Research Article

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The greek version of the sense of coherence scale (soc-29): psychometric properties and associations with mental illness, suicidal risk and quality of life

Abstract

Background: Sense of coherence (SOC) is defined as a global orientation based on a person's confidence that stimuli are structured and predictable, the resources needed to meet these demands are available, and these demands are seen as challenges, worthy of investment, and engagement. The SOC scale is an instrument measuring how people manage stressful situations and stay well. We aimed to assess the psychometric properties of its Greek version in two samples, people with and without long-term conditions (LTCs). Associations between sense of coherence and mental illness, suicidality, and quality of life were also investigated.

Methods: The Antonovski's Sense of Coherence Scale (SOC-29) was administered to 374 participants; 245 patients with diabetes, chronic pulmonary obstructive disease and rheumatic diseases attending specialty clinics or the emergency department and 129 individuals without LTCs. Diagnosis of mental disorders was established by the Mini International Neuropsychiatric Interview. Associations with depressive symptom severity (PHQ-9), suicidal risk (RASS), and health-related quality of life (WHOQOL-BREF) were also investigated.

Results: The Greek version of SOC-29, when used as a whole, presented a coherent structure with remarkable stability in people with and without LTCs. Cronbach's alphas were 0.89 for patients with LTCs and 0.91 for people without LTCs, being 0.90 for the entire sample. Greater levels of SOC were associated with better mental health, lower depressive symptom severity and better quality of life. Furthermore, greater levels of SOC were associated with lower suicidal risk even after adjustment for depressive symptom severity.

Conclusion: The results of the present study showed that the Greek version of SOC-29 may reliably assess SOC. Moreover, lower levels of SOC are associated with established mental disorders and increased suicidal risk, and thus may detrimentally impact mental health. These findings may have important clinical implications, especially as far as the prevention of suicidal risk is concerned.

Keywords: sense of coherence, soc-29, chronic illness, mental illness, suicidality, quality of life

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Abbreviations: LTCs, long-term conditions; DM, type-ii diabetes mellitus; RD, rheumatological disorders; COPD, chronic pulmonary obstructive disease; MDD, major depressive disorder; GAD, generalized anxiety disorder; SOC, sense of coherence; MINI, mini international neuropsychiatric interview; PHQ-9, patient; health questionnaire-9; RASS, risk assessment suicidality scale; HRQoL, health-related quality of life

Introduction

Thirty years ago, the medical sociologist Aaron Antonovsky introduced his salutogenic theory, in which adaptive coping is "the secret of movement toward the healthy end of the health ease/dis-ease continuum".[1] Seeking a theoretical understanding of *why* "generalized resistance resources" such as wealth, ego strength, cultural stability, knowledge, commitment, magic, religion/philosophy or social support promoted health and "what did they have in common?" he concluded that the answer is the *sense of coherence* (SOC),[2] shifting from the pathogenic focus on risk factors for disease to the salutogenic focus on the strengths and determinants for health.[3] According to Antonovsky, "resources were seen as leading to life experiences which promoted the development of a strong SOC, a way of seeing the world which facilitated successful coping with the innumerable, complex stressors confronting us in the course of living".[2]

Sense of coherence is defined as a global orientation that expresses the extent to which one has a pervasive, enduring though dynamic feeling of confidence that

I. The stimuli deriving from one's internal and external environments in the course of living are structured, predictable, and explicable;

II. The resources are available to one to meet the demands posed by these stimuli; and

III. These demands are challenges, worthy of investment and engagement.[2] It is a dispositional orientation rather than a personality trait/type or a coping strategy[2,4] and its importance to a person's mental and physical health has been widely recognized in a number of studies and excellent reviews.

SOC has been found strongly related to perceived health, especially mental health; this relation was manifested regardless of age, sex, ethnicity, nationality, and study design, while SOC was able to predict health.[5] SOC has been also found to have an impact on the quality of life; the stronger the SOC, the better the quality of life, and longitudinal studies confirm the predictive validity of the SOC for a good quality of life.[6] Furthermore, a strong sense of coherence among older people was associated with better physical, social and mental health[7] and low SOC could be a marker of risk for high suicidality in

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the aftermath of a suicide attempt.[8] Finally, studies provide support for the clinical relevance of SOC in cancer patients[9] with SOC having both a moderating and mediating effect on health (especially mental health and quality of life) in colorectal cancer patients, while preliminary data indicate that SOC may be an independent predictor of colorectal cancer patients survival.[10]

As research on SOC continues to grow, it is essential to have brief, reliable and valid assessment measures of SOC for a range of populations. The SOC scale has been translated across several different languages and used in several populations worldwide. A systematic review published in 2005 revealed that the SOC questionnaire has been used in at least 33 languages in 32 countries, with samples varying from large samples of the general population covering 20 000 persons to small samples of 20 people.[3]

The SOC scale has been translated in Greek and its test-retest reliability was estimated in a small sample with 22 persons and found 0.859.[11] However, any additional information regarding the psychometric properties of the Greek version of SOC (e.g. factorial structure, internal consistency, or convergent validity) is lacking, possibly due to the small sample size. Prompted by this fact, and given that the study of the psychometric properties of SOC continues to grow[12–15] as additional studies in specific populations would provide a better appreciation of its psychometric potential, especially regarding its association with parameters that have attracted less attention such as suicidal risk in both health and disease, the aim of the present study was to examine the psychometric properties of the Greek version of the SOC-29 scale in two different samples:

a. Patients with long-term conditions (LTCs) attending specialty clinics or the emergency department (ED), and

b. People without LTCs. Furthermore, we aimed to assess its convergence and concurrent validity by analyzing associations with established mental disorders, depressive symptom severity, suicidal risk and health-related quality of life (HRQoL).

Methods

Participants

Data were collected during the baseline assessment of the cohort study "Assessing and enhancing resilience to depression in people with long term medical conditions in the era of the current Greek social and financial crisis". This research has been co-financed by the European Economic Area (EEA) Financial Mechanism 2009-2014 and National funds as part of the program "Dissimilarity, Inequality and Social Integration", and its main objective is to develop psychosocial strategies to enhance resilience to depression in most affected by the current Greek social and financial crisis vulnerable patients with LTCs, through a program of applied clinical research.

Of a total number of 505 adults participated in the study, 374 completed the RS-14 scale (response rate: 74.1%) and thus were included in the present report. The sample comprised 245 patients with LTCs and 129 individuals without LTCs. The patient sample comprised patients with at least one of three LTCs: type-II diabetes mellitus (DM), rheumatological disorders (RD) and chronic pulmonary obstructive disease (COPD) who were seeking unscheduled or urgent care at the emergency department (ED) of the University Hospital of Ioannina or were attending routine care in the respective follow-up specialty clinics during a six-month period. These three conditions are among the leading 15 discharge diagnoses of emergency departments[16] and are associated with an increased risk of an emergency hospital

admission during the subsequent 6month periods.[17] Exclusion criteria were: inability to read and write Greek, mental retardation, active psychosis, state of intoxication or confusion, or being severely unwell physically to respond to the study's questionnaires.

Of 476 patients attending specialty clinics and the ED who were approached, 436 were eligible and 376 agreed to participate (response rate 79.0%); 121 with DM only, 177 with RD only, 29 with COPD only and 49 with a combination of conditions. Ages ranged from 18 to 94 years (mean, 66.2; SD, 14.7); 136 were males (55.5%) and 109 females (44.5%). One-hundred and one patients did not complete the SOC-29 for certain reasons, mainly because they were severely unwell physically to complete all the study's instruments, or they left several items unanswered and were excluded from the present study, thus 245 patients were included in the analyses of the current study.

People without LTCs were recruited from the hospital staff. Healthcare workers in all hospital's departments and clinical units were invited to participate. Exclusion criterion was a self-reported LTC (i.e. DM, RD or COPD). Two hundred and twenty potential participants were approached, 200 were eligible and 129 agreed to participate (response rate 64.5%). Ages ranged from 20 to 58years (mean, 39.5; SD, 10.7); 32 were males (24.8%) and 97 females (75.2%). No statistically significant differences were found in age, sex, education and marital status between participants and non-participants as well as between those who had completed the SOC-29 and those who did not provide complete responses to this instrument across all samples (data available upon request).

Researchers were in the hospital from 8.00 a.m. to 4.00 p.m. every day and participants were consecutively recruited during this time frame. Participants of either gender aged ≥18years old were considered for inclusion and, for patients, a diagnosis of DM, RD or COPD was confirmed by the attending physician. Three trained research psychologists (EN, VP, and DP) collected the data. The interviewers had at least 4years of research and clinical experience at the Department of Psychiatry of the University of Ioannina and were also trained on the administration of diagnostic instruments and screens. The interviewers were blind to scores of the self-report questionnaires, which were administered on the same day. All study procedures were in accordance with the World Medical Association Helsinki Declaration. The study was approved by the hospital's ethics committee (617/17–09-2015). Signed informed consent was obtained from all participants.

Measures and study instruments

Socio-demographic variables including age, sex, educational level, marital status, residence, employment status and occupation were collected for all participants. For patients with LTCs clinical features, disease severity indices and laboratory data were obtained from patients' records using a standardized data collection form. Coexisting medical diseases were scored using the Charlson comorbidity scale,[18] which is one of the most extensively validated comorbidity indices.

Sense of coherence was assessed using the Greek translation of the Antonovski's sense of coherence scale.[11] The Sense of Coherence (SOC) Scale is a 29-item questionnaire based on Aaron Antonovsky's salutogenic theory, and it is considered to be a measure of the stable dispositional orientation of a person,[2,19] and it is essentially a measure of an individual's capacity to cope with stress. Those having high SOC scores are likely to perceive stressors as predictable and comprehensible and to perceive the challenges of life as meaningful and worth making commitments for, and, in addition, they have

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confidence in their capacity to manage. Respondents are asked to select a response, on a seven-point semantic differential scale with two anchoring phrases. There are 11 comprehensibility, 10 manageability and 8 meaningfulness items. Thirteen of the items are formulated 'negatively' and have to be reversed in scoring, so that a high score always expresses a strong SOC.[2] The psychometric properties of the scale have been extensively tested in a number of studies across several samples and languages with Cronbach's alpha coefficients ranging from 0.70 to 0.95, supporting the internal consistency reliability of the SOC.[3]

Diagnoses of *mental disorders* were established using the Greek version 5.0.0 of the Mini International Neuropsychiatric Interview (MINI).[20] The MINI is a structured psychiatric interview that ascertains the diagnosis of mental disorders according to DSM-IV or ICD-10 criteria.[21] It focuses mainly on current diagnosis and contains 120 questions for screening 17 axis I disorders. Being fully structured to allow administration by clinicians after a brief training session, it was designed to meet the need for a short but valid psychiatric interview for epidemiology studies.[21] MINI has been previously used in studies with Greek medical patients.[22,23]

Depressive symptom severity was assessed using the validated Greek version of the Patient Health Questionnaire-9 (PHQ-9).[22,24] This instrument screens for DSM-IV major depressive disorder. The frequency of symptoms over the past 2weeks is rated on a 0–3 Likert-type scale; summed scores range from 0 to 27. Higher scores indicate more severe symptoms. It has been translated into numerous languages including Greek and is considered a valid measure of depressive symptom severity.[22,25] Cronbach's alpha for PHQ-9 derived from the present sample was 0.83.

Suicidal risk was assessed using the standardized Greek version of the Risk Assessment Suicidality Scale (RASS).[26] RASS is a brief 12-item self-report instrument assessing suicidal risk behaviours and contains items relevant to intention, life, and history of suicide attempts. Items are rated on a 0-3 Likert–type scale (*not at all* to *very much*) and the scores were transformed according to the suggestions of the standardization study for use within the Greek population.[26] In patients with LTCs attending the ED Cronbach's alpha for the RASS was 0.80 and alpha derived from the present sample was 0.77.[27] Higher scores indicate greater suicidal risk.

Health-related quality of life (HRQoL) was assessed using the 26-item validated Greek version of the World Health Organization Quality of Life Instrument, Short Form (WHOQOL-BREF).[28] It assesses six domains of HRQoL, *overall* HRQoL, *satisfaction with general health*, *physical*, *mental*, *social relations* and *environment* HRQoL. Each item is rated on a 5-point Likert scale, and the scores are transformed on a scale from 0 to 100. Higher scores indicate better HRQoL.

Statistical analysis

All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 21.0 (SPSS Inc., Chicago, IL, USA) for Windows. Summary statistics for all variables were calculated. Normality was tested by the Kolmogorov-Smirnov test.[29] To test whether the SOC-29 items gather in clusters and to assess the stability of its factorial structure across the 2 samples, principal component factor analyses (PCA) with varimax rotation were performed separately for each sample as well as in the total sample. Internal consistencies (Cronbach alphas) were next calculated for the factors derived from the PCA.

The criterion and concurrent validity was tested with the following hypotheses in mind:

a. SOC is associated with health.[2,5,7] Accordingly, people without LTCs should present higher levels of SOC compared to medical patients. For this, two-tailed t-tests were carried out to assess the differences in SOC-29 scores between the two groups;

b. Sense of coherence is associated with mental health.[2,5,9,10] Accordingly, SOC-29 score should be negatively associated with a diagnosis of mental disorder. For this, two tailed t-tests were performed to assess the differences in SOC-29 scores between those diagnosed with a mental disorder and those who didn't. To quantify the differences, simple logistic regression analyses were next performed with dependent variable the specific mental diagnosis and independent variable the SOC-29 score. In addition, to assess the relationship of SOC-29 with depressive symptom severity as assessed with the PHQ-9, bivariate correlation analyses were performed followed by partial correlation analyses adjusted for age, sex, education, family status, disease type and comorbidities;

c. SOC is associated with lower suicide risk.[8] To assess the relationship between SOC-29 scores and RASS scores bivariate correlation analyses were performed followed by partial correlation analyses adjusted for age, sex, education, family status, disease type and comorbidities;

d. SOC is associated with better wellbeing, satisfaction with health and health-related quality of life.[6] Accordingly, SOC-29 scores should be positively associated with WHOQOL-BREF scores. To test this, bivariate correlation analyses were performed followed by partial correlation analyses adjusted for age, sex, education, family status, disease type and comorbidities.

Results

Factor structure

Three independently produced principal component exploratory factor analyses were performed for the total sample and for each one group of participants, i.e. the participant without LTCs sample, and the medical patient sample. Principal component analyses across the three groups showed Kaiser-Mayer-Olkin statistics of 0.907, 0.853, and 0.876 respectively; all Bartlett's tests were significant for sphericity (x2=3369.2, df=406, p<0.001; x2=1626.0, df=406, p<0.001; and x2=2181.2, df=406, p<0.001, respectively), supporting the factorability of the correlation matrices. An inspection of the screen plot in the total sample as well as in all the two groups of participants (data available upon request) revealed a large component and a number of "elbows" resulting in small eigenvalues after the fifth component, revealing the presence of a multidimensional structure. However, we concluded that the item loadings were scattered in the five factors and the analyses did not help identify any latent factor, i.e. the *manageability*, *meaningfulness* and *comprehensibility* theoretical dimensions of SOC, as the items representing these dimensions were present in each of these five factors. Given this and take also into consideration the Antonovski's warning that "the SOC scale is not wisely used to study component interrelations, as there is no basis for deriving distinguishable sub-scores for comprehensibility, manageability and meaningfulness",[2] we repeated the factor analyses using the fixed number of factors to be extracted model, defining one factor to be extracted.

Table 1 Factor loadings of the Greek version of the Sense of Coherence scale (SOC-29)

	Total Sample (N=374)	Participants without LTCs (N=129)	Patients with LTCs (N=245)
Item 1 - When you talk to people do you have the feeling that they don't understand you? (Never have this feeling/Always have this feeling) (R)	.466	.502	.438
Item 2 - When you have to do something which depends on co-operation with others, do you have the feeling that it: (Surely won't get done/Surely will get done)	.420	.544	.366
Item 3 - 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? (You feel that they're strangers/You know them very well)	.403	.360	.431
Item 4 - Do you have the feeling that you don't really care about what goes on around you? (Very seldom or never/Very often) (R)	.444	.535	.395
Item 5 - Are you surprised by the behaviour of people whom you thought you knew well? (Never/Always) (R)	.398	.346	.403
Item 6 - Has it happened that people whom you counted on have disappointed you? (Never happened/Always happens) (R)	.411	.378	.406
Item 7 - Life is: (Full of interest /Completely routine) (R)	.574	.594	.548
Item 8 - Until now your life has had: (No clear/very clear goals and purpose)	.501	.679	.414
Item 9 - Do you have the feeling that you are being treated unfairly? (Very often/Very seldom or never)	.472	.512	.452
Item 10 - In the past ten years your life has been: (Full of changes without your knowing what will happen next /Completely consistent and clear)	.341	.334	.343
Item 11 - Most of the things that you do in future will probably be: (Completely fascinating /Deadly boring) (R)	.497	.565	.436
Item 12 - Do you have the feeling that you are in an unfamiliar situation and don't know what to do? (Very often/Very seldom or never)	.668	.735	.640
Item 13 - What best describes how you see life: (One can always find a solution/There is no solution to painful things in life) (R)	.532	.591	.494
Item 14 - When you think about life. you very often: (Feel how good it is to be alive/Ask yourself why you exist at all)	.691	.662	.696
Item 15 - When you face a difficult problem the choice of a solution is: (Always confusing and hard to find/Always completely clear)	.532	.617	.488
Item 16 - Doing things you do every day is: (A source of deep pleasure and satisfaction/A source of pain and boredom) (R)	.632	.596	.649
Item 17 - Your life in the future will probably be: (Full of changes without your knowing what will happen next/Completely consistent and clear)	.181	.115	.222
Item 18 - When something unpleasant happens your tendency is: ("To beat yourself up" about it/To say "ok. that's that. I have to live with it", and go on)	.551	.585	.561
Item 19 - Do you have very mixed up feelings and ideas? (Very often/Very seldom or never)	.667	.672	.677
Item 20 - 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) (R)	.617	.479	.662
Item 21 - Does it happen that you have feelings inside which you would rather not feel? (Very often/Very seldom or never)	.537	.625	.523
Item 22 - You anticipate that your personal life in future will be: (Totally without/Full of meaning or purpose)	.620	.630	.596
Item 23 - Do you think that there will always be people whom you'll be able to count on in the future? (You're certain there will be/You doubt there will be) (R)	.374	.474	.319

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Table Continued...

	Total Sample (N=374)	Participants without LTCs (N=129)	Patients with LTCs (N=245)
Item 24 - Does it happen that you have the feeling that you don't know exactly what's about to happen? (Very often/Very seldom or never)	.463	.502	.422
Item 25 - Many people – even those with a strong character – sometimes feel like losers in certain situations. How often do you feel this way? (Never/Very often) (R)	.590	.533	.623
Item 26 - When something happened, have you generally found that: (You overestimated or underestimated its importance/You saw things in the correct proportion)	.427	.452	.446
Item 27 - When you think of 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) (R)	.565	.599	.529
Item 28 - How often do you have the feeling that there's little meaning in the things you do in your daily life? (Very often/Very seldom or never)	.661	.738	.627
Item 29 - How often do you have feelings that you're not sure you can keep under control? (Very often/ Very seldom or never)	.593	.588	.612
% of Variance	37.5	40.5	36.1

Table 2 Internal consistency coefficients and SOC total scores across the three samples

	Total Sample (N=374)	Participants without LTCs (N=129)	Patients with LTCs (N=245)
Internal Consistencies (Cronbach's alphas)	0.9	0.91	0.89
SOC Total score (mean ± SD)	137.3 ± 25.9	142.9 ± 23.4 *	134.3 ± 26.7 *

(*) asterisk indicate statistically significant difference at a p=0.002 between participants without LTCs and patients with LTCs based on two-tailed t-test

Table 3 Sense of Coherence and Mental Illness in the Total Sample (N=374)

SOC-29 Total Score	Any Mental Disorder		Major Depression		Panic Disorder		Generalized Anxiety Disorder	
	Yes (N=143)	No (N=231)	Yes (N=73)	No (N=231)	Yes (N=19)	No (N=231)	Yes (N=53)	No (N=231)
Mean ± SD (Two-tailed t-tests)	121.5±22.4	147.0±23.0 ***	115.3±21.8	147.0±23.0 ***	112.9±30.4	147.0±23.0 ***	117.6±21.7	147.0±23.0***
OR (95% CI)	0.95 (0.940-0.963) ***		0.94 (0.926-0.956) ***		0.97 (0.949-0.984) ***		0.95 (0.930-0.962)***	

OR: Odds Ratio; CI: Confidence Interval;

*** p< 0.001.

Table 4 Sense of Coherence and Depressive Symptom Severity, Suicidal Risk, and Health-Related Quality of Life (HRQoL) (N=374)

	Sense of Coherence (SOC-29) Correlation Coefficients	
	Unadjusted	Adjusted
Depressive Symptoms (PHQ-9)	-0.572 ***	-0.530 ***
Suicidal Risk (RASS)	-0.564 ***	-0.526 ***
HRQoL		
Overall HRQoL	0.498 ***	0.467 ***
Satisfaction with General Health	0.411 ***	0.344 ***
Physical HRQoL	0.515 ***	0.476 ***
Mental HRQoL	0.698 ***	0.652 ***
Social Relations HRQoL	0.462 ***	0.427 ***
Environment HRQoL	0.416 ***	0.418 ***

Note: Values Shown are Bivariate Pearson Correlation Coefficients and Partial Pearson Correlation Coefficients

Adjusted for Age, Sex, Education, Family Status, Number of Medical Illness (0 for Healthy Participants) and Comorbidities

***p< 0.001

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As shown in Table 1, all but one items loaded saliently on this factor, with item loadings ranged between 0.341 and 0.691 in the total sample, confirming the coherent one-factor structure of this version of the instrument. Similar results were observed regarding the item loadings across the two sub-samples. The only exception was for item 17 ("Your life in the future will probably be: Full of changes without your knowing what will happen next/Completely consistent and clear") that presented lower loadings across all samples (0.115-0.222) (Table 1).

Internal consistency, total scores and associations with demographics

As shown in Table 2, Cronbach's alphas for the one-factor solution were 0.91 for the participant without LTCs sample and 0.89 for the medical patient sample, and alpha for the total sample was 0.90. Mean scores of SOC-29 was lower for patients with LTCs compared to participants without LTCs (p=0.002) (Table 2). Females presented a trend towards lower SOC compared to males (p=0.079) while mean rates of SOC-29 did not differ significantly across marital status (p=0.501); the stronger the sense of coherence the better the education received (r=0.236, p<0.001), while older people tended to report lower SOC-29 scores, although the correlation coefficient failed to reach statistical significance (p=0.070).

Resilience and mental illness

One hundred and forty-three (38.2%) participants were diagnosed with a mental disorder, 73 (19.5%) with major depressive disorder (MDD), 19 (5.1%) with panic disorder and 53 (14.2%) with generalized anxiety disorder (GAD). As shown in Table 4, people diagnosed with any mental illness, either MDD, panic disorder or GAD, presented lower scores in SOC-29 compared to those without a mental disorder. The binary logistic regression analyses performed to quantify the differences confirmed these associations (Table 3).

Sense of coherence and depressive symptom severity, suicidal risk, and HRQoL

Table 4 presents the results of the unadjusted and adjusted (partial) correlation analyses performed to assess the associations of SOC-29 with PHQ-9, RASS, and WHOQOL-BREF scores. As shown in this table, both unadjusted and adjusted scores of SOC-29 were significantly associated with depressive symptom severity, suicidal risk, and HRQoL. The higher the sense of coherence the lower the depressive symptom severity and the suicidal risk; also, the higher the sense of coherence the better the overall HRQoL, satisfaction with general health as well as the physical, mental, social relations and environment HRQoL.

In the further linear regression analyses performed separately for patients with LTCs and for people without LTCs with dependent variable the RASS score, SOC remained a significant correlate of suicidal risk even after depressive symptom severity was taken into account (Table 5).

Table 5 Linear Regression Analyses with Dependent Variable the Suicidal Risk (Rass) in People with and without Long-Term Conditions (LTCs)

	Participants without LTCs (N=129)		Patients with LTCs (N=245)	
	Beta	P	Beta	P
Sense of Coherence (SOC)	-0.48	<0.001	-0.201	0.001
Depressive Symptom Severity (PHQ-9)	0.32	<0.001	0.518	<0.001
Age	0.151	0.028	-0.033	0.555
Sex	0.09	0.157	-0.077	0.115
Divorced/Widowed/Separated	-0.107	0.101	-0.015	0.757
Education	-0.098	0.154	-0.048	0.413
Adjusted R Square	0.514		0.457	

Discussion

The results of the present study revealed that the one-dimensional use of the Greek version of SOC-29 showed a coherent structure with remarkable stability across the two samples studied, i.e. in people with and without LTCs. In terms of the factors' content, all items loadings were similar to its original version. Internal consistency coefficients were adequate across the samples and all indices of criterion and convergent validity were in the expected direction. Present findings support the validity of the SOC-29 for use within the Greek population.

The results of the studies assessing the factorial status of SOC are inconclusive. Some studies confirmed the one factor solution proposed by Antonofski,[30,31] while others, similar to our findings, failed to support the one factor solution.[32,33] A two,[34] three[35] and five[36] factor solutions have been also proposed, but failed to actually support the theoretical construction principles which suggest three sub-dimensions.

namely *manageability*, *meaningfulness* and *comprehensibility*. Our findings and the results of previous studies indicate that it would be rather preferable to use the SOC scale as a measure of the whole, not examining the three subscales separately, which was also Antonovsky's intention.[3] In this respect, our factor analysis defining one factor to be extracted revealed a coherent structure of the instrument with a remarkable stability when used in people with and without medical illnesses, with acceptable percentages of variance explained (36.1-40.5%) and significant item loadings, 90% of them being greater than 0.40 and 60% greater than 0.50. The coherent structure of the one factor solution is also supported by the high internal consistency coefficients observed (0.89-0.91). A systematic review on the validity of SOC found that in 124 studies using SOC-29 the Cronbach's a ranges from 0.70 to 0.95.[3]

The criterion validity of the SOC-29 was supported in four ways. First, patients with LTCs presented lower levels of SOC compared to people without LTCs. In addition, people with mental disorders, either MDD, panic disorder or GAD presented lower SOC rates compared to those without a mental disorder. SOC was also negatively associated with depressive symptom severity. These findings indicate that SOC, as assessed by this version of the scale, is associated with both physical and mental health and are in accordance with the results of numerous previous studies performed.[2,5,7,9,10] A systematic review including 458 scientific publications and 13 doctoral theses found that SOC was strongly related to perceived health, especially mental health, regardless of age, sex, ethnicity, nationality, and study design and it was able to predict health, and concluded that SOC is an important contributor for the development and maintenance of people's health [5].

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By including patients with established medical illnesses and by using a structured psychiatric interview for reliably establishing mental diagnoses, our results support the relationship of SOC with physical and mental health, further confirming the available evidence.

Second, in line with the results of previous studies, higher levels of SOC were associated with better overall HRQoL and satisfaction with general health as well as with better HRQoL in all dimensions of WHOQOL-BREF, i.e., physical, mental, social relations and environment HRQoL, confirming our hypothesis. Erickson et al. (2007) systematic review found that SOC has an impact on the quality of life; the stronger the SOC, the better the quality of life, while longitudinal studies confirm the predictive validity of the SOC for a good quality of life.[6] Previous studies of our research group have also shown a strong association between SOC and HRQoL in patients with rheumatologic disorders[37–40] and cancer.[41–45]

Third, similar to the findings of other studies reporting that men usually have a slightly higher SOC than women but the differences are small,[3] we also observed a trend males to present higher levels of SOC compared to females (p=0.079). Despite, however, that studies have shown that SOC tends to increase with age over the whole life span,[3] we found that older people tended to report lower SOC-29 scores, although this relationship failed to reach statistical significance (p=0.070). We also found that greater SOC is associated with better education received. This is important, as evidence suggests that the SOC is applicable in learning processes and evaluation of education.[6] An analysis of the similarities between the learning process and the salutogenic model has been reported, as the learning process is facilitated when the information is structured and comprehensible and thus becomes meaningful.[6] It has been therefore suggested that integrating the salutogenic perspective in all activities and programmes in school also means that health promotion becomes integrated with school development.[46]

Finally, one of our main findings was that lower levels of SOC were associated with increased suicidal risk. It is worth noting that this relationship remained stable even after depressive symptom severity was taken into account, indicating that SOC is a strong correlate of suicidal risk independent of depressive symptoms. The relationship of SOC with suicide and suicidal risk has attracted less attention. Low SOC at index attempt in suicide attempters has been found associated with suicidality at 2-month follow-up, and, in line with our findings, the associations were independent of major depression and symptom burden, suggesting that the SOC scale is more than just a mirror of psychopathology.[47] A link between low SOC and suicidal ideation and attempts has been also reported in one clinical study[48] and in some studies with non-clinical populations.[49–51] Our findings further support the link between sense of coherence and suicidality and provide additional evidence with regard to the validity of both SOC-29 as well as the newly introduced scale for the assessment of suicidality risk, i.e. the RASS.

Strengths of our study include the use of the MINI structured interview for establishing a diagnosis of mental disorder, which was conducted face-to-face with the participant on the same day as the self-report questionnaires. Also, we used well recognized, standardized instruments for all validity measures, and we recruited patients with established LTCs. Nevertheless, some limitations need to be addressed. It could be argued that a limitation of our study lies in the composition of the "healthy" participant sample, which was recruited from hospital staff and could not be considered representative of the general population. In addition, although mental illness was confirmed by a structured interview, the drawback of using self-report measures

for depressive symptom severity, suicidal risk and HRQoL means that we cannot refute the criticism that an underlying response style might have intervened with the results. Finally, the cross-sectional design of the current study precluded the establishment of causal inferences.

In conclusion, the results of the present study showed that the Greek version of the SOC-29 when use as a whole presents a coherent structure with adequate internal consistency and quite satisfactory concurrent and convergent validity. These findings support the applicability of the Greek version of SOC-29 within the Greek population, and future studies could further explore the relevance of SOC-29 with additional scales and outcomes as well as its predictive validity.

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Declarations

Ethics approval and consent to participate

a. All study procedures were in accordance with the World Medical Association Helsinki Declaration.

b. The study was approved by the Ioannina Teaching General Hospital hospital's ethics committee (617/17–09-2015).

c. Signed informed consent was obtained from all participants.

Authors' contributions

All authors were involved in drafting the article or revising it critically for important intellectual content, and all authors approved the final version to be submitted for publication. TH had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. TH, VP, and EN were involved in study conception and design. VP, EN, and DP were involved in acquisition of data. TH, VP, EN, and DP were involved in analysis and interpretation of data.

Conflicts of interest

Author declares there are no conflicts of interest.

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