The Mental Health Continuum-Short Form in Organisational contexts: Factorial validity, invariance and internal consistency

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Abstract

The study aimed to examine the psychometric properties of the MHC-SF within selected organisational contexts. Specifically, the aim was to determine the factorial validity, measurement invariance and reliability of the instrument for South African organisations. A cross-sectional online survey-based research design was employed coupled with a convenience sampling strategy (*N*=624). The results showed that the original three-dimensional factor structure of the MHC-SF fitted the data the best. Items loaded statistically significantly on all three subscales (emotional-, psychological-, social wellbeing). Further, the scale showed full configure, convergent and metric invariance between males and females. However, invariance was not established in either age cohorts, language groups or marital status. The instrument proved to be reliable at both a lower (Cronbach Alpha) and upper level (Composite reliability) limit within South African organisational contexts.

Key words: Measurement Invariance; Mental Health Continuum Short Form; Mental Wellbeing; Psychometric properties

Introduction

Mental health, as a construct of interest for organisations, has long been defined as the absence of mental illness (Keyes 2002, 2005; Westerhof and Keyes 2008). According to Keyes (2005) mental health is conceptualized as a "complete state in which individuals are free of psychopathology and flourishing with high levels of emotional, psychological and social wellbeing" (p. 539). In effect, Keyes (2002) argued that mental health is a function of feeling good (emotional wellbeing) and functioning well (psychological wellbeing; social wellbeing)

Emotional well-being, stemming from the Greek concept of *hedonic* well-being, involves the study of happiness that focuses on positive emotions and one's overall level of life satisfaction or affect balance (Diener 1984; Seligman 2011; Uchida, Norasakkunkit and Kitayama 2004). Specifically, happiness relates to dynamic positive affective experiences ('states') that encompass positive thoughts, feelings, behaviours and attitudes, which fluctuate over time but remain at a positive median (Gavin and Mason 2004). According to Diener and Biswas-Diener (2008) happy people tend to live longer, is healthier, have more fulfilling jobs and forms better quality personal relationships.

Functional well-being, also known as eudaimonic well-being, incorporates aspects of psychological well-being (Ryff, 1989) and social well-being (Keyes 2002) and reflects one's meaning in life. According to the eudaimonic approach, happiness is more related to positive relationships and a sense of purpose in life than the experience of mere positive emotions. Well-being in this context means to function well in life and is related to personal growth and fulfilment (Perugini, de la Iglesia, Solano and Keyes 2017).

Keyes (2002, 2005) unified the hedonic and eudaimonic perspectives of well-being and developed the *Mental Health Continuum* (MHC) and *Mental Health Continuum–Short Form* (MHC-SF) to measure these well-being components, also known as flourishing. The MHC and MHC-SF assess the degree of mental health across three domains: emotional well-being (feeling well) and psychological and social well-being (functioning well).

Emotional well-being (EWB) consists of the presence of positive emotions and satisfaction with life (Diener, Suh, Lucas, and Smith 1999). *Psychological well-being* (PWB) measures how much individuals see themselves thriving in their personal life (Keys, 2002) and includes aspects of an individuals' psychological functioning such as self-acceptance, autonomy and having meaning and a purpose in life (Ryff, 1989). *Social well-being* (SWB) captures an individuals' social integration and contribution as a member of a larger society. Social well-being evaluates the individuals' evaluations of their social and public lives and includes dimensions of social integration, social contribution, social coherence, social actualisation, and social acceptance (Keyes 2002).

The well-being of individuals on the MHC and MHC-SF are measured on a continuum that include three varying levels of positive mental health: from flourishing, to moderately mentally healthy to languishing (Keyes, 2005). Flourishing individuals are high in hedonic and positive functioning and thus experience high levels of emotional, psychological and social well-being. Languishing individuals, however, are low in hedonic and positive functioning and thus display low well-being and an absence of mental health.

A mentally healthy or flourishing workforce is not only beneficial to individuals (i.e., in terms of longevity, mental fitness, buffers against the onset of illness) but also dramatically impacts on organizational outcomes such as performance, productivity, staff retention, quality of work and excellent customer service (Rothmann 2014, 2013; Seligman 2011). Individuals with high amounts of wellbeing were, for example, found to display higher amounts of resilience (Burns et al. 2011), and optimism (Carver and Scheier 2014; Peters, Flink, Boersma, and Linton 2010; Wu et al., 2013), and were additionally found to make use of adequate coping strategies (Carver and Connor-Smith 2010), and psychological flexibility (Kashdan and Rottenberg 2010; Woodruff et al. 2014). With respect to the organizational level individuals with high amounts of wellbeing were among others found to function superior at the workplace. This excellent functioning is illustrated through the increased efficiency and capacity to perform at work, through the enhanced initiative, interest and responsibility, as well as through a raise in concern for the organisation and the colleagues (Fairbrother and Warn 2003). The beneficial effects of mentally healthy employees for organisations, as well as the possibility to influence wellbeing through the use of simple interventions, has increased the popularity of wellbeing and mental health promotion within the working environment (Bonde 2008). Given that mental health is such a beneficial component for both individual and organisational outcomes, it is imperative to measure it accurately within organizational contexts.

Although the psychometric properties of the MHC-SF were determined in several other studies across many countries, this study expands on the previous studies in a number of ways: (a) it assesses all known factor structures of the MHC-SF in organisational contexts, (b) the measurement invariance of the MHC-SF will be studied between different genders and across age cohorts, language groups and relationship status of individuals and (c) the internal consistency will be determined by calculating not only Cronbach's alpha values but composite reliabilities as well.

Factorial validity

The MHC-SF have been adapted in many countries providing a considerable volume of evidence to support not only the utility, but the validity and reliability of the instrument. Several previous studies have confirmed the three-factor structure (EWB, SWB, PWB) of the MHC-SF using confirmatory factor analyses (CFA). For example Karas, Cieciuch, and Keyes (2015) on a Polish sample; Lamers, Westerhof, Bohlmeijer, ten Klooster and Keyes (2011) on a Dutch sample; Petrillo, Capone, Caso, and Keyes (2015) in the Italian context; Guo, Tomson, Guo, Li, Keller, and Söderqvist, (2015) in Chinese adolescents, Salama-Younes (2011) in a sample from Egypt and Joshanloo, Wissing, Khumalo, and Lamers, (2013) across three cultural groups: Dutch, South African and Iranian. In contrast, in a 38-country comparison on the factor structure of the MHC-SF, Żemojtel-Piotrowska et al. (2018) could not find adequate data fit (i.e. CFI > 0.90) for the three-factor model within samples from Algeria, Armenia, Bulgaria, Chile, Colombia, India, Iran, Kenya, Latvia, Nepal, Panama, Pakistan, Puerto Rico, Serbia, Slovakia, and Spain. These authors also did not find support for a one factor structure of overall wellbeing in any of the surveyed countries (Żemojtel-Piotrowska et al 2018). Further, with the exclusion of Kazakhstan, Malaysia and the Ukraine, Żemojtel-Piotrowska et al. (2018) also did not find support for a two factor structure (i.e. hedonic and eudaimonic wellbeing) of the MHC-SF. Despite these findings, the three-factor structure is predominantly reported as the best-fitting model within diverse cultural contexts such as South Africa (Rothmann, 2013; Schutte and Wissing, 2017; Żemojtel-Piotrowska et al. 2018).

Although only a small number of studies specifically investigated the factorial validity of the MHC-SF within the South African context, several structural equation modelling (SEM) studies, employing a CFA measurement modelling strategy, have shown better fit for the three-factor correlated structure rather than a two or one factor model. Both De Bruin and Du Plessis (2015) and Van Zyl and Rothmann (2012) confirmed the three-factor structure in a multi-cultural sample of higher education students; Keyes et al. (2008) the same within the general population of collectivistic Tswana speaking individuals from a rural area in the North-West Province; Janse van Rensburg, Rothmann, and Diedericks (2017) within a sample of employed individuals within the information technology sector; Żemojtel-Piotrowska et al. (2018) within the general population and Niemand (2019) in a sample of industrial and organisational psychologists. Neither the one or two factor structures reported in other international papers have been found to fit the data better than the three-factor structure within the South African context. There is therefore support that the three components of mental health presented by

Keyes (2002) and measured by the MHC-SF, is applicable to the diverse, multi-cultural, and socio-economically divided population within South Africa. However, the fit indices of several of these studies were only marginal acceptable according to conventional criteria (Brown 2006). Further, according to Jovanovic (2015) in a three-factor structure the effects of general well-being are not controlled for with the result that there is limited evidence that each subscale reflects variation on the specific component of well-being.

Therefore, several other researchers (De Bruin and Du Plessis 2015; Hides, Quinn, Stoyanov, Cockshaw, Mitchell and Kavanagh 2016; Jovanovic 2015; Żemojtel-Piotrowska et al. 2018) extended their research into the validity of the MHC-SF by testing a bi-factor model. They provided evidence that a bi-factor model, consisting of one general factor of overall mental health and the three factors of EWB, SWB, PWB, where each item was allowed to load both on the general factor (overall wellbeing) and specific factor (EWB, SWB, PWB) (Reise, Kim, Mansolf and Widaman 2016), provided the best-fitting solution. It was however found in the study conducted by Jovanovic (2015) that although the bi-factor model provided strong support for the general factor of well-being for the MHC-SF , some of the PWB and SWB items did not display significant loadings on their specific factors providing limited evidence for a viable multi-dimensional structure of the MHC-SF. Machado and Bandeira (2015) employed various techniques such as principal component analysis, factor analysis, Item Response Theory and network analysis to determine the psychometric properties of the MHC-SF among Brazilian-Portuguese speaking adults and found support for a unidimensional structure of the MHC-CF.

Both Joshanloo (2016) in an Iranian sample, and Joshanloo, Jose, and Kielpikowski (2017) in a New Zealand context, found support for the tripartite model of mental well-being in comparison with one- and two factor models using both Exploratory Structural Equation Modeling (ESEM) and CFA. However, ESEM provided a more sensitive fit and greater factor distinctiveness to the data than did CFA.

Results of a study conducted by Longo, Jovanović, Sampaio de Carvalho and Karaś (2017) in four countries (The Netherlands, Poland, Portugal, and Serbia) indicated that a bifactor ESEM model in comparison to a 3-factor ESEM and 3-factor CFA, provided the best fit to the data in all samples. This thus supports the bifactor structure of well-being with a strong general factor explaining most of the variance in the items. Similarly, Schutte and Wissing (2017) reported that a bifactor model displayed superior fit among a culturally diverse South African sample.

Although various factorial permutations of the MHC-SF are reported in the literature, it would seem as though the three-factor structure is the most frequently occurring and best-fitting model across cultures, continents and population groups. Given that the three-factor mental health structure predominantly shows superior fit within the South African context, it is presumed that such will fit the data the best within the a sample of employees from South African organisations.

Measurement invariance

Various studies have attempted to establish the invariance of the MHC-SF for demographic characteristics, and the results varied between sample types, cultures and nations. For example, in a 38-country comparative study on the structure and application of the MHC-SF, Żemojtel-Piotrowska et al. (2018) could not establish full or strong invariance between different nations (i.e. different cultures). This indicates that the way in which mental health is perceived and the components of the MHC-SF is interpreted, differs significantly between cultures. This is not surprising as Keyes (2002) argued that demographic characteristics such as culture, gender, age, level of education, relationship status, language group and occupational status might affect ongoing mental health. It is therefore important to investigate invariance on various demographic characteristics within multi-cultural contexts such as South Africa.

Measurement invariance of the MHC-SF across gender in several diverse cultures were reported in various previous studies suggesting that the same basic factor structure (configural invariance), similar factor loadings (full metric invariance) an no differences in the intercepts were found between the genders (Guo et al. 2015; Joshanloo 2016; Joshanloo and Jovanović, 2016; Karaś et al. 2014; Lamers et al. 2011; Petrillo et al. 2014). Using differential item functioning, Machado and Bandeira (2015) reported no difference between the two gender groups. However, it should be noted that these studies investigated the measurement invariance of the MHC-SF across genders within primarily individualistic cultures, where gender diversity is valued.

Westerhof and Keyes (2010) reported partial support for differences between age groups. They found that older adults experience more emotional, similar social and less psychological well-being in comparison to younger adults. Guo et al. (2015) reported measurement invariance across age amongst Chinese adolescents.

Schutte and Wissing (2017) reported full configural-, but partial metric- and scalar equivalence across three language groups within South Africa: English, Afrikaans and

Setswana speakers. No studies could be found testing for measurement invariance across language groups within organisational contexts.

Further, no studies were found establishing measurement invariance between individuals in different relationship/marital status groups. Research suggests that significant differences in the levels of mental health exist between married and unmarried individuals (Diener et al., 2000; Chapman and Guven, 2016; Qian and Qian, 2015; Veenhoven, 2015). Married individuals report to be healthier, happier and live longer than their unmarried counterparts (Diener et al., 2000). Within the marital dynamic, the interpretation of individual emotional-, psychological- and social wellbeing could largely be influenced by the nature and quality of the relationship (Chapman and Guven, 2016). Helliwell and Putman (2004) in their study across a US and Canadian sample found that marriage seems to increase subjective well-being equally among men and women and is further enhanced by the presence of children. Having regular interactions with the family and spending more time with the family increases individual-level subjective well-being. The wellbeing of the family (as a unit), directly influences the wellbeing of the individual members (Helliwell and Putman, 2004; Kamp Dush and Amato, 2005). Further, within collectivistic cultures, such as those found predominantly within South Africa, the wellbeing of the family, is not distinguishable from the wellbeing of the individual (Diener and Suh, 2003). It seems that being in a romantic relationship is not only beneficial to people's health and happiness, due to the social support and social integration that it provides, but could affect how wellbeing is seen, perceived and interpreted. Relationship status could therefore affect how the components of mental health are perceived, interpreted and experienced Testing measurement invariance across genders, age cohorts, language groups and between different relationship/marital status does not serve to test the scale structure, but to determine whether there is possibility to allow meaningful cross-gender, -age, -language and –relationship status comparisons of the strength of the relationships between the latent factor of the scale and other constructs (metric); to meaningful compare latent means between males and females, age cohorts, language groups and between individuals in with different relationship/marital status (scalar); and to check whether there are identical patterns of factors and items across all these groupings(configural).

Therefore, the current study aims to investigate the configural-, metric-, and scalar measurement invariance across genders, age cohorts, language groups and between different relationship/marital status within South African organisational contexts.

Reliability

The internal consistency of the MHC-SF has been determined in various studies across a number of countries and was found to be a reliable measurement of well-being. In studies where the MHC-SF was presented as a three-factor structure acceptable Cronbach's alpha values well above 0.70 were reported (Guo et al. 2015; Karaś et al. 2014; Lamers et al. 2011; Petrillo et al. 2014). In these studies for example alpha values ranging between 0.86 and 0.92 were reported for the total MHC-SF; coefficients ranging between 0.81 and 0.86 for the psychological well-being subscale; values ranging between 0.75 and 0.92 for the emotional well-being scale and values between 0.70 and 0.83 for the subjective well-being scale. Predominantly, the internal consistency of the MHC-SF was estimated through the use of Cronbach's alpha, which often resulted in over- or underestimation of the reliability because it assumed that the factor loadings and error variances were equal (Cho and Kim 2015). Given the challenges and critiques associated with the use of Cronbach's alpha, an investigation was done and only one study was found that used a more 'accurate' estimation of internal consistency (i.e. composite reliability) (Wang and Wang 2012). Machado and Bandeira (2015) calculated the rho coefficients (as a measure of composite reliability) of the MHC-SF in a bi-factor model and reported a value of 0.90 for the general factor of well-being while the rho coefficients ranged between 0.34 and 0.47 for the three sub-factors.

In the majority of studies where a bifactor model of the MHC-SF were confirmed, coefficient omega hierarchical (ωh) was used to measure reliability. According to Zinbarg, Revelle, Yovel, and Li (2005) omega hierarchical outperform Cronbach's alpha because it indicates the reliability of the general trait controlling for specific factor variance. As a rule of thumb, a minimum of 50%, preferably 75% of subscale variance should be accounted for before a subscale is considered a valid representation of a separable dimension (Reise et al. 2016). Jovanović (2015) reported a high reliability as estimated by the omega coefficient for the general factor of well-being (ωh) = 0.81 in a student sample and 0.83 in an adult sample) but low omega-subscale coefficients. The reliabilities of the EWB, SWB, and PWB subscales reported were 0.28, 0.32, 0.10 in the student sample and 0.31, 0.35, 0.07 in the adult sample, respectively. These results illustrated that the ability of the subscales to reliably measure the specific variances of EWB, SWB and PWB is low, because they reflect variations primarily on the general well-being factor. These results were affirmed by De Bruin and Du Plessis (2015) who reported a McDonald's coefficient ω-hierarchical for the general factor of 0.74 and coefficient ω-specific of 0.26, 0.38 and 0.19 for the EWB, PWB and SWB subscales respectively. Similarly, Hides et al. (2016) as well as Longo et al. (2017) found only the general factor of well-being to be reliable as evidenced by an omega hierarchical (ωh) of above 0.80. The sub-factors were however not reliable, with all ωhs below 0.41.

As such, the current study will aim to determine the internal consistency of the MHC-SF at both the lower (Cronbach's alpha ≥ 0.70) and upper (composite reliability/rho coefficients > 0.80) level limits.

Current study

Based on the discussion above, the purpose of this study was to examine the psychometric properties of the MHC-SF within selected organisational contexts. Specifically, the aim was to determine the (a) factorial validity, (b) measurement invariance between genders and across age cohorts, language groups and relationship status as well as (c) to determine the reliability of the instrument for South African organisations. It was expected that the instrument validly, invariably and reliability measures mental health within the South African business environment.

Methods

Participants

A convenience sampling strategy, following a descriptive cross-sectional survey-based research design was employed to withdraw 624 respondents from various South African organisations. The demo- and biographic information of the respondents are summarized in Table 1.

Table 1 Demo- and biographic characteristics

Variable	Category	Frequency (*f*)	Percentage (%)
Gender	Male	285	45.7
	Female	339	54.3
Age in years	19 to 29 years	158	25.3
	30 to 39 years	182	29.2
	40 to 49 years	131	21.0
	50+ years	153	24.5
Ethnicity	Asian	47	7.5
	African	203	32.5
	Coloured	61	9.8
	Caucasian	286	45.8
	Other	27	4.3
Home Language	English	166	26.6

Variable	Category	Frequency (*f*)	Percentage (%)
	Afrikaans	216	34.6
	African	242	38.8
Level of Education	Grade 11 and below	1	0.2
	Grade 12	149	23.9
	National Certificate	72	11.5
	Higher Certificate	30	4.8
	Bachelor's Degree	97	15.5
	Master's Degree	272	43.6
	Doctoral Degree	3	0.5
Marital Status	Single	128	20.5
	Married	290	46.5
	Divorced or Widowed	206	33.0

Table 1 Demo- and biographic characteristics

The majority of the participants were married (46.5%) Afrikaans speaking (34.6%) Caucasian (45.8%) females (54.3%) between the ages of 30 to 39 (29.2%) with a master's degree (43.6%). Further, almost all the participants were full time, permanent employees (98.4%) of their respective companies.

Procedures

The sample consisted out of three independent organisations where the MHC-SF scale was used. The procedure involved the distribution of electronic surveys using LimeSurvey™ to various organisations within the broader South African context. Primarily, the sample consisted out of registered industrial psychologists, selected Blue Chip Financial Companies, and a Public Utility. The data was captured online and stored on a secure SQL server for later retrieval. The data was downloaded in MS Excel format and prepared for analysis in both SPSS and Mplus.

Measures

The following instruments were used to gather data for this study:

A self-developed *biographical questionnaire* was used to gather biographic information of the participants relating to the gender, ethnicity, age group, home language, level of education, marital status and employed status.

The *Mental Health Continuum – Short Form* (MHC-SF; Keyes, 2002, 2005) was used to measure the emotional-, psychological-, and social well-being of the participants. The instrument consisted of 14 items, which is rated on a 5 point Likert scale ranging from 1 (all of the time) to 5 (none of the time). Examples of the items are *During the last month how often did you feel…* “happy” (EWB), “that the way in which our society functions, makes sense to you” (SWB) and “confident to think or express your own ideas and opinions” (PWB). High levels of internal consistency have been found in various clinical studies ranging from Cronbach Alpha levels of 0,7 to 0,9 (Keyes, Shmotkin and Ryff 2002; Keyes and Shapiro 2004).

Analysis

The statistical analysis was conducted with the aid of SPSS 24 (IBM, 2016) and Mplus version 8 (Muthén and Muthén 2017). First, *factorial validity* was estimated through a confirmatory factor analytic (CFA) approach; employing the maximum likelihood estimator (Muthén and Muthén 2017). Structural equation modelling (SEM) was employed to assess the model fit for the competing measurement models whereby the following fit indices were considered: a) *absolute fit indices* which included the χ^2 statistic, the Root-Means-Square Error of Approximation (RMSEA) and the Standardized Root Mean Residual (SRMR), b) *incremental fit indices*, including the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI) and c) *comparative fit indices*, Akaike information criterion (AIC) and Bayesian information criterion (BIC) were used to compare competing models. Model fit is considered when the TLI and CFI are greater than 0.90, and RMSEA and SRMR are lower than the 0.05 and 0.08 cut-offs (Wang and Wang 2012). Further, the lowest AIC, BIC and χ^2 values indicates the best fitting model (Muthén and Muthén 2017).

Second, to assess the *internal consistency* or ‘reliability’ of the MHC-SF, both Cronbach Alpha (lower-bound) and Rho (upper-bound) was estimated. Rho is calculated through the use of Rothmann’s (2013) rho calculator, which estimates internal consistency though the proportion variance explained by a factor divided by the total variance (Wang and Wang 2012). Reliability cutoffs are set at 0.70 (Cronbach Alpha; Nunnally and Bernstein 1994) and 0.80 (Rho; Wang and Wang 2012) respectively.

Finally, *measurement invariance* was investigated based on gender, age cohorts, predominant languages in the South African culture, and relationship/marital status. Configural- (similar factor structures), metric- (similar factor loadings), and scalar- (similar intercepts) was computed. Before invariance testing would be computed, the sampling adequacy for each demographic characteristic needed to be established. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was employed to assess the adequacy of the sample size for each sub-sample of the demographic characteristics which were to be employed for invariance testing (p < .01; KMO < 0.70) (Cerny and Kaiser 1977). To assess whether MHC-SF was perceived similarly or differently by respondents of different genders, ages, and language groups: configural- (similar factor structure / model form), metric- (equivalence of the item loadings), and scalar (similar intercepts) invariances were computed. Invariances estimation was based on ***non-significant*** (p > .05) (a) chi-square ($\Delta\chi^2$) as well as (b) ΔCFI differences between the configural-, metric-, and scalar invariance models (Wang and Wang 2012). Further, (c) changes greater than 0.01 in the magnitude of the CFI was regarded as an indication that the more restrictive model should be rejected (Wang and Wang, 2012). Finally, (d) all invariance models needed to meet the cut-off criteria of the fit-indices mentioned above. Invariance was only established if all four these conditions (non-significant $\Delta\chi^2$ & ΔCFI, ΔCFI > 0.01 and model fit) were simultaneously satisfied (Chen, 2007; Cheung and Rensvold, 2002; Van de Schoot et al., 2012; Vandenburg and Lance, 2000). If the conditions for strong invariance was not met, and at least two out of the three invariant model comparisons showed non-significant differences (e.g. metric vs configural and scalar vs. configural), partial invariance testing was pursued. A top-down approach would be employed where constraints were sequentially released on parameters that lacked invariance (Byrne, 2012; Van de Schoot et al., 2012). If the conditions for partial scalar invariance was met, the variance and means of the common factors were evaluated to determine if these were invariant. Here, common factor means, and variances would be constrained to be equal (Wang and Wang, 2012).

In instances where full/strong or partial invariance was established, *latent mean differences* between the groups were computed and categorically compared. Here, one group was identified as a reference group (its mean is set to zero), whilst the comparative groups' mean was estimated freely. Should the comparative group's latent mean differ significantly from zero, then groups are found to differ significantly from one another (Byrne 2012; Wang and Wang 2012).

Results

To test the six hypotheses of this study, the results of the factorial validity, measurement invariance and internal consistency (reliability) will be separately reported. The results will be presented in tabulated format with a brief subsequent interpretation.

Factorial Validity

To determine the factorial validity of the MHC-SF, CFA approach was employed comparing all theoretically known factor structure permutations of the MHC-SF. A competing measurement model strategy was employed where these theoretical models where systematically compered through (exploratory) structural equation modelling. No items were omitted and observed/measured items were used as indicators of the latent variables within these measurement models (Wang and Wang, 2012). These observed variables (measured items) were treated as continuous variables (given the level of measurement) and measurement errors terms were uncorrelated. Neither, item parcelling nor correlations between items, or error terms were allowed.

The following models were tested:

Model 1 was hypothesized as a unidimensional factorial model of overall mental health which consisted out of all 14 items (see Fig 1 in Appendix A)

Model 2 was specified as the original theoretical model proposed by Keyes (2002) which comprised out of three first-order factors consisting out of EWB (Item 1, 2 &3), SWB (Item 4, 5, 6, 7 & 8) and PWB (Item 9, 10, 11, 12, 13 & 14) (see Fig 2 in Appendix A)

Model 3 was hypothesised as a second order hierarchical model comprised out of three first-order factors consisting out of EWB (Item 1, 2 &3), SWB (Item 4, 5, 6, 7 & 8) and PWB (Item 9, 10, 11, 12, 13 & 14) as well as a second-order factor for overall Mental Health (see Fig 3 in Appendix A)

Model 4 was a first-order factorial model which consisted out of the hedonic (EWB items 1, 2 & 3) and eudemonic (PWB and SWB items 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14) components of wellbeing (see Fig 4 in Appendix A)

Model 5 was hypothesised as a second order hierarchical model comprised out of two first order factors namely: hedonic- (EWB items 1, 2 & 3) and eudemonic- (PWB and SWB items 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14) wellbeing which loaded on a second order factor for general mental health (see Fig 5 in Appendix A)

Model 6 specified a bi-factor model with three first-order factors consisting out of EWB (Item 1, 2 &3), SWB (Item 4, 5, 6, 7 & 8) and PWB (Item 9, 10, 11, 12, 13 & 14) and a global mental health factor comprised of all items. All factors were specified as orthogonal, with inter-factor correlations constrained (see Fig 6 in Appendix A)

Model 7 specified a bi-factor model with two first-order factorial models which consisted out of the hedonic (EWB items 1, 2 & 3) and eudemonic (PWB and SWB items 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14) components of wellbeing, coupled with a global mental health factor comprised of all items. Again, all were specified as orthogonal, with inter-factor correlations constrained (see Fig 7 in Appendix A)

Although the results (reflected in Table 2) indicated that the two bi-factor models (Models 6 and 7) fitted the data significantly better than the unidimensional- (Model 1), first-order (Models 2 & 4) and the hierarchical models (Models 3 & 5), several items had non-significant factor loadings (Items 10 11 12 13 & 14 on Model 6 and Items 10, 12, 13 & 14 on Model 7). These models were therefore not further considered as significant modifications to the instrument (i.e. error term correlations, item omissions, slope /intercept constraints) would need to be made in, rendering comparisons within the current framework as well as in relation to theory impractical.

Table 2 Fit statistics for competing measurement models

Model	χ^2	*df*	TLI	CFI	RMSEA	SRMR	AIC	BIC	90% C.I RMSEA	
									LL	UL
Model 1	2136.43	77	0.64	0.57	0.21	0.18	25676.13	25862.45	0.08	0.10
Model 2	436.24	74	0.94	0.92	0.08	0.06	23983.94	24188.08	0.08	0.09
Model 3	436.24	74	0.94	0.92	0.08	0.06	23983.94	24188.08	0.08	0.09
Model 4	1480.37	76	0.71	0.75	0.17	0.16	25022.07	25212.82	0.16	0.18
Model 5	1480.37	75	0.70	0.75	0.17	0.16	25024.07	25219.26	0.17	0.18
Model 6	316.81	63	0.94	0.96	0.08	0.05	23884.51	24132.93	0.07	0.09
Model 7	298.39	63	0.94	0.96	0.08	0.04	23866.09	24114.51	0.07	0.09

χ^2 = Chi-square; *df* = degrees of freedom; TLI = Tucker-Lewis Index; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardised Root Mean Square Residual; AIC = Akaike Information Criterion; BIC = Bayes Information Criterion; LL = Lower Level; UL = Upper Level

As such, Model 2 ($\chi^2 = 436.24$; $df = 74$; TLI = 0.94; CFI = 0.92; RMSEA = 0.08; SRMR = 0.06; p < 0.01) with three first-order factors best fitted the data. Model 2 fitted the data significantly better than its closest competitor (Model 4) ($\Delta\chi2 = 118.77$; $\Delta df = 1$; ΔCFI = -0.03; $p < 0.01$). These results suggest that a three-factor first order model or a second order hierarchical three first-order factorial model would fit the data significantly better than other factorial permutations.

Table 3 Standardized factor loadings for latent variables

Factor	Item No	Item text	Loading	S.E.
Emotional Wellbeing	1	Happy	0.81*	0.02
	2	Interested in life	0.81*	0.02
	3	Satisfied with life	0.82*	0.02
Social Wellbeing	4	That you had something important to contribute to society	0.62*	0.03
	5	That you belong to a community (like a social group or your neighbourhood)	0.85*	0.02
	6	That our society is a good place, or is becoming a better place, for all people	0.84*	0.02
	7	That people are basically good	0.76*	0.02
	8	That the way our society works makes sense to you	0.73*	0.02
Psychological Wellbeing	9	That you liked most parts of your personality	0.57*	0.03
	10	Good at managing the responsibilities of your daily life	0.68*	0.03
	11	That you had warm and trusting relationships with others	0.64*	0.03
	12	That you had experiences that challenged you to grow and become a better person	0.63*	0.03
	13	Confident to think or express your own ideas and opinions	0.73*	0.02
	14	That your life has a sense of direction or meaning to it	0.80*	0.02

* p < .001; No cross-loading items; S.E. = Standard Error

Table 3 provides an overview of the standardised item loadings for the three latent variables of the best fitting Models (Model 2 & 3). The results showed that the items loaded sufficiently on the respective latent factors (>0.40) with small standard errors (<0.04). For emotional wellbeing the item loadings ranged from 0.81 to 0.82, whereas the item loadings for social wellbeing ranged from 0.62 to 0.85. Items loading on psychological wellbeing ranged from 0.57 to 0.80. These item loadings are significantly higher than the suggested 0.40 cut-off as suggested by Wang and Wang (2012).

Measurement Invariance

Measurement invariance was assessed in two phases. *First*, KMO sphericity was assessed to determine sampling adequacy for each sub-category of the demographic characteristics being employed. The results showed that all categories i.e. genders (male vs female), age categories (19 to 29 years; 30 to 39 years; 40 to 49 years; 50+ years), language groups (Afrikaans, English and African) and marital status (single, married, and divorced/widowed) had adequate sample sizes to continue with invariance testing (KMO < 0.70, p < 0.01; Cerny and Kaiser 1977). Second, measurement invariance was assessed. The specifics of each analysis are presented below.

Invariance was first tested between different genders (males vs females). The participants consisted out of 285 Males and 339 Females. The results provided strong evidence of measurement invariance across the different genders (see Table 4). No significant $\Delta\chi^2$ or ΔCFI differences could be found between the configural-, metric-, and scalar models ($p > .05$).

Table 4 Invariance testing based on gender

	Model	χ^2	*df*	TLI	CFI	RMSEA	SRMR	AIC	BIC	Model Comparison	$\Delta\chi^2$	ΔCFI
M1	Configural Invariance	436.24	146	.94	.92	.03	.05	23983.94	24188.08	-	-	
M2	Metric Invariance	552.94	157	.92	.93	.05	.06	23889.52	24235.55	M2 vs M1	116.70*	-.01*
M3	Scalar Invariance	537.62	168	.92	.93	.03	.06	23902.20	24310.33	M3 vs M2	-15.32*	.00*

* **No statistically significant differences** exist ($p >.05$)

Strong invariance was supported between males and females, therefore latent mean differences between the groups were investigated. With males as the reference group, the results showed that females did not score statistically significantly lower on the unstandardized fitted mean on

EWB ($M = 0.04$, $SE = 0.09$, $p = 0.68$), PWB ($M = -0.06$, $SE = 0.09$, $p = 0.49$) or SWB ($M = -0.07$, $SE = 0.09$, $p = 0.41$).

Table 5 Invariance testing based on Age

	Model	χ^2	*df*	TLI	CFI	RMSEA	SRMR	AIC	BIC	Model Comparison	$\Delta\chi^2$	ΔCFI
M1	Configural Invariance	751.15	292	.92	.90	.10	.07	23943.40	24759.64	-	-	
M2	Metric Invariance	796.24	325	.92	.91	.09	.08	23922.47	24592.33	M2 vs M1	45.08	-.01
M3	Scalar Invariance	865.85	358	.91	.91	.09	.09	23926.09	24449.58	M3 vs M2	69.92	.00

* **No statistically significant differences** exist ($p > .05$)

Next, invariance was assessed between different age categories (see Table 5). The participants consisted out 158 individuals between the ages of 19 and 29 years, 182 between 30 and 39 years, 131 between 40 and 49 years and 153 that were over 50 years of age. The results indicated no evidence of measurement invariance across the groups. Significant differences in both $\Delta\chi 2$ and ΔCFI were found between the configural, metric, and scalar invariance models ($p < 0.05$). Partial invariance was not pursued as comparisons between all invariance models showed to be statistically significant. Further, none of the models met the RMSEA and SRMR requirements for model fit. Therefore, the MHC-SF was not invariant among age categories and meaningful mean comparisons cannot be made.

Further, measurement invariance was assessed between different language groups (see Table 6). The participants consisted out English- (n=166), Afrikaans- (n=216) and African language groups ($n = 242$). Again, the results indicated no evidence of measurement invariance across the different language groups. Significant differences in both $\Delta\chi^2$ and ΔCFI were found between the configural, metric, and scalar invariance models ($p < .05$). Partial invariance was not pursued as comparisons between the invariance models showed that a non-statistically significant difference only existed for one model (the configural vs. metric model). Further, none of the models met the model fit criteria for RMSEA and only the configural model met the requirements for SRMR. The conditions for further investigations was thus not met. Therefore, the MHC-SF was not invariant among different language groups and meaningful mean comparisons cannot be made.

Table 6 Invariance testing based on Language

Model		χ^2	*df*	TLI	CFI	RMSEA	SRMR	AIC	BIC	Model Comparison	$\Delta\chi^2$	ΔCFI
M1	Configural Invariance	638.02	219	.93	.91	.09	.06	23733.03	24345.22	-	-	
M2	Metric Invariance	666.86	241	.92	.93	.09	.08	23717.86	24232.46	M2 vs M1	28.83*	.02*
M3	Scalar Invariance	726.42	263	.92	.92	.09	.08	23733.42	24150.42	M3 vs M2	59.56	-.01

* **No statistically significant differences** exist (p >.05)

Table 7 Invariance testing based on Marital Status

Model		χ^2	*df*	TLI	CFI	RMSEA	SRMR	AIC	BIC	Model Comparison	$\Delta\chi^2$	ΔCFI
M1	Configural Invariance	712.06	219	.90	.92	.10	.07	23454.31	24066			
M2	Metric Invariance	740.112	241	.91	.92	.10	.08	23438.36	23952.96	M2 vs M1	28.06*	.00
M3	Scalar Invariance	859.86	263	.90	.91	.10	.09	23514.14	23931.13	M3 vs M2	119.77	-.01

* **No statistically significant differences** exist (p >.05)

Finally, measurement invariance was assessed for individuals with different marital statuses (see Table 7). The participants consisted out Single- (*n* = 128), Married- (*n* = 290) and Divorced/Widowed individuals (*n* = 206). Again, the results indicated no evidence of measurement invariance across the different groups. Significant differences in both $\Delta\chi^2$ and

ΔCFI were found between the configural, metric, and scalar invariance models ($p < .05$). Partial invariance was not pursued as comparisons between the invariance models showed that a non-statistically significant difference only existed for one model (the configural vs. metric model). Further, none of the models met the model fit criteria for RMSEA and only the configural model met the requirements for SRMR. The conditions for further investigations was thus not met. Therefore, the MHC-SF was not invariant among people with different marital statuses and meaningful mean comparisons cannot be made..

Reliabilities and descriptive statistics

Table 8 indicates the descriptive statistics (means, standard deviations, skewness, kurtosis), Cronbach alphas, composite reliabilities and Pearson/Spearman relationships amongst the latent variables. The results showed that all the scales are reliable at both the lower (Cronbach Alpha > 0.70) and upper bound limits (Composite reliability / Rho coefficients (ρ) > 0.80). *Hypotheses 5*, which indicates that the MHC-SF is a reliable measure, can therefore be *accepted.*

Table 8 Descriptive statistics, Cronbach alpha coefficients, and composite reliabilities for Model 2&3

Variable	$\bar{x}$	σ	Skewness	Kurtosis	ρ	α
Overall Mental Health	4.33	0.88	-0.57	0.31	0.94	0.80
Emotional Wellbeing	4.71	0.99	-1.13	1.38	0.85	0.86
Psychological Wellbeing	4.74	0.89	-0.94	1.07	0.83	0.86
Social Wellbeing	3.54	1.27	-0.13	-0.87	0.87	0.88

$\bar{x}$ = mean; σ = standard deviation; ρ = composite reliability; α = Cronbach's alpha

Discussion

The purpose of this paper was to investigate the psychometric properties of the MHC-SF within selected organisations within the South African context. Specifically, the aim was to determine the factorial validity, the measurement invariance for different demographic factors and to determine the reliability of the instrument for South African organisations. The results showed that the original three-dimensional factor structure of the MHC-SF proposed by Keyes (2002) fitted the data comparatively better than any other theoretical permutation of the model. Items loaded statistically significantly on all three subscales (emotional-, psychological-, social wellbeing) of the best-fitting model. Further, the scale showed full configure, convergent and metric invariance between males and females. Within the current study, no differences in emotional-, psychological- and social wellbeing between genders were found. However, invariance was not established for different age cohorts, language groups or marital statuses. The instrument proved to be reliable at both a lower (Cronbach Alpha) and upper level (Composite reliability) limit within South African organisational contexts.

The factorial validity of the MHC-SF

Various factor-structure permutations of the MHC-SF exists within the literature; with little consistency in their application across samples or contexts. Research has shown that the MHC-SF is used either as (a) a unidimensional model (i.e. general mental health), (b) a three- (emotional, psychological and social wellbeing) or two- factor (hedonic and eudemonic wellbeing) first order model, or (c) as a hierarchical model comprised out of either the three- or two- first order factors which builds up to an overall second-order called 'Overall Mental Health'. Contemporarily, two additional types of models have been introduced in the literature: ESEM and Bi-Factor models (Joshanloo 2016; Joshanloo and Jovanović 2016; Joshanloo et al. 2017; Żemojtel-Piotrowska et al., 2018).

The current study attempted to categorically compare all the aforementioned models (with the exclusion of the ESEM approach) within the South African organisational context. Initially, the results indicated that both bi-factor models assessed in this study fitted the data best. However, with further inspection it was found that even though these models fitted the data comparatively better than the other competing models, the majority of the items on the 'psychological well-being' (or eudemonic subscales for the two-factor, bi-factor model) had non-significant factor loadings. De Bruin and Du Plessis (2015) presented similar results. These authors found that the bi-factor model fitted the data better a large amount of total test variance. However, even though the general mental health factor's items loaded significantly on the global factor, most of the item loadings reported on the individual subscales did not meet Wang and Wang's (2012) suggested item loading cut-off of 0.5 nor Field's (2016) more lenient 0.40.

Reise et al. (2016) explains that even though bi-factor models provide better fit relative to unidimensional or correlated factor models (as a result of the complexity of the specified model; it's the least restrictive out of all possible models), it "accommodates implausible, possibly invalid, response patterns. We warn readers that, even if such suspect patterns could be reliably identified with high precision, there is no “adjustment” to factor score estimates that can turn invalid responses into valid score estimates ” (p. 19). These authors specifically warn against employing bi-factor models in general, as these models do not provide the “answers” to the traditional questions which is posed when developing, or validating instruments; especially when competing CFA approaches are is employed. Bifactor models are predispositioned to ignore cross-loadings and may result in biased estimates (Joshanloo, 2016). Finally, in some instances and for some psychometric instruments the general factor estimated in bi-factor models, does not function as a ‘true’ general factor, but rather acts as a general function to superficially inflate model-fit (Morgan, Hodge, Wells and Watkins 2015). In these instances, a normal two-level hierarchical factorial model would be more preferential and could yield better results (Reise et al., 2016; Żemojtel-Piotrowska et al., 2018).

As such, these bi-factor models were disregarded form further analyses. The results therefore showed that Keyes’ (2002) original three factor model (Model 2: EWB, PWB, SWB; Model 3: Overall Mental Health = EWB, PWB, SWB) fitted the data significantly better than the unidimensional- (Model 1), first-order (Model 4) and the hierarchical models (Model 5). For employees within the South African organisational context, there is a clear distinction between three different, yet complimentary components of well-being: emotional wellbeing, psychological wellbeing and social wellbeing. Our results are aligned to several studies conducted by Joshanloo and colleagues (2017) ranging from Italy (Petrillo et al. 2011), and the Netherlands (Lamers et al, 2011), to France (Salama-Younes and Ismail 2011) and Argentina (Perugini et al. 2017). It is also important to note, that our findings were also in contrast to other studies which conceptualised Keyes’ (2002) instrument as a unidimensional-, two-factor model- or two-factor hierarchical models (Joshanloo, 2017).

Measurement invariance for Genders, Age cohorts, Language groups and Relational /marital status

Determining the best fitting model, allowed for further investigation into equivalence factor structures (configural invariance), the similarity in factor/item loadings (metric invariance) and to determine if different groups have similar intercepts (scalar invariance). The aim as to specifically investigate the measurement invariance of genders, age cohorts, language groups and between different relationship /marital status. The results only showed support for invariance between males and females; and in contrast to our initial belief, not for individuals of different ages, from different language groups and people whom are in different types of relationships. Partial invariance for these groups could also not be established. This implies that men and woman interpret the items of the MHC-SF in a similar way, and therefore interpret emotional-, psychological- and social wellbeing in the same way (Van Der Schoot, Lugtig and Hox 2012). As such, future studies can make meaningful cross-gender comparisons on the occurrence, determinants and consequences of the components of MHC-SF within South African organisational contexts. This is in-line with the findings of Guo et al. (2015), Joshanloo et al. (2017), Karaś et al. (2012), Petrillo et al. (2017) whom all reported invariance in gender in different cultures and contexts.

In contrast, Guo et al. (2015) and others, individuals from different ages and with different relationship status will interpret the constructs being measured differently and therefore cross-generation and cross-relationship comparisons cannot reasonably be made. Importantly, differences which may occur between these groups could therefore be due to inadequate measurement of mental-health within these groups. Further, in contrast to Schutte and Wissing (2017), measurement invariance could not be established between the different language groups within the current sample. Within the South African context, native language is used as a proxy for the cultural identification and classification. Seeing that significant differences exist between Afrikaans, English and African speaking individuals within this sample, cross-cultural comparisons on mental health between these groups, within this context, cannot meaningfully be made.

Care should therefore be given when applying the instrument to people from different ages, as they may understand and interpret the information differently due to the magnitude of experiences accumulated over time (older generations) or due to nativity as a result of a lack of insight (younger generations). Similarly, when applied to or within cross-cultural or multi-lingual environments, it is suggested to utilise one of the many translated and validated versions of the MHC-SF in order to ensure that language does not impact on the quality of the results. Finally, although we know that differences in wellbeing exists between individuals in or out of relationships, when applying the MHC-SF to measure and compare wellbeing between individuals that are in relationships, that are single or that are divorced/widowed, one must be cognisant that underlying relational dynamics may affect how the questions are interpreted.

The internal consistency of the MHC-SF

Although the MHC-SF is considered to be a reliable instrument to assess mental health, it has shown to fluctuate in reliability between different cultures, between adults and adolescents as well as within different contexts (Karas et al. 2014; Keyes et al. 2008; Singh, Bassi, Junnarkar and Negri 2015). The reliability also depends on the type of theoretical model which was employed in the given context (e.g. a unidimensional measure may present with higher levels of internal consistency than the three-factor model in the same context).

The results of this study showed that the instrument is a reliable measure (at both the lower and upper bound consistency limits) for mental health within South African organisational contexts. Results showed acceptable levels of internal consistency (Cronbach Alpha > 0.70; Nunnally and Bernstein 1994) and composite reliability (Rho / (ρ) > 0.80; Wang and Wang, 2012). Our findings are primarily aligned to the other South African studies where the MHC-SF was applied to multi-cultural groups and found to be reliable (Keyes et al. 2008).

Recommendations and Limitations

This study has a number of limitations which need to be reported in order to appropriate interpret the results and discussion. The first limitation of this study pertains to the fact that the MHC-SF is a self-report measure and relied on the self-knowledge and subjective experience of situations of the individual which might have an impact on the accuracy of the results. Secondly, a convenience South African sample was utilised, therefore the results cannot be generalised to other samples. In this study only the positive mental health model were tested. It might be beneficial to determine the factor structure of both positive and negative patterns at the same time in future studies. Third, this was a cross-sectional study. Seeing that mental health fluctuates over time, it might be viable to conduct longitudinal validation studies.

Conclusion

The MHC-SF is a proven instrument to assess the mental health of both students (Van Zyl and Rothmann, 2012b) and adults (Keyes et al., 2008) within the South African context. This study showed that it could further be used as a tool to assess the wellbeing and mental health of working adults within the given context. This, however, should be taken against the backdrop that within the current study a number of context specific factors and differences from the literature exists. The MHC-SF can be used to differentiate between genders, but not between different languages (i.e. cultures), age cohorts and people within various marital statuses. Albeit such, the tool is still one of the most prominent positive psychological assessment measures which has… stood the test of time!

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References

Bonde, J. P. E. (2008). Psychosocial factors at work and risk of depression: a systematic review of the epidemiological evidence. *Occupational and Environmental Medicine,* 65, 438-445. doi: 10.1136/oem.2007.038430

Brown, T. A. (2006). Confirmatory factor analysis for applied research. NY: Guilford Publications.

Burns, R. A., Anstey, K. J., & Windsor, T. D. (2011). Subjective well-being mediates the effects of resilience and mastery on depression and anxiety in a large community sample of young and middle-aged adults. *Australian and New Zealand journal of psychiatry*, *45*(3), 240-248.

Byrne, B. M. (2012). *Structural equation modeling with Mplus: Basic concepts, applications and programming.* New York, NY: Taylor & Francis

C. M., Kamp Dush & Amato, P. R. (2005). Consequences of relationship status and quality for subjective well-being. *Journal of Social and Personal Relationships*. *22*(5), 607–627, doi: 10.1177/0265407505056438

Carver, C. S., & Connor-Smith, J. (2010). Personality and coping. *Annual Review of Psychology*, *61*, 679-704. doi:10.1146/annurev.psych.093008.10035

Carver, C. S., & Scheier, M. F. (2014). Dispositional optimism. *Trends in cognitive sciences*, *18*(6), 293-299. doi: 10.1016/j.tics.2014.02.003

Cerny, B. A., & Kaiser, H. F. (1977). A study of a measure of sampling adequacy for factor-analytic correlation matrices. *Multivariate Behavioral Research*, *12*(1), 43-47. doi: 10.1207/s15327906mbr1201_3

Chapman, B., & Guven, C. (2016). Revisiting the relationship between marriage and wellbeing: Does marriage quality matter? *Journal of Happiness Studies, 17*(2), 533-551.

Chen, F.E. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling, 14*, 464–504.

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9,* 233-255.

Cho, E., & Kim, S. (2015). Cronbach’s coefficient alpha: Well-known but poorly understood. *Organizational Research Methods*, *18*(2), 207–230. https://doi.org/10.1177%2F1094428114555994

De Bruin, G. P., & Du Plessis, G. A. (2015). Bifactor analysis of the Mental Health Continuum—Short Form (MHC—SF). *Psychological Reports, 116*(2), 438-446. doi:10.2466/03.02.PR0.116k20w6

Diener, E. (1984). Subjective well-being. *Psychological Bulletin*, *95*, 542–575.

Diener, E., & Biswas-Diener, R. (2008). *Rethinking happiness: The science of psychological wealth*. Malden, MA, USA: Blackwell.

Diener, E., & Suh, E. M. (Eds.). (2003). *Culture and subjective well-being*. MIT press, MA.Diener, E., Gohm, C. L., Suh, E., & Oishi, S. (2000). Similarity of the relations between marital status and subjective well-being across cultures. *Journal of Cross-Cultural Psychology*, *31*(4), 419-436.

Diener, E., Suh, E.M., Lucas, R., & Smith, H.L. (1999). Subjective well-being: Three decades of progress. *Psychological Bulletin*, *125*(2), 276–302, doi:10.1037/0033-2909.125.2.276

Fairbrother, K. & Warn, J. (2003). Workplace dimension: Stress and Job satisfaction. *Journal of Management Psychology*, 18(1), 8-21. doi: 10.1108/02683940310459565

Field, A. (2016). *An adventure in statistics: The reality enigma*. Sage.

Gavin, J. H., & Mason, R. O. (2004). The virtuous organization: The value of happiness in the workplace. *Organizational Dynamics*, *33*(4), 379–392.

Guo, C., Tomson, G., Guo, J., Li, X., Keller, C., & Söderqvist, F. (2015). Psychometric evaluation of the Mental Health Continuum-Short Form (MHC-SF) in Chinese adolescents–a methodological study. *Health and quality of life outcomes*, *13*(1), 198. doi:10.1186/s12955-015-0394-2

Helliwell, J. F., & Putnam, R. D. (2004). The social context of well-being. *Philosophical Transactions of the Royal Society B: Biological Sciences, 359*, 1435–1446, doi:10.1098/rstb.2004.1522

Hides, L., Quinn, C, Stoyanov, S., Cockshaw, W., Mitchell, T. & Kavanagh, D. (2016). Is the mental wellbeing of young Australians best represented by a single, multidimensional or bifactor model? *Psychiatry Research, 241*, 1–7. doi.org/10.1016/j.psychres.2016.04.077

Janse van Rensburg, C., Rothmann, S., & Diedericks, E. (2017). Person-environment fit, flourishing and intention to leave in universities of technology in South Africa. *SA Journal of Industrial Psychology, 43*(1), 1-10.

Joshanloo, M. (2016a). A new look at the factor structure of the MHC-SF in Iran and the United States using exploratory structural equation modeling. *Journal of clinical psychology*, *72* (7), 701-713. doi: 10.1002/jclp.22287

Joshanloo, M. (2016b). Revisiting the empirical distinction between hedonic and eudaimonic aspects of well-being using exploratory structural equation modeling. *Journal of Happiness Studies*, *17*(5), 2023-2036.

Joshanloo, M. (2017). Factor structure and measurement invariance of the MHC-SF in the USA. *European Journal of Psychological Assessment*. Advance online publication. https://doi.org/10.1027/1015-5759/a000425

Joshanloo, M., & Jovanović, V. (2016). The factor structure of the Mental Health Continuum-Short Form (MHC-SF) in Serbia: An evaluation using exploratory structural equation modeling. *Journal of Mental Health*, *26* (6), 510-515. doi: 10.1080/09638237.2016.1222058

Joshanloo, M., Jose, P. E., & Kielpikowski, M. (2017). The value of exploratory structural equation modeling in identifying factor overlap in the Mental Health Continuum-Short Form (MHC-SF): A study with a New Zealand sample. *Journal of Happiness Studies*, *18* (4), 1061-1074. doi: 10.1007/s10902-016-9767-4

Joshanloo, M., Wissing, M. P., Khumalo, I. P., & Lamers, S., M., A. (2013). Measurement invariance of the Mental Health Continuum-Short Form (MHC-SF) across three cultural groups. *Personality and Individual Differences*, *55*, 755-759, doi:10.1016/j.paid.2013.06.002

Jovanovic, V. (2015). Structural validity of the Mental Health Continuum-Short Form: The bifactor model of emotional, social and psychological well-being. *Personality and Individual Differences, 75,* 154–159. doi: 10.1016/j.paid.2014.11.026

Karaś, D., Cieciuch, J., & Keyes, C. L. (2014). The polish adaptation of the mental health continuum-short form (MHC-SF). *Personality and Individual Differences*, *69,* 104-109. doi: 10.1016/j.paid.2014.05.011

Kashdan, T.B., & Rottenberg, J. (2010). Psychological flexibility as a fundamental aspect of health. *Clinical Psychology Review, 30*(7), 865-78. doi: 10.1016/j.cpr.2010.03.001

Keyes, C. L. M. (2002). The mental health continuum: From languishing to flourishing in life. *Journal of Health and Social Research, 43*, 207–222.

Keyes, C. L. M. (2005). Mental illness and/or mental health? Investigating axioms of the complete state model of health. *Journal of Consulting and Clinical Psychology, 73*, 539–548.

Keyes, C. L. M., & Shapiro, A. D. (2004). Social Well-Being in the United States: A Descriptive Epidemiology. In O. G. Brim, C. D. Ryff, & R. C. Kessler (Eds.), *The John D. and Catherine T. MacArthur foundation series on mental health and development. Studies on successful midlife development. How healthy are we? A national study of well-being at midlife* (pp. 350-372). Chicago, IL, US: University of Chicago Press.

Keyes, C. L. M., Shmotkin, D., & Ryff, C. D. (2002). Optimizing well–being: The empirical encounter of two traditions. *Journal of Personality and Social Psychology, 82*, 1007–1022.

Keyes, C. L., Wissing, M., Potgieter, J. P., Temane, M., Kruger, A., & Van Rooy, S. (2008). Evaluation of the mental health continuum–short form (MHC–SF) in setswana-speaking South Africans. *Clinical Psychology & Psychotherapy*, *15*(3), 181-192.

Lamers, S. M. A., Westerhof, G. J., Bohlmeijer, E. T., ten Klooster, P. M., & Keyes, C. L. M. (2011). Evaluating the psychometric properties of the mental health continuum - short form (MHC-SF). Journal of Clinical Psychology, 67(1), 99-110. doi:10.1002/jclp.20741

Longo, Y., Jovanović, V, Sampaio de Carvalho, J, & Karaś, D. (2017). The general factor of well-being: Multinational evidence using bifactor ESEM on the mental health continuum–short form. *Assessment 1–11*. doi: 10.1177/1073191117748394

Machado, W. L., & Bandeira, D. R. (2015). Positive mental health scale: validation of the mental health continuum – short form. *Psico-USF. Braganca Paulista, 20* (2), 259–74. doi: 10.1590/1413-82712015200207

Morgan, G. B., Hodge, K. J., Wells, K. E., & Watkins, M. W. (2015). Are fit indices biased in favor of bi-factor models in cognitive ability research? A comparison of fit in correlated factors, higher-order, and bi-factor models via Monte Carlo simulations. *Journal of Intelligence*, *3*(1), 2-20.

Muthén, L., & Muthén, B. (2017). *Mplus user's guide*. Los Angeles, CA: Muthén & Muthén.

Niemand, C. (2009). Mental health of South African industrial psychologists: Results of a latent profile analysis. Unpublished master thesis. North-West University, Vanderbijlpark.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). New York:

Perugini, M. L. L, de la Iglesia, G., Solanoa, A. C., Keyes, C. L. M. (2017). The Mental Health Continuum–Short Form (MHC–SF) in the Argentinean Context: Confirmatory Factor Analysis and Measurement Invariance. *Europe's Journal of Psychology*, *13*(1), 93–108, doi:10.5964/ejop.v13i1.1163

Peters, M. L., Flink, I. K., Boersma, K., & Linton, S. J. (2010). Manipulating optimism: can imagening a best possible self be used to increased positive future expectancies? *Journal of Positive Psychology*, *5*, 204-211. doi: 10.1080/17439761003790963

Petrillo, G., Capone, V., Caso, D., & Keyes, C. L. M. (2015). The Mental Health Continuum–Short Form (MHC–SF) as a measure of well-being in the Italian context. *Social Indicators Research*, *121*, 291-312. doi:10.1007/s11205-014-0629-3

Qian, Y., & Qian, Z. (2015). Work, family, and gendered happiness among married people in urban China. *Social Indicators Research*, *121*(1), 61-74.

Reise, S. P., Kim, D. S., Mansolf, M., & Widaman, K. F. (2016). Is the bifactor model a better model or is it just better at modeling implausible responses? Application of iteratively reweighted least squares to the Rosenberg Self-Esteem Scale. *Multivariate behavioral research*, *51*(6), 818-838

Rothmann, S. (2013). From happiness to flourishing at work: A southern African perspective. In M.P. Wissing (Ed.), Well-being research in South Africa: In *Wellbeing research in South Africa* (pp. 123–151). The Netherlands: Springer.

Rothmann, S. (2014). Flourishing in work and careers. In M. Coetzee (Ed.), *Psycho-social career meta-capacities* (pp. 203–220). The Netherlands: Springer.

Ryff, C. D. (1989). Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *Journal of Personality and Social Psychology*, *57*, 1069–1081.

Salama-Younes, M., & Ismaïl, A. (2011). Validation of the factor structure of the Mental Health Continuum Short Form (MHC-SF) for physically active old out. *World Journal of Sport Sciences*, *4*(1), 24-30.

Schutte, L., & Wissing, M. P. (2017). Clarifying the factor structure of the Mental Health Continuum Short Form in three languages: A bifactor exploratory structural equation modelling approach. *Society and Mental Health*, *7*(3), 142-158. doi:10.1177/2156869317707793

Seligman, M. E. P. (2011). *Flourish: A visionary new understanding of happiness and well-being*. New York, NY: Free Press.

Singh, K., Bassi, M., Junnarkar, M., & Negri, L. (2015). Mental health and psychosocial functioning in adolescence: An investigation among Indian students from Delhi. *Journal of Adolescence, 39,* 59–69.

Uchida, Y., Norasakkunkit, V., & Kitayama, S. (2004). Cultural constructions of happiness: Theory and empirical evidence. *Journal of Happiness Studies, 5*, 223–239.

Van de Schoot, R., Lugtig, P., & Hox, J. (2012). A checklist for testing measurement invariance. *European Journal of Developmental Psychology, 9(*4), 486-492. doi: 10.1080/17405629.2012.686740

Van Zyl, L. E., & Rothmann, S. (2012a). Beyond smiling: the evaluation of a positive psychological intervention aimed at student happiness. *Journal of Psychology in Africa, 22* (3), 369-384. http://goo.gl/ZLpLrY

Van Zyl, L. E., & Rothmann, S. (2012b). Flourishing of students in a tertiary education institution in South Africa. *Journal of Psychology in Africa, 22*(4), 593-599

Vandenburg, R.J., & Lance, C.E., 2000. A review and synthesis of the measurement invariance literature: Suggestions, practices, and recommendations for organizational research. *Organizational Research Methods, 3,* 4-69. doi:10.1177/109442810031002

Veenhoven, R. (2015). Social conditions for human happiness: A review of research. *International Journal of Psychology*, *50*(5), 379-391.

Wang, J., & Wang, X. (2012). *Structural equation modelling: Applications using Mplus.* Chichester, UK: Wiley & Sons.

Westerhof, G. J., & Keyes, C. L. M. (2010) Mental illness and mental health: The two Continua model across the lifespan. *Journal of Adult Development 17,* 110–119. doi 10.1007/s10804-009-9082-y

Woodruff, S. C., Glass, C. R., Arnkoff, D. B., Crowley, K. J., Hindman, R. K., & Hirschhorn, E. W. (2014). Comparing self-compassion, mindfulness, and psychological inflexibility as predictors of psychological health. *Mindfulness*, *5*(4), 410-421.

Żemojtel-Piotrowska, M., Piotrowski, J. P., Osin, E. N., Cieciuch, J., Adams, B. G., Ardi, R., ... & de Clunie, G. T. (2018). The mental health continuum-short form: The structure and application for cross-cultural studies–A 38 nation study. *Journal of Clinical Psychology*, *74*(6), 1034-1052.

Zinbarg, R. E., Revelle, W., Yovel, I., & Li, W. (2005). Cronbach's α, Revelle's ß, and McDonald's ωh: Their relations with each other and two alternative conceptualizations of reliability. *Psychometrika, 70,* 123–133. doi:10.1007/s11336-003-0974-7.

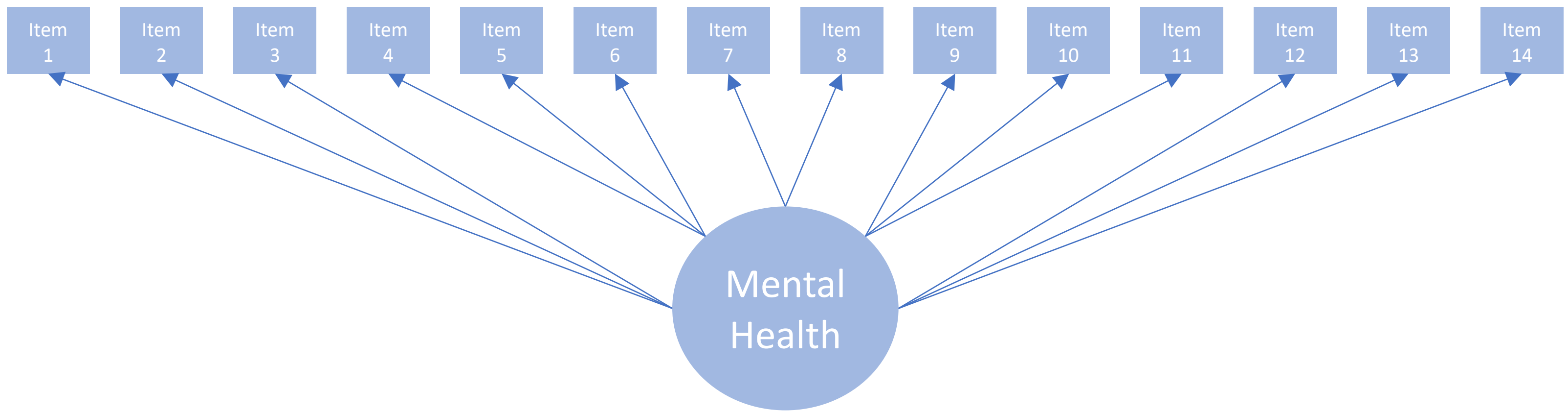

Fig 1 Model 1: Unidimensional Factorial Model

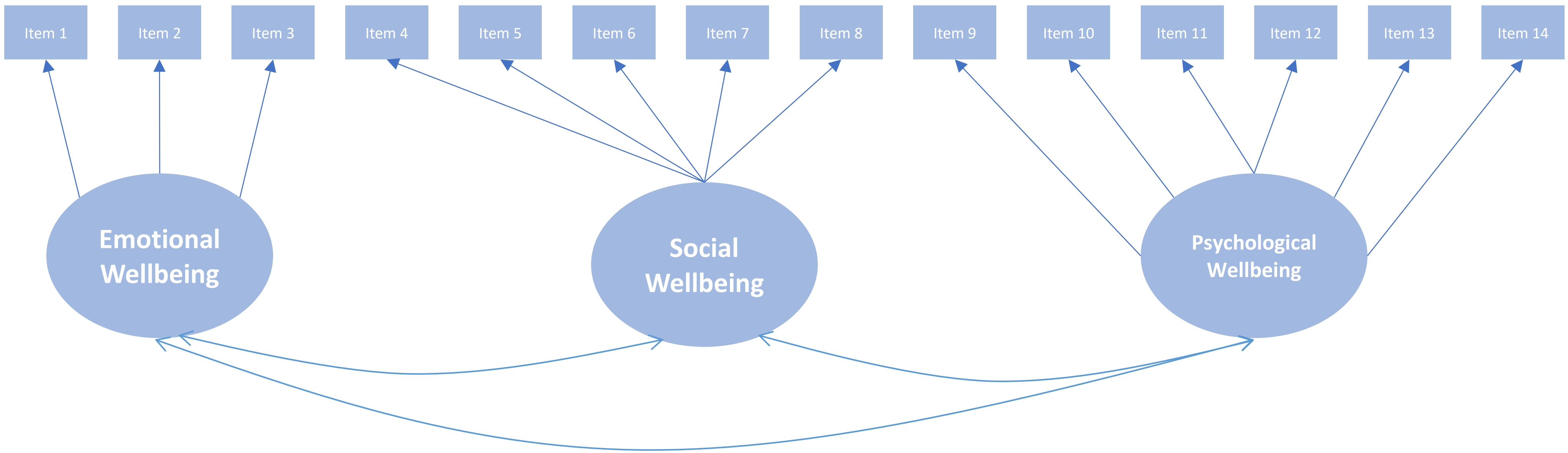

Fig 2 Model **2:** Three first-order Factorial Model

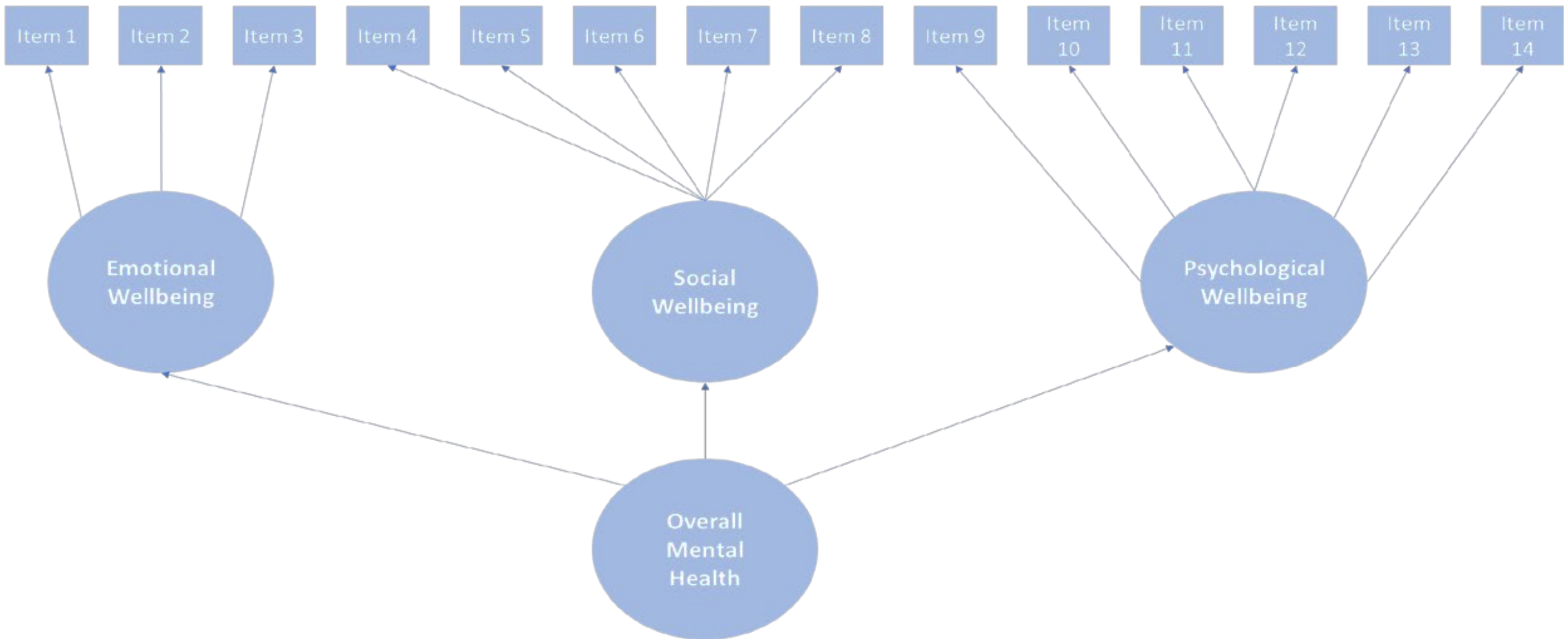

Fig 3 Model **3:** Second order Hierarchical Three first-order Factorial Model

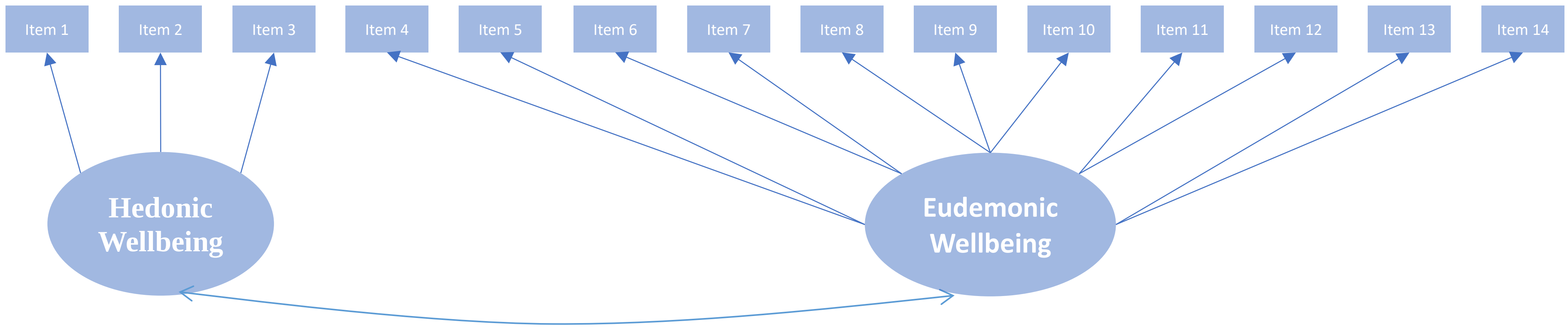

Fig 4 Model 4: Two first-order Factorial Model

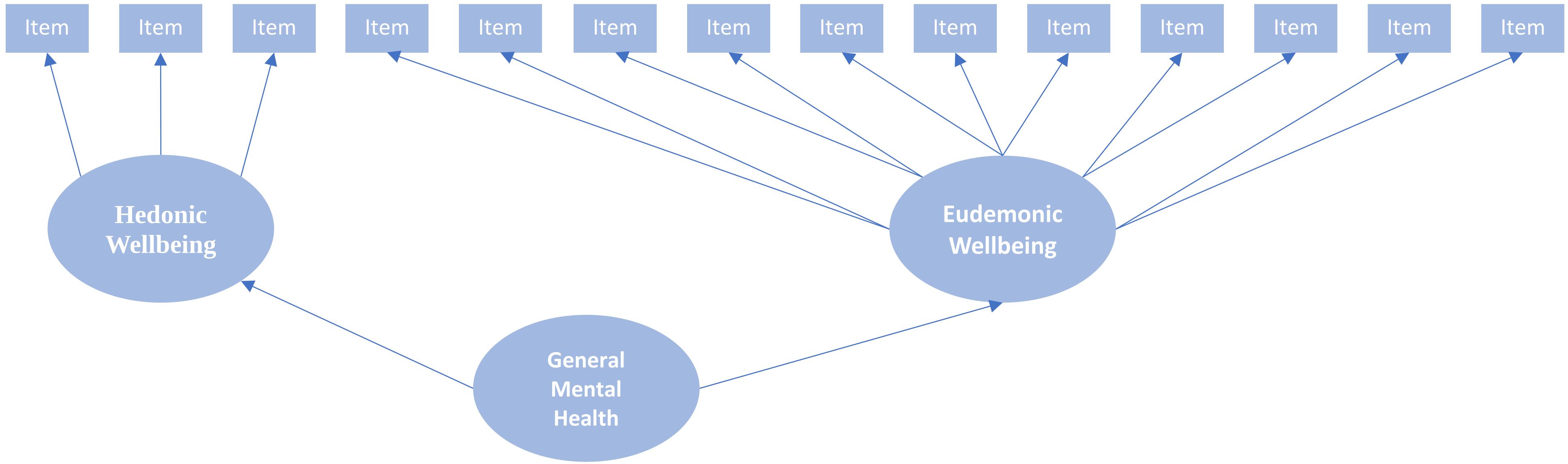

Fig 5 Model 5: Second order Hierarchical two first-order Factorial Model

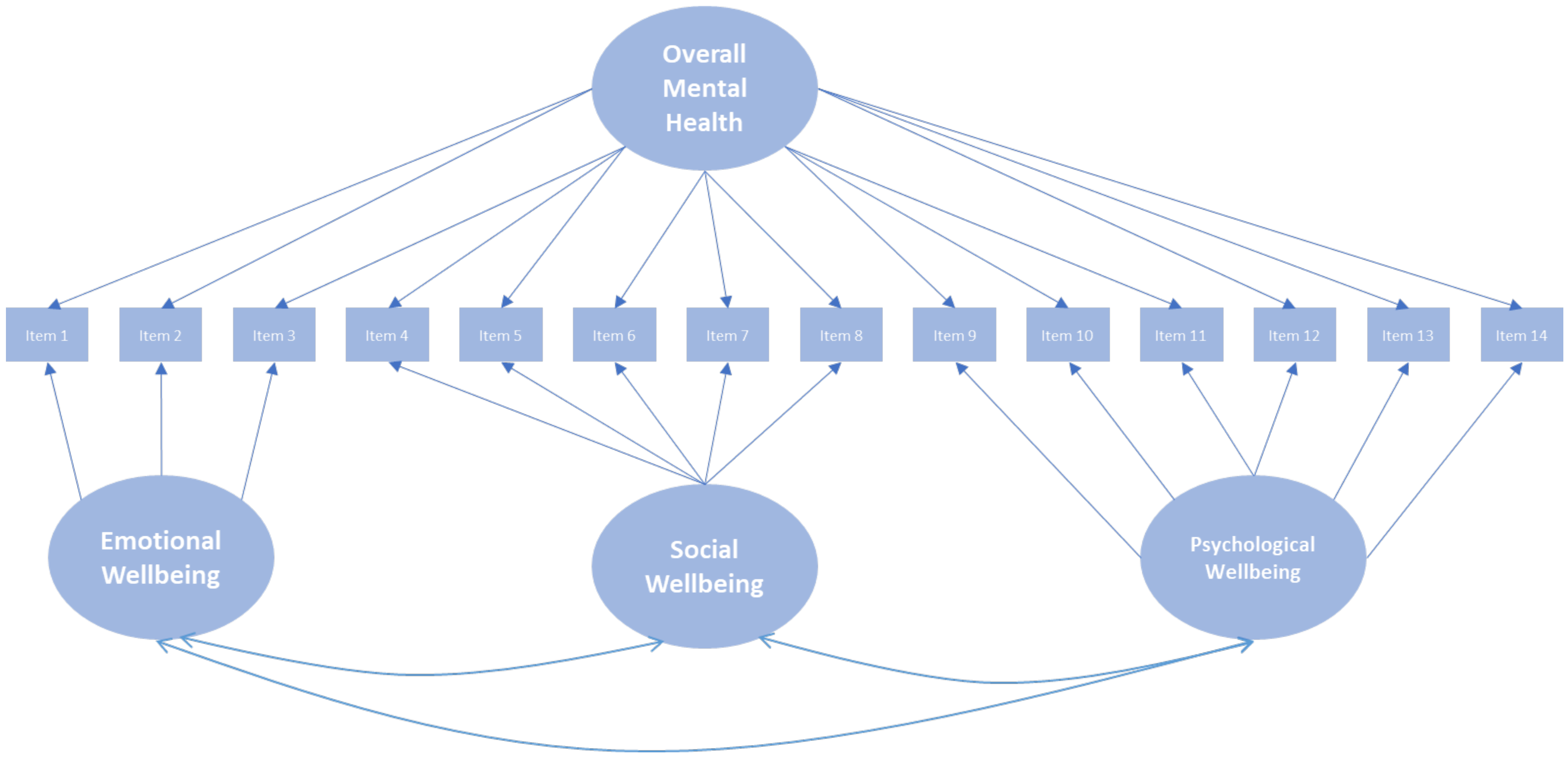

Fig 6 Model 6: Bi-factor model with three first-order factors

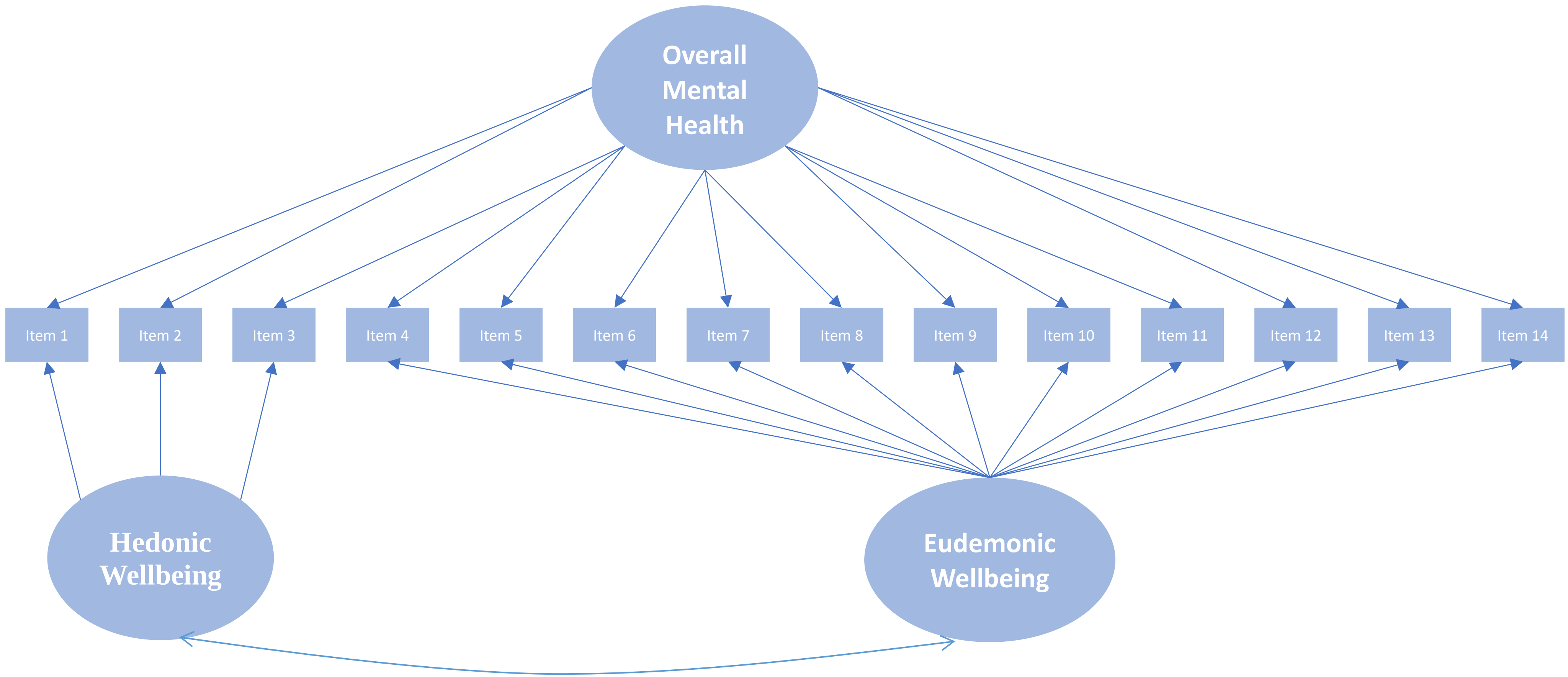

Fig 7 Model **7:** Bi-factor model with two first-order factors