The Mental Health Continuum – Short Form: The structure and application for cross-cultural studies – a 38-nation study

Abstract

Objective: The Mental Health Continuum – Short Form is a brief scale measuring positive human functioning. The study aimed to examine the factor structure and to explore the cross-cultural utility of the MHC-SF using bifactor models and exploratory structural equation modelling (ESEM). **Method**: Using multigroup confirmatory analysis (MGCFA) we examined the measurement invariance of the MHC-SF in 38 countries (university students, *N* = 8,066; 61.73% women, mean age 21.55 years). **Results:** MGCFA supported the cross-cultural replicability of a bifactor structure and a metric level of invariance between student samples. The average proportion of variance explained by the general factor was high (ECV = .66), suggesting that the three aspects of mental health (emotional, social, and psychological well-being) can be treated as a single dimension of well-being. **Conclusion**: The metric level of invariance offers the possibility of comparing correlates and predictors of positive mental functioning across countries; however, the comparison of the levels of mental health across countries is not possible due to lack of scalar invariance. Our study has preliminary character and could serve as an initial assessment of the structure of the MHC-SF across different cultural settings. Further studies on general populations are required for extending our findings.

Key words: Mental Health Continuum-Short Form; measurement invariance, cross-cultural study

Introduction

Emerging adults are frequently exposed to the challenges of transitioning into adulthood (low personal finances, entering the workplace, changes in personal relationships) (Arnett, 2000; Roberts, Golding, Towell, Reid, & Woodford, 2000) and are at risk for various mental health problems (Eisenberg, Gollust, Golberstein, & Hefner, 2007). Also, the mental health of university students is found to be worse than that of the general population (Stock et al., 2008; Mikolajczyk et al., 2008; Vaez, Kristenson, & Laflamme, 2004), perhaps due to the additional challenges and risks facing them, such as increased financial worries, costs, and debt associated with university, academic pressure, moving away from home, changes in sources of emotional support, dealing with new environments, and increased exposure to drinking and drug-taking culture. However, despite the variety of studies reporting low mental health scores among students across the globe (see Boot, Donders, Vonk, & Meijman, 2009; Kurré, Scholl, Bullinger, & Petersen-Ewert, 2011; Stewart-Brown et al., 2000; Vaez, Kristenson, & Laflamme, 2004), still little research has been done regarding comparisons between different countries. This may be due to the lack of a valid standardized measure which could be used in cross-cultural studies aimed at assessing well-being and could consequently guide the assessment and mental health promotion of university students across the globe.

The consideration and assessment of mental health is one of the most broad and complex phenomena in psychology (see Sirgy, 2012), with there being a number of distinct sources of happiness (Keyes, Ryff, & Shmotkin, 2002; Keyes, 1998; 2002; Ryff, 1989). Therefore it is suggested that it is crucial to provide a single valid and reliable instrument that could be used to consider, assess and promote students' mental health. To achieve these goals we focus on exploring the cross-cultural utility of a measure that assesses a number of theoretical domains in the well-being literature: the Mental Health Continuum – Short Form (MHC-SF; Keyes, 1998).

The MHC-SF is based on the concept of positive mental health proposed by Keyes (2002) and is an abbreviated form of the 40-item MHC-LF (Keyes, 2002). It is an effort to integrate hedonic and eudaimonic aspects of well-being. Specifically, the Mental Health Continuum is regarded as a syndrome encompassing three broad aspects: emotional well-being (EWB: positive emotions along with life satisfaction), social well-being (SWB, based on the definition offered by Keyes, 1998, comprised of: social coherence, social acceptance, social actualization, social contribution, and social integration), and psychological well-being (PWB, based on a model by Ryff, 1989, including: self-acceptance, positive relationships with others, autonomy, purpose in life, environmental mastery, and personal growth).

Comprising 14 items, the MHC-SF (Keyes et al., 2008) measures all three dimensions: emotional, psychological, and social well-being. It can be used both for research purposes (as an indicator of positive functioning of individual) and for diagnosis of the levels of positive functioning (Keyes, 2002). The MHC-SF captures three categorical diagnoses: flourishing, languishing, and moderate mental health. Flourishing is diagnosed when someone reported having experienced at least one of the three hedonic well-being symptoms (items 1–3) and at least 6 of the 11 positive functioning symptoms (items 4–14) “every day” or “almost every day” within the past month. Languishing is diagnosed when someone reports having experienced at least one of the three hedonic well-being symptoms and at least 6 of the 11 positive functioning symptoms “never” or “once or twice” in the past month. Individuals who are neither “languishing” nor “flourishing” are considered “moderately mentally healthy” (Keyes, 2002).

Currently, there are several language versions of this scale (see Keyes, 1998, and Karaś, Cieciuch, & Keyes, 2014, for review) including Korean (Young-Jin, 2014), Serbian

(Jovanović, 2016), Italian (Petrillo, Capone, Caso, & Keyes, 2015), and Polish (Karaś et al., 2014). Therefore it seems to be a perfect tool for cross-cultural research studies of well-being among university students. Such research could focus both on searching for the risk factors and factors important for increasing mental health and focus on diagnosis the number of languishing, flourishing, and moderately healthy individuals within particular populations.

As the MHC-SF has been used in a number of countries, one could expect that this tool is well validated in different cultural contexts and there are no controversies and/or obstacles to implementing it in the cross-cultural surveys. Nevertheless, despite the work of Keyes (1998) that assumes a three-factor structure of the MHC-SF, other findings suggest that the proposed three-factor structure of the MHC-SF scale is problematic (deBruin, & duPlessis, 2015; Jovanovich, 2015).

Researchers have proposed two alternative, more flexible models, for MHC-SF. First, a bifactor model, in which the variance of items is partitioned between a general factor (reflecting a common construct) and a set of uncorrelated group factors (capturing the content similarity of homogeneous groups of items). This approach was suggested as particularly useful for composite models of subjective well-being, because it allows to separate the general well-being dimension from specific factors related to particular life domains or aspects of human functioning (Sirgy, 2012) and it has been applied successfully with MHC-SF (Jovanovich, 2015).

Another analytic solution recently proposed for MHC-SF is Exploratory Structural Equation Modeling (ESEM). Unlike conventional CFA models (termed “independent-cluster model”, or ICM-CFA), ESEM models allow for non-zero cross-loadings, addressing the issue of imperfect indicators. Although a three-factor ESEM model was previously applied for MHC-SF (Joshanloo, Jose, & Klepikowski, 2016; Joshanloo & Jovanovic, 2016), a bifactor ESEM model (Morin, Arens, & Marsh, 2016) would be more relevant, due to the presence of a common factor, whose variance could potentially contribute to item cross-loadings in a three-factor model. However, the complexity of ESEM models, which involve a much larger number of free parameters (i.e., loadings), compared to CFA, is supposed to result in increased sample size requirements and may entail convergence difficulties in smaller samples. Also, ESEM models can be viewed as more data-driven, because strong item loadings on non-target factors can affect the theoretical interpretation of factors.

Past cross-cultural studies using MHC-SF did not take advantage of bifactor models and have compared only a limited number of national samples (Joshanloo, Wissing, Khumalo, & Lamers, 2013). Because the MHC-SF seems a promising brief measure of positive mental functioning, the issues of structure and measurement invariance of MHC-SF need to be studied in diverse cultural contexts to reveal the possibilities and limitations of this measure for multicultural projects.

The Present Study

The aim of the present study is, firstly, to examine the structure of MHC-SF in different cultural contexts, comparing the bifactor model to the three-factor solution and, secondly, to examine the applicability of MHC-SF to cross-cultural studies using multi-group CFA analyses with data from 38 countries. This aim is not only theoretical, but could allow to address applied issues, i.e., the comparability of findings on mental health among youth populations obtained in different cultures. The levels of measurement invariance indicate to what extent findings on mental health can be compared in terms of conceptual invariance, its predictors, correlates, and finally, the levels of mental health across countries.

Method

Sample and Procedure

The sample included 8,066 university students (61.7 % women), ranging in age from 16 to 50 (*M* = 21.55, *SD* = 4.37), originating from 38 countries (see Table 1 for details). The students filled out the MHC-SF as part of a broader research project on entitlement and well-being. In addition to the MHC-SF, the study included other measures of subjective well-being: Personal Well-being Index (Cummins, Eckersley, Pallant, Van Vugt, & Misajon, 2003), Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffin, 1985) Positive and Negative Affect Schedule (Watson, Clark, & Tellegen, 1998), and two scales measuring attitudes: Entitlement Attitudes Scale (Żemojtel-Piotrowska et al., 2015) and belief in life as zero-sum game (Różycka-Tran, Boski, & Wojciszke, 2015). Data were collected in paper-pencil form and also online (presented in Table 1) between March 2015 and March 2016. The students participated in the study voluntarily and informed consent was obtained from all study participants. The registered data was alphanumerically coded, ensuring anonymity. The study has been conducted according to the principles expressed in the Declaration of Helsinki. All procedures were approved by each participating University Ethics Committee.

The selection of participating countries aimed to reflect cultural diversity in the most comprehensive way possible. In terms of cultural regions, we included countries representative of all Huntington (1996) cultural groups (i.e., Western, Orthodox, Confucian, Japanese, Latin American, Hindu, Buddhist, Islamic, African, and Sinic) and, in terms of religion, we had countries representing all main world religions. In the current study, we included data from: Europe (16), Asia (13), Africa (3), and Latin America (6). Former studies indicate the importance of cultural, political, and economic factors related to subjective well-being. For instance, subjective well-being is related to income inequalities (Berg & Veenhoven, 2010), values (Sagiv & Schwartz, 2000; Welzel & Inglehart, 2010), and religion (Donahy, Lewis, Schumaker, Akuomah-Boateng, Duze, & Sibiya, 1998). Therefore, our aim was to include countries with different levels of affluence, cultural values, and religion in order to indicate usefulness of the MHC-SF in measuring mental health as a multi-dimensional construct.

(Table 1 about here)

Measure

The *Mental Health Continuum – Short Form* (MHC-SF; Keyes, 2013) comprises 14 items that represent various aspects of well-being (the items were chosen from the longer version of this tool, as the most prototypical for each aspect of well-being). The response scale consists of 6 points, which describe the frequency of experiencing various well-being symptoms during the past month, ranging from 1 = *never* to 6 = *every day*. The MHC-SF allows two kinds of assessments, of the level of well-being (and its three dimensions: social, psychological, and emotional) and a categorical assessment of mental health status, with three categories: flourishing (i.e., high levels of well-being), languishing (i.e., the absence of mental health), and moderate mental health (located between these two extremes).

We used translation and back-translation procedure to obtain versions of the scale in different languages. The resulting back-translated versions were discussed with the author of the MHC-SF, Corey Keyes. We do not report the results of validation of the MHC-SF, as they would go beyond the scope of the present paper. However, in different countries we have found a consistent pattern of negative correlations of MHC-SF with revengefulness and belief in life as zero-sum game, as well as positive correlations of MHC-SF with other scales measuring subjective well-being.

Data Analysis

The analyses were conducted using SPSS 20 and Mplus 7.4. The robust MLM estimator with Satorra-Bentler-scaled chi-square resulted in fewer convergence problems and inadmissible solutions for the bifactor model, compared to the ML and MLR estimators. Unfortunately, the MLM estimator in Mplus currently does not handle missing data. Because the percentage of missing responses was quite small (0.28%) and the data were missing at random, we used EM imputation in SPSS to impute the missing values, in order to take advantage of the MLM estimator.

Preliminary Confirmatory Factor Analyses. First, we performed a confirmatory factor analysis (CFA) in each sample separately. These analyses were aimed at finding the best measurement model of the MHC-SF to be used as a basis for cross-cultural comparison.

We identified the models by fixing the latent factor variances to 1 and freely estimating the factor loadings. In order to assess the model fit, we relied on practical fit indices using guidelines proposed by Hu and Bentler (1999), i.e., the values of CFI close to .95 or above, RMSEA close to .06 or below, SRMR close to .08 or below as indications of good fit, using these indices in combination (Brown, 2015). In order to compare the fit of nested models in individual samples, we relied on the scaled chi-square difference test (Satorra & Bentler, 2001).

Based on theory and previous findings (Jovanovich, 2015; Karaś, et al., 2014), we tested four different CFA models of the MHC-SF: (1) a single-factor model, in which all 14 items load on one underlying dimension of well-being; (2) a two-factor model with two correlated dimensions of well-being – hedonic well-being (comprising EWB; items 1 through 3), and eudaimonic well-being (comprising both SWB and PWB; items 4 through 14); (3) a three-factor model with three correlated dimensions of well-being – hedonic well-being (items 1 to 3), eudaimonic social well-being (items 4 to 8), and eudaimonic psychological well-being (items 9 to 14); and (4) a bifactor model (Reise, 2012), with a general factor and three uncorrelated "group factors", capturing specific variance or hedonic, social, and psychological well-being. We did not test the hierarchical model with a single second-order factor separately, because a hierarchical solution with three first-order factors is mathematically equivalent to the correlated-factor model.

The advantage of the bifactor model is that it makes it possible to separate the general and specific variance. To evaluate the reliability of the general dimension and the subscales, we calculated the omega coefficient (Reise, 2012), which is similar to the alpha, as it reflects the proportion of total item variance explained by the model, with joint contribution of the general well-being factor and group factors. To separate the effects of the general well-being factor and those of the group factors, we calculated coefficients ω_H and ω_S (Reise, 2012), the former reflecting the share of total variance explained by the general factor and the latter reflecting the unique share of variance explained by each group factor (excluding the contribution of the general factor). We also calculated the Explained Common Variance (ECV) coefficient (Reise, Scheines, Widaman, & Haviland, 2013), which measures the relative strength of the general factor to the group dimensions.

Measurement Invariance Analyses. The second aim of study was to evaluate the measurement invariance of the MHC-SF and establish non-equivalent parameters using multi-group bifactor CFA model. Because chi-square difference test is known to be overly sensitive in large samples, we used the ΔCFI and ΔRMSEA cutoff values of .010 and .015, respectively, as indicators of pronounced difference in fit between nested models (Chen, 2007; Cheung & Rensvold, 2002). Because of the large number of parameter constraints tested, we only relied on modification indices significant at $p < .05$ with Bonferroni correction in order to prevent false positives. We relaxed the parameter constraints sequentially (Yoon & Kim, 2014), one at a time, after which the model was re-estimated.

There are three levels of measurement invariance that are most commonly used to establish whether a measure is equivalent. Configural invariance indicates that the general factor structure of the measure is the same across different groups. At this level, the construct is measured by the same set of indicators in different samples. Metric invariance implies that the factor loadings of items are similar across groups. At this level, the effects of correlates and/or predictors of the measure may be compared across samples. Scalar invariance indicates that item intercepts are equal across groups. At this level, mean scores may be compared between samples (Davidov, Meuleman, Cieciuch, Schmidt, & Billiet, 2014). Scalar invariance is rarely found in large cross-cultural comparisons (see Davidov et al., 2014), so we expected to find metric invariance of the MHC-SF. To examine the structure of the scale and its cross-cultural replicability, however, only configural invariance is required. Since most cross-cultural studies focus on examining predictors and correlates of subjective well-being, the metric level of invariance is sufficient.

ESEM analyses. We also performed single-group ESEM analyses based on a model with three correlated factors and a bifactor model. However, because of complexity of this model, which resulted in convergence issues, we could not use the ESEM model as a basis for multigroup comparison and we present these results as supplementary findings.

Results

Preliminary Confirmatory Factor Analysis

Single-group analyses. The single-factor model did not fit the data well, with at least 2 out of 3 fit indices lying outside the acceptable ranges for all samples. Across the 38 countries, the CFI ranged from .508 to .868 (*M* = .791, *SD* = .066), the RMSEA ranged from .079 to .144 (*M* = .112, *SD* = .015), and the SRMR ranged from .058 to .134 (*M* = .079, *SD* = .013). The two-factor model (i.e., factors representing hedonic and eudaimonic well-being) showed a better fit, with CFI ranging from .587 to .926 (*M* = .848, *SD* = .060), RMSEA ranging from .067 to .133 (*M* = .095, *SD* = .014), and SRMR ranging from .053 to .132 (*M* = .072, *SD* = .013). However, based on the combination of fit indices, the fit was still unacceptable in all countries but one (Ukraine).

The fit indices for the three-factor model and the bifactor model are shown in Table 2. Based on the combination of indices, the three-factor model showed a good fit in 2 countries

(Ukraine and Uruguay) and acceptable fit in 14 countries (Azerbaijan, Belgium, Brazil, Czech Republic, Estonia, Hungary, Indonesia, Japan, Kazakhstan, Malaysia, Portugal, Russia, South Africa, and Vietnam). In most of the remaining cases, the fit was marginal. The correlations between the factors were moderate to strong in all samples. The mean correlation between the emotional and psychological well-being factors was .75, and social well-being was correlated at .69 and .62 with psychological and emotional well-being, respectively.

The unrestricted bifactor model failed to converge in 10 countries out of 38. To improve the model identification by ruling out inadmissible solutions, we introduced inequality constraints, restricting the estimates of residual variances of observed variables to values above 0. As a result, model convergence was obtained in all samples.

The bifactor model showed good fit in 16 countries (Azerbaijan, Belgium, Brazil, Bulgaria, Czech Republic, Estonia, Hungary, Indonesia, Japan, Latvia, Malaysia, Portugal, South Africa, Spain, Ukraine, and Uruguay) and acceptable fit in all others, except Kenya and Iran, where the fit was marginal. The investigation of modification indices revealed an unexplained error covariance of items 9 and 10 in the Kenyan sample. In Iran, we found no pronounced modification indices, but exploratory factor analyses showed that items 4 to 8 failed to form a single dimension. To avoid the necessity for model modifications, we opted to exclude these two samples from the multigroup model.

(Table 2 about here)

Bifactor structure analyses. Based on the bifactor models for each sample, we calculated a set of indices to evaluate the reliability and dimensionality of the MHC-SF in each sample. The results are shown in Table 3. The ω reliability coefficients, reflecting the proportion of true score variance (with contribution of both the general factor and group factors), ranged from .82 to .95 for the general well-being index and from .57 to .92 for the subscales, indicating good reliability. The social well-being subscale showed somewhat lower reliability, compared to the emotional and psychological well-being subscales.

The ω_H coefficient, reflecting the proportion of total variance explained by the general factor, ranged from .56 to .87, indicating a substantial contribution of the general factor. The ECV index, reflecting the share of the general factor in the true score variance, ranged from .40 to .76 (*M* = .66). This suggests that, on average, two-thirds of the variance captured by the MHC-SF is shared by the three scales, and only one-third is related specifically to emotional, psychological, or social well-being. According to O'Connor's (2014) recommendations, ECV values above .70 indicate unidimensionality of scales. In Brazil, Colombia, Germany, Estonia, Hong Kong, Iran, Kazakhstan, Malaysia, Poland, Russia, UK, and Vietnam, ECV exceeded this value, suggesting that the general dimension of MHC-SF may be most relevant in these countries as an indicator of overall mental health.

The residual reliability coefficients (ω_S) reflect the proportion of true score variance of each subscale excluding the contribution of the general factor. The psychological well-being subscale reveals a comparatively small amount of unique variance (*M* = .12), indicating that the variance it captures is mainly shared by all three subscales of MHC-SF. The emotional and social well-being subscales emerge as more distinct (*M* = .29 and .31, respectively), suggesting that their associations with other variables may be different from those exhibited by the MHC-SF as a whole. These findings support the validity of the general index of the MHC-SF and the discriminant validity of its individual subscales.

Measurement Invariance Analyses

We proceeded by investigating the measurement invariance of the MHC-SF based on the bifactor model for 36 countries (excluding Kenya and Iran). We failed to achieve convergence of an unrestricted configural invariance model. To rule out inadmissible solutions, we introduced 20 inequality constraints restricting residual variances of observed variables to positive values. This allowed to obtain convergence of the configural invariance model, which showed good fit.

The fit of the metric invariance model was acceptable. Using Bonferroni correction, we established critical chi-square values to detect loading and intercept non-invariance ($\Delta\chi^2$ = 16.46 based on N=1008 for loadings and $\Delta\chi^2$ = 15.15 based on N=504 for intercepts). We proceeded by searching for non-invariant loadings based on the metric invariance model. The complete list of non-invariant parameters is given in Supplementary Information 1.

Only one loading revealed a strong non-invariance ($\Delta\chi^2$ = 39.57), the loading of item 12 on the general well-being factor in Algeria, which was negative (λ = -.22). To prevent a negative group factor variance in Algeria, we also relaxed the constraint for this loading on the psychological well-being factor. The remaining four modification indices were marginal ($\Delta\chi^2$ = 19 or below) and, when they were all addressed, the fit of the model did not change substantially (ΔCFI $\leq$ .001, ΔRMSEA $\leq$ .001), so we opted against including them into the model for the sake of theoretical parsimony.

The non-invariance of intercepts was more pronounced. The fit indices of the model with full scalar invariance were well outside the acceptable range. Based on modification indices, we relaxed the equality constraints for 54 non-invariant intercepts (listed in Supplementary Information 1). Although the target difference in practical fit indices was only reached for the RMSEA, but not for the CFI (ΔCFI = .024, ΔRMSEA = .007), the remaining modification indices were all below the cut-off and exhibited no pronounced outliers.

The items tapping into social well-being turned out to be the most problematic, with 30 non-invariant intercepts (55.6%). The psychological well-being items were less biased, with 15 non-invariant intercepts (27.8%). Finally, emotional well-being items only revealed 9 instances of intercept bias (16.7%), mainly confined to item 3 (“satisfied with life”, N = 6). After all the relevant constraints were relaxed in the model, the resulting partial scalar invariance model showed acceptable fit. There were no non-invariant intercepts in 10 countries (Chile, Colombia, India, Kazakhstan, Nepal, Pakistan, Portugal, South Africa, UK, and Vietnam), suggesting that MHC-SF data across these countries can be considered scalar-invariant.

The parameters of the model were within acceptable ranges in all groups. The model-based estimates of ω ranged from .84 to .96 (*M* = .93, *SD* = .02) for the general index and from .67 to .93 (*M* = .84, *SD* = .05) for the subscales. The ω_H values ranged from .73 to .85 (*M* = .82, *SD* = .02). The ω_S values ranged from .11 to .15 (*M* = .14, *SD* = .01) for hedonic well-being, from .28 to .35 (*M* = .32, *SD* = .01) for social well-being, and from .14 to .19 (*M* = .15, *SD* = .01) for psychological well-being. The ECV based on the multigroup model was .72. These bifactor structure estimates based on the multi-group model were consistent with the results of single-group analyses.

In our sample of countries, metric and scalar invariance were partially supported. The comparison of practical fit indices between the nested models indicates that the non-invariance of loadings is much less pronounced, compared to the non-invariance of intercepts. We only found one strongly non-invariant factor loading (i.e., item 12 in Algeria), suggesting that metric invariance can be assumed for all the other countries. These findings indicate that the effects found using the MHC-SF can be safely compared across countries, but the comparison of mean individual and group scores necessitates using latent factor scores based on the partial invariance model.

We used the final partial invariance model to investigate the mean scores across countries. We chose the Armenian group, whose scores were the closest to the grand mean, as the reference group, setting its latent factor variances to 1 and latent means to 0. The results are shown in Supplementary Information 2. We used a basic multilevel model to investigate the associations of observed scores with latent score estimates based on the multigroup bifactor model at the individual and group level. For the general factor, this association was very strong at the individual level (r = .98), but moderate at the group level (r = .31). Similarly, the correlations of subscale scores with estimates of group factors were moderate to strong at the individual level (.71, .68, and .62 for hedonic, social, and psychological well-being, respectively), but weak at the group level (.26, .61, and .28). These findings suggest that observed scores provide fairly good estimates of the general factor and group factors for individual-level analyses, but country-level analyses may be biased, unless the non-invariance of intercepts is accounted for.

To find out the possibility that the mode of administration could contribute to measurement non-invariance, we conducted measurement invariance analyses across the mode of administration. The differences in practical fit indices were well below the thresholds (ΔCFI < .003, Δ RMSEA < .002), supporting scalar invariance. This suggests the absence of effects of mode of administration independent of those of culture and language.

ESEM analyses

The results of single-group ESEM analyses are given in Supplementary Information. We failed to obtain convergence of the 3-factor ESEM model in two samples, and the bifactor ESEM model failed to converge in five other samples. Predictably, the fit of the 3-factor ESEM model was generally better, compared to that of the ICM-CFA model (scaled chi-square difference test significant at p < .05 in 34 out of 36 samples). However, the difference in the change in practical fit indices showed a great variability, with ΔCFI ranging from -.090 to .107 (M = .032, SD = .038), and ΔRMSEA ranging from -.033 to .042 (M = -.006 to SD = .016) across the samples.

Out of the 33 samples where the bifactor ESEM model converged, its fit, compared to that of the bifactor model, was only significantly better in 21 samples, based on the scaled chi-square difference test (p < .05). The change in practical fit indices was quite marginal, with ΔCFI ranging from -.097 to .087 (*M* = .015, *SD* = .031), ΔRMSEA ranging from -.060 to .054 (*M* = -.004, *SD* = .022). These findings suggest instability of the ESEM model.

We failed to obtain convergence of the multigroup bifactor ESEM model in the 36-country sample (excluding Kenya and Iran). The 3-factor ESEM model converged only after five countries were removed, which contributed to negative residual variances (Hungary, India, Colombia, Hong Kong, Pakistan). The fit indices of the 3-factor metric invariance model were comparable to those of the bifactor metric invariance model, $\chi^2(2602)=4896.49$, CFI=.928, RMSEA=.063 (90% CI: .061-.066), SRMR=.073. However, most of the cross-loadings were weak (below .20), the only exception being the cross-loading of item 4 ("that you had something important to contribute to society") on the psychological well-being factor (in the .30-.40 range). The factor intercorrelations remained strong, ranging from .44 to .86 across the samples, with mean correlation of emotional and psychological well-being *r* = .69, and those of social well-being .57 and .62 with emotional and psychological well-being, respectively, suggesting a strong common construct.

Discussion

The current study aimed to examine the measurement invariance of the Mental Health Continuum – Short Form across 38 countries. It is the first attempt to establish metric invariance for the MHC-SF in a broad group of countries. Additionally, we examine whether the proposed bifactor structure of the MHC-SF is cross-culturally replicable and whether it represents the factor structure of this scale better in comparison to other competitive models, especially the three-factor model proposed by Keyes (1998) and replicated in some cultural context (e.g., Joshanloo et al., 2013; Jovanović, 2015; Young-Jin, 2014), as well as three-factor and bifactor ESEM models.

We believe that the findings reported in this study will have both theoretical and applied significance. From the theoretical perspective, a bifactor model allows to examine the extent to which specific (group) factors are independent from the general factor, and therefore may have a differential association with other mental health predictors, correlates or outcomes. At the same time, the bifactor approach also supports the validity of Keyes's (1998) broad model of mental health as comprised by three components (i.e., emotional, psychological, and social). Regarding the applied perspective, it is useful to know whether the MHC-SF could be used as a screening test measuring mental health in different cultural contexts. Given that nowadays many young people study and work in different countries, it is necessary to have a valid instrument to assess their mental health across countries. Finally, in cross-cultural studies the issue of measurement invariance is crucial to evaluate the possibility of generalizing findings across cultural contexts and comparing the levels of mental health across populations.

Our study has shown that a bifactor model provides a better approximation of the factor structure of the MHC-SF than alternative models, including a three-factor solution. We have found that the bifactor model showed a good fit to the data in nearly all countries (with the exception of Kenya and Iran). More in-depth analyses revealed substantial differences in terms of common and specific variance captured by different MHC-SF subscales. In short, emotional and social well-being subscales capture a more substantial proportion of specific variance, whereas the variance captured by the psychological well-being factor largely overlaps with that of the general factor. These findings indicate that the effects obtained for the psychological well-being subscale are most likely to be very similar to those obtained for the total score and using this subscale on its own may be the best choice when a shorter instrument is needed.

We also found differences across countries in the extent of common variance captured by the general factor. Most of these countries are collectivist (with exception for Germany and UK, see Hofstede, Hofstede, & Minkov, 2010). In collectivistic countries, the general factor turned out to be stronger, to the point of making subscale scores redundant. There are two potential explanations. First, due to interdependent self-construal present among collectivistic societies, individual and social well-being could be less distinct domains of subjective well-being (Cross, Bacon, & Morris, 2000; Singelis, 1994). Second, because there are no reverse-scored items, the effects of acquiescence, which are stronger in collectivistic contexts (Harzing, 2006), may contribute to the common factor variance.

We also investigated differences in the invariance of items belonging to different well-being domains. The data supported metric invariance of the MHC-SF in all countries except Algeria, where partial metric invariance was found, as well as scalar invariance in 10 countries and partial scalar invariance in 26 countries. Although the target ΔCFI was not reached, recent studies suggest that more lenient cutoff criteria are optimal when the number of groups is large (Rutkowski, & Svetina, 2014) and models based on a more realistic approximate invariance assumption may perform better in these conditions (Kim, Cao, Wang, & Nguyen, 2017).

The emotional well-being subscale emerged as the most universal in terms of item invariance, whereas the social well-being turned out to be the most problematic. There are two possible explanations for these findings. First, the items measuring emotional well-being have simple content; therefore, their translations were likely to be less biased than those of more complex social and psychological well-being items. Second, cultural differences exist: while emotions seem to be universal (Frijda, 2016), social context is strongly culturally diverse, as it is conditioned by the type of interpersonal relations in society (e.g., collectivism-individualism, power distance), quality of social environment (as measured by functioning of democracy or number of crimes), and social beliefs (such as interpersonal trust or societal cynicism).

We found the application of ESEM models to MHC-SF to be problematic, for several reasons. The instability of ESEM models can be explained by their complexity and by the presence of an underlying common construct (as a result, the factors in a correlated-factor ESEM model are expected to correlate strongly, making it difficult to separate the shared variance of items due to common construct from that due to indicator cross-loadings). Given the presence of a common construct, a bifactor model ESEM model would be more appropriate. However, its non-convergence is not surprising, given the similarity of bifactor ESEM models to multitrait-multimethod models, where this issue is well-known (Marsh & Bailey, 1991). Also, in our analyses, we found that the factor correlations based on correlated-factor ESEM models were not much lower than those obtained using a conventional ICM-CFA model, the difference in the fit indices between the correlated-factor ICM-CFA and ESEM models was minor, and most cross-loadings (except for the cross-loading of item 4) were quite weak. Together these findings suggest that indicator cross-loadings do not pose a serious issue in the case of MHC-SF and that bifactor CFA model is an optimal choice.

In general, our analyses suggest that the MHC-SF is invariant at the metric level across university students from most countries and partially invariant at the scalar level. Therefore, research findings on correlates, predictors, and consequences of mental health measured by MHC-SF could be regarded as cross-culturally comparable among university students, but the bias needs to be addressed whenever a comparison of mean scores is to be performed. Because the participants in our study were sampled from 38 different countries with different cultural traditions and socio-political situations our findings concerning the metric invariance suggest that MHC-SF can be used with confidence for the assessment and promotion of mental health in university students around the globe. This finding has applied importance, given the internationalization of university students at both undergraduate and postgraduate level, as it suggests that health promotion campaigns encompassing emotional, psychological and social well-being developed for home students may translate well for international students at a university.

An important limitation of our findings is the inclusion of convenience samples, made up of students, which reduces the level of representativeness. Therefore, future research should prioritize the study of the validity of the MHC-SF in more heterogeneous samples, accounting for individual difference in such variables as age, sex, socio-economic status, educational level, and level of exposure to stressful life events. Our study focuses on measurement issues, therefore it should be further developed by including some validity criteria, i.e., correlations of three MHC-SF factors with objective or observational data or other established indicators of good vs. poor emotional and psycho-social functioning. Another limitation of the present study is that some languages are represented by samples from more than one country (i.e., English, Portuguese, Russian, and Spanish) and include samples collected on paper and online. Although we found no uniform effects of the mode of administration on invariance across countries, the effects of language and mode of administration could potentially interact with those of culture. Specially designed future studies using parallel samples of respondents from the same cultures filling out the questionnaire in different languages and using different modes of administration are needed to separate these effects reliably.

Conclusion

The MHC-SF was shown to be a reliable and valid instrument for cross-cultural research and our results are congruent with the results obtained by other studies (de Bruin & du Plessis, 2015; Joshanloo et al., 2013; Jovanović, 2015; Keyes, 1998; Young-Jin, 2014). Moreover, our project extends previous findings to other countries from different cultural regions (like Asia, e.g., Nepal, Vietnam, and Korea; Africa, e.g., RSA or Kenya; and Latin America, e.g., Brazil, Chile, and Puerto Rico). Despite the fact that the findings of our study suggest that the bifactor model is adequate across different countries, we recommend to test the internal structure of the MHC-SF in each country in order to determine which solution fits the data best. More specifically, in collectivistic countries the general score of the MHC may be the most informative. Our findings suggest that although social and psychological well-being are important aspects of overall mental health, the differentiation between the indicators of emotional, social, and psychological well-being is not very pronounced.

Therefore, using the MHC-SF for categorical diagnosis in collectivistic countries should be done so with caution, as this diagnosis is based on distinction between hedonic (emotional) and eudaimonic (psycho-social) functioning. On the other hand, considering that the psychological well-being scale has little to no unique contribution to the general score of mental health in many countries, it could be used on its own as a brief indicator of general positive functioning, especially when a very short indicator is required. In sum, we believe that our study provides initial evidence showing that the MHC-SF demonstrates good psychometric properties in student samples from 38 different countries. This empirical evidence of its structural validity and reliability can contribute to the progress in the study of mental health in cross-cultural perspective.

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Table 1
Descriptive statistics for the 38 countries

Country	N	Female%	Age*M*(*SD*)	SES*M*(*SD*)	Language	procedure	MHC-SF*M*(*SD*)	α
Algeria	240	61.25	19.54 (1.58)	4.13 (1.30)	arabic	Paper-pencil	51.04(11.39)	.79
Armenia	223	47.98	19.00 (1.17)	4.98 (1.20)	Armenian	Paper-pencil	55.74(10.31)	.81
Azerbaijan	120	60.83	20.83 (1.95)	3.38 (0.99)	russian	Online	51.55(12.19)	.88
Belgium	232	74.14	19.74 (3.95)	4.63 (1.09)	Flemish	Online	53.99(10.27)	.87
Brazil	223	63.68	20.94 (5.21)	4.38 (0.99)	Portuguese	Paper-pencil	51.44(12.25)	.89
Bulgaria	200	66.00	23.59 (5.25)	4.66 (1.16)	bulgarian	Paper-pencil	53.16(11.34)	.87
Chile	241	52.28	22.00 (2.10)	4.34 (1.03)	Spanish	Paper-pencil	56.07(11.63)	.90
Colombia	138	50.00	18.82 (1.72)	5.74 (0.90)	Spanish	Online	58.09(12.38)	.92
Czech Republic	223	74.89	24.52 (7.75)	4.37 (1.23)	Czech	Paper-pencil	50.50(12.08)	.89
Estonia	301	69.10	23.11 (6.05)	4.41 (1.23)	Esti	Online	53.84(11.24)	.89
Germany	233	82.83	24.99 (6.53)	4.56 (1.29)	German	Online	54.51(13.02)	.91
Hong Kong	172	68.02	18.82 (1.16)	4.31 (1.39)	English	Paper-pencil	53.17(12.03)	.94
Hungary	206	68.93	21.00 (1.68)		hungarian	Paper-pencil	56.92(10.46)	.88
India	200	68.50	22.59 (1.45)	4.32 (1.07)	English	Paper-pencil	63.41(10.40)	.86
Indonesia	200	50.00	21.38 (1.65)	4.70 (1.02)	Bahasa	Online	58.98(11.90)	.90
Iran	201	50.25	21.28 (1.53)	4.46 (1.41)	English	Paper-pencil	49.25(11.80)	.86
Japan	195	26.15	18.96 (1.13)	4.11 (1.33)	Japanese	Paper-pencil	42.55(12.81)	.89
Kazakhstan	285	74.74	20.12 (2.32)	3.43 (0.89)	Russian	Online	58.02(13.95)	.92
Kenya	162	53.09	23.49 (4.54)	4.07 (0.92)	English	Paper-pencil	58.09(9.47)	.80
Korea (S)	212	54.72	22.20 (1.91)	3.90 (1.24)	Korean	Paper-pencil	45.81(10.97)	.92
Latvia	221	72.40	27.80 (7.91)	2.97 (0.79)	Russian	Online	53.40(9.86)	.90
Malaysia	199	50.25	21.96 (1.22)	4.02 (1.20)	Malay	Paper-pencil	55.91(11.30)	.93
Nepal	203	49.75	22.70 (4.44)	4.08 (0.93)	English	Paper-pencil	55.34(10.22)	.82
Panama	170	33.53	21.41 (5.08)	4.13 (1.00)	spanish	Online	56.83(12.89)	.90
Pakistan	200	49.00	21.50 (1.59)	4.97 (1.05)	English	Paper-pencil	54.36(10.13)	.82
Poland	227	60.79	22.31 (4.14)	4.69(1.15)	Polish	Paper-pencil	49.83(13.11)	.92

Portugal	193	77.20	22.18 (5.73)	4.11 (1.08)	Portuguese	Online	54.52(11.50)	.90
Puerto Rico	300	42.67	20.26 (2.23)	4.14(1.24)	Spanish	Paper-pencil	55.67(12.76)	.91
Romania	206	48.54	21.33 (3.47)	4.72 (1.13)	Romanian	Paper-pencil	58.45(11.68)	.90
Russia	229	79.48	21.64 (4.13)	3.11 (1.04)	Russian	Online	49.90(13.54)	.90
Serbia	205	60.98	22.46 (5.75)	3.77 (1.10)	Serbian	Paper-pencil	53.06(12.08)	.90
Slovakia	202	71.78	21.13 (1.26)	4.76 (1.00)	Slovak	Paper-pencil	53.03(11.78)	.90
Spain	196	50.51	21.02 (4.66)	4.01 (1.05)	Spanish	Online	56.29(11.57)	.89
South Africa	186	67.20	20.17 (1.86)	4.49(1.25)	English	Paper-pencil	57.58(11.06)	.86
Ukraine	171	80.70	19.86 (2.66)	3.21 (1.06)	Russian	online	53.00(12.28)	.88
United Kingdom	303	80.86	19.53 (2.80)	4.21 (1.33)	English	online	54.50(13.40)	.92
Uruguay	197	80.71	23.51 (6.14)	5.02 (1.00)	Spanish	Paper-pencil	56.81(10.17)	.87
Vietnam	251	52.19	20.51 (2.68)	4.25(1.01)	Vietnamese	Paper-pencil	53.26(14.17)	.92
Overall	8066	61.73	21.55 (4.37)	4.27 (1.25)			54.12(12.37)	.89

Note. SES = subjective economic status of family (range 1-7).

Table 2

Fit indices for the 3-factor and the bifactor model in 38 countries

Country	3-Factor model				Bifactor model			
	$\chi^2(74)$	CFI	RMSEA (90% CI)	SRMR	$\chi^2(63)$	CFI	RMSEA (90% CI)	SRMR
Algeria	135.03***	.899	.059 (.043-.074)	.057	101.40**	.936	.050 (.031-.068)	.046
Armenia	177.02***	.838	.079 (.064-.094)	.067	128.25***	.898	.068 (.051-.085)	.058
Azerbaijan	116.43**	.922	.069 (.044-.092)	.069	77.46	.973	.044 (.000-.074)	.051
Belgium	154.32***	.922	.068 (.053-.084)	.060	103.63**	.960	.053 (.034-.070)	.046
Brazil	156.93***	.929	.071 (.055-.086)	.058	96.90**	.971	.049 (.028-.068)	.038
Bulgaria	165.95***	.887	.079 (.063-.095)	.073	101.80**	.952	.055 (.035-.075)	.043
Chile	208.16***	.889	.087 (.073-.101)	.070	121.09***	.952	.062 (.045-.078)	.044
Colombia	164.27***	.888	.094 (.075-.113)	.066	101.70**	.952	.067 (.042-.090)	.046
Czech R.	149.00***	.929	.067 (.052-.083)	.056	98.32**	.966	.050 (.030-.069)	.039
Germany	211.84***	.908	.089 (.075-.104)	.074	122.11***	.960	.063 (.046-.080)	.037
Estonia	156.24***	.941	.061 (.047-.074)	.048	109.46***	.966	.049 (.033-.065)	.037
Hong Kong	160.06***	.940	.082 (.065-.100)	.049	126.53***	.956	.077 (.057-.096)	.039
Hungary	147.03***	.912	.069 (.053-.086)	.064	100.54**	.955	.054 (.033-.073)	.043
India	140.04***	.898	.067 (.050-.084)	.059	115.30***	.920	.064 (.045-.083)	.051
Indonesia	147.04***	.921	.070 (.053-.087)	.061	99.21**	.961	.054 (.032-.073)	.047
Iran	190.15***	.862	.088 (.073-.104)	.066	157.93***	.887	.087 (.070-.104)	.057
Japan	145.21***	.918	.070 (.053-.087)	.066	86.73*	.973	.044 (.016-.065)	.046
Kazakhstan	175.91***	.938	.070 (.056-.083)	.045	140.72***	.953	.066 (.051-.080)	.041
Kenya	191.15***	.777	.099 (.082-.116)	.103	136.36***	.860	.085 (.065-.104)	.086
Korea (S)	209.09***	.902	.093 (.078-.108)	.070	134.50***	.948	.073 (.056-.090)	.043
Latvia	182.14***	.881	.081 (.066-.096)	.081	106.35***	.952	.056 (.037-.074)	.046
Malaysia	142.83***	.946	.068 (.051-.085)	.051	84.20*	.983	.041 (.010-.063)	.047
Nepal	144.92***	.865	.069 (.052-.085)	.071	108.88***	.913	.060 (.040-.079)	.063
Panama	198.87***	.869	.100 (.083-.116)	.089	119.56***	.941	.073 (.053-.092)	.055
Pakistan	165.01***	.843	.078 (.062-.094)	.075	118.00***	.905	.066 (.047-.084)	.062
Poland	192.74***	.915	.084 (.070-.099)	.061	142.04***	.944	.074 (.058-.091)	.043
Portugal	139.51***	.935	.068 (.050-.085)	.058	92.01**	.971	.049 (.025-.069)	.039
Puerto R.	253.88***	.892	.090 (.078-.102)	.067	132.31***	.958	.061 (.046-.075)	.039
Romania	170.37***	.911	.080 (.064-.095)	.063	133.72***	.935	.074 (.056-.091)	.057
Russia	174.29***	.921	.077 (.062-.092)	.065	120.41***	.955	.063 (.046-.080)	.048
Serbia	223.02***	.868	.099 (.084-.114)	.074	111.47***	.957	.061 (.042-.080)	.042
Slovakia	221.42***	.873	.099 (.084-.114)	.095	112.10***	.958	.062 (.043-.081)	.042
S. Africa	135.29***	.905	.067 (.049-.084)	.061	95.32**	.950	.053 (.029-.073)	.048
Spain	177.14***	.886	.084 (.068-.100)	.077	98.31**	.961	.053 (.032-.073)	.047
Ukraine	109.55**	.956	.053 (.030-.073)	.056	74.20	.986	.032 (.000-.059)	.038
UK	247.14***	.915	.088 (.076-.100)	.066	155.31***	.955	.070 (.056-.083)	.038
Uruguay	118.98***	.950	.056 (.036-.074)	.063	82.37	.978	.040 (.000-.062)	.041
Vietnam	187.83***	.923	.078 (.064-.092)	.057	124.38***	.959	.062 (.046-.078)	.041

Note. Satorra-Bentler χ^2, *** $p < .001$, ** $p < .01$, * $p < .05$. CFI = Comparative Fit Index, RMSEA = Root Mean Square of Approximation, SRMR = Standardized Root Mean Square Residual. The comparisons between models are impossible as they are not nested models.

Table 3

Reliability and dimensionality indices for the MHC-SF in 38 countries

	Reliability, ω					Variance explained			
Country	Gen	EWB	SWB	PWB	ω_H	ω_S EWB	ω_S SWB	ω_S PWB	ECV
Algeria	.82	.73	.63	.67	.68	.17	.30	.24	.61
Armenia	.83	.74	.57	.82	.68	.42	.40	.07	.54
Azerbaijan	.91	.81	.78	.82	.83	.33	.28	.02	.69
Belgium	.90	.87	.74	.83	.78	.39	.35	.09	.62
Brazil	.92	.85	.74	.86	.83	.31	.27	.10	.71
Bulgaria	.90	.84	.73	.81	.80	.18	.27	.14	.66
Chile	.91	.83	.80	.85	.79	.18	.32	.22	.65
Colombia	.94	.89	.84	.87	.86	.12	.28	.09	.71
Czech Rep.	.92	.85	.80	.83	.83	.23	.36	.06	.69
Estonia	.91	.85	.76	.84	.83	.32	.31	.03	.70
Germany	.94	.88	.81	.89	.87	.18	.33	.00	.72
Hong Kong	.95	.90	.87	.92	.87	.27	.27	.11	.74
Hungary	.90	.79	.78	.84	.80	.27	.30	.14	.62
India	.89	.76	.79	.79	.76	.32	.38	.07	.57
Indonesia	.92	.82	.81	.87	.83	.31	.30	.07	.69
Iran	.88	.83	.67	.78	.78	.09	.15	.31	.71
Japan	.92	.83	.81	.86	.84	.46	.17	.11	.66
Kazakhstan	.94	.85	.83	.89	.87	.23	.28	.00	.76
Kenya	.86	.75	.82	.78	.56	.50	.20	.68	.40
Korea (S)	.94	.91	.83	.89	.85	.36	.35	.03	.69
Latvia	.93	.88	.83	.87	.76	.18	.47	.28	.60
Malaysia	.95	.87	.88	.89	.86	.40	.00	.28	.71
Nepal	.86	.67	.75	.77	.71	.40	.43	.07	.52
Pakistan	.86	.69	.75	.80	.71	.44	.50	.00	.51
Panama	.93	.88	.83	.88	.83	.47	.35	.00	.64
Poland	.94	.88	.83	.89	.85	.32	.35	.03	.72
Portugal	.92	.86	.79	.87	.82	.29	.29	.14	.69
Puerto Rico	.93	.87	.82	.86	.81	.15	.32	.20	.69
Romania	.92	.87	.77	.89	.80	.49	.38	.06	.65
Russia	.92	.86	.76	.88	.84	.30	.34	.04	.71
Serbia	.92	.88	.77	.87	.82	.11	.35	.20	.67
Slovakia	.93	.78	.81	.89	.82	.17	.36	.15	.66
Spain	.92	.85	.77	.87	.83	.36	.34	.01	.66
South Africa	.89	.76	.77	.79	.77	.27	.40	.01	.62
Ukraine	.91	.84	.75	.84	.80	.35	.27	.15	.67
UK	.94	.90	.86	.85	.85	.18	.29	.13	.72
Uruguay	.90	.87	.72	.85	.78	.31	.38	.08	.63
Vietnam	.94	.84	.86	.89	.86	.37	.11	.18	.71
M	.91	.83	.78	.85	.80	.29	.31	.12	.66
SD	.03	.06	.06	.05	.06	.11	.09	.13	.07

Note. Gen = general score; EWB = emotional well-being; SWB = social well-being; PWB = psychological well-being.

Table 4

Fit indices for the multi-group models

Model	S-B χ^2	*df*	CFI	RMSEA (90 % CI)	SRMR
ICM-CFA models (36 countries)					
Configural invariance	3990.57*	2268	.955	.060 (.057-.063)	.045
Metric invariance	5875.03*	3108	.928	.065 (.062-.067)	.081
Scalar invariance	9162.20*	3458	.851	.088 (.086-.090)	.102
Partial metric invariance	5834.54*	3106	.929	.064 (.062-.067)	.080
Partial scalar invariance	7047.52*	3402	.905	.071 (.068-.073)	.084

Note. Satorra-Bentler χ^2, * $p < .001$. CFI = Comparative Fit Index, RMSEA = Root Mean Square of Approximation, SRMR = Standardized Root Mean Square Residual.

Supporting Information 1

List of non-invariant parameters

	Loadings	Intercepts
Algeria	12	3, 4, 5, 7
Armenia		3, 5, 14
Azerbaijan		8
Belgium		1, 6, 8, 11, 12
Brazil		6, 12
Bulgaria		8
Chile		
Colombia		
Czech Rep		4
Estonia		4, 8, 13
Germany		4, 14
Hong Kong		6, 12
Hungary		5, 6, 14
India		
Indonesia		7
Japan		3, 5, 11
Kazakhstan		
Korea		2, 13, 14
Latvia		3
Malaysia		4
Nepal		
Pakistan		
Panama		5
Poland		3
Portugal		
Puerto Rico		12
Romania		6, 7
Russia		1, 13
Serbia		4, 6, 11, 14
Slovakia		5, 8
South Africa		
Spain		5
Ukraine		4, 7
United King.		
Uruguay		4, 9
Vietnam		

Supporting information 2

Estimated latent factor parameters

	Means				Standard deviations			
	MHC	EWB	SWB	PWB	MHC	EWB	SWB	PWB
Algeria	1.61	-3.12	-0.87	-1.72	1.31	1.03	1.21	0.80
Armenia	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00
Azerbaijan	-0.23	-0.85	0.23	-0.54	1.43	1.09	1.16	0.04
Belgium	-1.51	1.76	1.37	1.30	1.14	1.10	0.91	0.59
Brazil	0.20	-0.50	-1.22	-1.16	1.43	0.93	1.04	0.88
Bulgaria	-0.03	-0.41	-0.29	-0.40	1.30	0.89	1.11	0.48
Chile	0.15	-0.19	-0.22	-0.15	1.30	0.57	1.28	0.83
Colombia	0.26	0.08	0.21	-0.30	1.45	0.41	1.24	0.44
Czech Rep.	0.41	-1.06	-0.50	-1.65	1.40	1.03	1.15	0.31
Estonia	-0.30	0.00	0.21	-0.01	1.29	1.02	0.95	0.37
Germany	0.42	-0.69	-0.34	-0.64	1.58	0.85	1.30	0.08
Hong Kong	-1.79	1.45	2.40	1.18	1.33	0.75	1.07	0.80
Hungary	-1.16	1.03	1.01	1.32	1.14	0.86	1.14	0.45
India	0.08	0.18	1.52	0.81	1.09	0.88	1.27	0.34
Indonesia	-0.29	0.04	1.49	0.29	1.31	0.86	1.08	0.78
Japan	-2.33	-0.08	1.12	-0.05	1.46	1.34	0.96	0.68
Kazakhstan	0.34	-0.40	0.68	-0.57	1.58	0.86	1.16	0.64
Latvia	-0.39	-0.77	0.88	-0.29	1.15	0.89	1.02	0.71
Malaysia	-1.23	0.86	2.01	0.81	1.29	0.93	0.86	0.60
Nepal	-0.98	0.27	1.58	0.77	1.08	1.06	1.11	0.54
Pakistan	-0.69	-0.04	1.36	0.08	0.99	1.02	1.39	0.87
Panama	0.47	-0.29	-0.16	-0.50	1.47	1.22	1.41	0.53
Poland	-1.38	0.19	0.80	0.58	1.49	1.19	1.06	0.70
Portugal	0.01	-0.04	-0.28	-0.38	1.29	0.81	1.04	0.79
Puerto Rico	0.26	-0.33	-0.24	-0.59	1.52	0.72	1.32	0.78
Romania	-0.24	0.53	1.30	0.43	1.27	1.08	1.09	1.01
Russia	-0.32	-0.48	-0.02	-1.03	1.59	1.09	1.22	0.80
S. Korea	-0.74	-0.64	0.07	-0.83	1.27	0.91	1.02	0.57
Serbia	1.03	-1.86	-1.05	-1.31	1.39	0.99	1.21	0.57
Slovakia	-0.43	0.15	0.08	-0.17	1.33	0.65	1.21	0.93
South Africa	-0.44	0.15	0.70	0.90	1.23	0.87	1.27	0.32
Spain	0.26	-0.19	-0.43	-0.44	1.32	0.95	1.20	0.66
Ukraine	0.42	-0.92	-0.46	-1.21	1.45	1.25	1.04	0.68
United King.	-0.64	0.70	0.59	0.14	1.51	0.94	1.33	0.51
Uruguay	1.09	-1.03	-1.19	-0.92	1.18	0.89	1.14	0.44
Vietnam	-0.58	-0.45	1.27	-0.25	1.57	1.21	1.04	0.92

Note. EWB = emotional well-being; SWB = social well-being; PWB = psychological well-being.

Supporting Information 3

Fit indices for the 1-factor and the 2-factor model in 38 countries

Country	1-Factor model				2-factor model			
	$\chi^2(77)$	CFI	RMSEA (90% CI)	SRMR	$\chi^2(76)$	CFI	RMSEA (90% CI)	SRMR
Algeria	191.74***	.810	.079 (.065-.093)	.067	173.94***	.838	.073 (.059-.088)	.064
Armenia	262.19***	.709	.104 (.090-.118)	.081	209.62***	.790	.089 (.075-.103)	.075
Azerbaijan	171.10***	.826	.101 (.081-.121)	.078	135.50***	.890	.081 (.058-.103)	.070
Belgium	331.37***	.752	.119 (.106-.133)	.084	21.13***	.869	.087 (.073-.101)	.068
Brazil	272.83***	.833	.107 (.093-.121)	.071	192.08***	.901	.083 (.068-.097)	.062
Bulgaria	233.62***	.808	.101 (.086-.116)	.074	208.93***	.837	.094 (.079-.109)	.071
Chile	315.43***	.802	.113 (.100-.127)	.079	271.54***	.838	.103 (.090-.117)	.074
Colombia	189.73***	.860	.103 (.085-.122)	.071	184.92***	.865	.102 (.083-.121)	.070
Czech Republic	260.76***	.825	.103 (.090-.117)	.071	214.92***	.868	.091 (.076-.105)	.065
Estonia	310.41***	.831	.100 (.089-.112)	.067	215.37***	.899	.078 (.066-.090)	.057
Germany	300.56***	.850	.112 (.098-.125)	.074	259.15***	.878	.102 (.088-.115)	.069
Hong Kong	330.83***	.823	.138 (.123-.154)	.070	241.08***	.885	.112 (.097-.128)	.061
Hungary	237.60***	.805	.101 (.086-.115)	.071	195.25***	.856	.087 (.072-.102)	.064

India	221.87***	.777	.097 (.082-.112)	.076	191.67***	.822	.087 (.072-.103)	.071
Indonesia	247.49***	.817	.105 (.091-.120)	.075	206.62***	.859	.093 (.078-.108)	.069
Iran	253.47***	.790	.107 (.092-.122)	.077	231.59***	.815	.101 (.086-.116)	.075
Japan	246.01***	.806	.106 (.091-.121)	.077	169.52***	.892	.079 (.063-.096)	.066
Kazakhstan	295.09***	.868	.100 (.088-.112)	.058	237.51***	.902	.086 (.074-.099)	.053
Kenya	335.56***	.508	.144 (.128-.160)	.134	292.93***	.587	.133 (.117-.149)	.132
Korea (S)	397.63***	.769	.140 (.127-.154)	.086	262.45***	.865	.108 (.094-.122)	.072
Latvia	321.01***	.732	.120 (.106-.133)	.104	275.42***	.781	.109 (.095-.123)	.098
Malaysia	270.37***	.848	.112 (.098-.127)	.067	196.09***	.906	.089 (.074-.105)	.058
Nepal	216.67***	.735	.095 (.080-.110)	.087	184.83***	.793	.084 (.069-.099)	.081
Pakistan	284.95***	.642	.116 (.102-.131)	.096	244.34***	.710	.105 (.091-.120)	.088
Panama	337.66***	.728	.141 (.126-.157)	.091	248.90***	.819	.116 (.100-.132)	.078
Poland	365.67***	.794	.129 (.115-.142)	.075	281.53***	.853	.109 (.096-.123)	.072
Portugal	265.25***	.812	.113 (.098-.128)	.074	187.80***	.888	.087 (.072-.103)	.064
Puerto Rico	380.09***	.818	.115 (.103-.126)	.078	311.90***	.858	.102 (.090-.114)	.073
Romania	359.26***	.741	.133 (.120-.147)	.090	23.06***	.858	.099 (.085-.114)	.075
Russia	297.11***	.827	.112 (.098-.125)	.077	24.31***	.871	.097 (.083-.111)	.072

Serbia	276.36***	.823	.112 (.098-.127)	.077	256.46***	.840	.108 (.093-.122)	.076
Slovakia	314.88***	.795	.124 (.110-.138)	.084	281.21***	.824	.116 (.101-.130)	.083
South Africa	210.83***	.793	.097 (.081-.112)	.074	189.59***	.824	.090 (.074-.106)	.071
Spain	256.43***	.802	.109 (.094-.124)	.081	197.59***	.866	.090 (.075-.106)	.073
Ukraine	202.79***	.843	.098 (.081-.114)	.073	135.21***	.926	.067 (.049-.086)	.061
United Kingdom	475.82***	.805	.131 (.120-.142)	.073	376.56***	.853	.114 (.103-.126)	.067
Uruguay	239.76***	.818	.104 (.089-.119)	.080	171.11***	.894	.080 (.064-.096)	.070
Vietnam	333.39***	.827	.115 (.103-.128)	.071	24.59***	.889	.093 (.080-.106)	.059

Note. Satorra-Bentler χ^2, *** $p < .001$, ** $p < .01$, * $p < .05$. CFI = Comparative Fit Index, RMSEA = Root Mean Square of Approximation, SRMR = Standardized Root Mean Square Residual. The comparisons between models are impossible as they are not nested models. 2-factor model is comprised by hedonic and eudaimonic well-being.

Supporting Information 4

Descriptive Statistics and Correlations of MHC-SF subscales by country

Country	N	Reliability, α			Mean (SD)			Pearson correlation, r		
		EWB	SWB	PWB	EWB	SWB	PWB	EWB-SWB	EWB-PWB	SWB-PWB
Algeria	240	.71	.61	.63	3.98 (1.23)	2.76 (1.07)	4.22 (0.89)	.44	.49	.41
Armenia	223	.73	.57	.78	4.42 (0.94)	3.13 (0.98)	4.47 (0.91)	.33	.49	.39
Azerbaijan	120	.80	.76	.78	3.94 (1.09)	3.21 (1.03)	3.95 (0.96)	.46	.64	.66
Belgium	232	.87	.72	.79	4.41 (0.93)	3.16 (0.90)	4.16 (0.84)	.41	.57	.57
Brazil	223	.84	.72	.85	4.36 (1.04)	2.87 (0.92)	4.00 (1.08)	.49	.66	.59
Bulgaria	200	.80	.73	.77	4.29 (1.04)	3.07 (0.96)	4.15 (0.90)	.50	.68	.56
Chile	241	.83	.78	.84	4.50 (0.88)	3.24 (1.08)	4.40 (0.92)	.56	.66	.57
Colombia	138	.85	.81	.84	4.70 (0.91)	3.54 (1.09)	4.38 (0.95)	.67	.77	.65
Czech Republic	223	.85	.77	.80	4.19 (1.11)	3.09 (0.99)	3.75 (0.96)	.53	.69	.59
Estonia	301	.85	.74	.81	4.35 (1.01)	3.18 (0.94)	4.15 (0.90)	.49	.66	.60
Germany	233	.88	.77	.86	4.39 (1.11)	3.19 (1.04)	4.23 (1.03)	.55	.78	.65
Hong Kong	172	.89	.85	.92	4.27 (0.89)	3.40 (1.00)	3.89 (0.96)	.63	.70	.70
Hungary	206	.77	.75	.80	4.39 (0.92)	3.39 (0.91)	4.47 (0.84)	.48	.59	.60
India	200	.74	.78	.73	4.64 (0.95)	4.06 (1.04)	4.86 (0.75)	.47	.55	.52
Indonesia	200	.82	.80	.84	4.35 (1.00)	3.95 (1.04)	4.36 (0.93)	.56	.62	.62
Iran	201	.81	.66	.77	3.59 (1.26)	2.73 (0.86)	4.14 (1.00)	.59	.61	.46
Japan	195	.82	.77	.82	3.24 (1.11)	2.88 (1.02)	3.07 (1.08)	.54	.51	.69
Kazakhstan	285	.84	.82	.86	4.47 (1.11)	3.77 (1.17)	4.29 (1.08)	.61	.73	.69
Kenya	162	.73	.75	.78	4.22 (1.05)	3.95 (0.96)	4.28 (0.84)	.39	.26	.24
Korea (S)	212	.91	.80	.87	3.63 (0.90)	2.94 (0.92)	3.37 (0.88)	.52	.67	.64
Latvia	221	.87	.82	.85	3.97 (0.94)	3.50 (0.86)	4.00 (0.79)	.52	.63	.47
Malaysia	199	.85	.84	.88	4.27 (0.96)	3.72 (0.93)	4.09 (0.88)	.60	.66	.70
Nepal	203	.67	.72	.72	4.07 (1.00)	3.55 (0.98)	4.23 (0.85)	.30	.45	.47
Pakistan	200	.68	.73	.74	4.11 (0.95)	3.58 (1.00)	4.02 (0.86)	.28	.41	.43
Panama	170	.88	.79	.84	4.63 (1.09)	3.31 (1.12)	4.39 (1.02)	.52	.60	.64
Poland	227	.86	.82	.87	3.88 (1.11)	2.98 (1.05)	3.88 (1.07)	.57	.68	.64
Portugal	193	.86	.78	.85	4.51 (0.88)	3.18 (0.98)	4.19 (0.96)	.53	.63	.62
Puerto Rico	300	.85	.78	.85	4.49 (1.06)	3.30 (1.08)	4.29 (1.02)	.58	.70	.60
Romania	206	.87	.75	.87	4.67 (0.99)	3.52 (0.99)	4.48 (0.99)	.45	.56	.58

Russia	229	.86	.75	.86	3.96 (1.21)	3.10 (1.07)	3.75 (1.14)	.52	.69	.56
Serbia	205	.83	.71	.76	4.12 (1.12)	3.17 (0.93)	4.14 (0.99)	.57	.72	.55
Slovakia	202	.76	.75	.88	4.35 (0.91)	3.11 (0.96)	4.07 (1.02)	.55	.65	.59
South Africa	186	.74	.75	.76	4.33 (0.98)	3.40 (1.08)	4.60 (0.83)	.47	.59	.53
Spain	196	.85	.72	.84	4.59 (0.99)	3.36 (0.96)	4.29 (0.96)	.52	.62	.59
Ukraine	171	.84	.73	.82	4.27 (1.14)	3.22 (1.03)	4.02 (1.00)	.45	.57	.60
United Kingdom	303	.89	.84	.84	4.52 (1.05)	3.27 (1.17)	4.10 (1.02)	.63	.72	.66
Uruguay	197	.87	.70	.81	4.58 (0.91)	3.26 (0.91)	4.46 (0.83)	.40	.66	.52
Vietnam	251	.84	.82	.87	3.92 (1.18)	3.57 (1.18)	3.94 (1.11)	.61	.58	.73

Note. EWB = emotional well-being subscale, SWB = social well-being subscale, PWB = psychological well-being subscale. Correlations are calculated on observed scores.

Supporting Information 5

Fit indices for the 3-factor and the bifactor ESEM models in 38 countries

Country	3-Factor ESEM model				Bifactor ESEM model			
	$\chi^2(52)$	CFI	RMSEA (90% CI)	SRMR	$\chi^2(41)$	CFI	RMSEA (90% CI)	SRMR
Kenya	120.13***	0.862	0.09 (0.069-0.111)	0.051	71.84**	0.937	0.068 (0.041-0.094)	0.036
United Kingdom	112.31***	0.968	0.062 (0.046-0.078)	0.026	75.85***	0.982	0.053 (0.034-0.071)	0.021
Serbia	106.57***	0.948	0.072 (0.052-0.091)	0.033	82.34***	0.961	0.07 (0.048-0.092)	0.025
Nepal	65.91	0.972	0.036 (0-0.061)	0.036	39.43	1	0 (0-0.045)	0.024
Chile	110.76***	0.948	0.068 (0.051-0.086)	0.034	69.79**	0.975	0.054 (0.031-0.075)	0.024
Portugal	89.54***	0.959	0.061 (0.039-0.082)	0.033	66.24**	0.972	0.056 (0.029-0.081)	0.025
Belgium	78.72*	0.973	0.047 (0.024-0.067)	0.031	NA	NA	NA (NA-NA)	NA
Hungary	103.08***	0.936	0.069 (0.049-0.089)	0.041	65.64**	0.969	0.054 (0.028-0.078)	0.032
Romania	123.31***	0.932	0.082 (0.063-0.1)	0.038	87.26***	0.956	0.074 (0.052-0.096)	0.029
Spain	94.03***	0.95	0.064 (0.043-0.085)	0.034	57.33*	0.981	0.045 (0.006-0.071)	0.024
Puerto Rico	106.15***	0.965	0.059 (0.043-0.075)	0.029	53.28	0.992	0.032 (0-0.054)	0.02
Indonesia	111.16***	0.933	0.075 (0.056-0.095)	0.038	51.02	0.989	0.035 (0-0.063)	0.021
India	174.75***	0.808	0.109 (0.091-0.127)	0.05	154.22***	0.823	0.118 (0.098-0.138)	0.036

Slovakia	114.17***	0.943	0.077 (0.058-0.096)	0.035	99.22***	0.947	0.084 (0.063-0.105)	0.027
Bulgaria	116.61***	0.916	0.079 (0.06-0.098)	0.04	NA	NA	NA (NA-NA)	NA
Iran	129.58***	0.903	0.086 (0.068-0.105)	0.043	NA	NA	NA (NA-NA)	NA
Panama	107.51***	0.937	0.079 (0.058-0.1)	0.034	NA	NA	NA (NA-NA)	NA
Japan	75.55*	0.971	0.048 (0.021-0.071)	0.034	55.03	0.983	0.042 (0-0.068)	0.026
Russia	122.99*	0.94	0.077 (0.06-0.095)	0.035	82.50***	0.965	0.066 (0.045-0.087)	0.027
Ukraine	74.61***	0.97	0.05 (0.02-0.075)	0.032	46.31	0.993	0.028 (0-0.061)	0.023
Malaysia	96.28***	0.962	0.065 (0.045-0.086)	0.036	43.00	0.998	0.016 (0-0.052)	0.019
Poland	172.59***	0.907	0.101 (0.085-0.118)	0.041	124.50***	0.936	0.095 (0.076-0.114)	0.031
Azerbaijan	NA	NA	NA (NA-NA)	NA	38.09	1	0 (0-0.056)	0.027
Latvia	91.35***	0.953	0.059 (0.038-0.078)	0.036	53.41	0.985	0.037 (0-0.063)	0.024
Colombia	97.08***	0.941	0.079 (0.054-0.103)	0.039	99.41***	0.924	0.102 (0.076-0.127)	0.029
Czech Republic	100.50***	0.951	0.065 (0.045-0.084)	0.034	69.41**	0.971	0.056 (0.032-0.078)	0.027
Kazakhstan	147.12***	0.937	0.08 (0.065-0.096)	0.035	97.48***	0.963	0.07 (0.052-0.087)	0.023
Hong Kong	122.28***	0.946	0.089 (0.068-0.109)	0.035	70.31**	0.978	0.064 (0.038-0.09)	0.024
Uruguay	75.39*	0.973	0.048 (0.02-0.07)	0.031	58.51*	0.98	0.047 (0.012-0.072)	0.024

Germany	NA	NA	NA (NA-NA)	NA	64.35*	0.983	0.049 (0.024-0.072)	0.019
Algeria	104.14***	0.909	0.065 (0.046-0.083)	0.04	NA	NA	NA (NA-NA)	NA
Pakistan	173.62***	0.779	0.108 (0.091-0.126)	0.05	52.02	0.98	0.037 (0-0.064)	0.027
Vietnam	118.26***	0.951	0.071 (0.054-0.088)	0.034	84.08***	0.968	0.065 (0.045-0.084)	0.025
Korea (S)	140.63***	0.932	0.09 (0.072-0.108)	0.038	79.49***	0.97	0.067 (0.044-0.088)	0.025
Armenia	118.11***	0.89	0.076 (0.057-0.094)	0.048	83.99***	0.929	0.069 (0.047-0.089)	0.032
South Africa	91.50***	0.935	0.064 (0.042-0.085)	0.042	57.43	0.973	0.046 (0.007-0.073)	0.03
Brazil	103.42***	0.953	0.067 (0.048-0.085)	0.033	85.90***	0.959	0.07 (0.049-0.091)	0.026
Estonia	118.65***	0.948	0.065 (0.05-0.081)	0.036	80.67***	0.969	0.057 (0.038-0.075)	0.026

Note. Satorra-Bentler χ^2, *** $p < .001$, ** $p < .01$, * $p < .05$. CFI = Comparative Fit Index, RMSEA = Root Mean Square of Approximation, SRMR = Standardized Root Mean Square Residual. The comparisons between models are impossible as they are not nested models. 2-factor model is comprised by hedonic and eudaimonic well-being.

Appendix

MHC-SF

Please answer the following questions are about how you have been feeling during the past month. Place a check mark in the box that best represents how often you have experienced or felt the following:

During the past month, how often did you feel …	never	once or twice	about once a week	about 2 or 3 times a week	almost every day	every day
1. happy	1	2	3	4	5	6
2. interested in life	1	2	3	4	5	6
3. satisfied with life	1	2	3	4	5	6
4. that you had something important to contribute to society	1	2	3	4	5	6
5. that you belonged to a community (like a social group, or your neighborhood)	1	2	3	4	5	6
6. that our society is a good place, or is becoming a better place, for all people	1	2	3	4	5	6
7. that people are basically good	1	2	3	4	5	6
8. that the way our society works makes sense to you	1	2	3	4	5	6
9. that you liked most parts of your personality	1	2	3	4	5	6
10. good at managing the responsibilities of your daily life	1	2	3	4	5	6
11. that you had warm and trusting relationships with others	1	2	3	4	5	6
12. that you had experiences that challenged you to grow and become a better person	1	2	3	4	5	6
13. confident to think or express your own ideas and opinions	1	2	3	4	5	6
14. that your life has a sense of direction or meaning to it	1	2	3	4	5	6