EVALUATION OF PSYCHOMETRIC PROPERTIES OF THE 'SENSE OF COHERENCE SCALE' IN SCHOOLCHILDREN

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ABSTRACT

The aim of this study was to evaluate the psychometric properties of the Brazilian version of Sense of Coherence scale (SOC-13) in schoolchildren. This study included eight to fourteen-year-old schoolchildren. Reliability, reproducibility and factorial analyses were performed. The Cronbach's alpha coefficient for SOC-13 measurement presented questionable results (0.63) and the Intra-Class Correlation Coefficient of 0.70 was statistically significant between different time points (p<0.01). Regarding the construct validity, significant values were observed between the SOC-13 components scores and the overall scale score. In the Confirmatory Factorial Analysis, the latent variable in the three dimensions were confirmed, through the standard factorial loads, to the other items of the questionnaire. We can conclude that the questionnaire performs well as a discriminant measure though more studies are necessary to determine its minimal clinically important difference.

Keywords
evaluation, sense of coherence scale, psychometric, social functioning, child

RESUMO

O objetivo deste estudo foi avaliar as propriedades psicométricas da versão brasileira da escala de senso de coerência (SOC-13) em escolares. Este estudo incluiu escolares de oito a quatorze anos. Confiabilidade, reprodutibilidade e análises confirmatórias foram realizadas. O coeficiente alfa de Cronbach para mensuração da SOC-13 apresentou resultados questionáveis (0,63) e o Coeficiente de Correlação Intraclasse de 0,70 foi estatisticamente significante entre os diferentes momentos (p <0,01). Em relação à validade de construto, foram observados valores significativos entre os escores dos componentes do SOC-13 e o escore global da escala. Na Análise Fatorial Confirmatória, a variável latente nas três dimensões foi confirmada, através das cargas fatoriais padrão, aos demais itens do questionário. Podemos concluir que o questionário funciona bem como uma medida discriminante e mais estudos são necessários para determinar sua mínima diferença clinicamente importante.

Palavras chave
avaliação, escala de senso de coerência, psicometria, funcionamento social, criança

AVALIAÇÃO DAS PROPRIEDADES PSICOMÉTRICAS DA 'ESCALA DE SENSO DE COERÊNCIA' EM CRIANÇAS EM ESCOLAS

Introduction

In the last few decades, international health programs have required more complex forms of intersectoral political actions, which analyze the health determinants and the population well-being (Marmot, 2010). In this way, psychological abilities such as optimism and resilience are correlated with individuals' quality of life; particularly how much a person is able to deal with poor health (Broder, 2001).

The Salutogenic Theory, proposed by Antonovsky in 1987, is in agreement with this modern political paradigm. Salutogenic Theory involves a context that goes beyond knowledge of pathogenic mechanisms and biological methods of prevention. It emphasizes the necessity of health to promote health. Accordingly, health must be understood as result of the equilibrium between strengths that predispose people to health or to disease (Antonovsky, 1987). The special feature of this theory is that it challenges the pathogenic model. Salutogenesis, from saluto (health) and genesis (origins), seeks to explain factors that promote health as distinct from those that modify the risk of specific diseases. The central construct of Salutogenic Theory is Sense of Coherence (SOC), which seeks to explain the relationship between life stresses and health. It is seen as a personality trait that introduces comprehension and gives meaning to events, thereby creating a sense of manageability of the environment and promoting healthy behavior. SOC influences habits that directly affect health and adaptive behavior to stress, and can therefore decrease the severity of illnesses (Antonovsky, 1987; Bonanato et al., 2008).

In this context, SOC has been associated with different aspects of health and disease (Baker, Mat, & Robinson, 2010). Several longitudinal studies clearly support the importance of a strong SOC for the development and maintenance of a positive state of mental health, and also seem to indicate a strong association with perceived good health (Eriksson, & Lindström, 2006). In relation to a particular age group, a systematic review showed that adolescents' SOC was related to health in terms of quality of life, health behavior, mental health and family relationships (Länsimies et al., 2017). However, the relation between SOC and physical health is more complex and seems to be weaker than with mental health. The same could be observed in other studies that evaluated the relationship between SOC and subjective measures of oral health, where individuals with high SOC had better oral health related quality of life (Eriksson, & Lindström, 2007; Machado

et al., 2017; do Carmo Matias Freire, Sheiham, & Hardy, 2001). However, there are studies that demonstrated that individuals with small SOC present more experiences of untreated caries (Lage et al., 2017; Savolainen et al., 2005), dental trauma (Baxevanos et al., 2017) and toothache (Vettore, 2016).

A questionnaire composed of 29 questions was developed by Antonovsky (Sense of Coherence - SOC-29) to standardize measurement of SOC (Antonovsky, 1987). The same author also proposed a shorter version of this instrument: a questionnaire composed of thirteen questions (Sense of Coherence - SOC-13). Both versions were found to be viable and valid in 14 languages, and with individuals of all ages (Antonovsky, 1993). Bachem and Maercker proposed, in 2016, a revised SOC scale that addressed the aforementioned shortcomings of the original scale This revised scale particularly addresses the co-existence and integration of positive and negative life experiences by respecting and accepting those as equivalent facets of life (Bachem, & Maercker, 2016). As the SOC scale was previously found psychometrically sound in many countries, there is no need to develop new SOC versions; rather, there is a need for consolidation and standardization of the existing instruments (Martins, 2006).

In Brazil, the SOC-13 scale was translated, adapted and validated to be used with mothers of preschool children (Bonanato et al., 2009). The findings of Brazilian researchers indicated that the adapted scale is comprehensible and, in fact, obtained a greater response rate than the originally validated scale. Internal consistency increased from 0.67 for the original scale to 0.71 for the adapted scale and this value was extended to 0.80 in the test with the randomly selected sample. Medium weighted Kappa coefficients were 49.5%. Spearman's test demonstrated that the questions were correlated with total SOC scores (Bonanato et al., 2009). However, this scale has not yet been validated with Brazilian schoolchildren. It is therefore important to evaluate the applicability and the psychometric properties of SOC-13 scale in this population, in order to better understand the influence of SOC on health outcomes among schoolchildren. We hypothesized that the SOC-13 scale has adequate psychometric properties to be used in this school-age population.

Method

Participants

For this study, children from five schools, in the western zone of the city, with similar characteristics, composed our convenience sample. All 382 children enrolled in 4th and 5th grades were invited to participate in the research. A total of 356 children were included in the study, corresponding to a 93.2% of response rate.

Study Design and Data Collection

The data used in this research came from a cross-sectional study, involving students from the city of Santa Maria, RS, Brazil. The city has an estimated population of 261,031 inhabitants, including 26,477 children ages 8 to 14 years (Instituto Brasileiro de Geografia e Estatística, 2013).

Sense of Coherence Scale. (Bonanato et al., 2009). The short version of the Sense of Coherence Scale was developed to understand how individuals deal with stressful events in their lives. The scale is comprised of 13 questions, covering the three dimensions of SOC: Comprehensibility, Management and Meaning. Comprehensibility is the global orientation, expressed in the people´s ability of understanding what happens around them. Management is one's confidence in ability exert a positive impact on life, using available resources. Lastly, meaning is the realization that life has a meaning and a purpose (Antonovsky, 1993). The Brazilian version of the scale allows responses on a five-point Likert scale. The first items of the scale include the following prompts: 1) "What you do daily is…"; and 2) "Until today your life has been…" The possible responses vary from 1 to 5 with 5 being: "an enormous suffering and annoyance" and 1 being "a great pleasure and satisfaction" for the first question and, "with no aim" to "full of aims", respectively, for the second question. Subsequent items are: 3) "Do you have interest in what happens around you?" 4) "Do you think that you are treated with injustice?" 5) "Do you have confused ideas and feelings?" 6) "Do you think that the things you do in your life make no sense?"7) "Have you already felt disappointed with people you trusted?" 8) "Do you have feelings you would not wish to have?" 9) "Do you have doubts if you can control your feelings?";10) "Have you ever felt surprised by the behavior of someone you knew well?" 11) "In some situations, people feel like they've failed. Have you ever felt that you failed?" and, 12) "Do you feel that you are in an unusual situation and you do not know what to do?". The answers vary

from "never" to "always." The last item of the scale is: 13) "Sometimes things happen in our lives and later we think we did not give the deserved importance to it. When something happens in your life, you think you gave it importance?". The answers can vary from "totally wrong" to "totally right" on the last question. The scale was administered by trained interviewers during a face-to-face interview with particpants. The answers to questions 1 and 13 were reverse-scored, thus they would have the same meaning as the others. The final score is obtained through the sum of the items, with a range of 13 to 65, and higher scores representing a greater SOC (Bonanato et al., 2009). The SOC-13 scale was administered twice to the same group of people after an average period of one month to evaluate its reliability.

Statistical Analysis

Data were analyzed using the statistical software STATA 14.0 and Mplus 6.12 version. The internal consistency of the SOC-13 was assessed using the Cronbach's Alpha Coefficient. The reliability of the scale was evaluated using a test-retest analysis to verify if the scale always measures equally, through Intra-Class Correlation Coefficient (ICC) calculation. For both Cronbach's Alpha Coefficient and ICC, values higher than 0.7 were considered acceptable (Martins, 2006).

The construct validity was verified by correlations between the scores of each component of SOC-13 with the overall score using Spearman's Correlation Coefficient ($p<0.05$). Finally, the Exploratory (EFA) and Confirmatory (CFA) Factor Analyses were performed to verify the relationships between the 13 items of the scale and the latent variable SOC. EFA with 1 factor and 3 factors (comprehensibility, management and meaning) were evaluated. The estimator Maximum Likelihood (ML) was used. Parameters of CFA models may be estimated using a variety of methods including ML. The ML estimation is described in the literature as relatively robust for extensive violations of distributional assumptions (Cautin, & Lilienfeld, 2015). EFA showed appropriate fit for datasets of three factor. Therefore, CFA was performed to compare the dimensional structure found by EFA. Modifications indices (MI) were also used for statistical fit, as correlations between items. The global model adjustments were analyzed using the following parameters: Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Standardized Root Mean Square Residual (SRMR), and Root Mean Square Error of Approximation (RMSEA). CFI and TLI

≥ 0.90, and RMSEA and SRMR ≤ 0.08, are considered indicative of a good model (Hooper, Coughlan, & Mullen, 2008).

Ethical Considerations

This study was approved by the Ethics Committee of the Federal University of Santa Maria (CAAE:43675415.4.0000.5346). The permissions were obtained from the Education Coordinator and from the schools involved in this study. Data was collected only after obtaining informed consent from the parents and assent from participants.

Results

We assessed 356 eight to fourteen-year-old children in the study. In the sample, 52% were female and 48% were male; 76% of the children identified themselves racially as white and 24% as other race, including black, brown, yellow or indigenous people. Most of the children had a low socioeconomic level, with mothers that had not completed high school (60%) and 51% of them had a household income lower than one Brazilian minimum wage (approximately USD 280 during the data gathering).

Table 1 presents a description of the mean distribution of SOC-13 overall and its components scores. SOC-13 scores ranged from 32 to 62, with a mean of 50.67 (SE: 6.22). The scores of the components of the questionnaire showed similar variations, and the "comprehensibility" component presented the greatest variation (range of 8 to 25).

The internal consistency of the Sense of Coherence scale was 0.63, showing a questionable correlation between the different items in the same test. The ICC was statistically significant, indicating a good reproducibility (ICC = 0.70, p = 0.01). The construct validity of SOC-13 questionnaire was assessed through the correlation between the scores of its components (comprehensibility, management and meaning) and the total score. The results showed a positive correlation for all components (p < 0.001). The components comprehensibility and management presented a strong and positive correlation with SOC-13 overall score (R = 0.78 and 0.72, respectively). These results are shown in Table 2.

Table 1

Descriptive Distribution of Overall and Components of SOC-13 Scores. Santa Maria, 2016

	Number of Items	Mean of SOC-13 Scores (SE)*	Possible Range	Observed Range
SOC-13 (Overall Scale)	13	50.67 (6.22)	13 – 65	32 – 62
Components				
Comprehensibility	5	19.55 (3.48)	5 – 25	8 – 25
Manageability	4	16.92 (2.80)	4 – 20	5 – 20
Meaningfulness	4	14.21 (2.66)	4 – 20	6 – 20

Abbreviations: SOC, sense of coherence; SE, standard error.
*Taking into account the sampling weight.

Table 2

Internal consistency, reproducibility and construct validity of the SOC-13 questionnaire. Santa Maria, 2016

Variables	Measure	Cronbach's Alpha Coefficient	Intra-class Correlation Coefficient	Spearman's Correlation Coefficient
		T1	T1 to T2	T1
Sense of coherence (SOC)	SOC-13 (Overall Scale)	0.63	0.70*	-
Components				
Comprehensibility	Items 5, 8, 10, 12 and 13 of SOC-13	0.58	-	0.78**
Manageability	Items 4, 7, 9 and 11 of SOC-13	0.50	-	0.72**
Meaningfulness	Items 1, 2, 3 and 6 of SOC-13	0.25	-	0.47**

Abbreviations: SOC, sense of coherence; T1, baseline; T2, one-month follow-up.
*The correlation coefficient is significant in the p value of 0.01 (two-tailed).
**p-value < 0.001.

The Exploratory Factorial Analysis (EFA) was performed to 1 factor and 3 factors. The global adjustments of the model for 3 factors (CFI= 0.97; TLI= 0.94; RMSEA = 0.03 (90%CI: 0.00-0.05); and SRMR= 0.03) was confirmed by CFA.

The Confirmatory Factorial Analysis (CFA) is shown in Figure 1 and factor loadings are shown in Table 3. The latent variable was related, through standardized factor loadings, to the other items in the questionnaire. The three-dimensional factors of SOC were confirmed.

Furthermore, questions 1 and 2, and 6 and 7 had weak correlations, but they were retained in the fit model. The global adjustments of the model were: CFI= 0.92; TLI= 0.89; RMSEA = 0.05; and SRMR= 0.04.
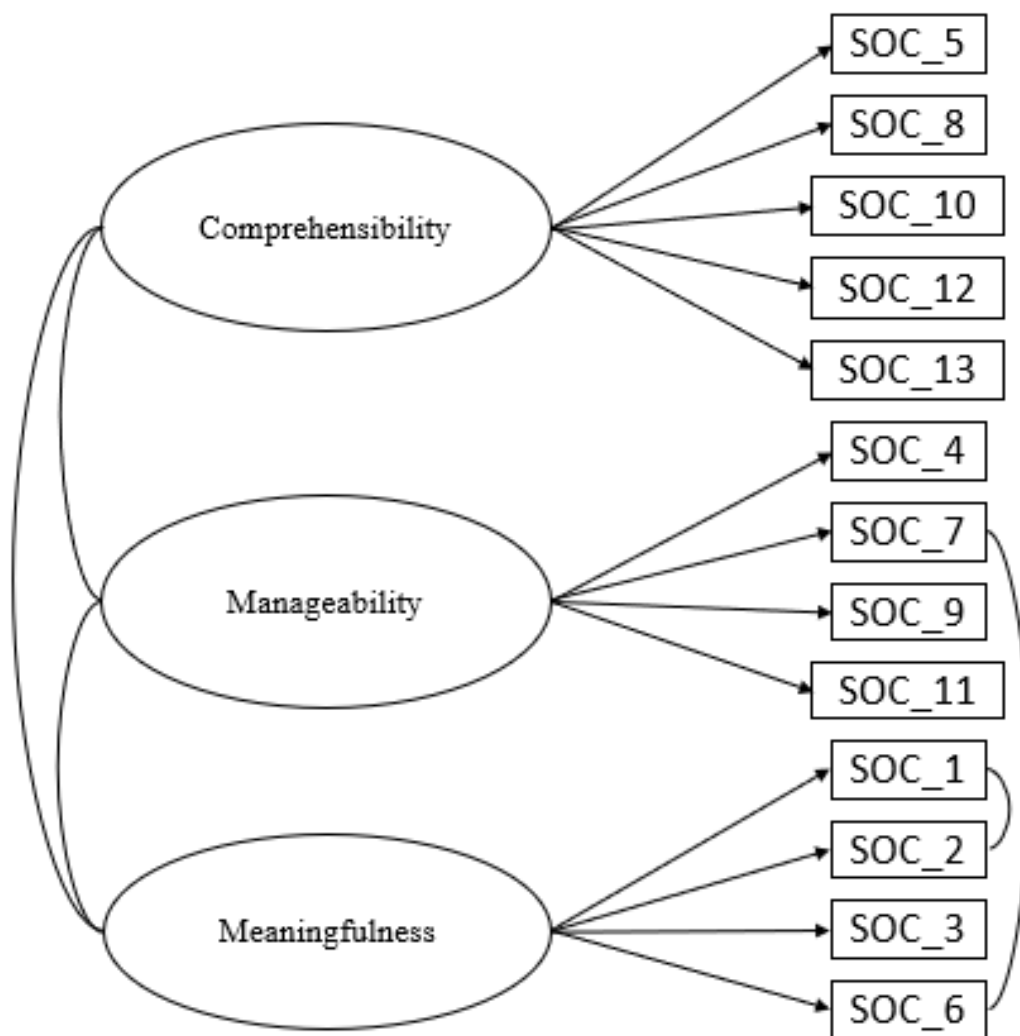

Figure 1. Confirmatory Factorial Analysis (CFA) of the SOC-13 questionnaire.

Table 3

Dimensional models of the Sence of Coherence (SOC) by confirmatory factor analysis (CFA)

Items (SOC-13)	3-Factor CFA			
	Comprehensibility Factor 1	Manageability Factor 2	Meaningfulness Factor 3	R-SQUARE
SOC-1			0.09	<0.01
SOC-2			-0.06	<0.01
SOC-3			-0.19*	0.03
SOC-4		0.35*		0.13
SOC-5	0.56*			0.31
SOC-6			0.64*	0.42
SOC-7		0.55*		0.30
SOC-8	0.68*			0.46
SOC-9		0.40*		0.16
SOC-10	0.51*			0.26
SOC-11		0.51*		0.26
SOC-12	0.50*			0.25
SOC-13	0.08			<0.01
F1<->F2[£]	0.93*			
F2<->F3[£]	0.98*			
F1<->SOC-3[£]	-0.19*			
SOC-1<->SOC-2[£]	0.26*			
SOC-6<->SOC-7[£]	-0.29*			
RMSEA (90%CI)	0.05 (0.03-0.06)			
CFI	0.92			
TLI	0.89			
SRMR	0.04			

*P<0.01; £: Factors correlation;

CI: Confidence Interval; RMSEA: Root Mean Square Error of Approximation; CFI: Comparative Fit Index; TLI: Tucker-Lewis Index; SRMR: Standardized Root Mean Square Residual.

Discussion

This study evaluated the psychometric properties of the Brazilian short version of Sense of Coherence Scale for students from southern Brazil. The absence of literature on this version indicated need for further research on the cross-cultural adaptation of the scale. Some information as dimensional issues and item review needs to be examined by confirmatory factor analysis and theoretical adaptations.

As previously stated, the reliability value of SOC-13 scale was acceptable (ICC 0.70). The same was seen in a previous study (Eriksson, & Lindström, 2005), showing a good correlation when SOC-13 is reapplied. In the analysis of construct validity, the Spearman's Correlation Coefficient showed statistically significant data. All scores of the components of SOC-13 questionnaire showed positive and strong relationships with the total questionnaire score. In addition, our values were higher than those obtained in another study, conducted in Sweden with

a group of physically active, elderly individuals (Söderhamn, & Holmgren, 2004), demonstrating highly significant correlations for all the questions proposed in this article.

The Cronbach's Alpha Coefficient for our study was not significant. This measure has been largely used to evaluate the consistency of the answers to a question group in a measurement instrument; with values of 0.65-0.70 being commonly deemed "acceptable." However, a high α value does not always represent good internal consistency for an instrument (Streiner, 2003). Notwithstanding, some authors show that the Cronbach's Alpha Coefficient, when solely interpreted, is not a reliable measure to reproduce the reliability of the data (Sijtsma, 2009; Schmitt, 1996).

Statistical critics comment that alpha values should be interpreted with caution, because the internal consistency of an instrument should be based on different statistical tests. First, alpha always has a value, which cannot be equal to the test score's reliability given the interitem covariance matrix and the usual assumptions about measurement error. Second, in practice, alpha is used more often as a measure of the test's internal consistency than as an estimate of reliability. However, it can be shown easily that alpha is unrelated to the internal structure of the test. Further, statistics based on a single test administration do not convey much information about the accuracy of an individuals' test performance (Sijtsma, 2009). Thus, only alpha values can conduct to an ambiguity of interpretation, being that very low or very high values would indicate the unidimensionality or the multidimensionality of the data (Schmitt, 1996).

With the intention to complete the gaps left by the internal consistency test, we used a Confirmatory Factorial Analysis (CFA). This analysis allowed us to verify the relationship between the 13 items of the SOC-13 with the global scale variable. The latent variable by dimension was related to the other variables (items), confirming the use of this scale for the concept of sense of coherence. Some factor loadings presented low values, such as items 1, 2 and 13, probably due to the negative factor expressed in these items. Since there is a change in language and cultural context between the original in Hebrew (Israel) to Portuguese (Brazil), the theoretical-cultural validation of the concept for Brazilian culture demands qualitative research as proposed by Herdman Fox-Rushby and Badia (1997), for the process of scale adaptation and validation to be better accepted (Herdman, Fox-Rushby, & Badia,1997). Implicitly, it was assumed that the SOC concept is expressed in the same way cross-culturally. However, Brazilian studies have reported respondents' difficulties in understanding some items due to cultural differences, making

it necessary for target population members and specialists to be consulted again for a cross-cultural readaptation of the scale to Brazilian Portuguese language (Bonanato et al., 2008; Tomazoni et al., 2019).

Items 1-2 and 6-7 are weakly correlated, however they have different constructs and for this reason initial construction should be maintained (Antonovsky, 1993). The overall values of the model were acceptable, which demonstrates the validity of the factorial structure for the sample of schoolchildren studied.

Moreover, in 1993, Antonovsky critically reviewed published papers that used the SOC in its different forms and concluded that several researchers noticed the occurrence of only extreme answers, which is one of the problems of the scale that merits further study (Antonovsky, 1993). Thus, the SOC scale needs to be validated for each specific population and new adaptations may be necessary for differentiated contexts (Martins, 2006).

As mentioned earlier, criticism of SOC measurement exists, for one, because various Sense of Coherence measures have been shortened, such as the SOC-13. This reflects the reality that in many health survey applications, questionnaires must be very brief. On the other hand, the critique stems from the fact that the SOC-13 are only moderately-to-weakly related to various measures of physical health (Eriksson, & Mittelmark, 2017). However, this version has been shown to be broadly associated with more subjective outcomes, important for health construction (Eriksson, & Mittelmark, 2017; Tomazoni et al., 2019).

Our findings should be interpreted with caution given their limitations and strengths. A convenience sample was used for this study, limiting the generalization of the findings for this population. Additionally, the participants involved in this research have high social vulnerability, which may have influenced their responses. Nonetheless, this is a study that evaluated the psychometric properties of an instrument, and we believe that these limitations do not interfere in the findings. Other studies should be carried out to investigate and determine the importance of SOC and its influence on clinical and psychosocial outcomes in this population.

Working with Sense of Coherence would be a useful strategy to improve the health of schoolchildren. Unhealthy factors are part of the environment, and a healthy state is more related to perception of and dealing with unhealthy factors than to their presence (Watt, 2002). Thus, it becomes necessary to measure and qualify the SOC in a standardized way in different populations.

The results of this study bring relevant information about the use of SOC-13 scale among Brazilian schoolchildren. It demonstrated acceptable values of validity and reliability of the scale.

Conclusion

In conclusion, the Brazilian version of the short Sense of Coherence scale (SOC-13) showed adequate validity in a school-aged population. These findings are important because they show that subjective measures can be used in promoting the oral health of populations. Validated questionnaires and scales allow reliable findings and, therefore, more accurate public planning can be undertaken in order to reduce health inequalities. In this regard, the questionnaire performs well as a discriminant measure, though more studies are necessary to determine the scale's minimal clinically important difference.

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