registration are required for use**. Should you decide to use WEMWBS (or SWEMWBS) you will need to register your use by completing an online registration form indicating how you are planning to use WEMWBS. The form is available on the University of Warwick website: http://www2.warwick.ac.uk/fac/med/research/platform/wemwbs Once submitted you will receive an email granting permission to use the scale.

If the scale is reproduced, it must include the copyright statement that appears below it and no changes to its wording, response categories, or layout must be made.

Any report regarding use of WEMWBS (or SWEMWBS) should include the following text:

"The Warwick–Edinburgh Mental Well-being Scale was funded by the Scottish Government National Programme for Improving Mental Health and Well-being, commissioned by NHS Health Scotland, developed by the University of Warwick and the University of Edinburgh, and is jointly owned by NHS Health Scotland, the University of Warwick and the University of Edinburgh."

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