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RESEARCH ARTICLE

Psychometric properties of the MHC-SF: An integration of the existing measurement approaches

Radosław Rogoza[1] | **Khanh Ha Truong Thi**[2] | **Joanna Różycka-Tran**[3] | **Jarosław Piotrowski**[4] | **Magdalena Żemojtel-Piotrowska**[1]

[1]Institute of Psychology, Cardinal Stefan Wyszyński University in Warsaw, ul. Wóycickiego 1/3, 01–938 Warsaw, Poland

[2]Faculty of Psychology, University of Social Sciences and Humanities in Hanoi, Nguyen Trai 336, Hanoi, Vietnam

[3]Institute of Psychology, University of Gdansk, Bażyńskiego 4, 80–309 Gdańsk, Poland

[4]Faculty of Social Sciences and Design, University of Social Sciences and Humanities, Kutrzeby 10, 61–719 Poznań, Poland

Correspondence
Cardinal Stefan Wyszyński University in Warsaw, Poland, Institute of Psychology, ul. Wóycickiego 1/3, 01–938 Warsaw, Poland.
Email: rogoza.radoslaw@gmail.com

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Abstract

Objective The purpose of the current study is to test the factorial structure of the Mental Health Continuum-Short Form (MHC-SF) in Asian population.

Method The study was conducted across three different Vietnamese samples (N = 2741). We present a comparison of the existing measurement models of the MHC-SF using two methodological approaches: confirmatory factor analysis (CFA) and exploratory structural equation modeling (ESEM) (both in exploratory—using bigeomin rotation; and in confirmatory variant—using target rotation).

Results The current report supported the targeted bifactor ESEM solution as better describing the factorial structure of the MHC-SF than the originally assumed three-factor solution in all samples.

Conclusion The structure of the MHC-SF is best represented as combination of the bifactor and ESEM model.

KEYWORDS
bifactor, ESEM, measurement, MHC-SF, well-being

1 | INTRODUCTION

The World Health Report (2001) explicitly states that the mental health is something more than just the lack of mental disorders and its structure is much more complex than claimed before. One of the important components of mental health is the evaluation and declaration individuals make about the quality of their lives, which is frequently referred as the subjective well-being (Keyes, 2005). The well-being research encompass two conceptions: (1) the hedonic well-being (i.e., subjective well-being; Diener, 2000), focusing on the life satisfaction and the emotional aspects of one's life, and (2) the eudaimonic well-being (i.e., psychological well-being; Ryff, 1989), focusing on actualization of human potentials (Ryan & Deci, 2001). The results of the seminal study of Waterman (1993) supports this differentiation, as it was demonstrated that whereas the measures of the hedonic and eudaimonic well-being were strongly correlated,

they still were correlated with the different types of personal expressiveness. Moreover, the eudaimonic well-being can be distinguished between psychological well-being, which measurement instrument, i.e., the Psychological Well-Being Scales (Ryff & Keyes, 1995) has been cross-validated in different samples (e.g., Sirigatti et al., 2013) and social well-being (Keyes, 1998). The psychological well-being refers to self-acceptance, positive relations with others, personal growth, environmental mastery, purpose in life, and autonomy (see Ryff & Keyes, 1995), while social well-being refers to the level of how individuals see themselves thriving in their public and social life (Keyes, 2005). Taken together—this tripartite model of well-being (i.e., the psychological, social, and subjective well-being) gives a comprehensive view on the one's mental health. Although, according to the World Health Report (2001), it is nearly impossible to exhaustively define mental health from cross-cultural perspective—within the current paper we aim at least to provide some context on how it is understood in Asia, particularly in the Vietnamese population.

Because the Mental Health Continuum-Short Form (MHC-SF; Keyes, 1998) is a brief screening test for mental health, it serves an important function as a tool for making preliminary diagnoses in relatively healthy populations in schools and workplaces (Keyes, 1998). "The mental health continuum consists of complete and incomplete mental health" (Keyes, 2002, p. 210). As stated by Keyes (2002), flourishing requires the combined presence of high levels of psychological, subjective, and social well-being. Thus, flourishing is equated with complete mental health. Languishing is a state of stagnation, in which there is an incomplete mental health and neither specific criteria for a psychopathology nor instances of positivity are met. Moreover, there are individuals who are "moderately mentally healthy" (Keyes, 2002, p. 210), namely neither languishing nor flourishing. Keyes (2002) argues that the diagnostic scheme for mental health parallels the DSM diagnostic criteria for psychiatric disorders. Therefore, to be languishing one has to exhibit low levels on one of the two measures of subjective well-being (i.e., positive/negative affect and life satisfaction), and low levels on the majority of the scales of positive functioning (i.e., psychological well-being, and social well-being).

As most research methods are developed in Western cultural contexts, it is crucial that they are validated in people living in or originating from non-Western cultures. The Vietnamese are significant cultural minority in the West—nearly 1.8 million people of Vietnamese origin live in the United States and about 1 million in European countries and they need to be diagnosed using measures that are valid and consider people's cultural background. Previous studies have reported that the MHC-SF has a three-factor (e.g., Karaś, Cieciuch, & Keyes, 2014) or two-factor structure (de Bruin & du Plessis, 2015; Jovanović, 2015)—therefore, examining the factorial structure of MHC-SF in Asian cultural context, particularly in Vietnam, was another issue of theoretical importance.

1.1 | The structure of Mental Health Continuum-Short Form

According to the results of recent studies it was confirmed that both hedonia and eudaimonia are important components of an overarching well-being construct (Delle Fave, Brdar, Freire, Vella-Brodrick, & Wissing, 2011). Keyes' complete state model of mental health (Keyes, 2005) includes both facets of well-being and is operationalized by the MHC-SF (Lamers, Westerhof, Bohlmeijer, ten Klooster, & Keyes, 2010), which comprises 14 items and was derived from the Mental Health Continuum-Long Form, a 40-item self-report questionnaire (Keyes, 2002). The hedonic well-being (emotional well-being) is assessed via three items related to positive emotions and life satisfaction. However, the eudaimonic well-being is split into two components: (1) positive individual functioning (psychological well-being), which is assessed via six items dealing with goals related to self-acceptance, positive relations with others, autonomy, environmental mastery, purpose in life as well as personal growth, and (2) positive social functioning (social well-being) which is assessed via five items relating to social coherence, social acceptance, social actualization, social contribution, and social integration (Lamers et al., 2010).

The internal consistency and discriminant, structural and external validity as well as other psychometric properties of MHC-SF were deeply explored and improved over many studies (e.g., Lamers et al., 2010) and the MHC-SF has been validated in various cultural contexts (Joshanloo, Wissing, Khumalo, & Lamers, 2013). The only, but crucial, problem is the structure of this measuring tool: Several past psychometric research suggests that the MHC-SF has a three-factor structure (e.g., Petrillo, Capone, Caso, & Keyes, 2015; Salama-Younes, 2013), where the metric and partial scalar invariance were demonstrated in South African, Dutch, and Iranian samples (Joshanloo et al., 2013) and

scalar measurement invariance across sex and educational levels was demonstrated in Polish samples (Karaś et al., 2014); however, recent research suggests that either a bifactor model (de Bruin & du Plessis, 2015) or a model based on exploratory structural equation modeling (ESEM; Joshanloo & Lamers, 2016) has a better fit than a three-factor solution.

There are two different methods of assessing whether data should be described in terms of more than basic factors: (1) test for the presence of higher-order factors representing common variance between basic factors and (2) test for the presence of a bifactor, which is a latent structure where each item in addition to load on group factors also loads on a general factor; thus, the bifactor can be understood as a result of what is common between the items (general variance) which is an addition to the items domain specificity (group variance; Reise, Moore, & Haviland, 2010; Rodriguez, Reise, & Haviland, 2016). A bifactor solution may be superior to models including higher-order factors, because such models can distinguish accurately between general and domain-specific factors, whereas in models including higher-order factors the basic traits are necessarily indicators of the higher-order factor(s). In a bifactor model the "role of domain specific factors that are independent of the general factor may be studied" (Chen, West, & Sousa, 2006, p. 196), thus, "allowing for correct separation of general and domain specific factors, whereas the second-order model 'forces' a primary trait to be a domain specific factor" (Reise et al., 2010, p. 555). It is worth noting that the bifactor models were already successfully applied in investigation of emotional distress or subjective well-being in general population (Chen, Jing, Hayes, & Lee, 2013; Iani, Lauriola, & Costantini, 2014; Luciano, Barrada, Aquado, Osma, & Garcia-Campayo, 2014), thus it is plausible to use this approach also in studying the structure of mental health.

Bifactor models can be implemented in confirmatory factor analysis (CFA) by specifying uncorrelated latent factors on which all items load, in exploratory factor analysis (EFA) using Schmid–Leiman rotation and in ESEM using target bifactor (in the more confirmatory variant) or bi-geomin rotation (in the pure exploratory variant). Basically speaking, the goal of the aforementioned statistical techniques is essentially the same, i.e., to identify, distinguish, and to reason about psychological constructs (Marsh, Morin, Parker, & Kaur, 2014). The fundamental difference between CFA and EFA lies in the assumption of the presence of cross-loadings, i.e., a CFA model assumes that one item cannot load on the different factor than the one which was theoretically assigned (what seems to be rarely met in the real-life setting; Morin, Marsh, & Nagengast, 2013), while in the EFA model, each item is allowed to freely load onto any factor. Figure 1 contrasts the different models: (1) a CFA model based on three first-order factors; (2) a higher-order CFA model; (3) a bifactor CFA model; (4) an exploratory ESEM model based on three first-order factors; (5) a bifactor exploratory ESEM model; (6) a bifactor confirmatory ESEM model.

The ESEM analysis, which was developed by Asparouhov and Muthén (2009), is a promising alternative to overly restrictive CFA. It integrates the best features of EFA and CFA, enabling, for example, multigroup analyses or testing complex structural equation models in exploratory setting (e.g., Marsh et al., 2014). In fact, both EFA and CFA can be considered special cases of ESEM; therefore, ESEM and CFA would produce identical results of a unidimensional model. What makes the ESEM a technique between confirmation and exploration is the target rotation, which allows the researcher to test *a priori* hypotheses about structural validity (confirmatory assumption), but still enabling for the presence of cross-loadings (exploratory realization; Asparouhov & Muthén, 2009). ESEM has already been used in research on the MHC-SF (Joshanloo & Lamers, 2016), but it was used in its purely exploratory variant. Because the structure of MHC-SF is well known from CFA studies (e.g., Karaś et al., 2014), it seems to be more appropriate to use the more confirmatory variant of ESEM and therefore to use the target rotation.

Two general conclusions can be drawn from this overview: (1) ESEM models offer a better representation of the structure of the MHC-SF than traditional CFA models (e.g., Joshanloo, Bobowik, & Basabe, 2016) and (2) the structure of the MHC-SF is better represented by a bifactor model than a three-factor model (e.g., Jovanović, 2015). Joshanloo and Jovanović (2016) as well as Joshanloo, Jose, and Kielpikowski (2016) questioned whether a bifactor model was indeed better; as a result, they attributed its apparently better fit to the presence of cross-loadings and argued that ESEM was a more reliable technique than bifactor analysis. However, their arguments (e.g., "fixing non-zero cross-loadings at zero can significantly inflate the variance attributed to the general factor in bifactor analysis,"

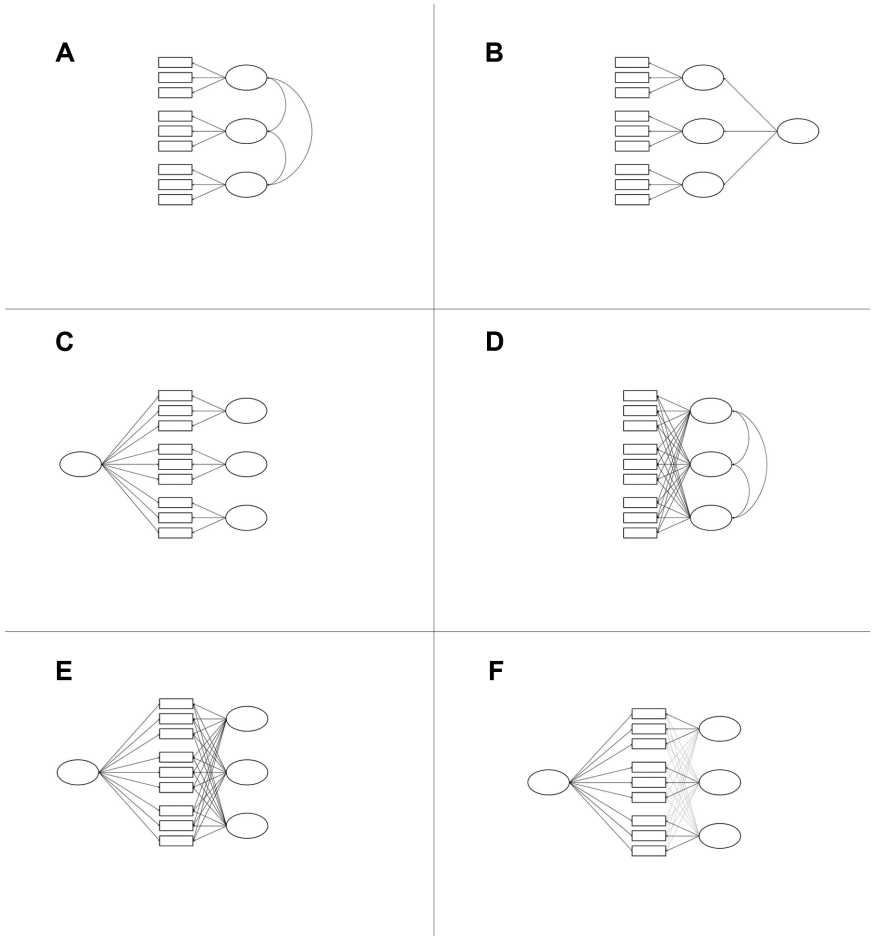

FIGURE 1 Comparison of graphical representations of different measurement models: A: confirmatory factor analysis (CFA) model based on a three first-order factors; B: a higher-order CFA model; C: a bifactor CFA model; D: an exploratory structural equation modeling (ESEM) model; E: a bifactor exploratory ESEM model; F: a bifactor confirmatory ESEM model

Joshanloo et al., 2016, p. 1071; or "however, as a form of CFA, bifactor analysis ignores cross-loadings, and hence can result in biased estimates," Joshanloo & Jovanović, 2016, p. 4) were treating the bifactor analysis as a CFA model only, while it is possible to test for a bifactorial structure using ESEM making these arguments inaccurate. Surprisingly, none of these studies tested a bifactor ESEM model of the MHC-SF and so our study is among the first (Longo, Jovanović, Sampaio de Carvalho, & Karaś, 2017) to (1) use ESEM with target rotation as a confirmatory technique and (2) assess a bifactor ESEM model of the MHC-SF.

So far, the MHC-SF has been translated into Chinese, Japanese, and Korean (e.g., Young-Jin, 2014) and the three-factor model has been validated in Asian context; however, the bifactor model has not previously been tested. The cultures of West and East are different, especially when it comes to the social well-being (high-context cultures have closer connections among group members, Gelfand et al., 2011) and the differences in independent versus interdependent self-concept construction (Singelis, 1994). Therefore, the aim of current study is to assess the structural validity of the MFC-SF as a part of the scale adaptation and validation process in Vietnam and to establish measurement invariance across three samples at different development stages: adolescents, students, and adults. To assess the structural validity of the MHC-SF we compared existing models and methodological approaches, i.e., we tested one-dimensional (1D), three correlated factors, and bifactor models using both CFA and ESEM.

2 | METHOD

2.1 | Participants

The samples comprise a total of 2,741 Vietnamese adolescents, students, and adults from three different (urban and rural) regions: North, Central, and South Vietnam (Hanoi, Hue, and Ho Chi Minh City, respectively). All the observations with missing values were deleted from the analyses. The first sample consisted of 802 adolescents (42% boys) aged between 14 and 19 years (M_{age} = 15.98 years; SD_{age} = 1.39) from 12 different schools in the participating regions. The second sample consisted of 532 undergraduate students (34.80% men) of various courses at public universities aged between 19 and 24 years (M_{age} = 20.23, SD_{age} = 1.12). The third sample consisted of 1,407 adults—the parents of participating students (49.30% men) aged from 26 to 76 years (M_{age} = 45.74, SD_{age} = 5.86).

2.2 | Procedure

2.2.1 | Representativeness of studied population and sampling procedure

The current sample is not strictly representative. First, although the data was collected from urban and rural areas in three different regions of Vietnam, the participants were adolescents and students studying at public schools and universities. In each province, two secondary schools and two high schools (one of each in urban and rural areas) were chosen from the list of average ranked schools. Within each school, after headmaster's approval, one class from 8th to 12th grade was randomly selected for participation in the study. Adolescents from each selected class were informed that the study is voluntary and anonymous and gave consent for participation. Our investigation included neither the many adolescents from rich families who are enrolled in private schools or international schools nor those who do not attend a school. Second, the student population was limited to Hanoi, which is the capital city of Vietnam. The students participating within the study were selected from several universities in Hanoi (i.e., Hanoi University of Science, University of Social Science and Humanity, University of Engineering and Technology, University of Education, and School of Law) with different fields of expertise (maths, sociology, psychology, social work, literature, ethnology, anthropology, orientalism, science of technology, law, physics, biology). First we looked at the aforementioned universities' academic schedule. Then we went to classes at halftime to meet lecturers and present the information about the study, and we asked for permission to do the survey on students in about 15 minutes. After obtaining permission from lecturers, the questionnaires were group administered in the classrooms, students were asked for cooperation and were informed that all participants were anonymous and voluntary, and that they were free to refuse. Lecturer and one or two researchers were present during the survey to answer any questions. The participants came from a variety of provinces across Vietnam. Although we included different universities across the city and the students came from different regions of Vietnam, we could not include those students who chose university near their place of origin. Third, adult population was limited to the parents of adolescents attending schools, which participated within the project. They were recruited after the adolescents had completed the survey—every student was asked to give his or her parents one big envelope with two paper questionnaires and one recommendation letter of the school teachers inside. The parents were asked for cooperation and were informed that the participation is anonymous and voluntary. Each adolescent's father and mother separately answered the questionnaire at home, and sent it back to school teacher through their child.

2.2.2 | Translation

Because presented research on the factorial structure of the MHC-SF is a part of the scale adaptation and validation process in Vietnam, our study included the translation procedure. The Vietnamese version of the MHC-SF scale (V-MHC-SF) was developed through a process of translation and independent back-translation to ensure translation equivalency. The translations were made by bilingual psychology researchers—first researcher translated the MHC-SF into Vietnamese, and then the other translated the V-MHC-SF back into English. The differences between the versions were discussed with the author of the MHC-SF to arrive at an official Vietnamese version (presented in the Appendix).

2.2.3 | Administration

The MHC-SF scale was administered in a paper-and-pencil format. Adolescents completed the scale in small groups (20-25 pupils) during classes and the adults completed the questionnaire during parental meetings, which are held twice a semester in all schools. The survey was administered by university students under the supervision of researchers specializing in clinical psychology after obtaining permission from teachers in participating institutions. The whole procedure took about 20 minutes. At first, researchers explained the aim of the survey, then participants were invited to complete the questionnaire; the researchers were open to answer any questions of their respondents. Participation was anonymous and voluntary; in addition, participants were paid. The adult respondents varied in terms of age, educational level (primary, secondary, intermediate, or graduate), and occupational backgrounds (e.g., officials, engineers, teachers, doctors and nurses, army and police staff, service workers, housewives, retirees, farmers, and other professions).

2.3 | Measures

The Mental Health Continuum-Short Form (Keyes, 2002) is a measure of subjective well-being. The scale comprises 14 items that represent various facets of well-being: emotional (i.e., subjective well-being), social, and psychological one. Respondents indicate how often they felt a certain way during the past month using a six-point scale ranging from 1 (*never*) to 6 (*every day*). The scale is used for assessment of well-being together with its three dimensions.

2.4 | Statistical analyses

2.4.1 | Assessment of the diagnostic categories

As according to Keyes (2002), the MHC-SF can be used to classify respondents into three categories. An individual is considered to be "flourishing" if over the past month he or she has felt at least one of the three hedonic well-being symptoms (items 1–3) and 6 of the 11 positive functioning symptoms (items 4–14) "every day" or "almost every day." If an individual has felt at least one of the three hedonic well-being symptoms (items 1–3) and 6 of the 11 positive functioning symptoms "never" or "once or twice" over the past month are considered to be "languishing." Individuals who are neither languishing nor flourishing are coded as "moderately mentally healthy."

2.4.2 | Reliability

The reliability of the scales was estimated using McDonald's ω coefficient. In preparation for bifactor analysis we assessed the explained common variance (ECV), which indicates the general factor saturation of a test (Zinbarg, Revelle, Yovel, & Li, 2005). A scale is regarded as multidimensional if the general factor explains less than 70% of the common variance. The ω coefficient is interpreted similarly to other popular indices of reliability, i.e., a higher value indicates greater reliability. We decided not to use Cronbach's α coefficient due to its assumptions, for example, requiring seldom met in psychological science essentially τ-equivalence (which is the assumption that all discrimination parameters, as e.g., factor loadings, are equal) or its limited use with multidimensional measures (including bifactorial models; Viladrich, Angulo-Brunet, & Doval, 2017). The ω coefficient, which is a factor analytic model-based reliability estimate, overcome these difficulties (Green & Yang, 2015; Rodriguez et al., 2016). These analyses were carried out in R software (R Development Core Team, 2016).

2.4.3 | Structural validity

All further analyses were conducted using Mplus v. 7.2 software (Muthén & Muthén, 2012) using the robust maximum likelihood estimation method, because Mardia's test indicated that our data violated the multivariate normality assumption. We compared the following models: (1) a one-factor model based on the assumption that all MHC-SF items measure a single global factor; (2) a three correlated factors model comprising emotional, social, and psychological well-being; (3) a bifactor model that assumed that particular items load simultaneously on a general factor and the

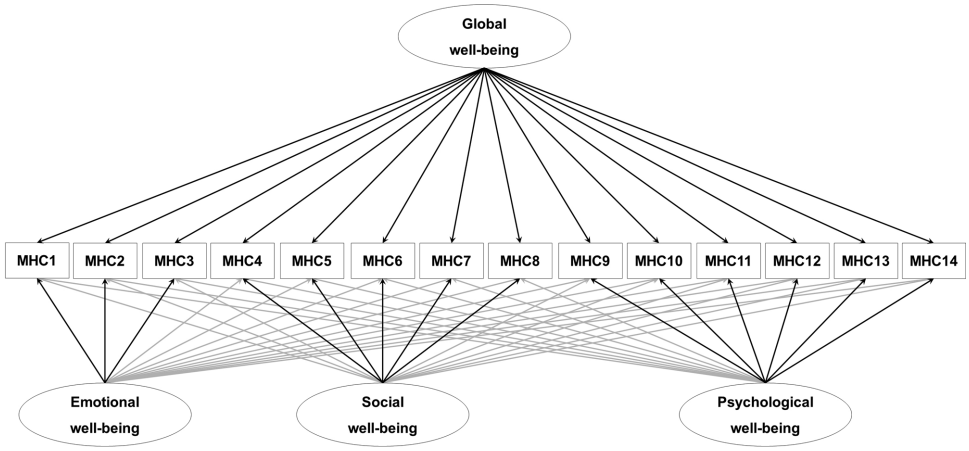

FIGURE 2 Graphical representation of the MHC-SF bifactor model. Note: Black arrows represent the confirmatory factor analysis model, and additional grey arrows (which are targeted to be as close to zero as possible) represents the exploratory structural equation model

relevant lower-level factor (i.e., emotional, social, or psychological well-being). See Figure 2 for graphical representations of the bifactor CFA and ESEM models of the MHC-SF.

We did not analyze any two-factor or hierarchical models as such structures had been ruled out in earlier research (e.g., Jovanović, 2015). Because we aimed to integrate our research with previous studies into the structure of the MHC-SF, we tested all the models using two different techniques: CFA, which predominates in the literature on the MHC-SF structure (e.g., Jovanović, 2015) and the more recently developed ESEM (e.g., Joshanloo et al., 2016). As previous research on the structural validity of the MHC-SF suggested that both ESEM and bifactor models are superior methods of structural assessment of the MHC-SF (Joshanloo & Lamers, 2016), we hypothesized that a model which combined the benefits of both approaches, i.e., a bifactor ESEM model would best represent the structure of the MHC-SF.

We used approximate statistics to assess model fit: comparative fit index (CFI) and root mean square error of approximation (RMSEA). Out of tradition we also report χ^2, but do not treat it as a reliable indicator, because χ^2 is almost significant, suggesting poor model fit when the sample size is large (i.e., >200). The RMSEA values are reported alongside two additional statistics: the 90% confidence interval and probability of close fit, i.e., the probability that the value of RMSEA is below .05. Models are considered to be a good fit to the data if CFI > .95 and RMSEA < .06 (Hu & Bentler, 1999).

2.4.4 | Multigroup comparisons

As a next step, we conducted a between-samples comparison using multigroup exploratory structural equation modeling (MGESEM; Marsh et al., 2014) to determine whether the MHC-SF data has a similar structure in the adolescent, student, and adult samples and whether the obtained results are invariant across gender. To test for gender invariance we combined all of the analyzed samples. We tested for three levels of measurement invariance using MGESEM (Davidov, Meuleman, Cieciuch, Schmidt, & Billiet, 2014): configural invariance (the same factor is measured by the same items across samples), metric invariance (the meaning of constructs is invariant across samples, i.e., the factor loadings of particular items equally load on latent factor), and scalar invariance (the scale is used in the same mode across samples). Chen (2007) recommended that in case of large groups ($N > 300$) models should display both metric invariance, such that the difference between configural and metric models does not exceed .010 (ΔCFI) or .015 (ΔRMSEA), and scalar invariance, such that the difference between metric and scalar models does not exceed .010 (ΔCFI) or .015 (ΔRMSEA). Once scalar invariance has been established it is legitimate to compare mean latent variable scores across samples (Van De Schoot, Schmidt, De Beuckelaer, Lek, & Zondervan-Zwijnenburg, 2015).

TABLE 1 Descriptive statistics of adolescent, student, and adult samples

Group	Well-being	*M*	*SD*	*S*	*K*	%Flourishing	%Languishing
Adolescent	Global	3.85	0.85	−0.32	−0.08	23.57 (55% girls)	8.35 (67.2% girls)
	Emotional	4.25	1.06	−0.64	−0.08		
	Social	3.26	1.06	0.02	−0.63		
	Psychological	4.15	0.95	−0.53	−0.08		
Student	Global	3.71	0.94	−0.19	−0.51	25.38 (64.4% women)	12.97 (68.1% women)
	Emotional	4.01	1.22	−0.48	−0.48		
	Social	3.33	1.07	0.02	−0.65		
	Psychological	3.88	1.03	−0.30	−0.67		
Adult	Global	4.23	0.90	−0.41	−0.07	42.86 (50.4% women)	3.84 (50% women)
	Emotional	4.42	1.08	−0.64	−0.02		
	Social	4.00	1.08	−0.29	−0.37		
	Psychological	4.46	0.94	−0.66	0.24		

3 | RESULTS

3.1 | Descriptive statistics

The descriptive statistics for the studied samples alongside with the percentage of individuals who are flourishing or languishing are presented in Table 1.

Skewness and kurtosis did not exceed 1 for any scale or sample and so the data were assumed to be normally distributed. Almost a quarter of the adolescent and student samples and almost half the adults were classed as flourishing. The proportion of individuals classified as languishing was lowest in the adult sample and highest in the student sample. The gender distribution in categorical diagnosis of student and adult group closely followed the general distribution (i.e., the mean difference from the general distribution in student sample equalled 1.85% and in adult sample equalled 0.5%). However in adolescent sample where the gender distribution with flourishing diagnosis was similar to the general gender distribution in the sample (the difference equalling 3%), visibly more girls were languishing (the difference equalled 9.2%). These results suggest that most adults in Vietnam are mentally healthy, but girls in the adolescent sample had more problems with the mental health.

3.2 | Reliability

Reliability estimates and the percentage of common variance in the general factor explained by the model (based on the bifactor model) are presented separately for all samples in Table 2.

The overall well-being score had excellent reliability in all the samples. Social well-being had the lowest reliability, but even this value was very good (mean $\omega = .85$). In summary, the V-MHC-SF is characterized by very good reliability across a wide range of ages.

3.3 | The structural validity of the V-MHC-SF in adolescents, students, and adults

Table 3 reports goodness-of-fit statistics and comparisons of the competing models in three samples.

The approximate fit statistics indicated that only the 1D model was a poor fit, in all samples; the other models were a good fit to the data. Fit statistics and information criteria indicated that the three correlated factors model as implemented in ESEM better represented the data than the same model implemented in CFA. Similarly, the ESEM technique produced the better bifactor model in all samples. Both the approximate fit indices and information

TABLE 2 Reliability estimates and explained common variance (ECV) for adolescent, student, and adult groups

Group	Scale	ω
Adolescent	Psychological well-being	.84
	Social well-being	.82
	Emotional well-being	.89
	General factor	.91
		$ECV_{Adolescent} = .62$
Student	Psychological well-being	.88
	Social well-being	.83
	Emotional well-being	.92
	General factor	.92
		$ECV_{Student} = .64$
Adult	Psychological well-being	.90
	Social well-being	.89
	Emotional well-being	.94
	General factor	.94
		$ECV_{Adult} = .73$

criteria suggested that the bifactor ESEM model offered the best representation of data from all three samples. Thus, the V-MHC-SF appears to be a structurally valid measure of well-being in Vietnamese adolescents, students, and adults. Based on these statistics we chose to use the bifactor ESEM model to investigate measurement invariance across the samples.

3.3.1 | Measurement invariance across age groups

The results of the measurement invariance analyses are presented in Table 4.

The bifactor ESEM model with three orthogonal factors failed to meet Chen's (2007) criteria for scalar invariance ($\Delta CFI = .013$; threshold: $< .010$), so we searched for the noninvariant parameters. It turned out that one of the items from psychological well-being scale (i.e., item 10) in adult group was noninvariant. After it was freed to vary, the model achieved satisfactory fit indices to be considered as partially well-fitted to the data at scalar level and so mean scores for latent variables can be meaningfully compared (although with caution in relation to adult's psychological well-being). The differences between samples with respect to latent mean scores are presented in Table 5.

Adolescents had the highest levels of emotional and psychological well-being, whereas adults had highest level of global well-being. Students had higher emotional well-being than adults, but a similar level of psychological well-being. There were no differences in social well-being between adolescents and students, but adolescents scored higher than adults. Finally, the adolescent and student samples had similar levels of general level of well-being.

3.3.2 | Measurement invariance across gender

Because the structure of the V-MHC-SF was partially invariant across age groups, we combined the age groups to assess measurement invariance across gender. The results of this analysis are presented in Table 6.

The structure of the V-MHC-SF is invariant across gender at the scalar level, so it is legitimate to compare the mean latent scores of male and female respondents. There were no gender differences in mean latent scores on any of the specific well-being factors, although Vietnamese males reported higher general well-being than females ($M = -.15$; $Z = -2.83$; $p < .01$).

TABLE 3 Fit indices of competing models in adolescent, student, and adult samples

Group	Model	Method	$\chi^2_{(df)}$	*p*	CFI	RMSEA	90%CI	*p*	AIC	SSABIC
Adolescent	Unidimensional	CFA/ESEM	$780.41_{(77)}$	.001	.783	.107	.100–.114	.000	35180.31	35243.80
Adolescent	Three correlated factors	CFA	$243.32_{(74)}$	.001	.948	.053	.046–.061	.217	34502.06	34570.08
Adolescent	Three correlated factors	ESEM	$173.54_{(52)}$	.001	.962	.054	.045–.063	.219	34454.70	34555.98
Adolescent	Bifactor and three orthogonal factors	CFA	$199.20_{(63)}$	.001	.958	.052	.044–.060	.336	34459.19	34543.84
Adolescent	Bifactor and three orthogonal factors	ESEM	**$123.06_{(41)}$**	.001	**.975**	**.050**	**.040–.060**	.484	**34404.13**	**34522.03**
Student	Unidimensional	CFA/ESEM	$633.16_{(77)}$	.001	.780	.117	.108–.125	.001	23577.04	23623.34
Student	Three correlated factors	CFA	$266.16_{(74)}$	.001	.924	.070	.061–.079	.000	23105.90	23155.51
Student	Three correlated factors	ESEM	$212.91_{(52)}$	.001	.936	.076	.066–.087	.001	23055.63	23129.49
Student	Bifactor and three orthogonal factors	CFA	$211.64_{(63)}$	.001	.941	.067	.057–.077	.003	23033.91	23095.64
Student	Bifactor and three orthogonal factors	ESEM	**$117.55_{(41)}$**	.001	**.970**	**.059**	**.047–.072**	.106	**22966.62**	**23052.61**
Adult	Unidimensional	CFA/ESEM	$1233.91_{(77)}$	.001	.836	.103	.098–.108	.000	55178.81	55265.86
Adult	Three correlated factors	CFA	$301.24_{(74)}$	.001	.968	.047	.041–.052	.831	53740.16	53833.43
Adult	Three correlated factors	ESEM	$212.54_{(52)}$	.001	.977	.047	.040–.053	.777	53648.48	53787.34
Adult	Bifactor and three orthogonal factors	CFA	$256.30_{(63)}$	.001	.973	.047	.041–.053	.960	53669.01	53785.07
Adult	Bifactor and three orthogonal factors	ESEM	**$133.59_{(41)}$**	.001	**.987**	**.040**	**.033–.048**	.984	**53537.64**	**53699.30**

Note. CFA = confirmatory factor analysis; ESEM = exploratory structural equation modeling; CFI = comparative fit index; RMSEA = root mean square error of approximation; AIC = Akaike Information Criterion; SSABIC = Sample Size Adjusted Bayesian Information Criterion. Highest value of CFI and lowest values of χ^2, RMSEA, AIC, and SSABIC within group were bolded. Information about the factor loadings, correlations, and residuals of the tested models are available upon request.

TABLE 4 Measurement invariance analysis across compared samples

Model	$\chi^2_{(df)}$	*p*	CFI	RMSEA
Configural	$333.32_{(120)}$	.001	.984	.044
Metric	$483.42_{(200)}$	.001	.979	.039
Scalar	$678.16_{(220)}$	.001	.966	.048
Partial scalar	$605.97_{(219)}$	.001	.971	.044
Δ Configural vs. Metric	150.10		.005	.005
Δ Metric vs. Scalar	194.74		.013	.009
Δ Metric vs. Partial Scalar	122.55		.008	.005

Note. For identification purposes one correlation between items 9 and 10 was added. In partial scalar model the intercept of item 10 was freed.

TABLE 5 Comparison of latent mean scores differences of well-being measured by V-MHC-SF between adolescent, student, and adult samples

Compared groups	Emotional well-being	Social well-being	Psychological well-being	Global well-being
Adolescent and student	−.24*	−.13	−.49*	.01
Adolescent and adult	−.39*	−.35	−.37*	.75*
Student and adult	−.42*	−.01	−.16	.79*

Note. The minus sign means higher score in the first of compared groups; *$p < .01$.

TABLE 6 Measurement invariance analysis across gender

Model	$\chi^2_{(df)}$	*p*	CFI	RMSEA
Configural	$263.38_{(82)}$	.001	.986	.040
Metric	$306.75_{(122)}$	.001	.986	.033
Scalar	$349.12_{(132)}$	.001	.983	.035
Δ Configural vs. Metric	43.37		.000	.007
Δ Metric vs. Scalar	42.37		.003	.002

3.4 | Results of bifactor ESEM in Vietnam

Because we found that the structure of the bifactor ESEM model was partially invariant across age groups and invariant across gender, the final step in our analyses was to assess this model using data from the combined sample of adolescents, students, and adults. Standardized factor loadings for the model are presented in Table 7.

This model was excellently fitted to the data ($\chi^2_{(41)} = 254.52$; $p < .001$; CFI = .984; RMSEA = .044 [90%CI = .039-.049]; $p = .979$). The bifactor was significantly loaded by all items, which provides evidence for its role in mental health. Cross-loadings were very low for items linked to all the specific factors (highest mean value was .06 for items designed to load on social well-being), which suggests that they capture different aspects of mental health. Target factor loadings were satisfactory for items designed to load on emotional and psychological well-being and simultaneously only two items from social well-being had acceptable factor loadings on their target factor. These results suggest slightly different structure of the mental health in Vietnam: (1) the general well-being can be described as a constellation of all three aspects of mental health; (2) emotional well-being is understood as being happy and contented with life; (3) social well-being is understood as belief that people are good and the way the society works makes sense, while feeling of belonging to a community and belief that one has something to contribute to the society are better markers of general well-being in Vietnam; and (4) psychological well-being is understood as the satisfaction of one's personality, managing responsibilities, quality of relationships, personal growth, and the feeling that life has sense. In summary, the general well-being factor and its specific aspects can be meaningfully differentiated although the differentiation of social well-being from general well-being appears problematic in Vietnamese population.

TABLE 7 Standardized factor loadings of the bifactor exploratory structural equation model of the MHC-SF

Item	General factor	Emotional well-being	Social well-being	Psychological well-being
1	**.57**	**.50**	−.04	.02
2	**.67**	**.60**	−.02	.04
3	**.62**	**.50**	.05	.05
4	**.71**	−.05	**.06**	−.10
5	**.68**	−.04	**.08**	−.06
6	**.73**	−.04	**.29**	−.05
7	**.60**	.05	**.47**	.08
8	**.62**	−.03	**.50**	.05
9	**.54**	.10	.20	**.42**
10	**.57**	−.01	.03	**.47**
11	**.56**	.09	.02	**.35**
12	**.68**	−.07	−.05	**.36**
13	**.65**	−.03	−.08	**.36**
14	**.65**	.07	−.06	**.33**

Note. Target factor loadings are shown in bold.

4 | DISCUSSION AND CONCLUSIONS

In this study we examined a variety of different proposed models of the MHC-SF in three age groups, using two different methodological approaches. Our analyses indicated that the Vietnamese version of the MHC-SF can be described by a bifactor model in all age groups and both gender, which corroborates findings with African and Serbian samples (e.g., Jovanović, 2015). Between-model comparisons indicated that a bifactor model provided a better representation of the factorial structure of MHC-SF data than the original three-factor model and moreover, the general and specific well-being factors had high reliability. The general factor explained less than 70% of variance in the adolescent and student samples, and 73% in the adult sample, indicating that specific well-being factors make independent, additional contributions to general subjective well-being.

Unlike previous research using ESEM (Joshanloo et al., 2016), we used it as a confirmatory method, using the target rotation; additionally, we implemented the bifactor model of the MHC-SF within the ESEM framework. Our results supported the hypothesis that the bifactor ESEM model of the MHC-SF would be invariant across age and gender. Thus, current study integrates the existing knowledge on the structural validity of the MHC-SF by providing information on fit statistics of different models and methods. The results suggested that ESEM was the best method of evaluating the structure of the MHC-SF, and that its structure was best represented by a bifactor model. This conflicts with the conclusion of Joshanloo and Lamers (2016) who argued that the presence of cross-loadings in ESEM is more reliable than bifactor analysis. The introduction of the bifactor in our study decreased the values of cross-loadings twice in comparison to the study of Joshanloo and Lamers (2016)—thus, both ESEM and bifactor are reliable and appropriate in the assessment of the structure of MHC-SF.

In the assessment of measurement invariance across age (which was partially invariant) and gender we detected some differences between samples. Emotional and psychological well-being gradually decreased with age, whereas global well-being gradually increased and social well-being was not related to age. It should be noted that the item concerning dealing everyday responsibilities in adult population was noninvariant as compared with the adolescent and student sample, which may be interpreted in terms of increased life independence as adults have to take care of everyday duties all by themselves, whereas adolescents and students can find support in their families. Such finding is consistent with result from the Italian study, where younger people reported higher level of emotional well-being and lower level of psychological and social well-being in comparison with people in midlife and older individuals

(Petrillo et al., 2015). In terms of mental health diagnosis, the proportion of people classified as flourishing was highest in the adult sample, suggesting that this group is mentally healthier than adolescents and university students. Such findings could be related to the different values endorsed by different generations of Vietnamese citizens, for example, it has been reported that tradition and familiar values are more important for adults than younger people (Truong, Van Luot, & Różycka-Tran, 2015).

Male respondents reported higher general well-being than female respondents. This last result can be set alongside Joshanloo et al.'s (2016) finding on lower levels of social well-being in Iran and the lack of gender differences in the U.S. sample. As Vietnam is a rather traditional society, social norms impose different obligations on men and women: women are expected to take care of the house and raise children whereas men are expected to earn money and build a career.

The structural validity of the MHC-SF has at least two further implications. First, our study suggests that a bifactor model should be preferred to a three correlated factors model in analyses and interpretation of MHC-SF data. The second implication is related to diagnosis in Vietnamese population—as analysis of the bifactor model indicated that the three specific factors each make an independent contribution to well-being, thus they could be used for diagnosis according to Keyes' (2002) recommendations. First of all, the general well-being in Vietnamese population is similarly understood as in other cultures (especially when the bifactor model was analyzed, e.g., in de Bruin & du Plessis, 2015) representing a mix of emotional, social, and psychological well-being (Keyes, 2002). Second, emotional well-being was found to be almost equally important for the quality of general well-being as well as an independent aspect, which supports the existing research on mental health (e.g., Karaś et al., 2014). Third, social well-being can be divided onto two: the core indicators of the social well-being (items 7 and 8) resembling faith in people and the belief in the society functioning and the social markers of general well-being regarding group belonging and belief in one's contribution to the society (items 4 and 5). The last remaining item of the social well-being (item 6) seems to reflect both of these aspects, possibly due to its dual construction (belief that society is a good place and that it is becoming such place). Such pattern is not typical for Vietnamese population as the low factor loadings on these items (4 and 5) were also common in other studies in different cultures using either bifactorial (de Bruin & du Plessis, 2015) or ESEM (Joshanloo & Jovanović, 2016) models. This suggests that for one to have high social well-being needs to: (1) have faith in other people and (2) belong to a group and to have a belief in one's contribution to the society. However, we do not suggest that feeling of belonging to the community and contribution to the society are unimportant, opposite—the bifactorial model revealed that these elements are significant for the level of the general mental health. Finally, the psychological well-being was found to be more important for general well-being, which is in line with the de Bruin and du Plessis (2015) reports, but it is also an important independent element of mental health—the inclusion of the bifactor within the model resulted in almost no cross-loadings on other aspects of mental health, which were frequently found in studies not including the bifactor (Joshanloo & Jovanović, 2016; Joshanloo & Lamers, 2016).

4.1 | Clinical implications

The current study provided further empirical evidence for the validity of a bifactor ESEM model of the MHC-SF (Longo et al., 2017) but in the Asian context. Better understanding of the factorial structure of the MHC-SF may help in everyday clinical practice as we provided evidence that clinicians who are using MHC-SF can simultaneously assess the general well-being as well as more specific psychological, subjective, and social well-being. In the Vietnamese population almost every other adult was diagnosed with flourishing mental health, while most of the individuals who were diagnosed as having languishing mental health were from the student population. The investigation of the bifactorial model revealed that adults, whose mental health was most frequently diagnosed as flourishing, scored highest only on general well-being and lowest on subjective well-being. Simultaneously, students, whose mental health was most frequently diagnosed as languishing, scored lower on psychological well-being than adolescents. Our results also revealed that across all compared groups, only in adolescents there were more girls whose mental health was languishing. This might suggest that adolescent girls in Vietnam are at more risk of developing disorders which are more typical for this developmental period and gender such as, for example, eating disorders (Rogoza, Brytek-Matera, & Garner, 2016).

Thus, from a clinical point of view it might be informative to assess both the general well-being and its components as it seems that the bifactorial model of the MHC-SF is more informative in explaining the differences in categorical diagnoses of the mental health.

4.2 | Future directions

The study presented throughout the paper was mainly focused on the examination of the factorial structure of the MHC, which is one of the elements of the scale adaptation and validation process in Vietnam. Although this is an important issue of the process itself, it does not fully address the requirements of scale adaptation. Within the future directions, three issues should be raised to meet these requirements, i.e.,: (1) examination of the structure identified in the current study within a representative sample of Vietnamese population; (2) assessment of the construct validity with similar constructs studied in Vietnam (with the emphasis put on social well-being whose structure was identified as the weakest); and (3) inclusion of the clinical samples or people experiencing stress which would provide further insight into the mental health research in Vietnam.

4.3 | Ethical statement

According to the local Vietnamese law, no written permission from participants was required, as data was collected and analyzed only anonymously. However, we followed APA standards and Declaration of Helsinki during data collection. The study was reviewed and accepted by Ethical Committee of University of Social Sciences and Humanities in Hanoi, Vietnam.

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ORCID

Radosław Rogoza http://orcid.org/0000-0002-4983-9320
Magdalena Żemojtel-Piotrowska http://orcid.org/0000-0002-8017-8014

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Appendix: Vietnamese Mental Health Continuum–Short Form

Xin hãy trả lời các câu hỏi dưới đây về việc bạn cảm thấy thế nào trong tháng qua. Hãy tích vào ô thể hiện tốt nhất việc bạn trải qua hoặc cảm thấy những trải nghiệm hay cảm xúc sau đây thường xuyên mức nào.

Trong tháng vừa qua, bạn trải qua hoặc cảm thấy những điều sau thường xuyên mức nào	Không lần nào	1,2 lần trong tháng	Khoảng mỗi tuần 1 lần	Khoảng mỗi tuần 2,3 lần	Gần như hàng ngày	Hàng ngày
1. Bạn cảm thấy hạnh phúc	1	2	3	4	5	6
2. Bạn cảm thấy yêu thích cuộc sống	1	2	3	4	5	6
3. Bạn cảm thấy hài lòng với cuộc sống	1	2	3	4	5	6
4. Bạn cảm thấy rằng bạn đã đóng góp một điều gì đó quan trọng cho xã hội	1	2	3	4	5	6
5. Bạn cảm thấy rằng bạn gắn bó với cộng đồng (một nhóm xã hội, hay làng quê, lối xóm)	1	2	3	4	5	6
6. Bạn cảm thấy rằng xã hội đang trở nên tốt hơn cho tất cả mọi người	1	2	3	4	5	6
7. Bạn cảm thấy rằng con người về cơ bản là tốt	1	2	3	4	5	6
8. Bạn thấy rằng cách vận hành của xã hội có ý nghĩa với bạn	1	2	3	4	5	6
9. Bạn cảm thấy thích phần lớn các phẩm chất nhân cách của bạn	1	2	3	4	5	6
10. Bạn cảm thấy có khả năng quản lý tốt các trách nhiệm trong cuộc sống hàng ngày của bạn.	1	2	3	4	5	6
11. Bạn cảm thấy rằng bạn có những mối quan hệ tin tưởng và ấm áp với những người khác	1	2	3	4	5	6
12. Bạn thấy rằng bạn đã vượt qua thử thách để phát triển và trở thành người tốt hơn	1	2	3	4	5	6
13. Bạn cảm thấy tự tin để suy nghĩ hay thể hiện những ý tưởng và quan điểm riêng của bạn	1	2	3	4	5	6
14. Bạn cảm thấy cuộc sống của bạn có định hướng và có ý nghĩa.	1	2	3	4	5	6