

# Testing Construct Validity of the 13-Item Sense of Coherence Scale in a Sample of Older People

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**Abstract:** The aim was to study the construct validity for the 13-item Sense of Coherence (SOC) scale among people aged 75+. This study comprised 1753 people aged 76–102 years. Construct validity was measured in terms of the instrument's factor structure as well as discriminant and convergent validity. The result revealed that the instrument failed to show acceptable construct validity in any of the tests or in any age group. The correlation analyses exhibited no clear pattern that could be interpreted as evidence of acceptable construct validity, and the result of the factor analyses did not support the factor structure proposed by Antonovsky. However, this does not necessarily mean that the theoretical concept is invalid, but that this version of the instrument may not be representative of the Sense of Coherence theory.

**Keywords:** Aged, psychometric evaluation, SOC, construct validity, statistics.

## INTRODUCTION

The Sense of Coherence (SOC) scale is a widely used instrument in medical as well as other research areas. Sense of coherence is assumed to be a useful concept when assessing an individual's orientation and internal strengths. However, despite frequent use in various research studies and several psychometric evaluations, there is no unequivocal evidence of its validity and reliability in certain areas.

The SOC theory was developed by Antonovsky [1, 2] and is a theoretical model that explains successful coping with stressors. SOC has a "salutogenetic orientation" searching for factors contributing to health, which is the opposite of the "pathogenetic orientation" (which focusing on factors contributing to disease). The salutogenetic orientation is not considering health as a dichotomous variable but as a continuum between health and disease, and striving to explain what makes a person move towards the healthy end of that continuum. According to Antonovsky's definition [1, 2], SOC consists of three components: comprehensibility, manageability, and meaningfulness. Comprehensibility deals with the extent to which a person sees the world as ordered and is able to mobilise the resources needed to cope. Manageability refers to understanding the problem and having the necessary resources to cope successfully. Meaningfulness pertains to the belief that coping makes sense and that one wishes to cope. All three components are viewed as determining how a person handles stress. The stronger the SOC is the more likely the person will be able to successfully cope with life stressors. According to Antonovsky, a person's SOC develops during childhood and early adulthood and remains and stabilises at around the age

of 30. Thereafter is SOC only affected in a minor way, in positive and negative directions, by major life events.

The most common way of measuring sense of coherence is to use the SOC scale developed by Antonovsky [2]. The original instrument consisted of 29 items with seven-point response scales. There is now a 29-item and a 13-item version of the SOC scale, and the items in the shorter version is simply a selection of 13 item from those included in the 29-item version. The latter was used in this study.

The instrument has been psychometrical tested in several studies [3-13]. However, even if the scale has been found to have acceptable validity and reliability in most studies some areas regarding the psychometric evaluation remains unclear, especially for the 13-item version. One such area is the factor structure of the SOC scale. The question is whether the items should be divided into one or three (or another number) factors has still not been fully elucidated. Antonovsky [2] stated that the components constitute one factor and for this reason did not recommend scoring each one separately.

The instrument's construct validity has been tested in rather few studies which have produced differing results [7, 12-14]. Construct validity has in these studies above all been assessed through factor analyses (i.e. investigating the factor structure). Antonovsky [12] presented some rather unconvincing results (i.e. that the instrument has acceptable construct validity) from studies that tested the SOC scale for construct validity. However, in that article he states that the results shows that the SOC scale has a clear one-factor structure [12]. In her book, Bowling [13] reported a study of US veterans (n=189) which included a factor analysis (probably explorative) on the 29-item version. The result showed that all 29 items loaded on only one factor. The study was poorly described and no reference was provided. In a Swedish study, construct validity was tested by means of a confirmatory factor analysis (AMOS) of the 29-item scale [14]. A three factor solution was chosen (in accordance with the three components; comprehensibility, manageability, and meaningfulness) and the result revealed

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an acceptable factor model. In a Swedish study focusing on the 13-item version, both confirmatory and exploratory factor analyses were conducted [7]. The study comprised about 4000 people aged 15-75 years, but the result did not show any satisfactory factor models in line with Antonovsky's theory. Instead, a two factor solution was found and the two factors were labelled "Social comprehension and commitment" and "Unpleasant emotions and inner tension" [7]. This could mean that the instrument has one positive and one negative factor.

The reliability of the instrument has been investigated mostly in terms of internal consistency. Cronbach's alpha has been reported to range between 0.79-0.95 for the 29-item version and between 0.74-0.91 for the 13-item version [12, 14, 15]. Test-retest analyses have not shown any firm evidence that the construct "SOC" is stable over time. The studies showed following results for: 1-week interval  $r=0.81-0.90$ ; 2-week interval  $r=0.91$ ; 6-months interval  $r=0.77-0.80$ ; and a 2-year interval  $r=0.54$  [12, 15].

The SOC scale does not seem to have been fully psychometrically tested and further studies are required for both versions, but especially for the 13-item version. Furthermore, psychometric testing of the SOC scale is mostly done in sample focusing younger and middle aged, and hence a study focusing on older people seems urgent. The aim was to study the construct validity of the 13-item SOC scale in people aged 75+.

## MATERIALS AND METHODOLOGY

### Sample

This study comprised 1753 respondents and data were collected through a postal questionnaire. The sample was selected from a larger cross-sectional population study that comprised 4093 people aged 75-105 years living in the south of Sweden [16]. The original sample was age-stratified (75-79;  $n=2500$ , 80-84;  $n=2500$ , 85-89;  $n=2000$  and 90+ years;  $n=1500$ ) and included older people living in their own homes and in special accommodation. Two reminders were sent. In total, 8500 questionnaires were distributed, of which 4278 were usable (mean age 83.7 years, SD 5.7 and 61.6% women). A further 82 questionnaires were returned, but had to be discarded due to the large internal drop out. The response rates in the age groups were; 75-79: 60%, 80-84: 56%, 85-89: 48% and 90+: 42%. Two hundred and fifty-five persons (3%) could not be contacted (199 deceased, 56 unknown addresses), giving an overall response rate of 53%. In the larger population study the non-responders were significantly ( $p<0.005$ ) older (mean age 85.7 SD 6.1) and significantly ( $p<0.005$ ) more women (69.6%) than those who participated. A total of 3402 persons did not report any reason for declining to participate, of whom 212 (6%) died within six months of the completion of the data collection. Only those who answered the SOC questionnaire were included in this study and hence this study consisted of a total of 1753 people aged 76-102 years. There were no significant differences in age or gender between those who answered the SOC questionnaire and those who did not.

Written informed consent was obtained. The study was conducted in accordance with the basic ethical principles of

medical research [17] and was approved by the Ethics Committee at Lund University (LU 478-99).

### Measurement

The questionnaire contained various questions about e.g. demographic data, accommodation situation, and self rated health. The 12-item Short Form health survey, SF-12 [18] was used to measure health-related quality of life. The instrument measures health-related quality of life with twelve items. Each items raw scores are coded, weighted, and summed into two scales: physical component summary score (PCS) and one mental component summary score (MCS) [18]. The 13-item SOC scale, which measures comprehensibility (5 items), manageability (4 items), and meaningfulness (4 items), was also included in the questionnaire. Each item in the 13-item SOC scale has seven graded (Likert-type) response scale, which is summed up and the total scores can range from 13 (low SOC) to the maximum of 91 (highest possible SOC). The items are presented in the Table 1.

### Data Analysis

Construct validity was measured in terms of the instrument's factor structure as well as discriminant and convergent validity. Convergent and discriminant validity were assessed by investigating inter-correlation between the items and by the correlation between the SOC scale and SF-12, using Spearman's rank order correlation. In order to investigate the factor structure of the SOC scale, an explorative factor analysis (i.e. principal component analysis) with varimax rotation was performed. An explorative factor analysis was chosen (instead of a confirmatory factor analysis) because the factor structure of the instrument is still rather uncertain, hence such factor analysis seems more appropriate. The number of factors to be extracted was based on the result from the scree-plots, and the Kaiser's eigenvalue criterion (eigenvalues greater than one). Missing values were excluded listwise. The quality of the factor analysis models was assessed using Bartlett's test for sphericity and the Kaiser-Meyer-Olkin (KMO) test. Bartlett's test is a measure of the probability that the initial correlation matrix is an identity matrix and should be  $<0.05$ . The KMO test measures the degree of multicollinearity (based on partial correlations) between the included items and varies between 0 and 1 (should be greater than 0.50-0.60). Reliability was measured in terms of internal consistency and was analysed by employing Cronbach's alpha [19]. All data were analysed using SPSS for Windows 17.0.

## RESULTS

The mean age was 83.5 years, SD 5.6, (range 76-102) and 57.2% of the respondents were women. The number of participants varied between the different age groups; 75-79 years: 499; 80-84 years: 584; 85-89 years: 383; and 90+ years: 287. A large number were living in their own homes (91.3%) of whom 56% lived alone. The mean SOC score in the total sample was 75.2 SD 11.9, and the mean score (SD) for the different age groups were; 75-79 years: 74.9 (12.1); 80-84 years: 75.2 (11.7); 85-89 years: 75.4 (11.8); and 90+ years: 76.0 (12.2). A total of 1753 people years responded to the SOC questionnaire and among these 404 did not respond

to all 13 items. The incompleteness rates for each item are given in Table 1.

In the total sample, the correlation between the 13 items did not show any clear pattern that could strengthen either convergent or discriminant validity (Table 2). Correlations of the 13 items were also examined separately for each age group, but yielded the same result i.e. no clear pattern that could be interpreted as evidence of the instrument's construct validity. Due to limitations of space, the correlation matrixes are not presented but the correlation matrix of the

total sample demonstrates the instrument's convergent and discriminant validity. When correlating the SOC scale with the SF-12 instrument rather low correlation ( $r=0.14$ ;  $p<0.001$ ) was found between the physical component of SF-12 (PCS), while higher correlation ( $r=0.40$ ;  $p<0.001$ ) was found with the mental component (MCS).

The scree-plots (Fig. 1a-d) present the non-rotated factor solutions, while the rotated factor solutions can be found in Tables 3-6. The results indicated that the SOC scale had between two and four sub-categories, depending on the age

**Table 1. Incompletion Rates for Each Item in the SOC Scale**

Item No.	Item Description	Incompletion Rate N = (%)
1	Do you have the feeling that you really don't care about what is going on around you?	119 (6.7)
2	Has it happened in the past that you were surprised by the behaviour of people whom you thought you knew well?	132 (7.4)
3	Has it happened that people whom you counted on disappointed you?	173 (9.7)
4	Until now your life has had: no clear goals – very clear goals and purpose	199 (11.2)
5	Do you have the feeling that you are being treated unfairly?	150 (8.4)
6	Do you have the feeling that you are in an unfamiliar situation and don't know what to do?	156 (8.8)
7	Doing the things you do every day is: a source of deep pleasure and satisfaction – a source of pain and boredom	181 (10.2)
8	Do you have very mixed-up feelings and ideas?	165 (9.3)
9	Does it happen that you experience feelings that you would rather not have to endure?	167 (9.4)
10	Many people, even those with a strong character, sometimes feel like losers in certain situations. How often have you felt this way in the past?	188 (10.5)
11	When certain events occurred, have you generally found that: you overestimated or underestimated their importance – you assessed the situation correctly?	240 (13.5)
12	How often do you have the feeling that there is little meaning in the things you do in your daily life?	159 (8.9)
13	How often do you have feelings that you are not sure you can control?	156 (8.8)

Items no. 2, 6, 8, 9, 11 = Comprehensibility.

Items no. 3, 5, 10, 13 = Manageability.

Items no. 1, 4, 7, 12 = Meaningfulness.

**Table 2. Inter-Correlation between the Items of the SOC Scale in the Overall Sample (n=1753)**

Item	1	2	3	4	5	6	7	8	9	10	11	12	13
1	-												
2	0.30	-											
3	0.23	0.54	-										
4	-0.28	-0.21	-0.17	-									
5	-0.24	-0.44	-0.45	0.34	-								
6	-0.29	-0.31	-0.26	0.33	0.37	-							
7	0.28	0.26	0.27	-0.35	-0.32	-0.32	-						
8	-0.27	-0.39	-0.37	0.38	0.45	0.45	-0.35	-					
9	-0.30	-0.36	-0.32	0.31	0.41	0.44	-0.34	0.65	-				
10	0.18	0.32	0.37	-0.25	-0.40	-0.40	0.31	-0.38	-0.40	-			
11	-0.20	-0.19	-0.17	0.25	0.24	0.33	-0.22	0.36	0.32	-0.29	-		
12	-0.30	-0.30	-0.31	0.40	0.40	0.45	-0.48	0.48	0.46	-0.38	0.34	-	
13	-0.32	-0.28	-0.28	0.31	0.36	0.53	-0.28	0.49	0.50	-0.32	0.34	0.43	-

Items no. 2, 6, 8, 9, 11 = Comprehensibility; Items no. 3, 5, 10, 13 = Manageability; Items no. 1, 4, 7, 12 = Meaningfulness. All correlations were significant at  $p<0.001$ .

### Scree Plot

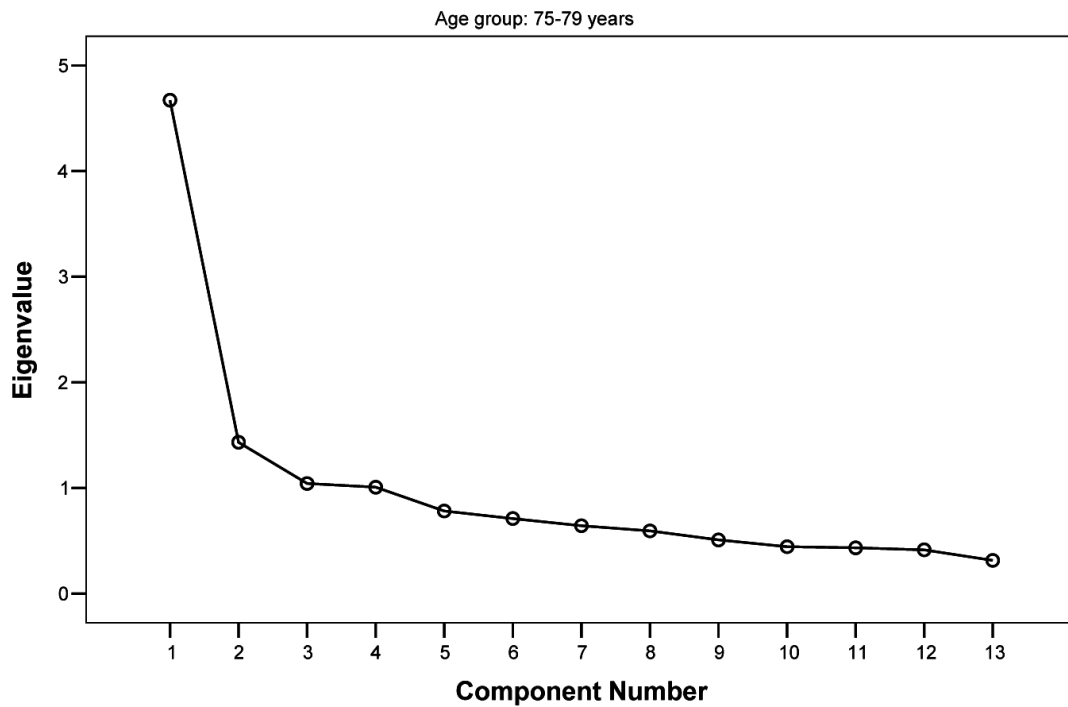


Fig. (1a). Scree plot of the 75-79 year age group.

### Scree Plot

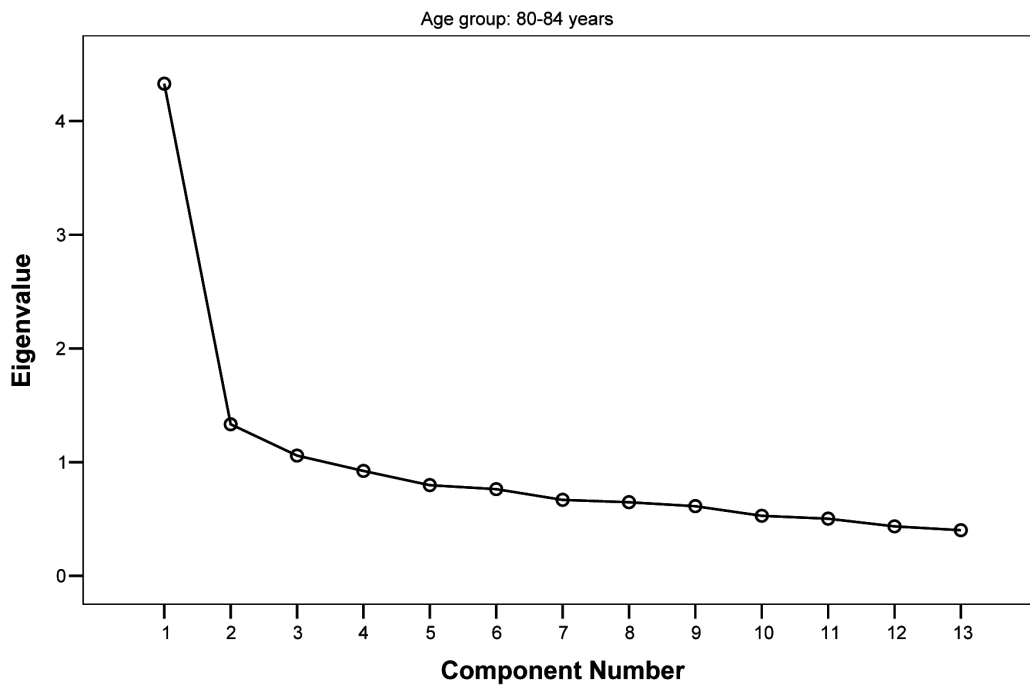
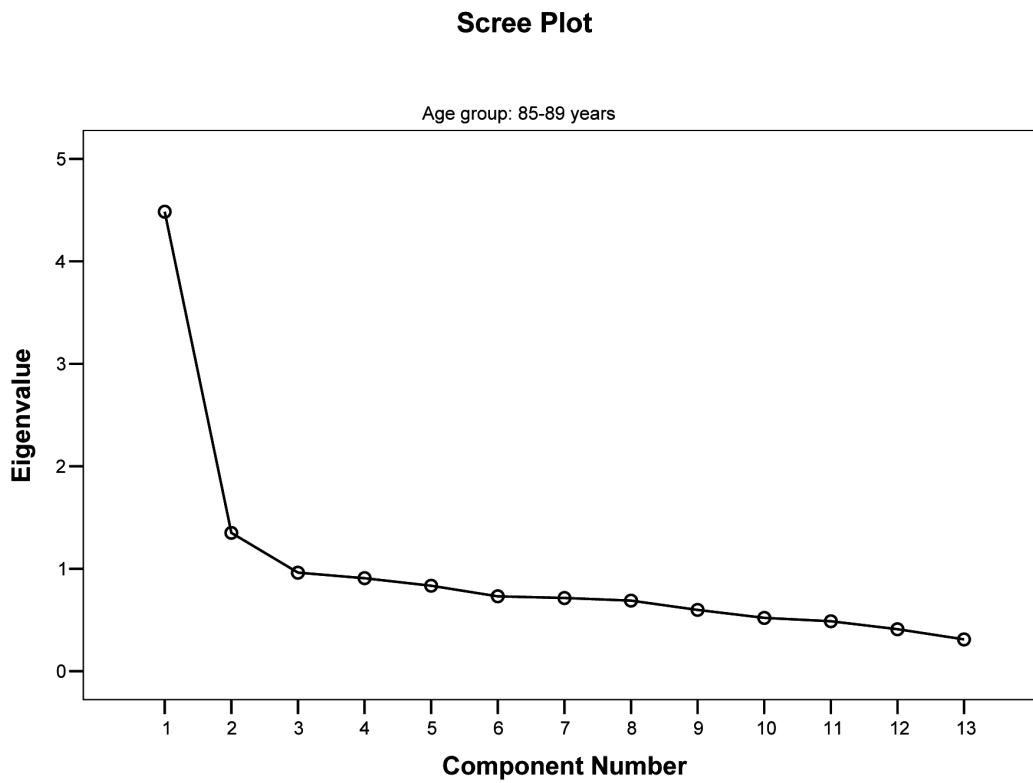


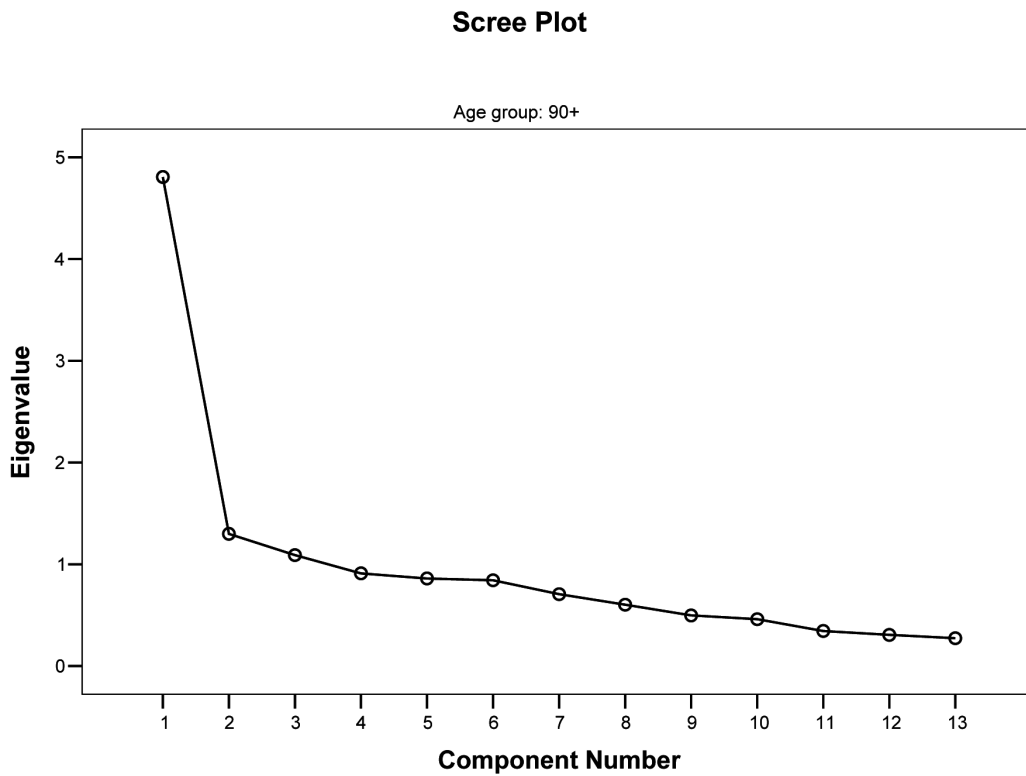
Fig. (1b). Scree plot of the 80-84 year age group.

group analysed. The 1-factor solution proposed by Antonovsky was not evident in any of the factor analyses, and none of the factor models followed any kind of structure related to the Sense of Coherence theory. However, the items in the meaningfulness component were sub-categorized in

the two youngest age groups (Tables 3 and 4). In the case of the youngest age group, F3 and F4 only contained items from the above-mentioned component, while in the 80-84 year age group the third factor (F3) only contained these items.



**Fig. (1c).** Scree plot of the 85-89 year age group.



**Fig. (1d).** Scree plot of the 90+ year age group.

Cronbach's alpha for the instrument in the total sample was  $\alpha = 0.816$  and for the four age groups; 75–79 years: 0.834; 80–84 years: 0.802; 85–89 years: 0.782; and 90+ years: 0.852.

#### **DISCUSSION**

This study investigated the construct validity of the SOC scale for use among older people, and the result revealed that the instrument failed to show acceptable construct validity.

Neither the analysis of factor structure nor the tests of the discriminant and convergent validity fully supported Antonovsky's SOC theory. Even if the correlation with SF-12 strengthens the discriminant and convergent validity, the instrument did show acceptable construct validity in other measures. The measures of internal consistency indicate homogeneity of the 13 items but the factor analyses and the inter-item correlation did show different results. It is worth pointing out the low communalities in Tables 4-6, especially for item 1, 4, 10, and 11. This may indicate that these items do not contribute significant information to the instrument, especially in the older sub-samples. Some of these items (i.e. item 4, 10, & 11) also had larger internal drop-out than the others items in the instrument. By rephrasing or deleting some of (or all) these items may one way to increase the validity of the instrument. Furthermore, Antonovsky's theory about the stability of SOC during life could unfortunately not be tested due to that the study design was cross-sectional, and hence no test-retest analysis was possible. However, the mean scores in the different age groups indicated that the assumption about stability may be true.

**Table 3. Principal Component Analysis with Varimax Rotation for the SOC Scale in the 75-79 Year Age Group**

Variables	Factor Loadings				Communalities
	F 1	F 2	F 3	F 4	
Item no. 1	-0.086	-0.163	-0.113	<b>0.839</b>	0.751
Item no. 2	<b>-0.707</b>	-0.085	0.064	0.414	0.683
Item no. 3	<b>-0.722</b>	0.101	-0.095	0.351	0.664
Item no. 4	0.113	0.236	<b>0.718</b>	0.138	0.603
Item no. 5	<b>0.668</b>	0.139	0.340	0.123	0.597
Item no. 6	0.204	<b>0.671</b>	0.286	-0.009	0.573
Item no. 7	-0.185	0.018	<b>-0.766</b>	0.272	0.694
Item no. 8	<b>0.602</b>	0.450	0.176	0.208	0.638
Item no. 9	<b>0.605</b>	0.459	0.208	0.074	0.626
Item no. 10	<b>-0.615</b>	-0.186	-0.271	0.037	0.488
Item no. 11	-0.023	<b>0.739</b>	-0.010	-0.137	0.566
Item no. 12	0.282	0.382	<b>0.633</b>	-0.107	0.637
Item no. 13	0.209	<b>0.738</b>	0.199	-0.077	0.634
Eigenvalues after rotation	2.795	2.254	1.914	1.192	
% explained variance	21.50	17.34	14.72	9.17	
Cumulative %	21.50	38.84	53.56	62.73	

Kaiser-Meyer-Olkin's test: 0.869.  
Bartlett's test of sphericity: <0.001.

Few previous studies have studied the construct validity/the factor structure of the SOC scale and thus no firm conclusion can be drawn. The study by Söderhamn and Holmgren [14] found acceptable validity, while Larsson and Kallenberg [7] found that the factor structure was not in accordance with the SOC theory. Furthermore, a study by

**Table 4. Principal Component Analysis with Varimax Rotation for the SOC Scale in the 80-84 Year Age Group**

Variables	Factor Loadings			Communalities
	F 1	F 2	F 3	
Item no. 1	-0.157	0.174	<b>-0.454</b>	0.261
Item no. 2	-0.067	<b>0.842</b>	-0.053	0.717
Item no. 3	-0.178	<b>0.804</b>	-0.101	0.689
Item no. 4	0.154	0.091	<b>0.738</b>	0.577
Item no. 5	0.224	<b>-0.554</b>	0.274	0.431
Item no. 6	<b>0.645</b>	-0.066	0.278	0.497
Item no. 7	-0.092	0.242	<b>-0.716</b>	0.579
Item no. 8	<b>0.721</b>	-0.247	0.089	0.589
Item no. 9	<b>0.750</b>	-0.222	0.072	0.617
Item no. 10	<b>-0.382</b>	0.295	-0.308	0.327
Item no. 11	<b>0.584</b>	0.012	0.172	0.371
Item no. 12	0.468	-0.188	<b>0.511</b>	0.516
Item no. 13	<b>0.716</b>	-0.127	0.140	0.548
Eigenvalues after rotation	2.859	2.014	1.846	
% explained variance	21.99	15.49	14.20	
Cumulative %	21.99	37.48	51.69	

Kaiser-Meyer-Olkin's test: 0.874.  
Bartlett's test of sphericity: <0.001.

**Table 5. Principal Component Analysis with Varimax Rotation for the SOC Scale in the 85-89 Year Age Group**

Variables	Factor Loadings		Communalities
	F 1	F 2	
Item no. 1	-0.082	<b>0.538</b>	0.296
Item no. 2	-0.034	<b>0.769</b>	0.593
Item no. 3	-0.125	<b>0.787</b>	0.635
Item no. 4	<b>0.487</b>	-0.130	0.254
Item no. 5	0.415	<b>-0.477</b>	0.400
Item no. 6	<b>0.612</b>	-0.177	0.406
Item no. 7	-0.398	<b>0.493</b>	0.401
Item no. 8	<b>0.746</b>	-0.304	0.650
Item no. 9	<b>0.682</b>	-0.260	0.533
Item no. 10	-0.359	<b>0.558</b>	0.441
Item no. 11	<b>0.599</b>	0.138	0.378
Item no. 12	<b>0.598</b>	-0.328	0.465
Item no. 13	<b>0.602</b>	-0.148	0.384
Eigenvalues after rotation	3.195	2.640	
% explained variance	24.58	20.31	
Cumulative %	24.58	44.89	

Kaiser-Meyer-Olkin's test: 0.867.  
Bartlett's test of sphericity: <0.001.

**Table 6. Principal Component Analysis with Varimax Rotation for the SOC Scale in the 90+ Year Age Group**

Variables	Factor Loadings			Communalities
	F 1	F 2	F 3	
Item no. 1	<b>-0.498</b>	0.215	-0.117	0.308
Item no. 2	-0.129	<b>0.812</b>	-0.077	0.682
Item no. 3	-0.184	<b>0.801</b>	-0.030	0.677
Item no. 4	0.070	-0.131	<b>0.836</b>	0.721
Item no. 5	0.208	<b>-0.567</b>	0.477	0.593
Item no. 6	<b>0.767</b>	-0.186	0.062	0.627
Item no. 7	<b>-0.604</b>	0.275	-0.063	0.445
Item no. 8	<b>0.625</b>	-0.377	0.184	0.567
Item no. 9	<b>0.671</b>	-0.448	0.097	0.661
Item no. 10	-0.268	<b>0.576</b>	0.014	0.404
Item no. 11	0.225	0.034	<b>0.614</b>	0.428
Item no. 12	<b>0.669</b>	0.023	0.212	0.493
Item no. 13	<b>0.753</b>	-0.104	0.126	0.593
Eigenvalues after rotation	3.277	2.484	1.436	
% explained variance	25.21	19.10	11.04	
Cumulative %	25.21	44.31	55.35	

Kaiser-Meyer-Olkin's test: 0.837.  
 Bartlett's test of sphericity: <0.001.  
 Construct Validity of the SOC Scale.

Hittner [6] found a clear one factor model, Gana and Garniers [20] findings supported both three factor model and a one factor model. However, the results of Hittner [6] study were based SOC data from 506 college undergraduates (mean age: 22.1 SD 3.7), the study of Gana and Garnier [20] was based on SOC data from 647 adults (mean age: 37.9 SD 15.7), Larsson and Kallenberg's [7] study was based on SOC data from 4000 people aged between 15 and 75 years, while Söderhamn and Holmgren's [14] study were based SOC data from 140 elderly people (aged: 65+) and this study was based on SOC data (from 1753 people aged 76–102 years). Thus, previous research along with the result from this study gives different conclusions and one possible reason to this might be the differences in age between the studies. This does not necessarily mean that the theoretical concept is invalid. The construct validity seems to be acceptable for younger samples [e.g. 6, 20], the instrument (the 13-item version) may not be fully representative of the SOC theory among older people. However, only two studies seem to have focused on the construct validity of the 13-item version and further studies on the psychometric properties of that version of the instrument are therefore needed.

### Study Limitations

Previous studies have indicated that older persons are more likely to decline participation or refuse to respond to certain questions than younger people [cf. 21], which could also be seen in this study. The external drop out (i.e. non-participants), if systematic, particularly affects the ability to generalize the result. In this study the non-participants were

significantly older and probably frailer, thus they may have been too sick or tired to take part. Therefore, the result probably gives a slightly skewed positive picture of the older people's daily life, and hence may best be generalized to younger and healthier elderly people. However, the strength of this study is the sample size and the fairly high response rate.

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### CONFLICT OF INTEREST

None declared.

### ABBREVIATIONS

SD = Standard deviation  
 SOC = Sense of Coherence

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