Measurement invariance of the Mental Health Continuum-Short Form (MHC-SF) across three cultural groups

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ABSTRACT

This study investigated the factorial structure and invariance of the Mental Health Continuum-Short Form (MHC-SF) across cultural groups from three nations, namely, the Netherlands, South Africa, and Iran ($N = 1120$). The three-dimensional structure of mental well-being was supported in all the groups. The results of measurement invariance testing confirmed the full metric and partial scalar invariance of the MHC-SF. The study also compared the latent means for the aspects of mental well-being in the three cultural groups, and found significant differences. The significance and implications of the results are discussed.

1. Introduction

Positive aspects of mental health are increasingly gaining attention in psychology as well as in economics and national policy making (De Vos, 2012; Lucas & Diener, 2008; Thin, 2012). Thus, data produced by measures of positive mental health are likely to influence psychological, social, and political policy making in various cultures. Therefore, due attention should be devoted to the factor structure of mental health, and the statistical characteristics of measures used to assess this construct. Otherwise the validity of the conclusions drawn in this field of research may be questioned.

Keyes (2005, 2013) proposes a dual continua model of mental health which defines positive mental health not simply as the absence of mental disorder but as the presence of positive qualities. Some models exclusively focus on the emotional aspect and ignore psychological and/or social functioning in the measurement of positive mental health (e.g., Kashdan, Biswas-Diener, & King, 2008). Unlike these models, in Keyes' comprehensive model, the degree of positive mental health is measured across the dimensions of emotional, social, and psychological well-being. Emotional well-

being captures the presence of positive emotions and an overall satisfaction with life (Diener, Suh, Lucas, & Smith, 1999). Psychological well-being captures aspects of individuals' psychological functioning (e.g., autonomy and a sense of personal growth, Ryff, 1989). Social well-being captures how well an individual functions in their social life as a member of a larger society (e.g., social integration and social contribution, Keyes, 1998). In line with Keyes' model (Keyes, 2002, 2007), factor analytic studies in various samples have supported the three-factor structure of positive mental health (Gallagher, Lopez, & Preacher, 2009; Keyes et al., 2008; Lamers, Westerhof, Bohlmeijer, ten Klooster, & Keyes, 2011; Robitschek & Keyes, 2009).

These three aspects of mental well-being have been assessed separately or in combinations via various measures of well-being. Examples are Ryff's psychological well-being scales (Ryff, 1989) and the Satisfaction With Life Scale (Diener, Emmons, Larsen, & Griffin, 1985). The Mental Health Continuum-Short Form (MHC-SF; Keyes, 2002) is a short scale to measure these three components. This scale has been used so far in various cultural contexts producing promising results (Lamers, Glas, Westerhof, & Bohlmeijer, 2012; Lamers et al., 2011; Keyes et al., 2008; Khumalo, Temane, & Wissing, 2012). However, previous research involving positive mental health measures has not paid enough attention to the issue of measurement invariance across cultures (Cheung & Rensvold, 2002). Measurement invariance is defined as whether "under different conditions of observing and studying phenomena,

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Table 1
Descriptive statistics and internal consistencies.

	N	Mean age	SD age	% of females	Language	Mean			SD			α		
						EW	SW	PW	EW	SW	PW	EW	SW	PW
Netherlands	308	21.6	5.04	66.6	Dutch	13.4	16.2	25.3	1.01	.98	.93	.85	.72	.81
S. Africa	328	20.8	1.59	78.6	English	13.8	18.0	28.7	.72	.90	.75	.77	.74	.79
Iran	484	21.7	2.21	59.3	Persian	12.0	15.2	24.0	1.23	1.15	1.10	.84	.74	.83
Total	1120	21.4	3.16	50		12.9	16.3	25.7	1.07	1.06	1.02	.84	.74	.84

Note: EW = emotional well-being; SW = social well-being; PW = psychological well-being.

measurements yield measures of the same attributes" (Horn & McArdle, 1992, p. 117). If measurement invariance of a scale is not tested, cross-cultural findings cannot be meaningfully interpreted (Cheung & Rensvold, 2002). Therefore, it is necessary to test the measurement invariance of well-being scales before using them in cross-cultural studies.

The main purpose of this study was to test the measurement invariance of the MHC-SF in three cultural groups, namely, the Netherlands, Iran, and South Africa. This study also compared the latent means of positive mental health aspects in these cultural groups. These groups were selected because of their remarkable differences in terms of language, religion, geography, social and economic indicators, and political perspectives. For example, they differ on individualism, with Iran scoring lower than the other two cultures (Hofstede, Hofstede, & Minkov, 2010). They also differ in terms of the human development index (measuring life expectancy, education, and income), with the Netherlands scoring the highest, South Africa scoring the lowest, and Iran in between the two (UNDP, 2012).

Although the MHC-SF has not been used in previous research in Iran, it has been used in the Netherlands and South Africa. Findings of a large and representative sample of Dutch adults confirmed the three-factor structure and convergent validity of the MHC-SF in the Netherlands (Lamers et al., 2011). Keyes et al. (2008) administered the Setswana version of the MHC-SF to a sample of 1050 participants from the rural and urban areas of the North West Province of South Africa, confirming the three-factor structure and the criterion-related validity of this scale. These results are promising and encourage researchers to further examine understudied aspects of this scale. The present study sought to expand the previous research by investigating the measurement invariance of the MHC-SF, and differences in the latent means of emotional, social, and psychological well-being across the three cultural groups.

2. Statistical strategy of the study

For testing measurement invariance, first, each group is individually tested for goodness of fit. Then a series of increasingly restrictive measurement invariance tests are performed. The most important tests are for configural, metric, and scalar invariance (e.g., Chen, 2008; Cheung & Rensvold, 2002). However, the test of measurement invariance may continue after scalar invariance is supported (e.g., testing the invariance of factor variances/covariances).

To some researchers, full measurement invariance seems scientifically unrealistic, in particular when the number of groups exceeds two, and the groups are from diverse national backgrounds (e.g., Torsheim et al., 2012). Moreover, when the instrument is translated into heterogeneous languages, full measurement invariance is unlikely (e.g., Lvina et al., 2012). In such occasions, establishing partial invariance is the best option. If at least two of the indicators of a factor are scalar invariant, its latent means can be compared across groups (e.g., Byrne, Shavelson, & Muthén, 1989). Latent mean analysis (using structural equation modelling) is more powerful, and leads to less biased mean estimates compared to

general linear models (e.g., ANOVA and *t* test) (Byrne et al., 1989; Steinmetz, 2011; Thompson & Green, 2006).

3. Method

3.1. Participants and procedure

A total of 1120 participants in three nations took part in this study (Mean age = 21.44, *SD* = 3.16). All participants were university students. The demographic characteristics of the samples are summarized in Table 1. Participants responded to the survey voluntarily or in exchange for course credit. Whereas the South African participants used the English version of the scale, the Iranian and Dutch participants used the Persian and Dutch versions. In Iran, the items were translated using the method of back-translation. In the Netherlands, the validated Dutch version was used (Lamers et al., 2011, 2012)[2].

3.2. Instrument

The MHC-SF (Keyes, 2002) consists of 14 items covering the three subscales of emotional well-being (3 items; e.g. 'How often did you feel happy?'), social well-being (5 items; e.g., 'How often did you feel that you belonged to a community?'), and psychological well-being (6 items; e.g., 'How often did you feel good at managing the responsibilities of your daily life?'). Each item represents a feeling of well-being, of which the frequency in the last month is rated (1 = *never* to 6 = *every day*). Total scores were computed for emotional well-being (range 1–18), social well-being (range 1–30), and psychological well-being (range 1–36). The internal consistencies of the subscales are presented in Table 1. Descriptive statistics for the items are presented in Table 3.

3.3. Statistical analysis

In the present study, confirmatory factor analyses were conducted using Mplus 6 (Muthén & Muthén, 2010). The kurtosis (ranging between −1.08 and 0.34) and skewness (ranging between −0.91 and 0.60) indexes of the 14 items were well below the absolute values suggested in previous research (e.g., Finney & DiStefano, 2006). Therefore, maximum likelihood (ML) estimation was used in all the analyses. Because the χ^2-difference test is sensitive to sample size, in the present study, the models were compared using ΔCFI test. An absolute difference in CFI that is less than 0.01 would indicate invariance (Cheung & Rensvold, 2002). Based on a principal axis factoring in all the three cultures (conducted in SPSS 19), we chose items 3, 6 and 13 as referent indicators for the three subscales (i.e., emotional, social, and psychological

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[2] It is worth mentioning that the South African sample consisted solely of bilingual Afrikaans mother tongue speaking participants, completing the English version of the MHC-SF. Individualistic values are more strongly emphasized in this group in comparison to other South African cultural groups. Therefore, the current findings should not be generalized to other groups in South Africa before further analyses are undertaken.

Table 2
Single-group confirmatory factor analyses.

	χ^2	df	p	CFI	SRMR	RMSEA	90% CI for RMSEA	
							LL	UL
The Netherlands	200.574	73	0.00	0.926	0.054	0.075	0.063	0.088
South Africa	217.554	73	0.00	0.905	0.062	0.078	0.066	0.090
Iran	227.876	73	0.00	0.940	0.042	0.066	0.057	0.076

Note: In all the groups, the residual terms of items 12 and 13 were allowed to covary.
CFI = comparative fit index; SRMR = standardized root mean squared residual; RMSEA = root mean square error of approximation; LL = lower limit; UL = upper limit.

Table 3
Factor loadings for baseline model and descriptive statistics for items.

	Unstandardized coefficients (standardized)			Descriptive statistics					
	Netherlands	South Africa	Iran	Netherlands		South Africa		Iran	
				M	SD	M	SD	M	SD
Item 1	1.10 (0.84)	0.86 (0.71)	0.71 (0.69)	4.35	1.13	4.74	.80	4.01	1.31
Item 2	1.09 (0.80)	1.01 (0.74)	0.97 (0.82)	4.65	1.19	4.72	.91	4.14	1.49
Item 3[a]	1.00 (0.78)	1.00 (0.74)	1.00 (0.89)	4.46	1.11	4.41	.89	3.86	1.42
Item 4	1.09 (0.64)	0.59 (0.47)	1.12 (0.61)	2.78	1.27	3.65	1.17	3.18	1.64
Item 5	1.07 (0.58)	0.86 (0.59)	1.29 (0.67)	4.10	1.39	4.55	1.37	3.51	1.71
Item 6[a]	1.00 (0.59)	1.00 (0.69)	1.00 (0.56)	2.35	1.27	2.97	1.35	2.34	1.59
Item 7	1.36 (0.67)	0.80 (0.63)	1.01 (0.56)	3.65	1.53	3.89	1.19	2.99	1.62
Item 8	1.00 (0.48)	0.91 (0.68)	1.08 (0.59)	3.39	1.56	2.96	1.25	3.24	1.62
Item 9	1.08 (0.70)	1.00 (0.70)	1.07 (0.75)	4.14	1.27	4.61	1.00	3.93	1.43
Item 10	0.87 (0.59)	0.81 (0.57)	1.07 (0.74)	4.22	1.19	4.77	.98	3.83	1.44
Item 11	0.90 (0.63)	0.95 (0.63)	0.90 (0.64)	4.79	1.16	5.00	1.04	4.27	1.39
Item 12	0.88 (0.52)	0.58 (0.41)	0.87 (0.54)	3.87	1.40	4.98	.97	3.91	1.60
Item 13[a]	1.00 (0.67)	1.00 (0.61)	1.00 (0.64)	4.08	1.22	4.67	1.14	3.97	1.54
Item 14	1.34 (0.77)	1.30 (0.76)	1.06 (0.67)	4.27	1.43	4.73	1.19	4.07	1.56
Item 12 with Item 13	0.28 (0.25)	0.20 (0.25)	0.38 (0.24)						
EM with SW	0.39 (0.60)	0.40 (0.65)	0.66 (0.58)						
EM with PW	0.61 (0.85)	0.35 (0.76)	0.78 (0.62)						
SW with PW	0.48 (0.78)	0.44 (0.67)	0.68 (0.76)						

Note: EW = emotional well-being; SW = social well-being; PW = psychological well-being.
All coefficients were significant at *p* < .001.
[a] Referent indicator.

well-being, respectively) because they had the highest factor loadings on their respective factors (detailed results of this analysis are available from the first author upon request).

4. Results

4.1. Single-group CFAs

We first tested the measurement model of the MHC-SF separately in each culture. The modification indexes showed that, in all three cultures, the fit of the model would improve if the residuals of item 12 and item 13 were free to covary. The fit of the baseline model with this covariance in all cultures was acceptable. The resulting fit indexes after allowing this modification are presented in Table 2. The factor loadings are shown in Table 3.

4.2. Configural invariance

The baseline model with no equality constraint was simultaneously tested across all groups. As can be seen in Table 4 (M1),

the fit of this model to the data was acceptable, indicating that the configural invariance of this scale is established.

4.3. Metric invariance

Equality constraints were imposed on all factor loadings. As shown in Table 4 (M2), the ΔCFI (=−0.01) was not large enough to reject metric invariance. This indicates full metric invariance.

4.4. Scalar invariance

We imposed equality constraints on all item intercepts to test scalar invariance (M3). The ΔCFI (=−0.06) was large. Inspection of the modifications indexes suggested that freeing the constraints for four items (1, 4, 8 and 12) would improve the fit of the model substantially. As can be seen in Table 4 (M4), after relaxing the equality constraints of these intercepts, the ΔCFI (=−0.01) was not large enough to reject partial scalar invariance.

Table 4
Testing for measurement invariance across three groups.

	χ^2	df	CFI	RMSEA	SRMR	M comparison	ΔCFI
M1. Configural invariance	646.00	219	0.92	0.072	0.052	–	–
M2. Full metric invariance	733.74	241	0.91	0.074	0.071	M2–M1	−0.01
M3. Full scalar invariance	1136.30	263	0.85	0.094	0.097	M3–M2	−0.06
M4. Partial scalar invariance	814.40	255	0.90	0.077	0.077	M4–M2	−0.01
M5. Full invariance of factor variances/covariances and the item residual covariance	986.566	269	0.87	0.085	0.171	M5–M4	−0.03
M6. Invariance of two factor variances, all factor covariances, and the item residual covariance	887.463	267	0.89	0.079	0.141	M6–M4	−0.01

Note: CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean squared residual.

4.5. Invariance of the item residual covariance and factor variances/covariances

We imposed equality constraints on all the factor covariances and variances and the single item residual covariance. As can be seen in Table 4 (M5), the ΔCFI (=−0.03) was large enough to reject invariance. By freeing the constraint of the variance of emotional well-being (as suggested by modification indexes), the fit of the model improved, and the ΔCFI (=−0.01) became small enough, indicating that the item residual covariance, two of the factor variances, and all of the factor covariances were invariant (M6).

4.6. Latent mean differences

Given that at least two indicators of each of the factors are scalar invariant, we proceeded with comparing latent means across groups (Byrne et al., 1989). In order to investigate latent mean differences, preserving all the constraints of the previous models, the latent factor means in the Netherlands were constrained to zero (i.e., this culture functioned as the reference group), whereas the latent means in South Africa and Iran were freely estimated (Byrne, 2012). This analysis showed that Iran scored significantly lower than the Netherlands on emotional (unstandardized fitted $\text{mean}_{(\text{Iran})}$ = −0.55, SE = 0.08, $p < 0.001$), social (unstandardized fitted $\text{mean}_{(\text{Iran})}$ = −0.38, SE = 0.07, $p < 0.001$), and psychological (unstandardized fitted $\text{mean}_{(\text{Iran})}$ = −0.27, SE = 0.07, $p < 0.001$) well-being. South Africa scored significantly higher than the Netherlands on social (unstandardized fitted $\text{mean}_{(\text{SAfrica})}$ = 0.40, SE = 0.08, $p < 0.001$), and psychological (unstandardized fitted $\text{mean}_{(\text{SAfrica})}$ = 0.44, SE = 0.07, $p < 0.001$) well-being. In a second analysis, South Africa was chosen as the reference group. This analysis revealed that Iran scored significantly lower than South Africa on emotional (unstandardized fitted $\text{mean}_{(\text{Iran})}$ = −0.56, SE = 0.07, $p < 0.001$), social (unstandardized fitted $\text{mean}_{(\text{Iran})}$ = −0.78, SE = 0.07, $p < 0.001$), and psychological (unstandardized fitted $\text{mean}_{(\text{Iran})}$ = −0.72, SE = 0.07, $p < 0.001$) well-being.

5. Discussion and conclusion

Keyes' mental health model (2002) posits that positive mental health has a three-factor structure, including emotional, psychological, and social well-being. This model has received some empirical support generally in studies conducted in single cultures (Gallagher et al., 2009; Keyes et al., 2008; Lamers et al., 2011; Robitschek & Keyes, 2009). Using samples from three different cultures from three continents, we investigated the cross-cultural utility of a short scale developed by Keyes (the MHC-SF) that captures these three factors. Our results confirmed that the factor structure proposed by Keyes fitted the data well in these cultural groups. This is in line with earlier findings in South Africa (Keyes et al., 2008) and the Netherlands (Lamers et al., 2011). The findings of the current multi-national study thus reinforce the previous studies suggesting that Keyes' three-dimensional model of positive mental health is a promising conceptualization that is applicable to various cultural contexts. Furthermore, this study was the first to investigate the factor structure of the MHC-SF in an Iranian sample, and thus can be considered an important contribution to the scientific study of positive mental health in this understudied culture.

The present study provides significant input into some of the current debates in the field of positive mental health. For example, the findings of the present study are clearly at odds with the line of theorizing that attempts to reduce positive mental health to its emotional aspects, ignoring psychological and social functioning (e.g., Helliwell, Layard, & Sachs, 2012; Kashdan et al., 2008). Our findings also highlight the importance of social well-being in

well-being research (Keyes, 1998). Neglect of social well-being as an aspect of positive mental health has led to sometimes simplistic understandings of the nature of positive mental health (Joshanloo & Ghaedi, 2009).

One of the significant contributions of the present study was to establish full metric invariance for the MHC-SF across these three samples. Metric invariance suggests that the strength of the relationships between the items and factors is equivalent across the populations used (Rock, Werts, & Flaugher, 1978). Therefore, the relationship between the latent factors of the MHC-SF and other concepts (e.g., physical health, certain beliefs) be reliably compared across groups (Chen, 2008). This study also established the partial scalar invariance of this scale. Four item intercepts were found to be noninvariant across the groups, namely item 1 (related to happiness), item 4 (related to social contribution), item 8 (related to social coherence), and item 12 (related to personal growth). These findings partially overlap the findings of Lamers et al.'s (2012) study in the Netherlands where items 8 and 12 showed differential item functioning across sex or age, respectively. That the intercepts of these items are not invariant means that individuals with the same score on the latent variable in the three groups would not obtain the same score on these four items (Chen, 2008). For example, a score of 3 in one culture corresponds to a score of 4 in another. In other words, individuals' scores on these items are partly the product of various group-dependent response biases rather than actual differences in latent means. Such information can help gain a better understanding of the interaction between positive mental health and culture, and help us improve the existing scales. It is also worth mentioning that, to many researchers, full measurement invariance seems scientifically unrealistic, in particular when the number of groups exceeds two, and the groups are from diverse national backgrounds and have various languages (De Beuckelaer & Swinnen, 2011; Horn, 1991; Lvina et al., 2012). For the MHC-SF, the majority of the item intercepts were invariant; a finding that is impressive given the diverse samples used in this study.

Another telling finding about the factor structure of this scale was that, in all the samples studied here, specifying a covariance between items 12 (related to personal growth) and 13 (related to autonomy) improved the fit of the model. This might be because both items are a reflection of one's ability for regulation from within and a need for self-actualization. Personal growth and autonomy capture existential aspects of well-being as formulated by existential and humanistic psychology (Ryff & Singer, 2008; Waterman et al., 2010). It is possible therefore to argue that with the fulfillment of autonomy and personal growth as intrinsically regulated, there is a subjective feeling of self-expression and authenticity. In light of this conceptual similarity, it seems also likely that continued personal growth leads to increased autonomy (or vice versa). Future studies along these lines can shed more light on the relationship between these two concepts.

We found that Iran scored the lowest among the three cultures on well-being. Using a more powerful statistical technique (i.e., latent mean analysis) and a more comprehensive scale, this finding reinforces previous findings showing that generally Iran scores low on mental well-being (e.g., Lischetzke, Eid, & Diener, 2012; Minkov, 2009). We also found that South Africa scored higher than the Netherlands on social and psychological aspects of well-being. Prior research shows that South Africa generally scores lower than the Netherlands on subjective well-being (e.g., Inglehart, 2010). To partially explain this inconsistency, it should be noted that South Africa scored higher than the Netherlands in the functional (i.e., social and psychological) aspects of mental well-being, which have not been measured in the prior studies on subjective well-being. These findings indicate that it is not sufficient to compare cultures only in emotional aspects of mental well-being. For a more com-

prehensive comparison, functional aspects should also be included. It is also noteworthy that our South African sample consisted solely of Afrikaans speakers, and the results cannot be generalized to all other South African groups.

In sum, the present study confirmed the cross-cultural utility of the MHC-SF. Although the findings are promising, the study inevitably had limitations. For example, whereas positive mental health can be negatively related to age (e.g., Lamers, Westerhof, Bohlmeijer, & Keyes, in press), and positively to educational level (Diener et al., 1999), the present samples consisted merely of young educated students. Therefore, the findings cannot be generalized to less educated and older samples in these cultures. This study also did not investigate the relationship of this scale with other constructs. Therefore, a fruitful avenue for future research would be to establish the nomological network of this scale across cultures.

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