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Confirmatory factor analysis of the five-item version of the Francis scale of attitude towards Christianity in adolescent students

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ABSTRACT

The brief scale of Francis for religiosity (Francis-5) has shown acceptable psychometric performance in Colombian adolescents. However, a confirmatory factorial analysis (CFA) has not been performed. The objective of the research was to make a CFA to the Francis-5 in a sample of students of Santa Marta, Colombia. A validation study was performed. 350 students between 10 and 17 years old, and 54% were female. A CFA was performed to test the dimensionality of different versions of five and four items of the scale. Authors calculated five goodness of fit indexes (Chi square, RMSEA, CFI, TLI, and SMSR). The Francis-5 presented as goodness-of-fit coefficients, chi squared = 18.5, $df = 5$, $p = .002$, RMSEA = .09 (CI90% .05 to .13), CFI = .99, TLI = .99, and SMSR = .01. And the version with the best coefficients of goodness was the Francis-5 without the fourth item ('Pray helps me a lot') with chi squared = .55, $df = 2$, $p = .76$, RMSEA = .00 (CI90% .00 to .07), CFI = 1.00, TLI = 1.00, and SMSR = .01. As conclusions, the dimensionality of the Francis-5 is questionable. For a version without the item 4 the data are better fit.

KEYWORDS

Christianity; validity and reliability; factor analysis; validation studies

Introduction

Religiosity is a concept, at least two-dimensional, that is understood as the set of behaviours, experiences or sensations related to the existence of a superior being (Hill and Hood 1999; George et al. 2000). In general, the first dimension is given the name of extrinsic religiosity and alludes to the demonstrable behaviours and the particular social activities associated with religious affiliation (Dein, Cook, and Koenig 2012). The second dimension is called intrinsic religiosity and considers the personal, intimate and transcendental experience with a deity (Peach 2003). With the dawn of the 21st century, religiosity tends to be used to refer to the extrinsic component and spirituality to the intrinsic; however, both dimensions overlap each other (Exline and Rose 2014; George et al. 2000; Peach 2003).

In the medical context, religiosity becomes relevant insofar as it can sometimes influence decision-making, an individual's relationship with medical professionals and

coping styles in the health-disease-care process (Koenig 2004; Panzini et al. 2017). In general, religiosity can be associated with well-being and quality of life (Bonelli 2017; Park et al. 2017; Sohail and Yasin 2017). For the above reasons, there is a growing number of instruments for measuring the construct in clinical contexts (Austin, Macdonald, and MacLeod 2018).

Further, in the educational context of countries with populations that follow Christianity, one of the most commonly used instruments is the short version of the Francis scale of attitude towards Christianity. This instrument is composed of seven items: five that explore the intrinsic component of Christianity and two that explore the extrinsic aspect (Francis 1993). However, given the problems in the content validity and dimensionality of that version (Campo-Arias et al. 2006; Francis et al. 1995; Lewis and Francis 2004; Lewis, Cruise, and Lattimer 2007; Maltby and Lewis, 1997; McGuckin, Cruise, and Lewis 2006), a shorter five-item version, the Francis-5, has been introduced that retains only the intrinsic component of Christianity, which quantifies the participant's attitude towards God, Jesus and prayer (Campo-Arias, Oviedo, and Cogollo 2009).

In the Colombian context, several validation studies show different aspects of the performance of the Francis-5. The scale has shown internal consistency between .74 and .97 measured with Cronbach's alpha or McDonald's omega (Campo-Arias, Herazo, and Oviedo 2017; Campo-Arias, Oviedo, and Cogollo 2009; Ceballos et al. 2015; Cogollo et al. 2012; Miranda-Tapia et al. 2010). The stability at month of application was estimated Pearson correlation coefficient and intraclass correlation and both were of .69 (Cogollo et al. 2012); and a one-dimensional structure that explained between 74 and 88% of the total variance in exploratory factor analyses (Campo-Arias, Herazo, and Oviedo 2017; Ceballos et al. 2015; Miranda-Tapia et al. 2010). There is no confirmatory factorial analysis (CFA) for the Francis-5 that corroborates the unidimensionality of the instrument (DiStefano and Hess 2005; Jackson, Gillaspay, and Purc-Stephenson 2009).

A CFA is needed, particularly for the Francis-5, given that previous studies showed internal consistency higher than .95 and exploratory factorial solutions in which the factor accounted for a variance greater than 75% (Campo-Arias, Herazo, and Oviedo 2017; Ceballos et al. 2015; Miranda-Tapia et al. 2010). Both eventualities may be related to the presence of redundant items, that is, items that show collinearity (Keszei, Novak, and Streiner 2010; Tavakol and Dennick 2011; Terwee et al. 2007). The CFA is an important contribution to the overall understanding of the construct and ensures the validity of any scale (DiStefano and Hess 2005).

The objective of the study was to carry out a CFA of the Francis-5 with adolescent students in Santa Marta, Colombia.

Method

A validation study was designed and approved by the Institutional Ethics Committee of the University of Magdalena, Colombia. The parents or legal representatives of the students signed informed consent forms, and the minors agreed to complete the Francis-5.

A convenience sample of 350 students was taken from the sixth to the eleventh grades, consisting of 236 (67%) students from secondary school (sixth to ninth grade)

and 114 (33%) students in vocational training. The ages of the participants were between 10 and 17 years ($M = 13.3$, $S. D. = 1.8$), and the gender distribution included 188 (54%) females and 162 (46%) males.

The students completed the Francis-5 in the classroom. The scale is self-administered and offers five response options for each item, ranging from completely disagreeing to completely agreeing. These responses are rated between one and five, which allows for total scores between five and twenty-five. It is understood that the higher the score is, the greater the positive attitude towards Christianity (greater religiosity). The items of the Francis-5 are:

- (1) I know that Christ helps me.
- (2) God helps me lead a better life
- (3) God means a lot to me.
- (4) Praying helps me a lot.
- (5) Jesus is always by my side.

The statistical analysis was carried out with version 13 of STATA (*STATA 13.0* 2013). In the CFA, the goodness-of-fit indices were also calculated: chi-square, RMSEA (Root Mean Square Error of Approximation), CFI (Comparative Fit Index), TLI (Tucker-Lewis index) and SRMR (Standardised Root Mean Square Residual).

Given the initial findings, exploratory factor analyses were performed for four-item versions of the scale. This process included the observation of eigenvalues and variance explained by a single factor. CFA was performed for each group of items. Additionally, the internal consistency of each factorial solution was estimated using Cronbach's alpha coefficients (Cronbach 1951) and McDonald's omega (McDonald 1970).

Results

The Francis-5 showed the following goodness-of-fit coefficients: chi-square = 18.5, $df = 5$, $p = .002$, RMSEA = .09 (90%CI .05 to .13), CFI = .99, TLI = .99, and SRMR = .01. The Francis-5 without the fourth item ('Praying helps me a lot') showed the best performance in the goodness-of-fit coefficients (chi-square = .55, $df = 2$, $p = .76$, RMSEA = .00 (90%CI .00 to .07), CFI = 1.00, TLI = 1.00, and SRMR = .01). The results for the exploratory factors (eigenvalues, variance explained and chi-square) and internal consistency (Cronbach's alpha and McDonald's omega) are presented in Table 1.

Discussion

The present study investigates the dimensionality of the Francis-5. The data for a version without the fourth item fit best. The CFA in the present study showed two indicators of goodness of fit with values that indicate that the data do not adequately fit the model, the chi-square and RMSEA. For the chi-square, a probability greater than 5% is expected, with degrees of freedom up to two or in a more conservative approach and a lower value for the division of the chi-square value between the degrees of freedom; the RMSEA must be less than .06 and above the lower limit of the 90%CI;

Table 1. Eigenvalues, chi-square, variances and internal consistency coefficients.

Version	Eigen value	Explained variance *	Squared chi +	Cronbach's alpha	McDonald's omega
Francis-5	4.62	92.4	18.4, $p = .002$	.98	.98
Without item 1	3.70	92.6	7.4, $p = .025$	.97	.97
Without item 2	3.69	92.2	6.3, $p = .043$	.97	.97
Without item 3	3.73	93.3	13.6, $p = .001$	.98	.98
Without item 4	3.72	93.0	0.5, $p = .763$	.98	.98
Without 5	3.72	93.1	7.5, $p = .024$	.98	.97

*Percentage.

+ All degrees of freedom = 6.

the CFI must be above .90; the TLI is expected to be higher than .90; and the SRMR is acceptable with values lower than .05 (Brown 2006).

In contrast, the EFA in the present study revealed that the factorial solutions of the single dimension explained between 92 and 93% of the variance. Such a high outcome is particularly infrequent. Usually, the retained dimensions are expected to explain at least 50%, and the variance explained rarely exceeds 75%. As a rule, in statistics, extreme or excessively high values suggest a problem; EFA warns about the presence of high collinearity between the items (Gorsuch 1997; Streiner 1994).

Moreover, in the present investigation, it was observed that the Francis-5 showed an internal consistency of .98, and in the versions that omitted an item, the value remained in the narrow range between .97 and .98. This value is strikingly high, particularly for four or five items (36). In general, for Cronbach's alpha and McDonald's omega, values between .70 and .95 are expected, depending on the characteristics of the construct and the stage of development of the instrument (Cho and Kim 2015; Cortina 1993; Cronbach 1951; Keszei, Novak, and Streiner 2010; Streiner and Norman 2008; Tavakol and Dennick 2011; Terwee et al. 2007; Watkins 2017). Values of internal consistency higher than .95 are observed with scales containing many items – 15 for the most conservative or 20 for the most liberal – or, as mentioned above, when there is high collinearity between the items (Keszei, Novak, and Streiner 2010; STATA 13.0 2013; Tavakol and Dennick 2011; Terwee et al. 2007; Watkins 2017). This finding needs to be corroborated in further research (Cortina 1993).

In the Colombian context, it is necessary to have a short, valid measurement of religiosity (attitude towards Christianity). Religiosity can be a mediating variable of health-related behaviours, such as the consumption of legal and illegal substances, and of general well-being in adolescents, such as the presence of depressive symptoms and suicidal ideation (Abdel-Khalek 2011; Abdel-Khalek 2009; Alves et al. 2010; Cotton et al. 2005; Rasic, Kisely, and Langille 2011).

This work is the first study showing a CFA for the Francis-5. However, the sample of fewer than 400 participants could be considered a limitation, as could the 'excessive' religiosity of the participants that led to extreme values in the different coefficients. It is well known that these coefficients require a sufficient degree of variation in response patterns (Cortina 1993).

It is concluded that the Francis-5 presents some issues in construct validity. Versions with four items have clearer dimensionality. It is recommended to review the performance of Francis-5 in samples from other populations.

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