VALIDATION OF THE CROATIAN VERSION OF THE SENSE OF COHERENCE 29-ITEM SCALE IN CROATIAN NURSES

OVREDNOTENJE HRVAŠKE VERZIJE DOLGEGA VPRAŠALNIKA O OBČUTKU KOHERENTNOSTI (SOC-29) PRI MEDICINSKIH SESTRAH

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ABSTRACT

Keywords:
Sense of Coherence, SOC-29 instrument, validity, reliability, occupational medicine, nurses

Introduction: The aim of the study was to validate the Croatian version of the Sense of Coherence 29-item instrument (SOC-29) within a nursing population.

Methods: The cross-sectional study was conducted between December 2017 and June 2018 at the University Hospital Centre Sisters of Mercy (UHCSM) in Zagreb, Croatia. A total of 711 nurses participated in this study. Internal consistency reliability was evaluated using Cronbach's alpha coefficient (α), while the structure of the questionnaire was verified by exploratory factor analysis (EFA) (method of extraction: principal component analysis (PCA)) and confirmatory factor analysis (CFA).

Results: The instrument demonstrated high internal consistency (α=0.885). PCA analysis has identified five factors that together account for 48% of the variance. However, the observed factors could not be interpreted. In the CFA, none of the models fitted well, although the fit of the three-factor model (CMIN/DF=4.786, CFI=0.767, RMSEA=0.073) was slightly better in comparison with the one-factor model (CMIN/DF=6.072, CFI=0.685, RMSEA=0.084). As the three-factor model in PCA has been shown to be uninterpretable, and all three factors were mutually positive and significantly correlated (correlation coefficients: 0.365-0.521), this indicated a single factor in the background. All items also showed saturation with the first factor (accounting for 25.7% of the variance).

Conclusions: The Croatian version of the SOC-29 instrument successfully fulfilled the necessary psychometric criteria for being used on the population of Croatian nurses. The study proposes that potential users use the single-factor structure.

IZVLEČEK

Ključne besede:
občutek koherentnosti, SOC-29, veljavnost, zanesljivost, medicina dela, medicinske sestre

Uvod: Želeli smo ovrednotiti, ali je hrvaška verzija dolgega vprašalnika o občutku koherentnosti (SOC-29) uporabna v raziskavah na področju promocije zdravja med hrvaškimi medicinskimi sestrami, zato smo si zadali za cilj oceniti izbrane psihometrične lastnosti instrumenta v tej določeni poklicni skupini tako z vidika zanesljivosti kot tudi z vidika veljavnosti.

Metode: Presečna raziskava, v kateri je sodelovalo 711 medicinskih sester, je bila izvedena v obdobju od decembra 2017 do junija 2018 v Univerzitetnem kliničnem centru Sestre milosrdnice v Zagrebu na Hrvaškem. Na področju zanesljivosti se je ocenjevala notranja skladnost. Uporabili smo Cronbachov alfa koeficient (a). Na področju veljavnosti se je ocenjevala struktura vprašalnika. Preverjala se je najprej s preiskovalno faktorsko analizo (EFA) (z metodo analize glavnih komponent (PCA) kot metodo ekstrakcije dejavnikov) in nato še s potrditveno faktorsko analizo (CFA).

Rezultati: Na področju zanesljivosti je analiza pokazala visoko notranjo skladnost instrumenta (a = 0,885). Na področju veljavnosti je analiza PCA pokazala pet dejavnikov, s katerimi se je skupaj dalo pojasniti 48,0 % variance, vendar opazovanih dejavnikov ni bilo mogoče razložiti. Tudi ko smo PCA omejili na tri dejavnike, teh ni bilo mogoče razložiti. V CFA noben od modelov ni najbolje ustrezal, čeprav je bila ustreznost trifaktorskega modela (CMIN/DF = 4,786, CFI = 0,767, RMSEA = 0,073) nekoliko boljša v primerjavi z enofaktorskim modelom (CMIN/DF = 6,072, CFI = 0,685, RMSEA = 0,084). Ker se trifaktorskega modela v PCA ni dalo interpretirati, prav tako pa so bili vsi trije dejavniki medsebojno pozitivni in so bistveno korelirani (korelacijski koeficienti: 0,365-0,521), je to kazalo en sam dejavnik v ozadju. Vse postavke so pokazale tudi nasičenost s prvim dejavnikom, s katerim se je dalo pojasniti 25,7 % variance.

Zaključek: Hrvaška različica instrumenta SOC-29 je uspešno izpolnila potrebna psihometrična merila za uporabo v populaciji hrvaških medicinskih sester, njenim potencialnim uporabnikom pa je predlagana uporaba enofaktorske strukture, ki jo je zagovarjal tudi avtor instrumenta, prav tako pa so prednost enofaktorski strukturi dali tudi številni drugi avtorji.

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1 INTRODUCTION

The Sense of Coherence (SOC) is a key concept of salutogenic model proposed in 1979 by the American-Israeli medical sociologist Aaron Antonovsky (1). It was seen as a coping resource that helped individuals to identify and use their external and internal resources for solving problems and managing life events (1). In order to measure the SOC, Antonovsky developed a special instrument: the Orientation to Life questionnaire, also named the SOC scale. The original version of the instrument consisted of 29 questions (SOC-29), while a shorter version contained 13 questions (SOC-13) (2). Current research by Mittelmark et al. indicates that the SOC-29 and SOC-13 have been used in at least 49 different languages in at least 48 different countries around the world (2). Both instruments were also assessed for their reliability and validity in different population groups, from the general population to various groups of patients (2-9). The results of validation studies proved both instruments to be reliable and cross-culturally appropriate tools (2-4). In these studies, a one-factor structure was often tested against a three-factor structure. Some authors have concluded that the SOC scale is more appropriate as a one-dimensional scale (3, 7), while others have suggested a multidimensional concept (2).

Research has proved that nurses constitute a vulnerable population group that faces significantly more stress compared to other professions (10), which may have a negative impact on their health (3-9, 11-14). Research findings on SOC in the nursing profession have so far shown that SOC is a protective factor against stressors in the work environment (15). A strong SOC is also a good predictor of nurses' ability to function healthily in the workplace, protecting them against burnout (16). Burnout is also a feature of the nursing profession in Croatia (11, 17). According to Mijakoski et al. (17), Croatian nurses reported high levels of depersonalisation and of organisational and emotional work demands. The study highlighted the need for specific organisational interventions to be implemented in hospital settings. An exploration of SOC among Croatian nurses is therefore urgently required.

In 2005 the SOC-29 was translated into Croatian (SOC-29-CRO) and psychometrically tested on the sample of 822 individuals from the general population (18). It has not, however, so far been used to assess the Croatian nursing population. Moreover, to our knowledge the literature currently contains only a handful of studies that attempt to validate the SOC-29 among nurses (19, 20). The study aimed to validate the SOC-29-CRO for use as part of health promotion research among Croatian nurses. Its objective study was to assess selected psychometric characteristics of the instrument within this particular occupational group.

2 METHODS

2.1 Study Design and Study Population

This cross-sectional study was carried out as part of a larger research project on the impact of SOC on work ablity of nurses at University Hospital Centre Sisters of Mercy (UHCSM) in Zagreb, Croatia between December 2017 and June 2018. The total population of 1,465 nurses of different profiles (registered nurses, Bachelors of nursing, Masters of Science in nursing) employed in different departments of the UHCSM were considered for inclusion in the study regardless of their education level. However, due to various absences (sick leave, annual leave, study leave), questionnaires could only be delivered to 1,300 nurses.

2.2 Description of the SOC-29 Study Instrument

SOC-29 is an instrument with 29 items, each of them being scored on a seven-point scale (1) (Table 1). Thirteen items are formulated negatively and have to be reversed in scoring. The measure given by SOC-29 is a summary score, obtained by adding the values of individual responses to all 29 items, ranging from 29-203 points, with higher scores indicating a stronger SOC (2, 3).

Written permission to use SOC-29-CRO was obtained from the translators, as well from the copyright holders of the original SOC-29 instrument.

2.3 Instrument Administration

After obtaining the approval of the Ethics Committee, a meeting was held at which the participants were informed of the objectives of the research and the overall procedure. After the meeting, all study instruments were distributed in sealed envelopes to all hospital departments. Participants were given the possibility of taking the questionnaire home, filling it in and returning it to the workplace. All questionnaires were returned anonymously in sealed envelopes to protect nurses' privacy.

2.4 Psychometric Validation

In order to assess the instrument's reliability, internal consistency was assessed by calculating Cronbach's alpha coefficient (α). The instrument was considered to be internally consistent if α≥0.80 (21). In order to assess the instrument's validity, the factor structure of the instrument was assessed by using exploratory factor analysis (EFA) as well as confirmatory factor analysis (CFA). In EFA, the data screening, assumption testing and sampling adequacy were performed first using the Kaiser-Meyer-Olkin (KMO) statistic with appropriate values >0.5 and Bartlett's sphericity test with appropriate values p≤0.05 (22). The Kolmogorov-Smirnov (K-S) test was also performed for testing the normality of distributions. The principal component analysis (PCA) was then used as the extraction method. In CFA, the robust maximum likelihood

Table 1.   Sense of Coherence 29-item instrument: items, their placement within three dimensions, and scoring (1).

Item no	Question*	Dimension	Scoring
Item_1	When you talk to people, do you have the feeling that they don't understand you?	C	R
Item_2	Think of the people with whom you come into contact daily, aside from the ones to whom you feel closest. How well do you know most of them?	C	O
Item_3	Has it happened in the past that you were surprised by the behaviour of people whom you thought you knew well?	C	R
Item_4	In the past ten years your life has been: (full of changes without your knowing what will happen next – completely consistent and clear)	C	O
Item_5	Do you have the feeling that you are in an unfamiliar situation and don't know what to do?	C	O
Item_6	When you face a difficult problem, the choice of a solution is: (always confusing and hard to find – always completely clear)	C	O
Item_7	Your life in the future will probably be: (full of changes without knowing what will happen next – completely consistent and clear)	C	O
Item_8	Do you have very mixed-up feelings and ideas?	C	O
Item_9	Does it happen that you have feelings inside you would rather not feel?	C	O
Item_10	Does it happen that you have the feeling that you don't know exactly what's about to happen?	C	O
Item_11	When something happened, have you generally found that: (you overestimated or underestimated its importance – you saw things in the right proportion)	C	O
Item_12	In the past, when you had to do something which depended upon cooperation with others, did you have the feeling that it: (surely wouldn't get done – surely would get done)	Ma	O
Item_13	Has it happened that people whom you counted on disappointed you?	Ma	R
Item_14	Do you have the feeling that you're being treated unfairly?	Ma	O
Item_15	What best describes how you see life: (one can always find a solution to painful things in life – there is no solution to painful things in life)	Ma	R
Item_16	When something unpleasant happened in the past your tendency was: ("to eat yourself up about it" – to say "OK that's that, I have to live)	Ma	O
Item_17	When you do something that gives you a good feeling: (it's certain that you'll go on feeling good – it's certain that something will happen to spoil the feeling)	Ma	R
Item_18	Do you think that there will always be people whom you'll be able to count on in the future?	Ma	R
Item_19	Many people – even those with a strong character – sometimes feel like sad sacks (losers) in certain situations. How often have you felt this way in the past?	Ma	R
Item_20	When you think of the difficulties you are likely to face in important aspects of your life, do you have the feeling that: (you will always succeed in overcoming the difficulties – you won't succeed in overcoming the difficulties)	Ma	R
Item_21	How often do you have feelings that you're not sure you can keep under control?	Ma	O
Item_22	Do you have the feeling that you don't really care about what goes on around you?	Me	R
Item_23	Life is: (full of interest – completely routine)	Me	R
Item_24	Until now your life has had: (no clear goals or purpose at all – very clear goals and purpose)	Me	O
Item_25	Most of the things you do in the future will probably be: (completely fascinating – deadly boring)	Me	R
Item_26	When you think about your life, you very often: (feel how good it is to be alive – ask yourself why you exist at all)	Me	R
Item_27	Doing the things you do every day is: (a source of deep pleasure and satisfaction – a source of pain and boredom)	Me	R
Item_28	You anticipate that your personal life in the future will be: (totally without meaning or purpose – full of meaning and purpose)	Me	O
Item_29	How often do you have the feeling that there's little meaning in the things you do in your daily life?	Me	O

Legend: *= the questions from the questionnaire are reprinted with the permission of the copyright holder; C=comprehensibility; Ma=manageability; Me=meaningfulness; O=original; R=reverse

estimator was applied and the following fit measures used in the assessment: the relative chi-square (chi-square/ degree of freedom) (CMIN/DF), the comparative fit index (CFI), and the root mean squared error of approximation (RMSEA). The criteria for fit measures were: CMIN/DF<5 (23), RMSEA<0.060 (24) and CFI>0.950 (24). Two models were defined and tested: the one- and three-factor model. Statistical analysis was performed using SPSS software, version 23.0 (SPSS Inc., Chicago, IL, USA), except for the CFA, where AMOS software was used.

3 RESULTS

3.1 Study Participants' Characteristics

Of the 1,300 nurses eligible for inclusion, 713 participated in the study (response rate 54.7%). The group consisted of 630 women and 83 men. The mean age was 38.4±12.5 years (range: 19-65 years). All other characteristics of the study participants are presented in Table 2.

Table 2. Socio-demographic and work-related characteristics of the study participants (n=713).

Characteristic	Category	N	(%)
Gender	Male	83	11.6
	Female	630	88.4
Age	19-30	247	34.6
	31-40	161	22.6
	41-50	159	22.3
	51-65	145	20.4
Marital status	Married	371	52.0
	Divorced	48	6.7
	Widowed	18	2.5
	Single	186	26.1
	Life partnership	89	12.5
Level of education	High school education	429	60.2
	Bachelor of nursing	256	35.9
	Master of nursing	28	3.9
Work department	Internal unit	179	25.3
	Surgery unit	157	22.2
	Operating room	33	4.7
	Intensive care unit	73	10.3
	Gynaecology unit	52	7.3
	Polyclinical unit	23	3.2
	Oncology and haematology unit	58	8.2
	Dermatology unit	13	1.8
	Emergency unit	27	3.8
	Ophthalmology unit	28	4.0
	Psychiatry unit	34	4.8
	Paediatrics unit	31	4.4
Length of service	Less than 1 year	23	3.2
	1-19 years	391	54.8
	20 or more years	299	41.9

The SOC-29-CRO instrument was completed by 711 participants. The mean value of the SOC-29-CRO summary score in our study was 145.0±22.1 points. The coefficient of relative variation was 15.2%. The statistical properties of the distribution of the individual item values are shown in Table 3.

Table 3. Statistical properties of the distribution of values of items of the Sense of Coherence 29-item scale in the validation study of Croatian nurses (n=711).

Item	$\bar{x}$	SD	Me	IQR
Item_1	4.8	1.6	5	4-6
Item_2	4.6	1.4	5	4-6
Item_3	3.8	1.4	4	3-5
Item_4	3.8	1.7	4	3-5
Item_5	4.8	1.6	5	4-6
Item_6	4.7	1.4	5	4-6
Item_7	4.3	1.5	4	3-5
Item_8	5.6	1.5	6	5-7
Item_9	5.0	1.7	5	4-6
Item_10	4.8	1.7	5	4-6
Item_11	4.6	1.4	6	5-7
Item_12	5.2	1.4	5	4-6
Item_13	3.8	1.5	4	3-5
Item_14	4.5	1.8	5	3-6
Item_15	5.6	1.5	6	5-7
Item_16	5.0	1.7	5	4-7
Item_17	4.9	1.7	5	4-6
Item_18	5.8	1.5	6	5-7
Item_19	4.4	1.4	5	3-6
Item_20	5.1	1.4	5	4-6
Item_21	5.0	1.7	5	4-6
Item_22	4.6	1.4	5	4-6
Item_23	3.8	1.4	4	3-5
Item_24	3.8	1.7	4	3-5
Item_25	4.8	1.6	5	4-6
Item_26	4.7	1.4	5	4-6
Item_27	4.3	1.5	4	3-5
Item_28	5.6	1.5	6	5-7
Item_29	5.0	1.7	5	4-6

Legend: x̄=mean; s=standard deviation; Me=median; IQR=interquartile range

3.2 Psychometric Validation

3.2.1 Reliability

Cronbach's alpha coefficient was high (α=0.885), indicating high internal consistency of the instrument.

3.2.2 Factor Structure

Both the KMO statistic (KMO=0.913) and Bartlett's sphericity test (p<0.001) indicated adequate properties for the PCA. The K-S test did not show statistically significant deviations from the normal distribution (p=0.063). PCA analysis has identified five factors which together accounted for 48% of the variance (Table 4). However, the observed factors could not be interpreted. A PCA limited to three factors also showed an uninterpretable structure.

The statistical properties of both models defined and tested using CFA are presented in Table 5. None of the models fitted well (Table 5). Moreover, all three factors in the three-factor model were mutually positive and significantly correlated (r=0.365-0.521).

Table 4. Results of exploratory factor analysis (extraction method: principal component analysis) in the validation study of the Sense of Coherence 29-item scale among Croatian nurses (n=711).

Component	Initial Eigenvalues			Extraction sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	7.453	25.700	25.700	7.453	25.700	25.700
2	2.396	8.262	33.962	2.396	8.262	33.962
3	1.693	5.839	39.801	1.693	5.839	39.801
4	1.236	4.262	44.063	1.236	4.262	44.063
5	1.143	3.943	48.005	1.143	3.943	48.005
6	0.982	3.388	51.393			
7	0.955	3.294	54.687			
8	0.935	3.223	57.910			
9	0.897	3.092	61.003			
10	0.841	2.900	63.903			
11	0.811	2.797	66.699			
12	0.767	2.646	69.345			
13	0.725	2.500	71.846			
14	0.700	2.415	74.261			
15	0.681	2.349	76.610			
16	0.643	2.217	78.827			
17	0.623	2.147	80.975			
18	0.593	2.046	83.021			
19	0.565	1.947	84.968			
20	0.547	1.886	86.854			
21	0.534	1.842	88.695			
22	0.515	1.776	90.471			
23	0.471	1.623	92.095			
24	0.448	1.546	93.640			
25	0.417	1.439	95.079			
26	0.389	1.340	96.419			
27	0.366	1.261	97.680			
28	0.345	1.189	98.869			
29	0.328	1.131	100.000			

Table 5. Results of confirmatory factor analysis in validation study of the Sense of Coherence 29-item scale among Croatian nurses (n=711).

Statistical property	one-factor model	three-factor model
Chi-square	2289.11	1790.13
Degrees of freedom	377	374
p	<0.001	<0.001
CMIN/DF	6.072	4.786
CFI	0.685	0.767
RMSEA	0.084	0.073

Legend: CMIN/DF=relative chi-square (chi-square/degree of freedom); CFI=comparative fit index; RMSEA=root mean squared error of approximation

Additionally, in PCA all the items have shown first factor, which accounted for 25.7% of the variance (Table 4), loading. The factor loadings, which were considered satisfactory, are shown in Table 6.

4 DISCUSSION

The results of our study show that the SOC-29-CRO successfully fulfilled the required psychometric criteria for being used within the Croatian nursing population.

The results of the reliability analysis in our study are

consistent with the results reported in other similar studies. First, the reliability obtained in our study is in the upper range of values for this measure obtained in other similar studies in general (range 0.70-0.95) (2-5).

Table 6. Factor loadings greater than 0.200 in the validation study of the Sense of Coherence 29-item scale among Croatian nurses (n=711).

Component	Component loads				
	1st	2t	3t	4st	5st
Item_1	0.443	0.363			
Item_2	0.342		0.320		-0.325
Item_3	0.352	0.521	0.262		0.257
Item_4	0.277		0.626	-0.340	
Item_5	0.483	0.277			-0.416
Item_6	0.468		0.392		-0.394
Item_7	0.305		0.600	-0.290	
Item_8	0.547	0.241	-0.301	-0.236	-0.216
Item_9	0.565	0.404		-0.306	
Item_10	0.399	0.246		-0.292	
Item_11	0.515			0.383	
Item_12	0.542		0.203	0.315	
Item_13	0.403	0.527			0.266
Item_14	0.512	0.383			-0.362
Item_15	0.520		-0.317		
Item_16	0.497				-0.225
Item_17	0.496			0.217	
Item_18	0.581	-0.204		0.210	
Item_19	0.500	0.317			
Item_20	0.589	-0.211			-0.203
Item_21	0.430	0.337		0.219	
Item_22	0.355	0.240	-0.210	0.340	
Item_23	0.551	-0.352	-0.260		
Item_24	0.626	-0.310			
Item_25	0.677	-0.355	-0.207		
Item_26	0.718	-0.243			
Item_27	0.625	-0.266			0.244
Item_28	0.667	-0.404	-0.223		
Item_29	0.345	0.310		0.209	

Finally, the results of our study are similar to the results of the study conducted among Portuguese nurses with a reported Cronbach's alpha value of 0.87 (19). The reliability obtained in our study is also completely consistent with the reliability obtained in the study by Kardum et al. (18). The value of Cronbach's alpha coefficient in this study was almost identical (α=0.88).

The analysis of factor structure in our study first identified five factors (a similar result was obtained in the studies conducted by Frenz et al. (7) and Paika et al. (5). In both studies in continuation one-factor structure was revealed. In the study by Frenz et al., subsequent analysis of the factor scores suggested the scale had one core factor. The authors stated that the results suggested that the SOC was best understood as having a single core factor (7). Paika et al. repeated the factor analysis using the fixed number of factors as the extracted model, which resulted in one factor being extracted. Their study revealed that an SOC-29 one-factor structure showed a coherent structure with remarkable stability (5). The study conducted among Portuguese nurses also confirmed the one-factor structure (19). As in our study all the items showed saturation with the first factor, we decided to use the one-factor structure advocated by other authors (5, 7). This was despite the fact that the percentage of the explained variance could not be considered satisfactory. However, we can justify this by the fact that we investigated a specific sample, i.e. a population of nurses employed in a precisely designated hospital. The coefficient of relative variation for SOC can also be considered low. Unlike our study, the study by Kardum et al. (18) showed a three-factor structure. However, in their conclusions they drew on the use of the overall result rather than the three components. This was because they discussed the inadequacy of their functional differentiation. In order to make a comparison with this study, we also tested a three-factor model. However, the three-factor structure deviated significantly from the structure advanced by other authors and, in our case, also proved uninterpretable, despite the rotations. For this reason, we decided to adopt the one-factor structure. These leads us to conclude that authors generally prefer the one-factor structure of the instrument. The one-factor model was also advocated by Antonovsky himself, since the instrument was not intended to measure dimensions individually (1).

Since the SOC-29-CRO has been already validated among the Croatian general population (18), it is important to explain why the authors considered it necessary to validate the instrument again on a specific nursing population. The first reason has been already presented: in the first SOC-29-CRO validation study, the factor structure of the instrument was not clear, even though the authors had proposed that a one-factor structure be used. This ambiguity could be the result of the internal heterogeneity of the sample of the general population. Consequently, we decided that it was important to re-examine the factor structure on a specific population (like the nursing population addressed in this study) for the purposes of further research. The nursing population predominantly consists of women who are of reproductive age, have a higher level of education and are also exposed to extremely high levels of workplace stress (12). A study on the perception of stress conducted in Slovenia, a country similar to Croatia, found that employed women with at least college-level education were at very high risk of suffering from frequent stress perception (25). Various studies show that differences exist between the genders as regards experience of stress, with women estimating stressors as more severe than men and tending to report higher rates of psychological distress (26). The reason for this may lie in the fact that employed women have to cope with various roles in their professional and private lives and that their experience of the environments in which they live and work is probably different from that of men. It is therefore reasonable to conclude that this group deviates very significantly from the general population, which could also be reflected in the results of the instrument validation.

Our study has some potential limitations. First, one can argue that this study only includes nurses from one hospital in Croatia. A counter-argument would be that this hospital is a typical large healthcare institution that employs a large number of nurses of different profiles. This allows in-depth research into health problems related to the nurses' workplace. Second, the response rate/number of participants was towards the lower recommended limit, but nevertheless still within the values that allow robust correct conclusions to be drawn. Third, one could argue this study used no method of measurement of stability of the instrument over time, e.g. the test-retest method. We counter this by the fact that the reliability of any self-reported outcome measure can be evaluated using measurement stability methods and/or measurement equivalence methods. The latter were developed from social science research for situations in which it was not possible to perform repeated measurements because the measured phenomenon had changed or could change over time (27). Finally, one can argue that this study tested only one- and three-factor models. Our argument here is that, in accordance with the existing theoretical assumptions (2), the results of other studies (2-5, 7, 8) that have the confirmed one- and three-factor structure of the SOC questionnaire, and with the results of PCA in our study, it was rational to test only the one- and the three-factor models.

The study also has several important strengths, the most prominent being that it provided additional and important information and knowledge about the psychometric

properties of the SOC-29-CRO when evaluated in a Croatian nursing population. The study showed the one-factor structure more directly than the study on the general population. As a result, the one-factor structure of the SOC-29-CRO can be more reliably used in subsequent research on nurses. Finally, the fact that the study was conducted among the nurses of a single hospital only can be an advantage as well as a limitation, since this institution is similar to many other institutions in countries that are experiencing similar transition processes to Croatia. The results of this study could apply to these hospitals as well, especially those in the countries of former Yugoslavia.

The study results are significant for occupational medicine, health organisations and nursing management in Croatia and beyond. Nurses are often exposed to occupational hazards in their work environment which can lead to stress (11). The outcome of these stressful events depends on how nurses cope with stress. Weak SOC prevents nurses from actively managing stressful events, which can lead to work-related health problems. The SOC-29-CRO instrument could be used by nursing managers to identify nurses with weak SOC and implement interventions to create healthy working environments and protect and promote nurses' health. Actively managing nurses' health can help to increase their work ability. This instrument could also be helpful when planning the introduction of coping strategies among nursing students as well as among students of other healthcare professions, since it has already been proven that high levels of perceived stress predispose health students to anxiety and a lower quality of life (28). A number of challenges remain for those studying the use of SOC-29-CRO in nursing populations. The dynamics/stability of the SOC-29-CRO must first be checked over a longer period of time in time, especially in relation to those nurses with more demanding jobs (e.g. in intensive care departments). With a focus on studying the properties of the SOC-29-CRO in the nursing population, our work could usefully be continued by analysing additional aspects of validity, e.g. criterion validity.

5 CONCLUSIONS

The adequate psychometric properties of the instrument indicate that SOC-29-CRO is a reliable tool for use in further research. In the near future, it may also be important to the process of designing measures for enhancing nurses' internal resources for the management of workloads.

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CONFLICTS OF INTEREST

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ETHICAL APPROVAL

The study was approved by tthe University Hospital Centre Sisters of Mercy (reference no EP-7811/16-19). The research was carried out in accordance with the ethical principles of the Helsinki Declaration. All respondents gave their informed consent to participate in the study.

REFERENCES

1. Antonovsky A. Unraveling the mystery of health: How people manage stress and stay well. San Francisco, CA: Jossey-Bass, 1987.
2. Mittelmark MB, Sagy S, Eriksson M, Bauer GF, Pelikan JM, Lindström B, et al, editors. The handbook of salutogenesis. Cham, CH: Springer, 2017.
3. Antonovsky A. The structure and properties of the sense of coherence scale. Soc Sci Med. 1993;36:725-33. doi: 10.1016/0277-9536(93)90033-z.
4. Eriksson M, Lindström B. Validity of Antonovsky's sense of coherence scale: a systematic review. J Epidemiol Community Health. 2005;59:460-6. doi: 10.1136/jech.2003.018085.
5. Paika V, Ntountoulaki E, Papaioannou D, Hyphantis T. The Greek version of the Sense of Coherence Scale (SOC-29): psychometric properties and associations with mental illness, suicidal risk and quality of life. J Psychol Clin Psychiatry. 2017;7:10. doi: 10.15406/jpcpy.2017.07.00449.
6. Bonacchi A, Miccinesi G, Galli S, Chiesi F, Martire M, Guazzini M, et al. The dimensionality of Antonovsky's Sense of Coherence Scales: an investigation with Italian samples. TPM Test Psychom Methodol Appl Psychol. 2012;19:115-34. doi: 10.4473/TPM19.2.4.
7. Frenz AW, Carey MP, Jorgensen RS. Psychometric evaluation of Antonovsky's sense of coherence scale. Psychol Assess. 1993;5:145-53. doi: 10.1037/1040-3590.5.2.145.
8. Spadoti Dantas RA, Silva FS, Ciol MA. Psychometric properties of the Brazilian Portuguese versions of the 29- and 13-item scales of the Antonovsky's sense of coherence (SOC-29 and SOC-13) evaluated in Brazilian cardiac patients. J Clin Nurs. 2014;23:156-65. doi: 10.1111/jocn.12157.
9. Stern B, Socan G, Rener-Sitar K, Kukec A, Zaletel-Kragelj L. Validation of the Slovenian version of short sense of coherence questionnaire (SOC-13) in multiple sclerosis patients. Zdr Varst. 2019;58:31-9. doi: 10.2478/sjph-2019-0004.
10. Geuens N, Braspenning M, Van Bogaert P, Franck E. Individual vulnerability to burnout in nurses: the role of Type D personality within different nursing specialty areas. Burnout Res. 2015;2:80-86. doi: 10.1016/j.burn.2015.05.003.
11. Hudek-Knezević J, Kalebić Maglica B, Krapić N. Personality, organizational stress, and attitudes toward work as prospective predictors of professional burnout in hospital nurses. Croat Med J. 2011;52:538-49. doi: 10.3325/cmj.2011.52.538.

12. Dobnik M, Maletič M, Skela-Savič B. Work-related stress factors in nurses at Slovenian hospitals - a cross-sectional study. Zdr Varst. 2018;57:192-200. doi: 10.2478/sjph-2018-0024.

13. Starc J. Stress factors among nurses at the primary and secondary level of public sector health care: the case of Slovenia. Open Access Maced J Med Sci. 2018;6:416-22. doi: 10.3889/oamjms.2018.100.

14. Labrague LJ, McEnroe-Petitte DM, Leocadio MC, Van Bogaert P, Cummings GG. Stress and ways of coping among nurse managers: an integrative review. J Clin Nurs. 2018;27:1346-59. doi: 10.1111/jocn.14165.

15. Malagón-Aguilera MC, Fuentes-Pumarola C, Suñer-Soler R, Bonmatí-Tomàs A, Fernández-Peña R, Bosch-Farré C. The sense of coherence among nurses. Enferm Clin. 2012;22:214-8. doi: 10.1016/j.enfcli.2012.06.002.

16. Basinska MA, Andruszkiewicz A, Grabowska M. Nurses' sense of coherence and their work related patterns of behaviour. Int J Occup Med Environ Health. 2011;24:256-66. doi:10.2478/S13382-011-0031-1.

17. Mijakoski D, Karadzinska-Bislimovska J, Milosevic M, Mustajbegovic J, Stoleski S, Minov J. Differences in burnout, work demands and team work between Croatian and Macedonian hospital nurses. Cogn Brain Behav. 2015;19:179-200.

18. Kardum I, Hudek-Knežević J, Kola A. The relationship between the sense of coherence, the dimension of the five-factor personality model and the subjective health outcomes. Psihol Teme. 2005;14:79-94.

19. Schmidt DR, Dantas RA. Analysis of validity and reliability of the adapted portuguese version of Antonovsky's sense of coherence questionnaire among nursing professionals. Rev Lat Am Enfermagem. 2011;19:42-9. doi: 10.1590/S0104-11692011000100007.

20. Langius A, Björvell H. Salutogenic model and utilization of the KASAM form (Sense of Coherence) in nursing research - a methodological report. Vard Nord Utveckl Forsk. 1996;16:28-32. doi: 10.1177/010740839601600106.

21. Howitt D, Cramer D. Introduction to statistics in psychology. 3rd ed. Essex: Pearson Education Limited, 2005.

22. Schmitt TA. Current methodological considerations in exploratory and confirmatory factor analysis. J Psychoeduc Assess. 2011;29:304-21. doi: 10.1177/0734282911406653.

23. Marsh HW, Hocevar D. Application of confirmatory factor analysis to the study of self-concept: first-and higher order factor models and their invariance across groups. Psychol Bull.1985;97:562-82. doi: 10.1037/0033-2909.97.3.562.

24. Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct Equ Modeling. 1999;6:1-55. doi: 10.1080/10705519909540118.

25. Zaletel-Kragelj L, Pahor M, Bilban M. Identification of population groups at very high risk for frequent perception of stress in Slovenia. Croat Med J. 2005;46:137-45.

26. Rivera-Torres P, Araque-Padilla RA, Montero-Simo MJ. Job stress across gender: the importance of emotional and intellectual demands and social support in women. Int J Environ Res Public Health. 2013;10:375-89. doi: 10.3390/ijerph10010375.

27. Ferligoj A, Leskošek K, Kogovšek T. Methodological notes 10: reliability and validity of measurement. Ljubljana: University of Ljubljana, FDV, 1995.

28. Racic M, Todorovic R, Ivkovic N, Masic S, Joksimovic B, Kulic M. Self-Perceived stress in relation to anxiety, depression and health-related quality of life among health professions students: a cross-sectional study from Bosnia and Herzegovina. Zdr Varst. 2017;56:251-9. doi: 10.1515/sjph-2017-0034.