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Validation of a Spanish Version of the Mental Health Continuum-Short Form Questionnaire

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Abstract

Background: The Mental Health Continuum-Short Form (MHC-SF) is a multidimensional measure of well-being designed to assess emotional, psychological and social well-being. It has been translated into different languages; however, there is no validated Spanish version. Our aim was to provide the Spanish-speaking community with a validated version of the MHC-SF. **Method**: We translated the questionnaire into Spanish (s-MHC-SF) and assessed its validity in a sample of 3,355 Chilean adults. The data was subjected to a confirmatory factor analysis using the original correlated-traits three-factor model and a recently described bifactor model. **Results**: The scores obtained with s-MHC-SF had excellent reliability (α = .94). While the correlated-traits three-factor model provided an acceptable fit to the data, the bifactor model yielded a superior fit. According to measurement invariance results, both models could be used to compare scores over gender, geographical region, age, and time in the sample. **Conclusion**: s-MHC-SF is a valid questionnaire for the evaluation of personal well-being in Spanish-speaking populations.

Keywords: Factor analysis, statistical, mental health, well-being, surveys and questionnaires, Spanish

Resumen

Validación de la versión en español del Cuestionario del Continuo de Salud Mental-Versión Corta. **Antecedentes**: el Mental Health Continuum-Short Form (MHC-SF) es un instrumento multidimensional diseñado para evaluar los componentes emocional, psicológico y social del bienestar personal. Ha sido traducido a varios idiomas; sin embargo, no hay una versión validada en español. Nuestro objetivo fue proveer a la comunidad hispanoparlante de una versión válida del MHC-SF. **Método**: MHC-SF se tradujo al español (s-MHC-SF) y se aplicó a una muestra de 3.355 adultos chilenos. Se realizó un análisis factorial confirmatorio usando el modelo original de tres factores correlacionados y un modelo bifactorial recientemente descrito. **Resultados**: los puntajes obtenidos con el s-MHC-SF mostraron alta confiabilidad (α = .94). Mientras el modelo correlacionado presentó un ajuste aceptable a los datos, el bifactorial mostró un ajuste superior. Según las pruebas de invarianza de medición, ambos modelos podrían ser utilizados para comparar puntajes según sexo, edad, región geográfica y tiempo en la muestra. **Conclusión**: s-MHC-SF es un cuestionario válido para evaluar el bienestar en la población de habla hispana.

Palabras clave: análisis factorial, estadístico, salud mental, bienestar, encuestas y cuestionarios, español.

Defining mental health positively implies conceiving mental health not only as the absence of mental disability or illness but also as the presence of different psychosocial resources that contribute to the realization of the full individual potential. This positive approach to mental health is receiving increasing attention in psychological research and practice, as well as in other disciplines such as economics, health, and policy-making (De Vos, 2012; Diener, Emmons, Larsen, & Griffin, 1985; Martínez Aldunate, Ivanovic-Zuvic Ramírez, & Unanue Manríquez, 2013; Nitsche, Bitran, Pedrals, Echeverría, & Rigotti, 2014; Thin, 2012).

In 2002, Corey Keyes formulated and operationalized a model of mental health continuum (Keyes, 2002). Unlike other models that focus on a particular area of well-being Keyes's model includes three dimensions of mental health: emotional (EWB), psychological (PWB) and social (SWB). EWB captures the presence of positive affect and satisfaction with life (Diener et al., 1985; Diener & Seligman, 2002; Lyubomirsky, King, & Diener, 2005). PWB focuses on the individual's intrapersonal and interpersonal functioning (Keyes, Shmotkin, & Ryff, 2002; Ryff, 2014). SWB reflects how well an individual functions in society. This model served as the theoretical foundation for the development of the Mental Health Continuum Scale (MHC-LF: Keyes, 2002, 2005, 2007), a 40-item self-administered questionnaire.

Subsequently, a shorter 14-item version of this scale was developed (Keyes, 2009). Unlike the original scale, MHC-SF has become popular in well-being research and assessment (Hone, Jarden, Schofield, & Duncan, 2014), presumably because of its brevity, in addition to its theoretical basis and comprehensive nature (Ro & Clark, 2009).

MHC-SF has been translated into different languages and validated across diverse cultural contexts (Joshanloo, Wissing, Khumalo, & Lamers, 2013; Jovanović, 2015; Karaś, Cieciuch, & Keyes, 2014; Lamers, Westerhof, Bohlmeijer, ten Klooster, & Keyes, 2011; Machado & Bandeira, 2015; Petrillo, Capone, Caso, & Keyes, 2014). While most studies confirmed the originally proposed

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three-factor structure, two recent studies (de Bruin & du Plessis, 2015; Jovanović, 2015) questioned the goodness-of-fit of this model and reported that a bifactor model best explains MHC-SF's inner structure in Serbian and South African samples, respectively. A bifactor model consists of one overall factor and many domain-specific factors, such that each item loads both on the general factor as well as on one of the domain-specific factors (Reise, 2012) (see fig. 1). From a conceptual point of view, the bifactor model seems a reasonable solution for multidimensional scales like the MHC-SF, aimed at measuring complex constructs with moderately associated components (Chen, West, & Sousa, 2006).

To our knowledge, there are no published Spanish versions of MHC-SF. To provide the Spanish-speaking community with a valid and reliable measure of personal well-being, we assessed the reliability and internal validity of a Spanish translation of the MHC-SF in a sample of Chilean adults.

Method

Participants

The sample of Chilean adults (N = 3,355) that answered the s-MHC-SF from January 2013 to July 2015 was primarily composed of women (71%) and young adults (mean age = 33.8, SD = 12.2, range = 20 to 83 years old). Most of them (78%) had completed more than 12 years of formal education, and almost two thirds (62%) lived in the Metropolitan Region of Chile, although the sample contained residents from all 15 regions of the country. For independent model goodness-of-fit evaluation and measurement invariance evaluation, the sample was randomly split into two samples. Sample 1 (n = 1,636), and sample 2 (n = 1,719) were statistically independent with equivalent composition by age (one-way ANOVA, p = .94), gender, geographical region, and response year (χ^2 sample independence test, p = .47, .77, and .36 respectively).

Instrument

The Mental Health Continuum-Short Form (MHC-SF: Keyes et al., 2008) consists of 14 items that measure emotional (3 items), social (5 items), and psychological well-being (6 items). Participants are asked to rate how often they felt a certain way during the last month, on a 6-point Likert scale.

Procedure

Translation. To ensure a proper translation of the MHC-SF, we adopted the back-translation approach. Two native Spanish

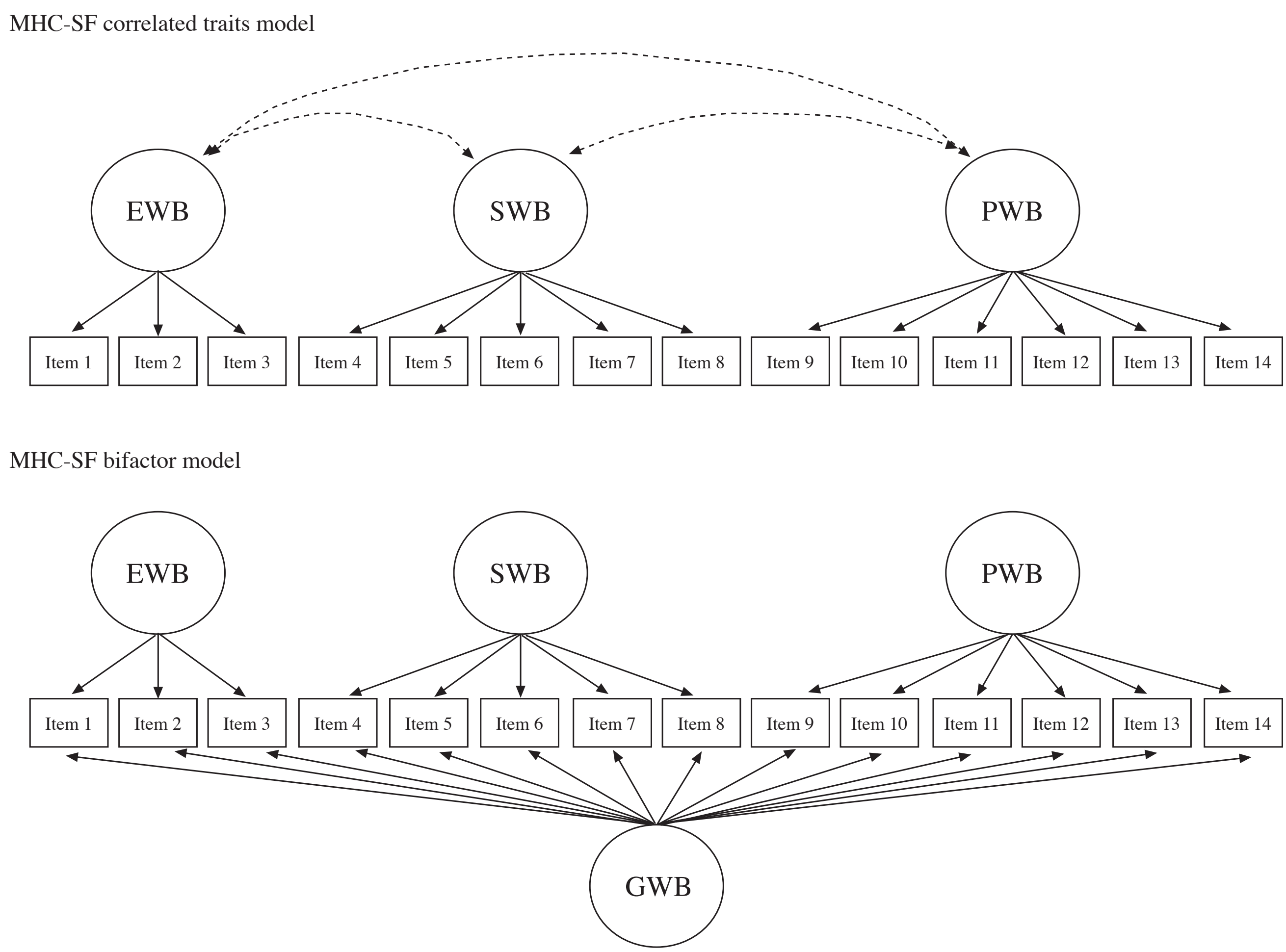

Figure 1. Evaluated models of s-MHC-SF's structure: correlated-traits model and bifactor model. GWB: general well-being, EWB: emotional well-being, SWB: social well-being, PWB: psychological well-being

speakers independently translated the English version of the MHC-SF into Spanish. A consensual version was generated by a third native Spanish speaker. Then, this consensual version was translated back into English by one native English speaker, and compared to detect any semantic differences and determine that there was no significant loss or bias in the translation process. Those invited to assist in the back-translation process jointly agreed upon the translation's accuracy. The s-MHC-SF has been made available (Echeverría et al., 2016) for public use provided that proper credits are given to the original author of the questionnaire.

Application. The translated instrument was completed by registered users at the online platform of *Aliméntate Sano* [Eat Healthy] Program of the Centre for Molecular Nutrition and Chronic Diseases from the Pontificia Universidad Católica de Chile. Participants voluntarily answered a set of well-being questionnaires, including the MHC-SF, after providing informed consent. The online platform and the study were reviewed and approved by the Ethics Committee of our institution.

Data analysis

There were no missing values due to the application method of the questionnaire.

Four models were specified for the confirmatory factor analysis (CFA): Three first-order models with one, two and three correlated factors respectively, and a nested-factor or bifactor model with three domain-specific factors. In the one-factor model all items load directly on a single general factor. In the two-factor model items 1-3 load on a latent variable corresponding to hedonic well-being and items 4-14 load on a latent variable corresponding to eudaimonic well-being. In the three-factor model, items 1-3 load on the latent variable of emotional well-being (EWB), items 4-8 on social well-being (SWB), and items 9-14 on psychological well-being (PWB) (Joshanloo et al., 2013; Karaś et al., 2014; Keyes et al., 2008; Lamers et al., 2011; Petrillo et al., 2014). In the bifactor model every item loads onto one of the three domain-specific factors (as specified in the first-order three-factor model), and also onto a general well-being (GWB) factor (de Bruin & du Plessis, 2015; Jovanović, 2015).

The correlated-traits three-factor (CTT) and the bifactor (BF) models were compared in detail. The one-factor and two-factor models were modeled for global goodness-of-fit comparison as in previous validation studies of the MHC-SF and versions.

For all correlation-based analyses, polychoric correlation matrices built from the raw data were used. Parameter estimates in CFA were obtained using the means and variance adjusted weighted least squares estimator, scale-shifted approach (WLSMV). WLSMV was chosen because it has been reported to give optimal results with ordinal, non-normal data (Beauducel & Herzberg, 2006; Flora & Curran, 2004; Lei, 2009; Li, 2014). Polychoric correlation and WLSMV estimator also correct for potential measurement error such as censored variables (Jöreskog, 2002; Kline, 1998/2015; Muthén & Muthén, 2012).

Several fit indices were used to evaluate and compare descriptive goodness-of-fit: two comparative fit indices: Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI); one parsimony correction index: Root-Mean-Square Error of Approximation (RMSEA); and one absolute fit index: Weighted Root-Mean-square Residual (WRMR).

Cutoff values were derived from simulation studies (Bentler, 1990; Browne & Cudeck, 1992; Hu & Bentler, 1999; Yu, 2002), using the following criteria: good fit cutoff values: CFI ≥ .96, TLI ≥ .95, RMSEA ≤ .05; acceptable fit cutoff values: CFI and TLI ≥ .90, RMSEA < .08; mediocre fit cutoff values: if .08 ≤ RMSEA ≤ .10, with CFI and TLI ≥ .90. Meeting at least two of the three criteria just described in one level of satisfaction, and the remaining in an adjacent level (upper or lower), the model fit was assumed as conforming to the former (Brown, 2006/2015; Hu & Bentler, 1999). Finally, if CFI or TLI < .90, or RMSEA > .10 the model were rejected. WRMR (smaller is better) was used to corroborate model comparison since it contributes to evaluating aspects of goodness-of-fit that the other indices do not evaluate (Muthén & Muthén, 2012); nonetheless, cutoff values were not used since they have not been properly studied yet (Muthén, 2013).

For reliability measures, several coefficients were calculated. Cronbach's α, and McDonald's ω and ω_t (McDonald, 1999/2013) were reported as indices of internal consistency of the respective constructs, *i.e.* the measure of the proportion of variance due to all common factors (ω_t) or items (α and ω). Additionally, for bifactor model constructs McDonald's ω_h (as relabeled by Zinbarg, Revelle, Yovel, & Li, 2005) with respective ω_s coefficients were reported as indices of factor saturation (domain-specific reliability).

Measurement invariance over sex, age, geographical region, and response year was evaluated in Sample 2 through multi-group CFA using χ^2-based likelihood-ratio test (LRT) with Satorra (2000) adjusted test statistic. For this purpose, latent variables were scaled with effects coding method (Little, Slegers, & Card, 2006). For every grouping variable, a random subsample was used to ensure equal *n* per group.

All statistical analyses were performed with R software 3.3.0 (R Core Team, 1997/2016). CFA was conducted with Lavaan package 0.5.20 (Rosseel, 2012).

Data and code have been made available (Echeverría et al., 2016) for reproducibility.

Results

Factorability of the data was excellent according to Bartlett's sphericity test ($\chi^2 = 16990$, $df = 91$, $p<.001$) and Kaiser-Meyer-Olkin (Kaiser & Rice, 1974) measure of sampling adequacy (.95). Data were not multivariate normal according to Henze-Zirkler's, Mardia's and Royston's tests ($p<.001$).

Descriptive goodness-of-fit indices

Based on obtained goodness-of-fit indices (Table 1), MHC-SF one-factor or two-factor models presented an *unacceptable* global fit, with RMSEA over the rejection cutoff value. The three-factor model (CTT) had an *acceptable* fit with CFI and TLI on good-fit values and RMSEA on mediocre-fit value. The BF model had *good* overall fit with CFI and TLI in good-fit values and RMSEA on acceptable value. WRMR comparison was consistent with these results.

Factor loadings and reliability

Factor loadings for the CTT model (Table 2) were all large (range = .70 - .89) and statistically significant ($p<.001$).

In the bifactor model (Table 2), item loadings onto the general factor were all large (range = .59 - .83, $p<.001$). All three domain-specific factors had at least two salient (≥ .30) loading. Some item loadings onto domain-specific factors were relatively small (< .30; items 1, 4, 5, 11 and 14), but none of them was close to zero, as all parameter estimates were statistically significant ($p<.001$). The variance of every domain-specific factor differed significantly from zero ($p<001$).

Cronbach's α indicates an excellent internal consistency of scores from both the total scale and its subscales for both models (Table 2). Coefficient ω for subscale internal consistency also exhibited excellent indices, the same in both models (reported only for CTT). The ω_t internal consistency coefficient presented excellent internal consistency for both models in both samples.

Table 1
CFA Global goodness-of-fit indices (Both samples)

Model	SBχ² (*df*)	SBχ² / *df*	CFI	TLI	RMSEA [90% CI]	WRMR
Sample 1						
Single factor	3368.9 (77)	43.8	.915	.899	.162 [.157, .166]	3.66
Two factors	2828.3 (76)	37.2	.929	.914	.149 [.144, .154]	3.32
Three factors	1256.6 (74)	17.0	.969	.962	.099 [.094, .104]	2.05
Bifactor	465.74 (63)	7.4	.990	.985	.063 [.057, .068]	1.10
Sample 2						
Single factor	3312.6 (77)	43.0	.913	.897	.156 [.152, .161]	3.62
Two factors	2770.8 (76)	36.5	.928	.914	.144 [.139, .148]	3.27
Three factors	1191.4 (74)	16.1	.970	.963	.094 [.089, .098]	1.99
Bifactor	489.8 (63)	7.8	.989	.983	.063 [.058, .068]	1.14

Note: SBχ² = Satorra-Bentler scaled chi-square, *df* = degrees of freedom, CFI = Comparative fit index. TLI = Tucker-Lewis index. RMSEA = Root-mean-square error of approximation. WRMR = Weighted root-mean-square residual

Factor saturation indices (domain-specific reliability) were calculated only for the bifactor model since ω_h and ω_s are -by definition- zero for non-hierarchical models. The high value of the ω_h coefficient indicates very high saturation of the general factor; thus, a sizable proportion of reliable variance in the scale scores was accounted for by the general well-being factor, and therefore a small portion of reliable variance in the scale scores could be accounted for by the domain-specific factors (cf. Brunner, Nagy, & Wilhelm, 2012; Reise, 2012).

Measurement Invariance through multi-group CFA

Alternative fit indices (CFI, RMSEA) for configural invariance were acceptable in the CCT and the BF models when analyzed by gender, geographical region, age and year-of-response groups (Table 3). Likelihood-ratio test indicates sustainable loadings' and intercepts' measurement invariance ($p>.05$) for every grouping variable. Age was the only one of these grouping variables that showed to be a statistically significant source of population heterogeneity in factor score means.

Discussion

The aim of this study was to assess the reliability and validity of a Spanish version of the MHC-SF (s-MHC-SF) in a sample of Chilean adults. We used Confirmatory Factor Analysis to evaluate and compare the fit of the originally proposed three correlated factors model and that of a recently described bifactor model (de Bruin & du Plessis, 2015; BF: Jovanović, 2015).

CTT model displayed acceptable goodness-of-fit indices, better than those of a single factor or a two-factor model. All factor loadings were large and statistically significant, and similar or larger than those reported in previous validations studies in other cultures (Joshanloo et al., 2013; Karaś et al., 2014; Lamers et al., 2011; Petrillo et al., 2014). These results contrast with the findings

Table 2
CFA Standardized factor loadings and strength indices (Sample 1)

Item & dimension	Correlated-Traits model				Bifactor model				
	EWB	SWB	PWB	total	EWB	SWB	PWB	GWB	total
01. Happiness	.81				.29			.74	
02. Interest	.88				.30			.81	
03. Life Satisfaction	.88				.44			.81	
04. Social contribution		.80				.17		.68	
05. Social integration		.70				.30		.60	
06. Social actualization		.82				.60		.62	
07. Social acceptance		.73				.53		.59	
08. Social coherence		.78				.62		.61	
09. Self-acceptance			.80				.36	.75	
10. Mastery			.80				.31	.70	
11. Positive relations			.82				.26	.77	
12. Personal growth			.82				.26	.74	
13. Autonomy			.81				.49	.67	
14. Purpose in life			.89				.09	.83	
Cronbach's α	.89	.86	.93	.94	.89	.86	.93	.94	.94
McDonald's $\omega_{(t/h/s)}$	ω=.87	ω=.85	ω=.91	ω_t=.95	ω_s=.16	ω_s=.31	ω_s=.11	ω_h=.86	ω_t=.94

Note: GWB = general well-being, EWB = emotional well-being, SWB = social well-being, PWB = psychological well-being

Table 3
Likelihood-ratio test (χ^2 difference test) for Multi-group Measurement Invariance (Sample 2)

Invariance level	Correlated-traits				Bifactor			
	χ^2 (*df*)	$\Delta\chi^2$ [CFI]	Δdf [RMSEA]	p (>χ^2)	χ^2 (*df*)	$\Delta\chi^2$ [CFI]	Δdf [RMSEA]	p (>χ^2)
Gender[a]								
Configural	436.3 (145)	[.969]	[.093]		213.3 (122)	[.984]	[.074]	
Loadings	482.2 (159)	2.87	2.92	.398	273.8 (150)	4.95	4.72	.385
Intercepts	489.2 (212)	1.00	9.96	>.999	267.0 (202)	-0.97	9.96	>.999
Means	529.6 (215)	3.33	1.59	.134	328.3 (206)	5.31	1.96	.068
Response Year[b]								
Configural	580.5 (145)	[.972]	[.092]		228.6 (122)	[.988]	[.066]	
Loadings	612.2 (159)	1.66	2.62	.573	266.7 (150)	2.65	4.30	.663
Intercepts	635.0 (212)	3.18	9.78	.973	289.4 (202)	3.17	9.78	.974
Means	652.2 (215)	1.34	1.57	.401	311.6 (206)	1.80	1.87	.378
Geographic Region[c]								
Configural	520.5 (216)	[.971]	[.094]		229.2 (181)	[.987]	[.069]	
Loadings	587.1 (244)	2.19	3.78	.668	444.6 (237)	10.58	6.67	.138
Intercepts	611.4 (350)	1.54	10.41	.999	387.1 (341)	-3.64	10.41	>.999
Means	684.1 (356)	2.78	1.73	.204	458.0 (349)	2.82	2.12	.265
Age[d]								
Configural	745.9 (216)	[.966]	[.088]		259.9 (181)	[.990]	[.061]	
Loadings	857.1 (244)	4.57	3.85	.314	457.2 (237)	10.39	6.10	.115
Intercepts	1,045.0 (350)	13.13	9.72	.199	521.8 (341)	4.51	9.72	.910
Means	1,304.5 (356)	9.76	1.56	.004	948.0 (349)	16.41	1.84	<.001

Note: SBχ^2 = Satorra-Bentler scaled chi-square, *df* = degrees of freedom. CFI = Comparative fit index, configural invariance only. RMSEA = Root-mean-square error of approximation, configural invariance only. [a] n = 483 per gender. [b] n = 715 per group. [c] n = 385 for metropolitan and south regions, n = 262 for north region. [d] n = 570±2 per group

reported by Jovanović (2015) in Serbian population, where the CTT model did not meet acceptable fit indices.

On the other hand, the bifactor solution introduced by Jovanović (2015) and de Bruin & du Plessis (2015) modeled our data better than the CTT model, displaying good to excellent fit indices. There were no reasonable indicators of psychometric irrelevance of any of the domain-specific factors when including the general factor in the model (cf. Chen et al., 2006). Thus, after adjustment for the general well-being factor, all three well-being subscales of the MHC-SF still account for some additional, unique variance in the indicators. This capability of the bifactor model to account for general and domain-specific variance simultaneously, with a better fit to the data, is a good reason to prefer it over the CTT model. Since MHC-SF is a broad measure aimed at measuring a complex construct consisting of moderately associated factors, it can be argued that the BF model has theoretical and methodological bases for better score estimation and interpretation of the s-MHC-SF.

In this set of results, the reliability of the s-MHC-SF scores with the CTT model was high both for the entire scale as well as for the specific subscales. With the BF model, total and general reliability were good, while domain-specific reliability was considerably lower. Even though the multidimensionality of data was supported by the size of factor loadings, and goodness-of-fit of the BF model, the variance explained over and above the general factor was relatively low for SWB, and low for EWB and PWB. These results suggest caution while interpreting subscale scores, and instead encourages the interpretation of a general score as it was suggested by the scale author (Keyes, 2009). Thus, the general construct of mental health as measured by the s-MHC-SF seems acceptable to be used as a measure of well-being in the Chilean population.

As shown by the measurement invariance tests, both the CTT and BF models could be used to compare parameter estimates over gender, geographical region, age and from one year to another. Since age showed to be a source of population heterogeneity, individual differences between younger and older people should be interpreted with caution. These findings extend the work by Joshanloo *et al*. (2013), who demonstrated measurement invariance of the MHC-SF CTT model across cultures.

Future studies should address issues such as a more exhaustive evaluation of model specification, identification of sources of domain-specific insufficient saturation, and consequential factor loadings and subscale factors reliability enhancement. Also, an examination of convergent validity comparing the s-MHC-SF with other well-being measures should be undertaken.

One of the strengths of this study is the large sample size: 3,355 Chilean adults, including residents of the 15 regions of Chile with ages ranging between 20 and 83 years old. However large, this is a convenience sample and as such it is not representative of the Chilean population. Among the sample´s biases are the predominance of females and young people, with a presumably high level of education. A motivation bias cannot be ruled out as all subjects voluntarily registered in a self-care program.

A more representative sample, additional test-retest studies, longitudinal cohorts, cross-cultural research, and other multi-group CFA analysis should provide additional information on this translated questionnaire when applied in mental health and well-being studies.

In this study, we report several approaches for determining the validity and reliability of the scores obtained with the Spanish version of MHC-SF. We conclude that in our sample of Chilean adults the s-MHC-SF behaves at least as reliably as other language versions of the questionnaire do in other cultures. In sum, s-MHC-SF showed to be a valid version of the MHC-SF; thus, it may prove useful in the evaluation of well-being of Spanish-speaking populations, in particular, within the Latin American region.

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