The Spanish-Chilean trait emotional intelligence questionnaire-short form: The adaptation and validation of the TEIQue-SF in Chile.

Abstract

There is little doubt that currently trait EI (Trait emotional intelligence) theory and their measures have been found valid and reliable in several research and application settings. This research provides psychometric evidence of the TEIQue-SF in Chilean general and clinical population sample (n_1 = 335, n_2 = 120). The results confirmed the factor structure of the instrument and supported its multidimensionality. Hierarchical and bi-factor CFA models with the Spanish-Chilean-TEIQue-SF analysed its internal structure in the R environment, following the assessment of bi-factor ESEM models in Mplus. We performed these analyses both at the global and factor-level. CFA models did not reach acceptable fit statistics for the models, whereas ESEM models reached good to excellent fit for the bi-factor models proposed. We also implemented measurement invariance analyses, which provided evidence for full measurement invariance between the original UK validation sample and the Chilean samples up to the scalar level. Also, the means for the global trait EI factor and the four factors (Well-being, Self-control, Emotionality and Sociability) were alike previous psychometric research with the questionnaire. The results highlight the importance of performing multidimensional factor analysis through ESEM following a bi-factor interpretation of the TEIQue-SF internal structure.

The study of Emotional Intelligence (EI) in Chile and Latin-America

Although some studies have addressed EI in Chile, either their nature do not fit with the taxonomies already in place, or they suffer from methodological flaws. Therefore, addressing EI scientifically, with well-defined construct operationalisations, is eventually the only pathway for assessing the subjectivity of emotional experience (Petrides, 2009). Current research on emotional intelligence in Chile and Latin-America has usually not responded to psychometrically founded constructs such as trait EI. At most, local research has relied on trait EI scales of which no previous supporting psychometric evidence has been reported in the country. The latter is a serious limitation for assessing trait EI accurately not only in Chile but also in the region. For instance, some studies in the country have relied on the Spanish adaptation of the TMMS-48 (Trait Meta-Mood Scale-Spanish translation), performed in the late nineties in Spain (Fernández-Berrocal et al., 1998). Fernández-Berrocal, Salovey, Vera, Ramos and Extremera (2001) conducted a study based on this questionnaire four measures of emotional stability, where participants of U.S.A., Spain and Chile were compared cross-culturally regarding their trait EI and emotional stability. The authors concluded that the Spanish sample had a significantly lowest mean for trait EI compared to the U.S.A. and the Chilean samples. This latter also obtained the highest score for emotional balance. Although these authors did not inform measurement invariance between the samples, it can be deducted from the significant differences in means, that the trait EI construct, as measured by the TMMS-48, is likely to be non-invariant across applications, which raises uncertainty regarding latent means equivalence. Consequently, as Putnick and Bornstein (2016) stated, performing measuring invariance is essential to assess the invariance of any construct. The previous justify the necessity of counting with a non-invariant measure for assessing trait EI in the region, which can be equivalent across countries and applications.

The TMMS-48 was later replaced by the Spanish validation of its modified version—the TMMS-24—, a task performed by the same research team (Fernández-Berrocal, Extremera, & Ramos, 2004). This shorter measure, with only 24 items, was claimed to be better than the previous by eliminating items with loadings below .40 through PCA. In northern Chile, the TMMS-24 was used for assessing 117 special education officers (Veloso-Besio, Cuadra-Peralta, Antezana-Saguez, Avendaño-Robledo & Fuentes-Soto, 2013). These researchers found a high and significant correlation between trait EI and life satisfaction, subjective happiness, and resilience. Also, a multiple regression model confirmed the role of trait EI as predictor explaining life satisfaction. A third study took place in southern Chile, where trait EI and psychological well-being were studied in a sample of 97 nurses (Veliz-Burgos, Dörner-Paris, Soto-Salcedo, Reyes-Lobos & Ganga-Contreras, 2018). In this study, the authors reported high levels of trait EI with the TMMS-24. An interesting result coming from this study is the high and positive correlation between trait EI scores and psychological well-being. The previous provides another argument for the inclusion of a trait EI measure—such as TEIQue-SF—in the country, as this includes Well-being as one of its factors (Petrides, 2009).

Omar, Salessi, Urteaga and Vaamonde (2014), cross-culturally validated the self-report emotional intelligence test (Schutte et al., 1998). The researchers could not replicate the original unidimensional solution claimed by Schutte et al. (1998), informing a satisfactory fit for a model with two latent variables. These researchers employed principal component analysis (PCA), although PCA is regarded as a linear combination of correlated variables; in contrast to factor analysis, in which factors represent latent variables that cannot be measured directly (Revelle, 2012; Surh, 2005). Besides, the authors did not inform a proper measurement invariance procedure. In Peru, Ugarriza (2001) examined the factor structure of Bar-On's Emotional Quotient Inventory (EQ-I) in a large sample, providing evidence for construct validity. However, beyond χ^2, fit indices were not informed in the study. The author did not provide any measurement invariance procedure. Finally, unsuccessful efforts for validating trait EI measures, such as the TEIQue-SF, have taken place in Mexico, where Neri-Uribe and Juárez-García (2016), did not find enough support for the questionnaire's original factor structure, nor for the fit of the overall model through confirmatory factor analysis (CFA) in Mexico.

Trait emotional intelligence theory and the trait emotional intelligence-short form (TEIQue-SF)

Petrides, Pita and Kokkinaiki (2007) have defined Trait EI as a constellation of emotional perceptions assessed through questionnaires and rating scales. According to Petrides (2009), the trait EI questionnaires—which are designed for assessing trait EI— have extracted four factors for assessing the trait EI construct, i.e., Emotionality, Self-control, Sociability and Well-being; plus 15 facets (see Petrides, 2009). The TEIQue-SF is a thirty items self-report questionnaire that was intended as a competent measure of the global trait EI factor, which is an overall portrayal of the different levels and facets interweaving the trait EI construct, more comprehensively characterised through the full form (Petrides & Furnham, 2006). It is worth mentioning that short forms, like TEIQue-SF, allow access only to the global trait EI and the four-factor structure, whereas full forms allow for facets descriptions (Cooper & Petrides, 2010). According to Petrides (2009), high scorers for Well-being have a generalised sense of fulfilment and happiness, while high scorers for Self-control display a healthy degree of control over their impulses and external circumstances. Similarly, high scorers for Emotionality are more connected with their own and other people's emotional states, whereas high scorers for Sociability are known for having a great social influence (see Petrides, 2009).

Factor-dimensionality of the TEIQue-Short form. Cooper and Petrides (2010), studied a large sample of university students and laypeople in the United Kingdom with the TEIQue-SF. The researchers advocated for the unidimensionality of the construct following an Item Response Theory (IRT) model with Exploratory Factor Analysis, in which they found a good model fit. The authors claimed the unidimensionality of the construct. In two consecutive studies, the researchers found ratios above this threshold. In Spain, Laborde, Allen, and Guillén (2016) provided contrasting results. The researchers supported a hierarchical four-factor structure with a second-order factor (Global trait EI) instead of a unidimensional, for both the full and short TEI questionnaires in a large sample of students. CFA showed that the TEIQue-SF four-factor structure replicated with an excellent fit: $\chi 2$ (2) = 6.29, p = 0.00, *CFI* = 0.99, *RMSEA* = 0.05, 90% *CI* [0.03, 0.08], and *SRMR* = 0.02. In Germany, Jacobs, Sim, and Zimmermann (2015) examined a large sample of occupational therapists, providing evidence for a multidimensional higher-order structure of the TEIQue-SF (Morin, Arens & Marsh, 2015; Rindskopf & Rose, 1988). The researchers informed a good model fit after allowing the correlation between factors' errors $\chi 2$ (84) =143.45, $p < 0.001$, *CFI* = 0.95, *RMSEA* = 0.04, and *SRMR* = 0.04. Both the German and the Spanish studies interpreted the internal structure of the questionnaire through parcels instead of performing item factor analysis.

Reliability of the TEIQue-Short form. Cooper and Petrides (2010), reported that the original questionnaire was reliable at the global trait EI factor in two consecutive studies conducted in the United Kingdom (Study 1, $\alpha Women$ = .88, αMen = .89 and Study 2, $\alpha Women$ = .87, αMen = .88). In Germany, Jacobs et al. (2015) reported a similar reliability score for the global trait EI factor (α = .88), although the researchers found only adequate reliability indices at the factor-level, being them all below .7 but Well-being (α = .85). In Greece, Stamatopoulou, Galanis and Prezerakos (2016) analysed the reliability of the questionnaire. The researchers reported similar reliability scores at the general and factor-level to the study by Jacobs et al., with Self-control being the lowest (α = .60) and Well-being the highest (α =.78), excluding the global trait EI (α = .89). Similarly, Laborde et al. (2016) reported in their Spanish sample, that the global trait EI (α = .88) and the Well-being factor (α = .83) were highly reliable, although the reliability scores for Self-control, Emotionality and Sociability were all around .7, which can be considered as fairly high (Taber, 2018). In China, Feher, Yan, Saklofske, Plouffe and Gao (2019) reported very similar figures for the global trait EI (α = .88) and for the trait EI factor-level, the latter ranging from .47 (Sociability) to .82 (Well-being) according to Cronbach's Alpha. Neri-Uribe and Juárez-García (2016) reported adequate reliability scores at the factor-level (ω =.61, .83) in their Mexican sample, although they did not consider a general factor explaining the variance for the full scale, which was the aim of the original TEIQue-SF (Petrides & Furnham, 2006). In summary, there is substantive evidence for asserting that the global trait EI, as measured by the TEIQue-SF, has been found highly reliable and that the factor-level reliability scores showed a greater dispersion, ranging from satisfactory to high-reliability scores.

The relevance of trait EI for clinical psychology

Until now, we have reviewed studies conducted through trait EI measures in general population samples, usually undergraduate students and layout people who comprised most validations. However, the relevance of the construct in clinical samples has been well documented. For example, different researchers have reported a negative correlation between trait EI and depressive, anxious, phobic and obsessive symptoms (see Mikolajczak, Petrides, Coumans, & Luminet, 2009), In addition, psychopathy and personality disorders have also been found inversely associated to trait EI (see Malterer, Glass, & Newman, 2008; Petrides, Pérez-González & Furnham, 2007). Moreover, Petrides, Gómez, and Pérez-González (2017) conducted a study on a sample of 121 psychiatric patients. The researchers fitted a model in SEM, by which they included three predictors: trait EI, mindfulness intervention and a measure of irrational beliefs, reporting that these accounted for 44% of the variance in psychopathology. In a subsequent analysis, the researchers discovered an incremental effect of trait EI over the remaining predictors, which was mainly attributable to the well-being factor.

Besides mood and overall psychopathology, trait EI has been linked to cancer. For instance, Smith, Petrides, Green and Sevdalis (2012) reported that trait EI was inversely associated to worries during the early onset of urological cancer, meaning that lower levels of trait EI were associated with increased worry, and vice-versa. Similarly, Smith et al. (2012), provided evidence with prostate and bladder cancer patients, which also suffered from state anxiety. After conducting a multiple regression analysis, the researchers concluded that trait EI was a significant predictor for state anxiety, worry about doctor’s appointment, the outcome of the consultation, and patient’s perceived social support.

Other syndromes and disorders have been related to trait EI. For instance, Petrides, Hudry, Michalaria, Swami, and Sevdalis (2011), compared a sample of clinically diagnosed Asperger patients in the United Kingdom with a control sample taken from normative data, using the full form of the trait emotional intelligence questionnaire (TEIQue). The researchers reported a significantly higher global trait EI for the controls than for the clinical sample ($p < .001$). This trend was fully supported when including the factor-level as predictors (i.e., well-being, self-control, emotionality and sociability), and almost completely replicated—with the exceptions of three facets—, when testing the same effect after including the fifteen facets that the TEIQue allows. Similarly, Baughman et al. (2011) have provided genetic and environmental evidence supporting a strong and inverse association between alexithymia and trait EI. Lastly, Aslanidou, Petrides, and Stogiannidou (2018) reported lower global trait EI scores for individuals suffering from drug addiction, when compared to controls. Besides, in the previous study, trait EI was negatively and significantly correlated with depression, anxiety and somatic symptoms ($p < .01$).

Gender-based differences regarding trait EI

Cooper and Petrides (2010) reported a significant gender difference regarding global trait EI, although of small effect size, favouring women to men in the original validation sample. Similarly, Tsaousis and Kazi (2013) reported gender differences in trait EI mainly favouring women over men. Fernández-Berrocal et al. (2001), provided cross-cultural evidence in favour of cultural differences (individualistic vs collectivist) influencing trait EI discrepancies between women and men. Petrides and Furnham (2000, 2006) did not find significant gender differences regarding trait EI in the U.K. Similarly, Ugarriza (2001) did not find notable differences between women and men regarding total EQ scores in Peru with the EQ-I (Emotional Quotient

Inventory), nor Saklofske, Austin, Galloway, and Davidson (2007) when using a global trait EI measure. The findings regarding trait EI and gender are inconclusive.

The present studies

The overall aim of the present studies was to adapt and validate the trait emotional intelligence questionnaire-short form (TEIQue-SF) in Chilean Spanish. We approached a pilot, a general and a clinical sample, comprising 525 individuals plus thirty-eight participants that assessed the translation. We were particularly interested in gathering evidence of a) possible gender differences for the global trait EI, b) reliability scores, c) internal factor structure, and d) measurement invariance for the general and clinical Chilean samples, when compared to the original validation sample approached in the U.K.

Readability and pilot sampling. Thirty-eight participants evaluated the linguistic and cultural appropriateness of the TEIQue-SF translation (layout, content and language), as previously performed by two certified translators. We followed the literature on transcultural validations for implementing this (see Eignor, 2013; Wild et al., 2005; Willis, 2006). We then approached a pilot sample with the adapted questionnaire in Santiago de Chile (N = 70), which was mainly comprised of high school teachers. We determined the reliability indices of the questionnaire were reliable at the global (ω = .92) and factor-level (Well-being = .89, Self-control = .82, Emotionality = .72, Sociability = .66) through the Omega index (McDonald, 1999). The global trait EI factor explained 47% of the variance (ωh = .47). The Alpha reliability index was at the lower bound when compared to omega at the global (α = .89) and factor-level (Well-being = .79, Self-control = .64, Emotionality = .63, Sociability = .48). The adapted questionnaire is available in Questionnaire S1 in the supplementary materials.

Study 1

The overall aim of the study was to validate the TEIQue-SF for use in general Spanish-Chilean population.

Method

Participants. We approached a validation sample (*N* = 335) in the cities of Santiago and Puerto Montt, administering the questionnaire to faculty in universities, evening students and layout people. The sample was broadly balanced regarding gender (Women = 45%, Men = 35%, 19% did not disclose their gender, while 1% declared not feeling identified with either category). 90% of participants were under 50 years old (*M* = 33.41, *SD* = 11.39). We disregarded five additional questionnaires through listwise deletion as they had the same pattern of response throughout the whole questionnaire and five more that presented missing values. Participants did not receive any monetary retribution. The inclusion criterion was: (a) Adults, aged 18 years or above. The exclusion criteria were: (a) being a current mental health patient, and (b) having any diagnosis of severe psychopathology. We performed a power analysis following the recommendations by MacCallum, Widaman, Zhang, and Hong (1999). Specifically, the obtained required sample size was 300, with a power goal of .8. The University College London-Research Ethics Committee granted ethical approval for the study.

Measures. The Spanish-Chilean TEIQue-SF. The questionnaire comprises thirty statements and a Likert-7 response scale ranging from 1 (Completely Disagree) to 7 (Completely Agree).

Design and Procedure. We implemented a convenience sample design, where we approached participants by two means: collective application (paper questionnaire) and online assessment through an anonymous Qualtrics form. Various institutions provided access to the participants at their work premises for collective application. As for the online assessment, we spread the anonymous Qualtrics link in institutions where members were likely to reach the inclusion criteria. The participants did not provide any personal data that could link their responses to their identity beyond informed consents. The researchers explicitly instructed participants to choose the option that represented them most.

Data analysis plan. We obtained the Omega index of reliability for assessing and interpreting the internal consistency of the questionnaire (McDonald,1999, 2014; Reise, 2012; Sijtsma, 2009; Zinbarg, Revelle, Yovel & Li, 2005). We conducted Confirmatory Factor Analyses (CFA) and subsequently, Exploratory Structural Equation Modelling (ESEM) for evaluating the internal factor structure of the questionnaire. We obtained Omega in R through the package Psych (Revelle, 2017), CFA through the package Lavaan (Rosseel, 2012), and ESEM in Mplus version 8.1 (Muthén & Muthén, 2017). We also implemented global trait EI gender-based analyses.

Regarding reliability, Zinbarg et al. (2005) proved how Omega (ω) becomes the most appropriate reliability index when the focus of interest is the proportion of scale variance due to all common factors; whereas Omega hierarchical (ωh) allows us to examine the proportion of scale variance due to a general factor. Hence, we reported both reliability statistics (ω and ωh) in our studies while contrasting these reliability indices when appropriate with the classical Alpha index at the global and factor-level. Sijtsma (2009) has shown that Cronbach’s Alpha is not a measure of internal consistency, and as such, does not convey information on the internal structure of a survey. As this author emphasised, Alpha suffers from random measurement error; being a desirable strategy to report Alpha in addition to a greater lower bound (such as Omega), as this will foster better reliability reporting practices.

Regarding factor analysis, we first implemented CFA with ML estimator and modification indices (M.I). In a second step, we employed ESEM with ML estimator, oblique rotations and M.I. The former since orthogonal rotations are often considered unrealistic in psychological research, and as Morin, Marsh and Nagengast (2013) posed "the choice of the most appropriate rotation procedure is to some extent still an open research area in EFA, an even more so in ESEM" (p. 403). We chose this progression from CFA to ESEM, based on several studies that have highlighted the methodological advantages that ESEM has over EFA and CFA (Marsh, Morin, Parker & Kaur, 2014). These authors posed that while ESEM remains a confirmatory approach, it is much less restrictive than CFA, which in turn allows for a better data fit for most psychological instruments that present cross-loadings. In this regard, they concluded that CFA usually produces inflated factor correlations, making it less suitable for assessing multidimensional constructs in comparison with ESEM. Perera (2015) has provided further evidence in favour of ESEM when compared to EFA and CFA for exploring the multidimensional structure of the TEIQue-SF.

In ESEM, we implemented bi-factor modelling. This approach is also known as general-specific or nested models as Holzinger and Swineford (1937) firstly termed it. In bi-factor modelling, the global or general factor is in pair with the remaining factors, allowing the items to load directly to the global and factor-level. It contrasts with second-order factorial modelling, where items cannot load onto the general factor directly, but only through their respective factors (see Chen, West, & Sousa, 2006; Reise, 2012). Although researchers in cognitive assessment have extensively studied bi-factor models (Gignac & Watkins, 2013; Gustafsson & Balke, 1993; Holzinger & Swineford, 1937; Luo, Petrill & Thompson, 1994), their applicability has also proved useful in the psychometric assessment of non-cognitive constructs (Morin et al., 2015). As Reise (2012) posed, second-order and unidimensional models are nested within bi-factor modelling, meaning that researchers should prefer the least restricted model (i.e., Bi-factor), instead of a constrained representation of it, which usually worsen model fit.

Results

Descriptive statistics for the trait EI factors in the general population sample are depicted in Table 1.

Table 1. Descriptive statistics for the Spanish-Chilean-TEIQue-SF in the Chilean samples (N = 445). As can be observed in Table 1, there is a common negative skewness which becomes more stressed for the Well-being factor, where participants tended to score higher.

PLEASE INSERT TABLE 1 HERE

Trait EI gender-based differences in the general sample. There were no statistical differences with respect to Gender for the global trait EI factor: t (115) = .114, p = .91, with the test value of 5.01 (M_{Women}). Indeed, the means for the global trait EI and descriptive statistics were strikingly similar: M_{Men} = 5.02, *SD* = .85, *Skewness* = -.30, *Kurtosis* = -.39, M_{Women} = 5.01, *SD* = .82, *Skewness* = -.33, *Kurtosis* = -.33.

Reliability analysis. These analyses revealed that the global score was highly reliable (see Taber, 2018), ω = .90 and ωh = 63. In addition, all factors showed good Omega reliability indices but Sociability, which displayed a rather low reliability index in comparison to the other factors (Well-being = .84, Self-control = .81, Emotionality = .63, Sociability = .41). As predicted by McDonald (1999, 2014), when compared to the Omega output, Cronbach's Alpha was at the lower bound of the total reliability score for the questionnaire (α = .88). The proportion of scale variance due to the general factor (global trait EI) indicated by ωh, was 63%, regardless of the variance explained by the remaining latent variables. Although Sociability had the lowest reliability score according to Omega, its reliability was higher by Cronbach's Alpha index: α = .47, 95% CI [.39, .56]. The same was true for the second lowest reliability score concerning Emotionality: α = .65, 95% CI [.60, .71]. The reliability indices for the factors Sociability and Emotionality may be labelled as adequate and acceptable, respectively (Taber, 2018).

Factor analysis for the general population data.

1) CFA models with modification indices (M.I.). For comparing different models with CFA, we contrasted a second-order model (model 1) with a bi-factor model (model 2) where all factors are correlated, following Morin et al.'s recommendations for analysing the factor structure of personality questionnaires.

1.1) Higher (second) order solution. We tested a hierarchical, second-order model (model 1) where each one of the factors was considered as a latent variable by its own with the corresponding items as indicators, while at the same time all factors were considered indicators of a greater second-order factor (i.e., Global trait EI). The R syntax for the model is available in Code S2 in the supplementary materials. Model 1 is depicted in figure 1. When the proposed model was nested with the test base model with only one factor, the resultant fit was poor: Minimum function statistic for the baseline model (325, 335) = 2442.862, $p < .001$, Model Fit Test Statistic for the augmented model (295, 335) = 993.582, $p < .001$), *CFI* = 0.670, *RMSEA* =

0.084 90% CI [0.078, 0.090] and *SRMR* = 0.092. The four factors loaded significantly onto the second-order factor (global trait EI) at $p < .05$. Also, all the items loaded significantly onto their keyed factor ($p < .0.1$). The two lowest loadings were observed for the Sociability factor, specifically item 25 and 11. The percentage of variance explained by the global factor was 50%, followed by Well-being accounting (35%), Self-control (23%), Sociability (7%), and Emotionality (6%).

1.2) Bi-factor model. We tested a bi-factor model (model 2) where a global factor enfolds all the items as a latent variable, and the factors are also latent variables by their own at the same level. The R syntax for the model is available in Code S3 in the supplementary materials. Model 2 is depicted in figure 1. We nested the bi-factor model with the test base model (one factor). The statistics for goodness of fit showed a better fit for this last model than the higher-order previously presented: Minimum function statistic for the baseline model (435, 335) = 3122.175, $p < .001$), Model Fit Test Statistic for the augmented model with one global factor and a four-factor-level (379, 335) = 1020.185, $p < .001$), *CFI* = 0.761, *RMSEA* = 0.071 90% CI [0.066, 0.076] and *SRMR* = 0.081. The last provided evidence for bi-factor models explaining better the internal structure of the Spanish-Chilean-TEIQue-SF. Regarding factor correlations, we found a greater heterogeneity when implementing this model. Thus, we observed non-significant loadings ($p > .1$) for Emotionality (Item 16) and Well-being (items 5 and 12), while at the global trait EI factor this only occurred for item 11. The previous analyses provided a basis for testing ESEM models with M.I., as the method of choice.

PLEASE INSERT FIGURE 1 HERE.

2) ESEM using ML estimator and oblique rotations.

2.1). Basic bi-factor ESEM with ML estimator and Geomin rotation. The first ESEM (Model 3) ratified the appropriateness of bi-factor modelling. All latent variables were a set of EFA, and their variances were constrained at one. Therefore, this model is an exploratory rather than a confirmatory ESEM, as the last is presented in the literature as ESEM-within-CFA (EwC) (Marsh et al., 2014; Marsh, Nagengast, & Morin, 2013; Morin & Asparouhov, 2018; Morin, Tran, & Caci, 2012). Also, the four-factor-level was standardised on global trait EI, as according to Muthén and Muthén (2017) *"this puts the results in the metrics of an EFA"* (p.105). The Mplus syntax for Model 3 is available in Code S4 in the supplementary materials.

Model 3 showed a better fit to the models previously presented, reaching an acceptable to good fit: χ^2 (295, 335) = 439.144, $p < .001$, *CFI* = 0.946, *RMSEA* = 0.038 90% CI [0.030, 0.045] and *SRMR* = 0.033. Nevertheless, modification indices suggested the inclusion of two arguments for correlated errors: the first one, between item 18 and item 3 (items theoretically loading only on the general factor), and the second one between item 21 (Sociability) and 17 (Emotionality). The former is theoretically appropriate because the re-specification of the model addresses two items not loading at the factor-level (18 and 3), which have been referred as difficult to address when reaching up to the four-factor structure in previous studies with the questionnaire using ESEM (Perera, 2015). Besides, they also point towards the same underlying facet (i.e., Self-motivation), as described in the full form of the questionnaire.

In addition, the correlation between items not belonging to the same factor (i.e., 21 and 17), can be understood by the similarity that item 21 (i.e., "I would describe myself as a good negotiator")—belonging in the full form to the facet *Social competence*—, took when translated into Spanish with the underlying facet *Trait empathy*, to which item 17 belongs (i.e., "I'm normally able to "get into someone's shoes" and experience their emotions").

2.2) Bi-factor ESEM with ML estimator, Target rotation, and introduction of M.I. Model 4 is the re-specification of model 3, following M.I. Here, we fixed correlations at zero for the items not theoretically associated with each of the factors, as recommended by Morin and Asparouhov (2018) in their ESEM-within-CFA (EwC) framework, since this allows complete CFA functionality with ESEM. We set the variance to 1 at the factor-level and implemented an oblique rotation as in the preceding model. Model 4 is depicted in figure 2. The Mplus syntax for Model 4 is available in Code S5 in the supplementary materials. This last bi-factor ESEM model showed the best fit from all the models already presented: χ^2 (293, 335) = 409.766, $p < .001$, *CFI* = 0.957, *RMSEA* = 0.034 90% CI [0.026, 0.042] and *SRMR* = 0.032. The factor loadings are depicted in Table 2. Significant factor loadings at bilateral $p < .05$ are shown in bold. Although most factor loadings were positive and did contribute significantly to their keyed factors, it is necessary to mention that some items did not load onto their keyed factor, but only on the global trait EI factor.

The R square results for the items in this final model were all significant at $p < .05$ with the only exception of item 11, which was significant at $p < .1$. The standardised model showed that all the items correlated significantly at $p < .05$ with the general factor (Global trait EI) but item 25 ($Z = .034$, $p < .1$). The factor structure did replicate with almost all items as theoretically presented at the factor-level (see Petrides, 2007). The factor determinacies for each one of the latent variables reached high values (i.e. closed to one): global trait EI (.949), Well-being (.776), Self-control (.832), Emotionality (.829), Sociability (.830); providing more robust evidence for the appropriateness of the final model in ESEM.

PLEASE INSERT FIGURE 2 HERE.

Table 2. Standardised Factor Loadings for the Spanish-Chilean-TEIQue-SF Items Following Model 5 in general population.

PLEASE INSERT TABLE 2 HERE

Study 2

The overall aim of the study was to validate the TEIQue-SF for use in clinical Spanish-Chilean population.

Method

Participants. The sample comprised 120 patients in treatment at university mental health clinics in the cities of Santiago, Castro and Puerto Montt. 69% of participants were women, 28% men, while 3% of the sample did not disclose their gender. 83% of participants were under 50 years old (M = 32.39, SD = 13.01). We disregarded two additional questionnaires through listwise deletion as they presented missing values. Participants did not receive any monetary retribution. The inclusion criteria were: (a) aged 18 years at least, (b) being a current mental health patient within the approached mental health centres. Patients undergoing acute symptomatology from a severe psychiatric disorder were excluded from the study (e.g., Schizophrenia). Thus, all enrolled patients suffered from mild depressive or anxious symptomatology, which is in line with the admission patient profile of the university mental health clinics in Chile. The University College London-Research Ethics Committee granted ethical approval for the study.

We obtained an Intraclass Correlation Coefficient (ICC) of .86 from a dataset provided by Cooper and Petrides (2010), upon which we based our power analysis for the sample. We performed cluster sample size estimations for achieving a power of .8. for a maximum target population of 1300 patients at university mental health clinics in the three cities according to MINEDUC's figures (2017).

Measures. We used the Spanish-Chilean TEIQue-SF, as developed in the previous study.

Design and procedure. Participants were assessed face-to-face by their mental health providers in their respective mental health centres and usual consultation settings; this avoided the researchers contacting patients directly without their consent and the related ethical implications. We implemented tailored in situ inductions to the psychotherapists working in the clinical centres where the data would be collected, emphasising that participants should choose the option that represented them most.

Data analysis plan. We performed internal consistency reliability analyses through Omega (ω) and factor validity through Bi-factor Exploratory Structural Equation Modelling (ESEM) in Mplus, version 8.1 (Muthén & Muthén, 2017). We did not assess CFA modelling for this sample as it proved inadequate in Study 1. Like Study 1, we implemented global trait EI gender-based analyses and amended a basic ESEM model through the introduction of modifications indices.

Results

Descriptive statistics for the trait EI factors in the clinical population sample are depicted in Table 1. As can be observed in Table 1, there is a slight common negative skewness that is more stressed for the Self-control factor, where participants tended to score higher.

Trait EI gender-based differences in the clinical sample. We did not find statistical differences between women and men for the global trait EI factor following a one-sample *t*-test in Study 2: t (33) = .844, p > .05, with test value of 4.78 (M_{Women}). Indeed, the means and descriptive statistics were similar: M_{Men} = 4.64, *SD* = .99, *Skewness* = -.29, *Kurtosis* = -.69, M_{Women} = 4.78, *SD* = .78, *Skewness* = .08, *Kurtosis* = -.25.

Reliability analysis. Reliability analysis revealed that the global score was highly reliable ω = .90 and ωh = 58. In addition, all the factors turned to have fair to good Omega reliability indices (Well-being = .82, Self-control = .84, Emotionality = .49, Sociability = .71). As predicted, when compared in the Omega output, α = .88 was found to be at the lower bound of the total reliability for the questionnaire. The proportion of scale variance due to the general factor only (Global trait EI), as presented by ωh, was 58%. Although Emotionality had the lowest reliability score through Omega, its reliability was higher when assessed by the traditional Alpha index (α = .62, 95% CI [.52,.72]). As Taber (2018) poses, the reliability indices for the factors Emotionality and Sociability —both the lowest— may be described as acceptable and good, respectively. Moreover, following the rationale stated by this author, the results for Well-being and Self-control can be considered as robust.

Factor analysis for the clinical data.

1) ***Bi-factor ESEM with ML estimator and Target rotation.***

We implemented a similar syntax as in Study 1 for assessing the factor structure through ESEM (see Code S6 in the supplementary materials). This model achieved a promising fit: χ^2 (293, 335) = 424.707, p < .001, *CFI* = 0.874, *RMSEA* = 0.061 90% CI [0.047, 0.073] and *SRMR* = 0.052. Although most standardised loadings contributed to their keyed factors, some did not, and three did not achieve statistical significance at the global factor (i.e., items 2, 11, and 25). Full standardised estimates and the R square table are available upon request from the authors. Modification indices suggested the inclusion of four correlated errors, all of them theoretically appropriate, as they correlate items depicting the same underlying factors (i.e., items 16 and 13, and, items 23 and 8 for Emotionality; items 22 and 7 for Self-control; items 12 and 27 for Well-being).

2) *Bi-factor ESEM with ML estimator, Target rotation and introduction of M.I.*

This model is the re-specification of the previous, as depicted in figure 3. The Mplus syntax for this second model is available in Code S7 in the supplementary materials. This model showed a better fit in comparison to the previous: χ^2 (291, 120) = 370.766, $p < .001$, *CFI* = 0.923, *RMSEA* = 0.048 90% CI [0.031, 0.062] and *SRMR* = 0.048. Factor loadings for the items are depicted in Table 3. Significant factor loadings at $p < .05$ are shown in bold. Although most items contributed significantly to their keyed factors, item 25 did not. Furthermore, items 2, 11, 23 and 25 did not have statistically significant loadings onto the global trait EI factor. Most items showed significant loadings ($p < .05$) at the factor-level. Consequently, the multidimensional factor structure replicated similarly as theoretically presented (see Petrides, 2007). Lastly, factor determinacies for the latent variables reached slightly higher values when compared to the general sample: global trait EI (.958), Well-being (.883), Self-control (.872), Emotionality (.876), Sociability (.871). The previous provides robust evidence for the validity of the overall factorial estimation.

Table 3. Standardised Factor Loadings for the Spanish-Chilean-TEIQue-SF items following the re-specification of the model with the clinical data.

PLEASE INSERT TABLE 3 HERE.

PLEASE INSERT FIGURE 3 HERE.

Multiple Group Measurement Invariance between the original questionnaire and the Chilean samples

As can be observed in table 4, we performed full measurement invariance analyses between the Chilean samples and the UK validation sample (Cooper & Petrides, 2010), which codes are available from Codes S8 to S10 in the supplementary materials. We tested the invariance through three stages: Configural, Metric and Scalar (see Putnick & Bornstein, 2016), following the recommendations by Hu and Bentler (1995), Cheung and Rensvold (2002), Chen (2007), and Meade, Johnson and Braddy (2008). We compared the model fit and applied decision rules to whether they complied or not with the type of invariance studied at each stage.

Meade et al. (2008) proposed applying differential criteria regarding sample size, type of invariance tested, and fit-statistic used for comparison. Accordingly, we assessed measurement invariance between the UK and the Chilean datasets. Our analyses revealed that the questionnaire showed configural and metric invariance by the less stringent .9 cut-off for CFI, while RMSEA and SRMR were also lower than the currently accepted thresholds of .06 and .08 (Hu & Bentler, 1999), respectively; when testing the combined Chilean samples against the UK sample, and also when contrasting the general and clinical population samples against each other. The former, despite some of our metric and scalar analyses yielded a higher Δ CFI (around .02) than the traditional .01 cut-off recommended by Cheung and Rensvold (2002), and Chen (2007). Although at the scalar level we only achieved the minimum CFI threshold of .9 between the Chilean samples, the RMSEA and SRMR indexes stayed below the accepted thresholds and their Δ RMSEA and Δ SRMR were in the expected range for both group comparisons ($\leq .015$ and $\leq .030$, respectively; see Chen, 2007), providing support for strong invariance. In this regard, Chen (2007) has stated that RMSEA and SRMR tend to over-reject invariant models, rendering another argument for considering the model as invariant up to the scalar level.

In summary, the trait EI latent variables were measured by the same items of the questionnaire across applications (Configural), factor loadings were equivalent between the UK validation and the Chilean samples (Metric), and items' intercepts are comparable across these groups (Scalar). Also, all fit statistics were in the expected boundaries when comparing the Chilean samples against each other.

PLEASE INSERT TABLE 4 HERE.

General Discussion

We examined and interpreted the psychometric scores of the Spanish-Chilean-TEIQue-SF version through CFA and ESEM with both general and clinical data. Reliability analyses confirmed the high reliability of the questionnaire, especially at the global level, which it was originally designed to assess (Petrides & Furnham, 2006). The models implemented allowed contrasting the unidimensionality of the Spanish-Chilean-TEIQue-SF versus its multidimensionality (one general plus a four factor-level). ESEM modelling confirmed the construct validity of the instrument, providing robust evidence for its multidimensionality through a bi-factor model. We performed measurement invariance analyses finding a satisfactory fit between the UK validation sample and the Chilean datasets, which allows for cross-cultural comparisons of latent means. Finally, the fit of the final model presented in study 1 was better than previous ESEM and CFA models with other TEIQue-SF validations (e.g., Cooper & Petrides, 2010; Jacobs et al., 2015; Laborde, Allen & Guillén, 2016; Neri-Uribe & Juárez-García, 2016; Perera, 2015). The fit of the last ESEM model in the clinical sample was adequate, in line with previous findings.

The present studies are the first piece of research examining the TEIQue-SF factor structure through a bi-factor method, in contrast to the original proposed hierarchical second-order structure for trait EI measures (e.g., Cooper & Petrides, 2010; Petrides, 2009). The results are promising. Almost all items of the Spanish-Chilean-TEIQue-SF correlated at an acceptable and significant degree with their keyed factors when tested through ESEM both in the general and clinical sample; being the previous especially noticeable for the global trait EI factor. On the contrary, the hierarchical models in our research, as presented in Study 1, had a poorer fit to the data and higher factor score indeterminacy when assessed in R through CFA. The exceptional fit found for the last bi-factor ESEM model in Study 1 and the satisfactory fit for the last model in study 2 represent unusual evidence of the instrument's construct validity when compared to other EI measures (e.g., Siegling, Saklofske & Petrides, 2015). These results highlight the importance of working with this novel methodological approach when assessing the factor structure of personality questionnaires, instead of the classical and often-less promising-results obtained through CFA modelling (Marsh et al., 2014).

Morin et al. illustrated the suitability of bi-factor models when assessing personality. There is a fair agreement in the psychometrics community that bi-factor models are often less stringent than hierarchical models (Chen, West, & Sousa, 2006; Jennrich & Bentler, 2011; Reise, 2012). Also, the constraints imposed by hierarchical modelling often worsen model fit (Brunner, Nagy & Wilhelm, 2012; Chen et al., 2006; Reise, 2012). For instance, Marsh, Lüdtke, Nagengast, Morin and Von Davier (2013) have proposed that the use of item parcels, as it usually implemented in hierarchical modelling, is likely to be unsuitable for scale development, latent means and measurement invariance. The latter supports implementing item-level ESEM bi-factor modelling as the method of choice, as we have performed it in the present studies, which highlights the advantage of our approach to previous psychometric investigations with the measure (e.g., Feher et al., 2019; Laborde et al., 2016). Our rationale was supported when contrasting our ESEM bi-factor models vis-à-vis hierarchical ESEM-within-CFA (see table S11 in the supplementary materials), due to hierarchical modelling—as anticipated—worsen model fit. Moreover, as Reise (2012) stated, bi-factor modelling is best suited for psychometric assessment of instruments primarily defined by a common and strong trait, where multidimensionality is driven by well-established subdomains, as we have proven in our Chilean studies with the TEIQue-SF.

We did not find any significant difference between women and men regarding their trait EI means in our Chilean studies. We argue that in sociocultural contexts where gender equality is higher, women could surpass, or at least be in pair with men regarding trait EI scores (see Fernández-Berrocal et al., 2001). In this regard, Petrides and Furnham (2000) have demonstrated that males tend to overestimate their trait EI when self-assessed through rating scales. The authors posed that women may tend to self-derogate themselves through self-estimated trait EI, which could have happened in our Chilean general sample as well, even when using a well-established self-report measure like the TEIQue-SF.

As for global trait EI, our findings were comparable to the original UK validation sample described by Cooper and Petrides (2010). In our general sample, the global trait EI mean and factor-level means were all above of what Laborde et al. reported using the TEIQue-SF in Spain with university students; where the most salient means differences were for Self-control (.32), Sociability (.22) and global trait EI (.20). In contrast, the trait EI means in our clinical sample were very much comparable to what Laborde et al. reported, being Well-being the only exception; as this trait was—understandably—significantly diminished in our clinical sample. Regarding the latter, it is worth noting that our clinical sample comprised patients suffering from common mental health disorders (i.e., depression and anxiety), which are the most prevalent diagnoses in clinical psychological settings, approximately affecting to 8% of the global population (World Health Organisation, 2017).

These first psychometric studies with the TEIQue-SF in Chilean samples will allow for inference, pertinence and comparability. They will also enrich the discussion in the field. In summary, the Spanish-Chilean-TEIQue-SF was shown to be reliable and valid in Chilean population. Regarding its factor validity, a model with a general factor plus a four-factor structure was also shown to have a better fit than a model with just one general factor. Our analyses supported latent-means invariance for the Spanish-Chilean-TEIQue-SF when paired to the original measure. Finally, the advantage of counting with a validated and invariant brief trait EI measure in Spanish represents an opportunity from the practitioner perspective for precise psychological assessment in numerous settings, including clinical, educational and organisational.

Limitations and future directions

An important limitation is the size of the samples in the two studies. Even though in Study 1 the sample size could be considered adequate for factor analysis according to Comrey and Lee (1992), and also fulfilled the requirement of 5 and 10 subjects per item based on the *N:p* ratio recommended by Gorsuch (1983) and Everitt (1975), respectively; Comrey and Lee (1992) advocate sample sizes of 500 or more for factor analysis. MacCallum et al. (1999) argue that when communalities are consistently low (i.e., below .5) but there is high overdetermination (i.e., six or more items loading onto one factor), as is the case with the TEIQue-SF, a sample size well over 100 should be enough for recovering the factor structure of a questionnaire.

It is worth noting that the reliability decreased from the pilot study in comparison to the general and clinical samples. We consider this difference could be accounted by participants' highest educational attainment, as 80% of participants in the pilot study had obtained a higher education or university degree in contrast to the main two studies, in which slightly more than 50% of participants were of comparable educational level. We observed this tendency to higher reliability in more educated participants when we compared the categories of maximum educational attainment in the general population sample, as the increase in reliability from participants having secondary education to those with master degree was close to .1. Similarly, the increase in reliability in the clinical sample from participants having secondary education to those with higher education was of .04.

Another limitation regarding the results from the measurement invariance analyses is that our Δ CFI between the models were mostly beyond the commonly accepted threshold of .01 (Hu & Bentler, 1999). Rutkowski and Svetina (2014) posed that relaxing this cut-off up to .02 is necessary when performing multigroup measurement invariance. Moreover, Putnick and Bornstein (2016), emphasised the current methodological restrictions for performing measurement invariance analysis, as they encouraged researchers to report it even when slight deviations from the standards could arise.

Future studies with trait EI measures can follow the rationale developed in this manuscript, especially regarding the investigation of the TEIQue-SF factor structure through ESEM. From the research and literature perspective, a new element, i.e., trait EI; will be now studied in Chile and nearby countries. In this respect, cross-cultural comparisons with the instrument in other Spanish background populations, especially in Latin America, are encouraged. Also, future research with this validated version of the questionnaire vis-à-vis other well-regarded personality measures is required (e.g., Big Five measures). The suitability for implementing such investigations will be enhanced by the studies displayed here.

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Table 1

Descriptive statistics for the trait EI factors in the Chilean samples

Trait EI measure	*Min*	*Max*	*M*	*SD*	*Skew*	*Kurt*
1.General population sample						
Global trait EI	2.40	6.80	5.03	0.85	-0.19	-0.54
Well-being	1.00	7.00	5.43	1.17	-0.92	0.80
Self-control	1.33	7.00	4.76	1.05	-0.15	-0.14
Emotionality	2.13	7.00	4.98	1.03	-0.22	-0.51
Sociability	2.33	7.00	4.83	0.92	0.02	-0.50
2. Clinical population sample						
Global trait EI	2.63	6.80	4.75	0.08	0.46	-0.26
Well-being	1.50	7.00	5.05	0.11	-0.39	-0.47
Self-control	2.00	6.83	4.39	0.11	1.06	-0.70
Emotionality	2.13	6.88	4.88	0.09	0.69	-0.37
Sociability	1.33	6.33	4.63	0.08	0.94	1.24

Note. EI = Emotional Intelligence. Min = Minimum, Max = Maximum, *M* = Mean, *SD* = Standard Deviation, *Skew* = Skewness, *Kurt* = Kurtosis.

Table 2

Standardised Factor Loadings for the Spanish-Chilean-TEIQue-SF Items Following Model 5 in general population.

Item	Wellbeing	Self-Control	Emotionality	Sociability
5	.257			
20	.183			
9	.201			
24	.195			
12	**.281**			
27	.345			
4		.138		
19		-.095		
7		**.544**		
22		**.642**		
15		.113		
30		.025		
1			-.017	
16			.128	
2			.373	
17			.219	
8			**.295**	
23			.003	
13			**.365**	
28			**.363**	
6				-.003
21				-.119
10				**.350**
25				**.602**
11				.018
26				**.595**

Note. All factor correlations in bold are significant at $p < .05$ or better.

Table 3

Standardised Factor Loadings for the Spanish-Chilean-TEIQue-SF items following the re-specification of the model with the clinical data.

Item	Wellbeing	Self-Control	Emotionality	Sociability
5	.171			
20	**.526**			
9	**.636**			
24	**.529**			
12	.045			
27	**.509**			
4		**.425**		
19		**.716**		
7		.145		
22		.001		
15		**.448**		
30		.199		
1			-.223	
16			**.406**	
2			**.334**	
17			.219	
8			.156	
23			.093	
13			**.434**	
28			.074	
6				**.296**
21				**.252**
10				**-.276**
25				.059
11				**.750**
26				.177

Note . All factor correlations in bold are significant at $p < .05$ or better.

Table 4
Multiple group measurement invariance model comparisons

Models	χ^2	$\Delta\chi^2$	*df*	*CFI*	Δ *CFI*	*RMSEA*	Δ *RMSEA*	*RMSEALb*	*RMSEAUb*	*SRMR*	Δ *SRMR*
1											
Configural	1506.16	—	879	0.917	—	0.046	—	0.042	0.050	0.036	—
Metric	2031.69	525.53	1129	0.880	0.037	0.049	0.003	0.046	0.053	0.054	0.018
Scalar	2253.93	222.24	1179	0.857	0.023	0.053	0.004	0.049	0.056	0.061	0.007
2											
Configural	1121.93	—	586	0.927	—	0.043	—	0.039	0.047	0.032	—
Metric	1398.02	276.09	711	0.907	0.020	0.044	0.001	0.041	0.048	0.044	0.012
Scalar	1593.17	195.15	736	0.884	0.023	0.048	0.004	0.045	0.052	0.049	0.005
3											
Configural	783.80	—	584	0.946	—	0.039	—	0.031	0.046	0.037	—
Metric	1013.49	229.69	709	0.918	0.028	0.043	0.004	0.037	0.049	0.052	0.015
Scalar	1053.43	39.94	734	0.914	0.004	0.044	0.001	0.038	0.050	0.055	0.003
4											
Configural	1135.40	—	588	0.916	—	0.046	—	0.042	0.050	0.034	—
Metric	1414.86	279.46	713	0.892	0.024	0.048	0.002	0.044	0.051	0.047	0.013
Scalar	1576.47	161.61	738	0.871	0.021	0.051	0.003	0.048	0.055	0.053	0.006

Note. Model 1 = UK validation sample, N = 537; Chilean general population, N = 335; and Chilean clinical population, N = 120. Model 2 = UK validation sample and combined Chilean samples. Model 3 = Chilean general and clinical samples.Model 4 = UK validation sample and Chilean general population. χ^2 = Chi Squared, $\Delta\chi^2$ = Chi Square difference, *df* = degrees of freedom, *CFI* = Comparative Fit Index, *ΔCFI* = CFI difference, RMSEA = Root Mean Square Error of Approximation , Δ *RMSEA* = RMSEA difference, RMSEALb = RMSEA Lower bound, RMSEAUb = Upper bound. SRMR = Standardized root mean residual , Δ SRMR = SRMR difference.

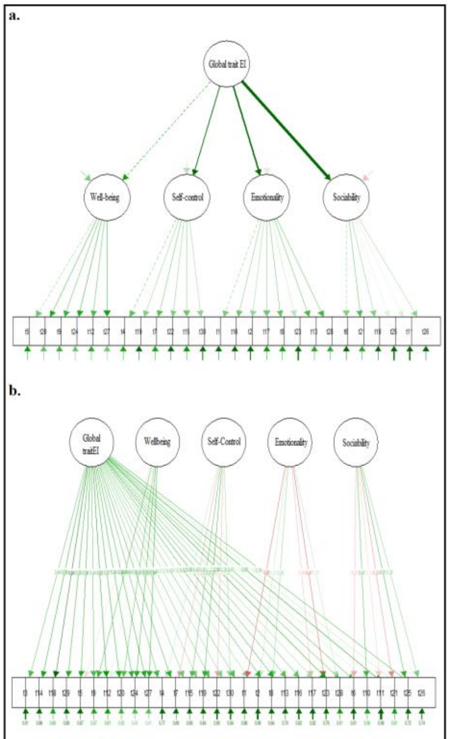

Figure 1. (a) Model 1. Higher order CFA model. (b) Model 2. Bi-factor CFA model. Both drawings were obtained through the semPaths package.

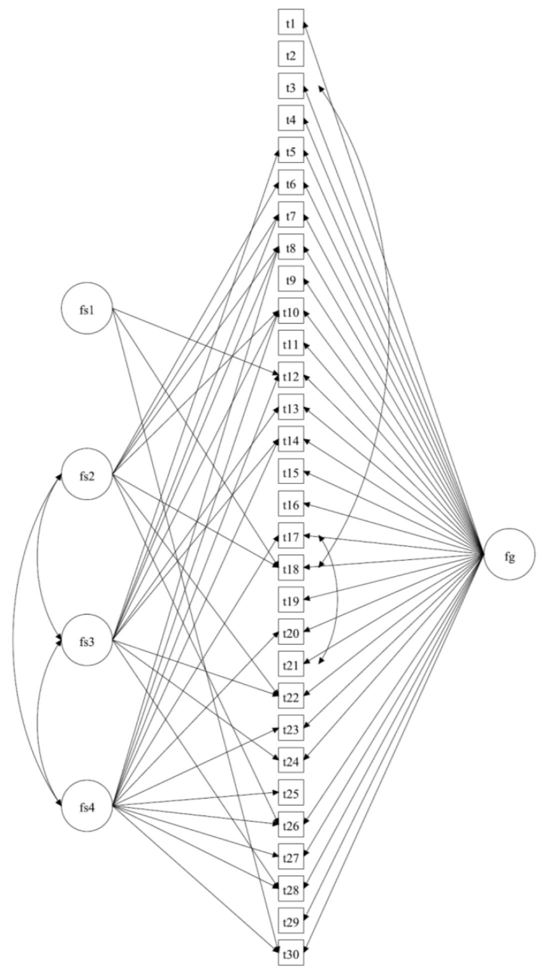

Figure 2. Model 4. Bi-factor ESEM with ML estimator Target rotation and M.I. in general population. Only significant correlations are depicted with arrows. Fg stands for the Global trait EI, fs1 for Well-being, fs2 for Self-control, fs3 for Emotionality and fs4 for Sociability.

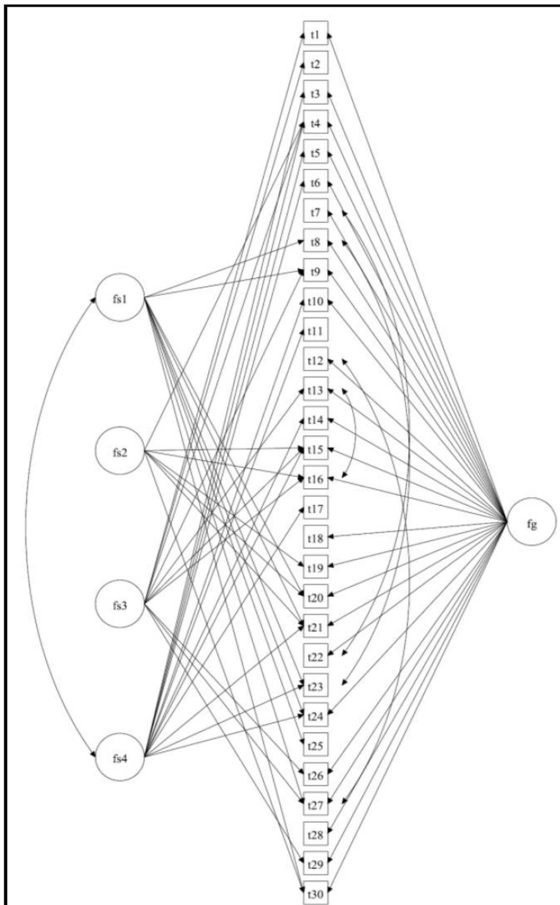

Figure 3. Bi-factor ESEM with ML estimator Target rotation and M.I in clinical population. Only significant correlations are depicted with arrows. Fg stands for the Global trait EI, fs1 for Well-being, fs2 for Self-control, fs3 for Emotionality and fs4 for Sociability.