



The Revised Mental Health Inventory-5 (MHI-5) as an ultra-brief screening measure of bidimensional mental health in children and adolescents

María Rivera-Riquelme^{a,*}, Jose A Piqueras^{a,*}, Pim Cuijpers^b

^a Department of Health Psychology, Miguel Hernández University of Elche, Avda. de la Universidad s/n, Alicante 03202, Spain

^b Department of Clinical, Neuro and Developmental Psychology, Vrije Universiteit Amsterdam, Amsterdam, the Netherlands

ARTICLE INFO

Keywords:

MHI-5
Well-being
Distress
Assessment
Validation
Factorial structure
Detection
Anxiety
Depression
Psychometrics
Spanish

ABSTRACT

The Mental Health Inventory-5 (MHI-5) is a brief, valid, and reliable international instrument for assessing mental health in adults. The aim of the present study is to examine the psychometric properties of the MHI-5 in children and adolescents. A sample of 595 students (10–15 years old) completed the MHI-5 Spanish version adapted for this study, as well as another measure of anxiety and depression symptoms, and a clinical interview as a gold standard. The overall coefficient obtained indicate good internal consistency. A unique factor solution explaining a 53.70% and a two-factor structure explaining 69.20% of the total variance were obtained. The correlations with total and subscale scores of anxiety and depression were significant. A ROC analysis showed good properties as a screening test to predict anxiety and depressive diagnoses in children and adolescents. The Revised MHI-5 presents two essential changes: a simplified 4-point response format and a new factor solution including distress and well-being. These outcomes show that the Revised MHI-5 is a brief, valid, and reliable measure to bidimensionally assess mental health and screening emotional disorders in children and adolescents.

1. Introduction

The concept of mental health has evolved over the years. World Health Organization defined health as a global state of complete physical, mental, and social well-being, and considering the absence of disease as well as the presence of well-being (WHO, 1948). However, through the years, studies on mental health have mainly focused on the development of concepts that explained psychopathology in terms of psychological distress, neglecting positive health aspects like well-being (Ryff and Keyes, 1995).

Most of the scientific literature published in the past century were associated with negative moods, and only around the 15% of them focused on well-being or similar variables (Salanova, 2008). On the contrary, over the past two decades, the relevance of positive psychological states and their relationship and impact on the evolution of several diseases have increased (Taylor et al., 2000). The reason for this rise is that well-being and positive psychology seem to be a cornerstone for prevention of and recovery from illness (Vázquez et al., 2009).

Therefore, these issues underscore the importance of assessing both mental health sides, according to the Bidimensional Mental Health Model (BMHM; Greenspoon and Saklofske, 2001), that recommends using mental health instruments comprising both facets.

The Mental Health Inventory (MHI; Veit and Ware, 1983) is a

validated 38-item instrument developed to assess psychological well-being and distress in the general population, comprising both facets of the BMHM in its structure. The MHI has a brief version called MHI-5 (Berwick et al., 1991), that comprises the five items from the original items pool that better reproduce the total score based on the MHI.

The MHI-5 is as effective as the comprehensive version, and it has the advantage of allowing a faster assessment (Berwick et al., 1991) and it seems sufficiently brief, easy to complete, valid, and reliable for use with different subgroups and in different cultures, including the United States (Ware et al., 1993), Norway (Strand et al., 2003), Denmark (Bültmann et al., 2006), Portugal (Pais-Ribeiro, 2001), Sweden (Sullivan and Karlsoon, 1998), and other European countries (e.g., Bray and Gunnell, 2006).

In contrast with other measures of mental health, this brief instrument has significant advantages. For example, according to Kelly et al. (2008), the MHI-5 performs remarkably well against the longer Mental Health Component Summary (MCS; Ware et al., 2000). Additionally, similar to the General Health Questionnaire (GHQ-12; Goldberg and Williams, 1988), the MHI-5 detects mental health problems, and the latter has the advantage that it can be used not only in mental health surveys, but also in general health and quality of life surveys (Hoeymans et al., 2004). Another benefit of the MHI-5 is that Strand et al. (2003) found it to be a better measure as compared to three

* Corresponding authors.

E-mail addresses: maria.rivera.riquelme@gmail.com, mrivera@umh.es (M. Rivera-Riquelme), jpiqueras@umh.es (J.A. Piqueras).

<https://doi.org/10.1016/j.psychres.2019.02.045>

Received 20 July 2018; Received in revised form 19 January 2019; Accepted 19 February 2019

Available online 20 February 2019

0165-1781/ © 2019 Elsevier B.V. All rights reserved.

Table 1
Means, Standard Deviations and factorial loading ($N = 595$).

Scale items	M	SD	Factor loading	
			1	2
1. Durante el último mes, ¿con qué frecuencia te has sentido muy nervioso?* (<i>How much of the time, during the last month, have you been a very nervous person?</i>)	2.17	0.71	0.76	−0.02
2. Durante el último mes, ¿con qué frecuencia te has sentido tranquilo y en paz? (<i>How much of the time, during the last month, have you felt calm and peaceful?</i>)	1.56	0.82	−0.09	0.87
3. Durante el último mes, ¿con qué frecuencia te has sentido desanimado o triste?* (<i>How much of the time, during the last month, have you felt downhearted and blue?</i>)	2.26	0.71	0.83	−0.17
4. Durante el último mes, ¿con qué frecuencia te has sentido feliz? (<i>How much of the time, during the last month, have you been a happy person?</i>)	1.97	0.79	−0.19	0.86
5. Durante el último mes, ¿con qué frecuencia te has sentido tan triste que nada lograba animarte?* (<i>How much of the time, during the last month, have you felt so down in the dumps that nothing could cheer you up?</i>)	2.54	0.68	0.77	−0.21

*Items are reverse-scored.

versions of the Hopkins Symptom Checklist (SCL-25, SCL-10, SCL-5 versions; Derogatis, 1983).

The interest in the utility of the MHI-5 has grown considerably in recent years, not only because of its brevity, but also because it has exhibited high sensitivity in detecting depressive and anxiety disorders diagnoses in the general population, according to the DSM-IV (Rumpf et al., 2001). Further, it is highly accurate in detecting some diagnoses like major depression or panic disorder in primary care patients (Means-Christensen et al., 2005).

Furthermore, the MHI-5 has the extra edge of assessing both psychological well-being and distress, which makes it suitable for using with a non-psychiatric population (Marques et al., 2011b). Some studies have divided the MHI-5 into two forms, MHI-a (for anxiety) and MHI-d (for depression), and it has been noted that both specific versions are as suitable as the 5-item questionnaire for screening. Consequently, the MHI-d and MHI-a can be used for assessing depression (Mitchell and Coyne, 2007) and anxiety (Kroenke et al., 2007), respectively. These data support the recent findings reported by Thorsen et al. (2013) that the MHI-5 was a better predictor of sick leave in the general population as compared to the Major Depression Inventory (MDI; Bech et al., 2001). Thus, the MHI-5 is a valuable instrument for screening depressive disorders in the general population, having high sensibility and specificity (Cuijpers et al., 2009).

Despite the increasing interest in the MHI-5 as a brief and simple mental health instrument for the general population and its use in different countries, there is little research on its use with youth population. Therefore, only one study reports the properties of the MHI-5 with children and adolescents (Marques et al., 2011b). Specifically, in this study with a sample of Portuguese adolescents, the MHI-5 obtained an internal consistency of 0.82, item-total correlations between 0.78 and 0.81, a single factor solution that explained 59.88% of the total variance, communalities from 0.60 to 0.73, and an external validity between 0.41 and 0.56 with other positive mental health measures. These data show that the MHI-5 is a valid and reliable measure for assessing mental health in children and adolescents. The same team carried out a longitudinal study in which MHI-5 was applied three times (time 1, time 2 = 1 year later, and time 3 = 2 years later), showing good estimations of reliability (0.82, 0.83, and 0.82, respectively), as well as correlation coefficients of 0.49 and 0.47 one year and two years later (Marques et al., 2011a).

In the present study, we examined the psychometric properties and the potential utility of a revised version of the MHI-5 to assess mental health in Spanish students. Thus, it is the second study to report data on the validation of the MHI-5 in children and adolescents. As a result, we expected to replicate and find similar psychometric properties to those reported in the study by Marques et al. (2011b).

2. Method

2.1. Participants

The sample comprised 595 students from seven schools in the province of Alicante (Spain), of which 146 (24.5%) and 147 (24.7%) were from the 5th and 6th grade of primary school, respectively, while 135 (22.7%) and 167 (28.1%) were from the 1st and 2nd grade of secondary school, respectively. Their mean age was 11.92 years ($SD = 1.34$), with age ranging from 10 to 15 years. Further, 289 of the students were girls (48.6%). Overall, the socio-economic status of the sample was medium-high (3.6% low, 54.8% medium, and 41.6% high).

2.2. Measures

2.2.1. Sociodemographic variables

Sociodemographic variables included age, gender, grade, classroom, date, and country of birth. It also included the Family Affluence Scale (FAS; Currie et al., 1997), which assesses the purchasing power of families using the following four questions: having one's own room, number of cars, number of computers, and number of holidays taken in the last 12 months. Responses to these questions yield a three-level hierarchical classification of wealth or socio-economic level (low, medium, and high).

2.2.2. Mental health Inventory-5 (MHI-5)

The MHI-5 is a brief version of the 38-item MHI developed by Veit and Ware (1983). It is included in both versions of the Medical Outcome Study (MOS), the MOS Short Form 20 (SF-20; Stewart et al., 1988) and the MOS Short Form 36 (SF-36; Ware and Sherbourne, 1992). The MHI-5 was developed for its use with the general population, and it includes items on psychological well-being (Berwick et al., 1991). The five items pertain to mood during the past month (see Table 1), assessing the presence of psychological well-being (2 items), and the absence of psychological distress (3 inverse-scored items). As recommended in the Standards (AERA, APA, and NCME, 2014), an iterative process involving translation and back-translation English-Spanish was used. Although the original version of the MHI-5 uses a 6-point Likert scale, we reduced the number of response options to 4-point Likert in our adaptation study for children and adolescents (AERA, APA, and NCME, 2014). Two reasons motivated this: 1. a fewer response options place a lower cognitive demand on students when completing surveys; and 2. there is virtually no difference in psychometric properties of the scales using 4, 5, or 6 categories (Lee and Paek, 2014). Therefore, we performed cognitive interviews with a focal group of 10 years old recruited randomly from the pool of youngest students. These students from the focal group indicated their preference for less options and less questions. Furthermore, the qualitative analyses with this method showed that the students understood the concept of each item properly as well as the choices of response. Consequently, this revised version uses a simplified 4-point Likert scale from 0 to 3

(0 = never, 1 = sometimes, 2 = several times, and 3 = always). The total score ranges from 0 to 15, with higher scores indicating better mental health. The internal consistency of the original tool ranged from 0.80 to 0.96, as reported in several studies in the general population (Ware et al., 1994) and 0.82–0.83 for a child and adolescent population (Marques et al., 2011a, b).

2.2.3. 30-item version of the Revised Child Anxiety and Depression Scale (RCADS-30)

The RCADS-30 (Chorpita et al., 2000; Sandín et al., 2010) is a self-report tool to assess anxiety and depression in children and adolescents. It is a reduced 30-item version of the original RCADS. It consists of six 5-item subscales assessing the same anxiety and depression syndromes as the original scale, namely, major depressive disorder, panic disorder, social phobia, separation anxiety disorder, generalized anxiety disorder, and obsessive-compulsive disorder. A 4-point response scale is used (0 = never, 1 = sometimes, 2 = often, and 3 = always). The 30-item version has a high internal consistency ($\alpha = 0.68$ – 0.89), which is equivalent to that of the 47-item version ($\alpha = 0.68$ – 0.93) (Piqueras et al., 2017a,b). In the present study, the internal consistency of the total scale was 0.91, and that of the subscales ranged from 0.72 to 0.84.

2.2.4. Anxiety Disorders Interview Schedule for DSM-IV: Child and Parent Version (ADIS-IV-C/P)

The ADIS-IV-C/P (Silverman and Albano, 1996; Silverman et al., 2001) is an interview for the diagnosis of anxiety and depression based on the DSM-IV criteria for children and adolescents. For the present study, we used the components that assess anxiety and depressive disorders of the Spanish version for children, which have good psychometric properties. Previous studies have indicated adequate inter-rater reliability for all the disorders evaluated ($\alpha = 0.75$ – 0.92) (Silverman et al., 2001).

2.3. Procedure

The study procedures were carried out in accordance with the Declaration of Helsinki. The Institutional Review Board of the University Miguel Hernandez (Elche, Spain) approved the study (reference numbers DPS-JPR001-10 and DPS-JPR.02.14).

Schools were contacted from a census of all the schools from the province of Alicante. They were contacted via email, with an attachment containing information about the study and an invitation to participate. Some conditions were needed to participate in the study: to have a computer room with internet connection and to have some offices free for doing the interviews when the centre was selected. A convenience sampling method was followed in order to ensure representativeness of the sample, choosing finally seven of the schools that expressed interest and agreed to participate: three semi-private and four public schools (from north, central, and south of the province of Alicante), to warrant that all geographic areas of the province were represented and the socioeconomic status. All parents and participants were informed about the study and all provided informed consent. The consent form explained the minimal risk and potential benefits associated with participation in this study and advised the parents and participants that they could drop out from the study at any time. Finally, the participation rate was 90%.

The administration of the questionnaires was conducted online, by means of a web platform adapted for this study (Piqueras et al., 2017a,b). For this, we complied with all ethical principles for research involving human subjects, the Data Protection Law and privacy rights of participants, international guidelines for ensuring the quality and security of the online assessments, and the informed consent guidelines on the treatment of data on underage children.

The questionnaires were completed in the computer room of the participating schools. Each child received a password to access to the platform and obtained an identifier key

“SCHOOLNAMEgradeCLASSlistnumber”, that guaranteed privacy. The average time taken to complete the questionnaires was 20 min. Subsequently, we interviewed 95 selected participants (16% of the total sample) using the ADIS-IV-C. We followed a random cluster sampling in order to warrant that all schools were represented. The professionals who performed the ADIS-IV-C were two trained psychologists specialized in clinical psychology with children and adolescents.

2.4. Statistical analysis

The SPSS 24.0 (IBM, USA) software was used to analyze the descriptive data, for exploratory factor analysis (using the principal component analysis with the Varimax rotation method), for estimations of reliability (internal consistency and test-retest), and to examine the construct validity (bivariate correlations for discriminant validity) of the RCADS-30. The magnitudes of correlations were interpreted based on the following criteria put forth by Cohen: small (0.10–0.29), medium (0.30–0.49), and large ($r \geq 0.50$) (Cohen, 1988; Lipsey and Wilson, 2001). We examined the construct validity through the examination of the accuracy of the MHI-5 as a screening-test based on its sensitivity (rate of correctly identified individuals having a disorder) and specificity (rate of correctly identified individuals having no disorder).

The FACTOR program (Lorenzo-Seva and Ferrando, 2006) was used to examine the internal consistency and for the exploratory factor analysis, because this enables parallel analyses to select the advised emerging factors (Timmerman and Lorenzo-Seva, 2011). Thus, we used the Unweighted Least Squares method (cat-ULS; Savalei and Rhemtulla, 2013) on the polychoric correlation matrix (Olsson, 1979), due to the ordinal nature of the item scores.

3. Results

3.1. Factor structure

Based on the minimum range of factors, the parallel analysis suggested a single dimension or factor according to Kaiser's test (Eigenvalue = 2.63) as best solution, with a total explained variance of 53.70%. One other factor had an eigenvalue > 1 (1.17; 23%) and we examined its factor structure with SPSS 24. The results were similar; we found two components: one with 45.7% explained variance and the other with 23.5%, having a total explained variance of 69.2% with the two factors. All items had factor loadings above 0.57 on general mental health (range = 0.57–0.77), and the factor loadings were higher for the two subscales obtained with the Varimax rotation method. Table 1 shows the factor loadings of each of the items. The estimated communality for each item differs between 0.59 and 0.77.

3.2. Reliability and validity

The internal consistency for the total scale score of the Revised MHI-5 was 0.78 according to McDonald's Omega (Ω) (McDonald, 1999), whereas the Cronbach's alpha (α) coefficient was 0.71 for the total score, and 0.71 and 0.70 for the distress and well-being subscales, respectively. The item-total correlations ranged between 0.39 and 0.53. The 1-year test-retest reliability coefficient for the Revised MHI-5 was 0.42 for a sample of 104 children (17.48% of the total sample) with a mean age of 11.30 ($SD = 0.48$) and an equal percentage of girls (50.96%) and boys.

The mean total score was 10.51 ($SD = 2.5$). The average score for each item is presented in Table 1. We found statistically significant gender differences ($t = 3.067$, $p = 0.002$), with boys exhibiting higher scores on mental health ($M = 10.92$, $SD = 2.23$) than girls ($M = 10.07$, $SD = 2.72$). There were no statistically significant differences in the Revised MHI-5 scores based on age or SES.

The criterion validity of the Revised MHI-5 was evaluated based on its correlation with another measure of anxiety and depression (RCADS-

Table 2
Correlations between the Spanish version of the MHI-5 and RCADS-30.

	MHI-5	Well-being	Distress
RCADS-30 total score	−0.48**	−0.15**	0.59**
Major depression disorder	−0.62**	−0.33**	0.66**
Panic disorder	−0.46**	−0.17**	0.55**
Social phobia	−0.41**	−0.16**	0.47**
Separation anxiety disorder	−0.25**	−0.08*	0.30**
Generalized anxiety disorder	−0.20**	0.02	0.31**
Obsessive-compulsive disorder	−0.31**	−0.05	0.42**

Abbreviations: MHI-5, Mental Health Inventory-5; RCADS-30, 30-items version Revised Child Anxiety and Depression Scale.

* $p < 0.05$.

** $p < 0.01$.

30). Table 2 presents these correlations.

3.3. Accuracy

We compared the areas under the curve (AUCs) by means of elevated emotional symptoms (RCADS-30) and clinical diagnoses with ADIS-IV-C/P. There were 79 participants with elevated anxiety or depression symptoms (> 2 SD) from the total sample and, from the randomized interviewed participants, 13 of 95 fulfilled any anxiety and/or depression diagnoses (Table 3; Figs. 1 and 2). The sensitivity and specificity were tested with anxiety/depression and well-being/distress dimensions. Although MHI-5 and Well-being factor do not have enough power of discrimination, Distress factor has the same optimal cut-off score for detecting anxiety and depressive symptoms and emotional disorders using RCADS-30 and ADIS-IV-C (Table 4).

4. Discussion

This study examined the psychometric characteristics of the Revised version of MHI-5 in a sample of Spanish students aged 10–15 years, supporting previous findings on this questionnaire in participants in this evolutionary period of pre-adolescence and adolescence (Marques et al., 2011b). The Revised MHI-5 presents two fundamental changes, namely, the simplified 4-point response format, and the new factor solution including distress and well-being.

Overall, it exhibited adequate internal consistency (Nunnally, 1978), and it replicated the factor structure previously reported for adults and adolescents, in addition to the new obtained factor solution, thus supporting its criterion validity. These outcomes indicate the possibility of assessing mental health in this population through a brief questionnaire previously validated extensively in the adult population (e.g., Bray and Gunnell, 2006; Bültmann et al., 2006; Pais-Ribeiro, 2001; Strand et al., 2003; Sullivan and Karlsson, 1998; Ware et al., 1993) and only preliminarily in adolescents (Marques et al., 2011b).

First, exploratory factor analysis supported the recognized single

Table 3
Area under the receiver operating characteristic (ROC) curves for different anxiety and depression symptoms and diagnostics.

	RCADS-30		ADIS-IV-C	
	AUC	(95% CI)	AUC	(95% CI)
MHI-5	0.79**	(0.74–0.85)	0.78**	(0.64–0.93)
Well-being	0.62**	(0.56–0.69)	0.70*	(0.53–0.87)
Distress	0.84**	(0.79–0.88)	0.80**	(0.68–0.92)

Abbreviations: MHI-5, Mental Health Inventory-5; RCADS-30, 30-items version Revised Child Anxiety and Depression Scale; ADIS-IV-C, Anxiety Disorders Interview Schedule for DSM-IV: Child Version.

* $p < 0.05$.

** $p < 0.01$.

mental health dimensionality of the Revised MHI-5, explaining approximately 53.7% of the total variance, being appropriate for the estimated communality for each item (Thompson 2004). With the criteria of eigenvalue > 1 (Kaiser's test) and by replicating the analyses employed by Ostroff et al. (1996) and Marques et al. (2011b), we found a new factor structure for the Revised MHI-5, which was different than the previously suggested MHI-d and MHI-a structure (e.g., Cuijpers et al., 2009). This finding is consistent with a recent methodological study reporting that the combination of regular and reversed items in the same test usually produces potential different understanding for participants (Suárez-Álvarez et al., 2018). Further, the present data fit the two-factor structure of the original MHI (well-being and distress), which explained about 70% of the total variance.

Second, the internal consistency of the scale used in our sample ($\Omega = 0.78$) was similar to that reported in the Portuguese study with adolescents of the same age range ($\alpha = 0.82$) (Marques et al., 2011b). It was also similar to that reported in other studies on adult samples in different cultures and countries ($\alpha = 0.74$ – 0.87), including the Portuguese version (Pais-Ribeiro, 2001), English version (McCabe et al., 1996; McHorney and Ware, 1995; Rumpf et al., 2001), Norwegian version (Loge and Kaasa, 1998; Strand et al., 2003) and Swedish version (Sullivan and Karlsson, 1998). The test-retest reliability of 0.42 over a 1-year interval evidenced the moderate stability of the scale, similar to the 0.49 reported by the Portuguese version (Marques et al., 2011b) in the same period and 0.47 over a 2-years interval (Marques et al., 2011a).

Both findings concerning factor structure and reliability are also consistent with the psychometrics of a new measure for BMHM, the Psychological Wellbeing and Distress Screener (PWDS). The PWDS showed a bifactorial structure (total variance explained = 52.17%), good reliability estimations (0.75–0.79), and evidences of validity to assess BMHM (Renshaw and Arslan, 2018; Renshaw and Bolognino, 2017). However, the PWDS is less brief and it has not yet reported evidences of validity concerning the diagnosis accuracy to screen anxiety and depressive disorders unlike the MHI-5.

Third, concerning the criterion validity, our results showed a negative and statistically significant correlation with the total score of the RCADS-30 and its subscales. These scores indicated a medium to large effect size (Cohen, 1988), depending on each specific symptomatology subscale. The highest correlations were obtained for the major depression and panic disorder subscales. The Revised MHI-5 used in the present study also showed good properties for screening symptoms as compared to the RCADS-30 and ADIS-IV-C because its area under the curve had more accuracy for assessing symptoms than for diagnostics. These outcomes could be related with previous studies reporting that the MHI-5 can be used as a screening tool for these disorders in the primary care setting (Means-Christensen et al., 2005). Furthermore, it supports the recommendation made by Rumpf et al. (2001) for using the MHI-5 as a check-up or screening measure for emotional disorders. In this study, the optimal cut-off was a score of 3 (Table 4).

Fourth, there were significant gender differences in relation to mental health scores, with higher mental health scores for boys as compared to girls. These results are consistent with previous data reported by Marques et al. (2011b), Ostroff et al. (1996), and Heubeck and Neill (2000).

5. Conclusions

The present study had some limitations. First, the sample was not entirely representative, since it belonged to a single province from Spain. Therefore, we must be cautious while generalizing the findings. In this sense, it is recognized that samples must be sufficiently broad to generalize the outcomes and to determine the response profile for each group (e.g., gender or age differences). Another limitation was the use of a single scale to contrast criterion validity, assessing only discriminant validity. It would have been preferable to use additional

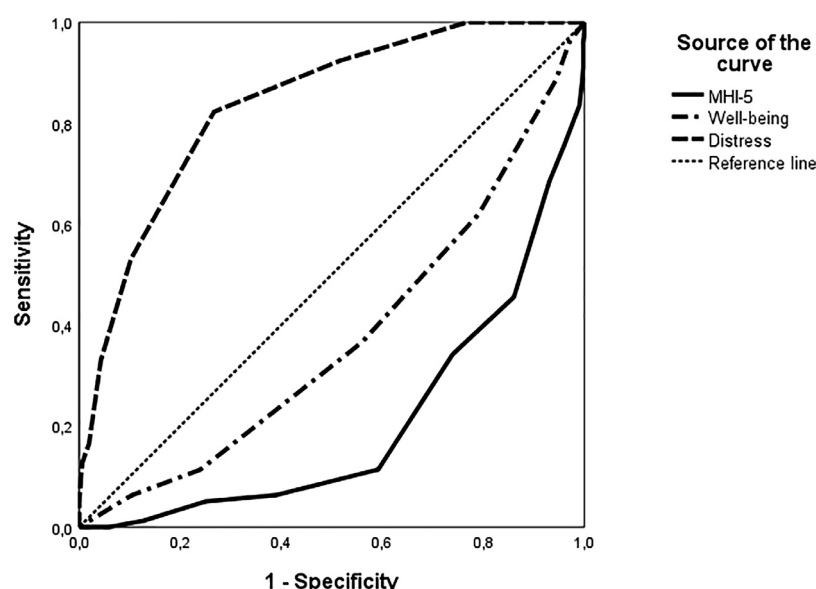


Fig. 1. ROC curve of the MHI-5 and Well-being and Distress factors for the detection of anxiety and depression symptoms.

instruments assessing similar variables (convergent validity). However, our data can be considered as complementary to those reported by Marques et al. (2011b), who investigated criterion-related validity through the examination of the relationships between the MHI-5 and other related construct measures such as hope, satisfaction with life, and global self-worth. Finally, the inter-rater reliability among interviewers and the equivalence between assessment methods (online versus paper-and-pencil form) was not assessed. Nevertheless, many different studies support the equivalence of online and paper-and-pencil modalities in psychological assessment (van Ballegooijen et al., 2016).

Thus, for future research on the validation of this questionnaire for children and adolescents, it would be advisable to consider more evidences of validity, specifically in terms of content and construct validity, and convergent and discriminant validity. It is also recommended to boost the sample in terms of the age of the participants and number of schools.

In conclusion, it is necessary to conduct more studies to assess mental health in children and adolescents, through the utilization of

brief, valid, and reliable instruments that allow the screening and early diagnosis of emotional disorders, as well as the prevention of distress and the promotion of well-being.

We found that the MHI-5 is a valid and reliable brief inventory for screening mental health in numerous studies with several age ranges and different cultures, displaying similar and adequate psychometrics in children and adolescent populations. This study showed that the Revised MHI-5 is a brief, easy to understand, reliable, and valid instrument to assess mental health in Spanish children and adolescents aged 10–15 years.

Funding

This research was supported by the Vicerrectorado for the Research and Technological Development from Miguel Hernández University [BANCAJA-UMH, call 2010] and by the Department of Education, Research, Culture, and Sport from Valencian Community of Spain through a grant for the hiring of PhD research assistant awarded to the

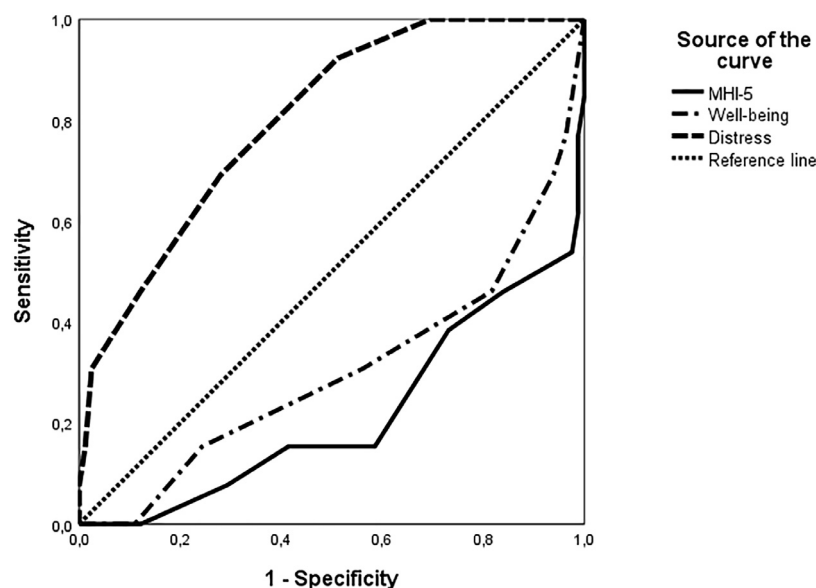


Fig. 2. ROC curve of the MHI-5 and Well-being and Distress factors for the diagnosis of depressive and anxiety disorders.

Table 4
Optimal cut-off points for the MHI-5 and Well-being and Distress factors.

	RCADS-30		ADIS-IV-C	
	Sensitivity	Specificity	Sensitivity	Specificity
MHI-5	0	1.00	0.00	1.00
	2	0.97	0.00	0.92
	3	0.96	0.00	–
	4	0.91	0.00	0.85
	5	0.89	0.00	0.77
	6	0.84	0.01	–
	7	0.76	0.04	0.62
	8	0.68	0.07	0.54
	9	0.46	0.14	0.46
	10	0.34	0.26	0.38
	11	0.11	0.41	0.15
	12	0.06	0.61	0.15
	13	0.05	0.75	0.08
	14	0.01	0.87	0.00
	15	0.00	0.94	0.00
Well-being	1	0.96	0.03	0.77
	2	0.89	0.06	0.69
	3	0.62	0.21	0.46
	4	0.37	0.44	0.31
	5	0.11	0.76	0.15
	6	0.06	0.90	0.00
Distress	1	1.00	0.23	1.00
	2	0.92	0.48	0.92
	3*	0.82	0.73	0.69
	4	0.53	0.90	0.46
	5	0.33	0.96	0.31
	6	0.16	0.98	0.15
	7	0.13	0.99	–
	8	0.05	1.00	0.08
	9	0.01	1.00	0.00

* Optimal cut-off score.

first author [ACIF/2015/155; VALi + d Program.

Compliance with ethical standards approval

The study procedures were carried out in accordance with the Declaration of Helsinki. The Institutional Review Board of the University Miguel Hernandez (Elche, Spain) approved the study (reference numbers DPS-JPR001-10 and DPS.JPR.02.14).

Conflict of interest

The authors state that there is no conflict of interest.

Acknowledgments

We are extremely grateful to all participants and to the teachers and the heads of the educational centers for their collaboration during the process. Also, to the institutions that helped make it possible with their funding.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.psychres.2019.02.045](https://doi.org/10.1016/j.psychres.2019.02.045).

References

- American Educational Research Association (AERA), American Psychological Association (APA), and the National Council on Measurement in Education (NCME) (2014). *The standards for educational and psychological testing*. Authors.
- Bech, P., Rasmussen, N.A., Olsen, L.R., Noerholm, V., Abildgaard, W., 2001. The sensitivity and specificity of the Major Depression Inventory, using the Present State Examination as the index of diagnostic validity. *J. Affect. Disord.* 66, 159–164. <https://doi.org/10.1016/S0165-0327>.
- Berwick, D.M., Murphy, J.M., Goldman, P.A., Ware Jr, J.E., Barsky, A.J., Weinstein, M.C.,

1991. Performance of a five-item mental health screening test. *Med. Care* 29, 169–176. <https://doi.org/10.1097/00005650-199102000-00008>.
- Bray, I., Gunnell, D., 2006. Suicide rates, life satisfaction and happiness as markers for population mental health. *Soc. Psychiatry Psychiatr. Epidemiol.* 41, 333–337. <https://doi.org/10.1007/s00127-006-0049-z>.
- Bültmann, U., Rugulies, R., Lund, T., Christensen, K.B., Labriola, M., Burr, H., 2006. Depressive symptoms and the risk of long-term sickness absence. *Soc. Psychiatry Psychiatr. Epidemiol.* 41, 875–880. <https://doi.org/10.1007/s00127-006-0110-y>.
- Chorpita, B.F., Yim, L., Moffitt, C., Umemoto, L.A., Francis, S.E., 2000. Assessment of symptoms of DSM-IV anxiety and depression in children: a revised child anxiety and depression scale. *Behav. Res. Ther.* 38, 835–855. <https://doi.org/10.1016/S0005-7967>.
- Cohen, J., 1988. *Statistical Power Analysis for the Behavioral Sciences*, 2nd ed. Lawrence Erlbaum Associates, Hillsdale, NJ.
- Cuijpers, P., Smits, N., Donker, T., Ten Have, M., de Graaf, R., 2009. Screening for mood and anxiety disorders with the five-item, the three-item, and the two-item Mental Health Inventory. *Psychiatry Res.* 168, 250–255. <https://doi.org/10.1016/j.psychres.2008.05.012>.
- Currie, C.E., Elton, R.A., Todd, J., Platt, S., 1997. Indicators of socioeconomic status for adolescents: the WHO Health Behaviour in School-aged Children Survey. *Health Educ. Res.* 12, 385–397. <https://doi.org/10.1093/her/12.3.385>.
- Derogatis, L., 1983. *SCL-90-R Administration, Scoring and Procedures Manual*. Clinical Psychometric Research, Towson, MD.
- Goldberg, D.P., Williams, P., 1988. *A User's Guide to the General Health Questionnaire: GHQ*. NFER-Nelson, Windsor, UK.
- Greenspoon, P.J., Saklofske, D.H., 2001. Toward an integration of subjective well-being and psychopathology. *Soc. Indic. Res.* 54, 81–108.
- Heubeck, B.G., Neill, J.T., 2000. Confirmatory factor analysis and reliability of the Mental Health Inventory for Australian adolescents. *Psychol. Rep.* 87, 431–440. <https://doi.org/10.2466/pr0.2000.87.2.431>.
- Hoeymans, N., Garssen, A.A., Westert, G.P., Verhaak, P.F., 2004. Measuring mental health of the Dutch population: a comparison of the GHQ-12 and the MHI-5. *Health Qual. Life Outcomes* 2, 23. <https://doi.org/10.1186/1477-7525-2-23>.
- Kelly, M.J., Dunstan, F.D., Lloyd, K., Fone, D.L., 2008. Evaluating cutpoints for the MHI-5 and MCS using the GHQ-12: a comparison of five different methods. *BMC Psychiatry* 8, 10. <https://doi.org/10.1186/1471-244X-8-10>.
- Kroenke, K., Spitzer, R.L., Williams, J.B., Monahan, P.O., Löwe, B., 2007. Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection. *Ann. Intern. Med.* 146, 317–325. <https://doi.org/10.7326/0003-4819-146-5-200703060-00004>.
- Lee, J., Paek, I., 2014. In search of the optimal number of response categories in a rating scale. *J. Psychoeduc. Assess.* 32, 663–673. <https://doi.org/10.1177/0734282914522200>.
- Lipsey, M.W., Wilson, D.B., 2001. *Practical Meta-Analysis*. Sage Publications, Inc, Thousand Oaks, CA.
- Loge, H.J., Kaasa, S., 1998. Short form 36 (SF-36) health survey: normative data from the general Norwegian population. *Scand. J. Soc. Med.* 26, 250–258.
- Lorenzo-Seva, U., Ferrando, P.J., 2006. FACTOR: a computer program to fit the exploratory factor analysis model. *Behav. Res. Methods* 38, 88–91. <https://doi.org/10.3758/BF03192753>.
- Marques, S.C., Pais-Ribeiro, J.L., Lopez, S.J., 2011a. The role of positive psychology constructs in predicting mental health and academic achievement in children and adolescents: a two-year longitudinal study. *J. Happiness Stud.* 12, 1049–1062. <https://doi.org/10.1007/s10902-010-9244-4>.
- Marques, S.C., Pais-Ribeiro, J.L., Lopez, S.J., 2011b. Use of the “Mental Health Inventory – 5” with Portuguese 10–15 years old. *Span. J. Psychol.* 14, 478–485. <https://doi.org/10.5209/rev.SJOP.2011.v14.n1.43>.
- McCabe, C.J., Thomas, K.J., Brazier, J.E., Coleman, P., 1996. Measuring the mental health status of a population: a comparison of the GHQ-12 and the SF-36 (MHI-5). *Br. J. Psychiatry* 169, 517–521. <https://doi.org/10.1192/bjp.169.4.516>.
- McDonald, R.P., 1999. *Test Theory: A Unified Treatment*. Lawrence Erlbaum, Mahwah, NJ.
- McHorney, C.A., Ware Jr, J.E., 1995. Construction and validation of an alternate form general mental health scale for the Medical Outcomes Study Short-Form 36-Item Health Survey. *Med. Care* 33, 15–28.
- Means-Christensen, A.J., Arnau, R.C., Tonidandel, A.M., Bramson, R., Meagher, M.W., 2005. An efficient method of identifying major depression and panic disorder in primary care. *J. Behav. Med.* 28, 565–572. <https://doi.org/10.1007/s10865-005-9023-6>.
- Mitchell, A.J., Coyne, J.C., 2007. Do ultra-short screening instruments accurately detect depression in primary care? A pooled analysis and meta-analysis of 22 studies. *Br. J. Gen. Pract.* 57, 144–151.
- Nunnally, J.C., 1978. *Psychometric Theory*, 2nd ed. McGraw-Hill, Hillsdale, NJ.
- Olsson, U., 1979. Maximum likelihood estimation of the polychoric correlation coefficient. *Psychometrika* 44, 443–460. <https://doi.org/10.1007/BF02296207>.
- Ostroff, J.S., Woolverton, K.S., Berry, C., Lesko, L.M., 1996. Use of the Mental Health Inventory with adolescents: a secondary analysis of the Rand Health Insurance Study. *Psychol. Assess.* 8, 105–107. <https://doi.org/10.1037/1040-3590.8.1.105>.
- Pais-Ribeiro, J.L., 2001. *Mental Health Inventory: um estudo de adaptação à população portuguesa*. *Psicol. Saúde Doenças* 2, 77–99.
- Piqueras, J.A., Garcia-Olcina, M., Rivera-Riquelme, M., Rodriguez-Jimenez, T., Martinez-Gonzalez, A.E., Cuijpers, P., 2017a. DetectaWeb Project: study protocol of a web-based detection of mental health of children and adolescents. *BMJ Open* 7, e017218. <https://doi.org/10.1136/bmjopen-2017-017218>.
- Piqueras, J.A., Martín-Vivar, M., Sandin, B., San Luis, C., Pineada, D., 2017b. The Revised Child Anxiety and Depression Scale: a systematic review and reliability

- generalization meta-analysis. *J. Affect. Disord.* 218, 153–169. <https://doi.org/10.1016/j.jad.2017.04.022>.
- Renshaw, T.L., Arslan, G., 2018. Testing the psychological wellbeing and distress screener with Turkish adolescents. *Int. J. Sch. Educ. Psychol.* 1–9. <http://dx.doi.org/10.1080/21683603.2017.1414007>.
- Renshaw, T.L., Bolognino, S.J., 2017. Psychometrics of the psychological wellbeing and distress screener: a brief measure of youth's bidimensional mental health. *Assess. Eff. Interv.* 42, 160–167. <http://dx.doi.org/10.1177/1534508416678970>.
- Rumpf, H.J., Meyer, C., Hapke, U., John, U., 2001. Screening for mental health: validity of the MHI-5 using DSM-IV Axis I psychiatric disorders as gold standard. *Psychiatry Res.* 105, 243–253. <http://dx.doi.org/10.1016/S0165-1781>.
- Ryff, C.D., Keyes, C.L., 1995. The structure of psychological well-being revisited. *J. Pers. Soc. Psychol.* 69, 719–727. <http://dx.doi.org/10.1037/0022-3514.69.4.719>.
- Salanova, M., 2008. Organizaciones saludables: una aproximación desde la Psicología Positiva. In: Vázquez, C., Hervás, G. (Eds.), *Psicología Positiva Aplicada*. Desclee de Brower, Bilbao, pp. 403–427.
- Sandín, B., Chorot, P., Valiente, R.M., Chorpita, B.F., 2010. Development of a 30-item version of the Revised Child Anxiety and Depression Scale. *Rev. Psicopatol. Psicol. Clin.* 15, 165–178. <http://dx.doi.org/10.5944/rppc.vol.15.num.3.2010.4095>.
- Savalei, V., Rhemtulla, M., 2013. The performance of robust test statistics with categorical data. *Br. J. Math. Stat. Psychol.* 66, 201–223. <http://dx.doi.org/10.1111/j.2044-8317.2012.02049.x>.
- Silverman, W.K., Albano, A.M., 1996. Anxiety disorders interview schedule for children for DSM-IV. Child Interview Schedule (ADIS-IV-C). Graywind Publications, New York.
- Silverman, W., Saavedra, L., Pina, A., 2001a. Test-retest reliability of anxiety and diagnoses with the Anxiety Disorders Interview Schedule for DSM-IV: child and parent version. *J. Am. Acad. Child. Adolesc. Psychiatry* 40, 937–944.
- Silverman, W.K., Albano, A.M., Sandín, B., 2001b. Entrevista Clínica ADIS-IV-C: Entrevista Para El Niño (ADIS-IV-C Clinical Interview. Interview Schedule For Children). UNED-Klinik, Madrid.
- Stewart, A.L., Hays, R.D., Ware, J.E., 1988. The MOS short-form general health survey: reliability and validity in a patient population. *Med. Care* 26, 724–735. <http://dx.doi.org/10.1097/00005650-198807000-00007>.
- Strand, B.H., Dalgard, O.S., Tambs, K., Rognerud, M., 2003. Measuring the mental health status of the Norwegian population: a comparison of the instruments SCL-25, SCL-10, SCL-5 and MHI-5 (SF-36). *Nord. J. Psychiatry* 57, 113–118. <http://dx.doi.org/10.1080/08039480310000932>.
- Suárez-Álvarez, J., Pedrosa, I., Lozano Fernández, L.M., García-Cueto, E., Cuesta, M., Muñiz, J., 2018. Using reversed items in Likert scales: a questionable practice. *Psicothema* 30, 149–158.
- Sullivan, M., Karlsson, J., 1998. The Swedish SF-36 Health Survey III. Evaluation of criterion-based validity: results from normative population. *J. Clin. Epidemiol.* 51, 1105–1113. <http://dx.doi.org/10.1016/S0895-4356>.
- Taylor, S.E., Kemeny, M.E., Reed, G.M., Bower, J.E., Gruenewald, T.L., 2000. Psychological resources, positive illusions, and health. *Am. Psychol.* 55, 99–109. <http://dx.doi.org/10.1037/0003-066X.55.1.99>.
- Thompson, B., 2004. *Exploratory and Confirmatory Factor Analysis: Understanding Concepts and Applications*. American Psychological Association, Washington, DC.
- Thorsen, S.V., Rugulies, R., Hjarsbech, P.U., Bjorner, J.B., 2013. The predictive value of mental health for long-term sickness absence: the Major Depression Inventory (MDI) and the Mental Health Inventory (MHI-5) compared. *BMC Med. Res. Methodol.* 13, 115. <http://dx.doi.org/10.1186/1471-2288-13-115>.
- Timmerman, M.E., Lorenzo-Seva, U., 2011. Dimensionality assessment of ordered polytomous items with parallel analysis. *Psychol. Methods* 16, 209–220. <http://dx.doi.org/10.1037/a0023353>.
- van Ballegooijen, W., Riper, H., Cuijpers, P., van Oppen, P., Smit, J.H., 2016. Validation of online psychometric instruments for common mental health disorders: a systematic review. *BMC Psychiatry* 16 (45). <http://dx.doi.org/10.1186/s12888-016-0735-7>.
- Vázquez, C., Hervás, G., Rahoma, J.J., Gómez, D., 2009. Bienestar psicológico y salud: aportaciones desde la Psicología Positiva. *Anu. Psicol. Clin. Salud* 5, 15–28.
- Veit, C.T., Ware, J.E., 1983. The structure of psychological distress and well-being in general populations. *J. Consult. Clin. Psychol.* 51, 730–742. <http://dx.doi.org/10.1037/0022-006X.51.5.730>.
- Ware, J.E., Kosinski, M., Dewey, J., 2000. How to Score Version 2 of the SF-36 Health Survey. Quality Metric Incorporated, Lincoln, RI.
- Ware, J.E., Kosinski, M., Keller, S.D., 1994. SF-36 Physical and Mental Health Summary scales: A user's Manual. Health Institute, New England Medical Center, Boston, MA.
- Ware, J.E., Sherbourne, C.D., 1992. The MOS 36-item short-form health survey (SF-36): I. Conceptual framework and item selection. *Med. Care* 30, 473–483. <http://dx.doi.org/10.1097/00005650-199206000-00002>.
- Ware, J.E., Snow, K.K., Kosinski, M., Gandek, B., 1993. *SF-36 Health Survey Manual and Interpretation Guide*. Health Institute, Boston, MA.
- World Health Organization, 1948. Preamble to the constitution of the World Health Organization. Official Records of the World Health Organization n 2. World Health Organization, Geneva, Switzerland, pp. 100.