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Sense of coherence as an independent predictor of health-related quality of life among coronary heart disease patients

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Abstract
Purpose The aim of this study was to determine whether sense of coherence (SOC) at baseline predicts health-related quality of life (HRQoL) at 12–28-month follow-up among patients with coronary heart disease when controlled for sociodemographic and medical variables.
Methods A total of 179 consecutive patients (58.28 ± 6.52 years, 16.8% women) scheduled for coronary angiography (CAG) were interviewed before CAG and 12–28 months after. SOC was measured with the 13-item Orientation to Life Questionnaire. HRQoL was measured using the Short Form Health Survey 36 (SF-36), from which the mental and physical component summaries (MCS, PCS) were calculated. The relationship between SOC and HRQoL was examined using regression analyses.
Results SOC proved to be a significant predictor of the MCS-score ($B = 0.29$; 95% CI = 0.17–0.41) and PCS-score ($B = 0.18$; 95% CI = 0.06–0.31) when not adjusted for possible confounding sociodemographic and medical variables. After adjustment for sociodemographic and medical variables, SOC remained a predictor of the MCS-score ($B = 0.26$; 95% CI = 0.14–0.39). SOC also remained a predictor of the PCS-score when controlled for gender, age and family income; however, the association disappeared after adjustment for functional status ($B = 0.07$; 95% CI = −0.05 to 0.19).
Conclusions SOC is a predictor of mental and physical HRQoL at 12–28-month follow-up, crude and also after adjustment. Patients undergoing CAG with low SOC thus deserve particular attention in regard to the maintenance and improvement of their HRQoL.

Keywords Quality of life · Health promotion · Coronary heart disease · Longitudinal study

Abbreviations

HRQoL	Health-related quality of life
CHD	Coronary heart disease
SF-36	Short form health survey questionnaire
SOC	Sense of coherence
CAG	Coronary angiography
PCI	Percutaneous coronary intervention
CABG	Coronary artery bypass grafting
OLQ	Orientation to life questionnaire
PCS	Physical component summary
MCS	Mental component summary
NYHA	New York Heart Association
CCS	Canadian cardiovascular society
CI	Confidence interval

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Introduction

Health-related quality of life (HRQoL) is an important outcome in patients with coronary heart disease (CHD) [1–5]. Many instruments have been developed to quantify patients' HRQoL, with the most frequently used instrument in cardiac patients being the Short Form Health Survey Questionnaire (SF-36) [6–9]. Studies have shown that poor HRQoL is independently associated with a higher risk of CHD [10], higher cardiac and total mortality [11, 12], more frequent hospitalisation among cardiac patients [13] and a higher occurrence of chronic disabling conditions such as stroke [10].

According to Antonovsky [14–16], sense of coherence (SOC) reflects a person's view of life and his or her capacity to respond to stressful situations. It is a global orientation to view life as structured, manageable and meaningful. Independent of the measure used, a stronger SOC has been shown to be associated with better HRQoL in persons who have undergone coronary artery bypass grafting (CABG) or percutaneous coronary intervention (PCI) [17, 18], cardiac arrest survivors [19] and angina patients [20]. Furthermore, a positive association between high SOC and good HRQoL has been found among patients with lower-limb ischaemia [21], patients hospitalised with a cardiac condition [22], CHD patients [23] and in men as well as older women following myocardial infarction [24, 25].

The number of studies on SOC among CHD patients is limited, even though CHD is a major cause of death and morbidity [26], and few studies on SOC and HRQoL among CHD patients have been longitudinal [17, 18, 24, 25, 27]. Those that are available were carried out among specific subgroups of patients (just men or women) [24, 25] or those treated with particular cardiac treatment [17, 18, 27]. Thus, the aim of this study was to determine whether the SOC at baseline predicts HRQoL at 12–28-month follow-up among patients with CHD, crude and adjusted for potentially confounding sociodemographic and medical variables. Potential confounders are age [28–30], sex [30, 31], socioeconomic position [32, 33] and medical factors such as the severity of the coronary disease and the type of therapeutic intervention [34]. Furthermore, compared with other studies in this research area, the present study was based on a sample covering a fuller range of patients with CHD.

Methods

Sample and procedure

The study sample consisted of patients who had been referred by their cardiologist for coronary angiography (CAG) in accordance with the European Society of Cardiology guidelines [35] and who had an abnormal CAG. The procedure was performed in the East Slovakian Institute for Cardiac and Vascular Diseases in Kosice, where patients from the whole East Slovakian region (about 1.5 million inhabitants) are referred to for diagnosis and treatment. Patients were enrolled in the study between November 2004 and January 2009. Inclusion criteria were as follows: CHD in the medical history, no diagnosis of severe cognitive impairments in the medical history (e.g. dementia of the Alzheimer's type, vascular dementia, amnestic disorders or mental retardation) and no diagnosis of psychiatric disorders in the medical history (e.g. substance-related disorders, schizophrenia and other psychotic disorders or mood disorders including depressive disorder and bipolar disorder). Furthermore, only patients aged 75 years or less were included in this study because above that age, mortality in a longitudinal design may be expected to be very high, as the life expectancy (in years) in Slovakia in 2004 was 70.3 years among men and 77.8 years among women. Choosing this cut-off as an inclusion criterion could potentially reduce loss at follow-up due to death. Additionally, patients with cardiovascular problems other than CHD (e.g. valve disease) and with a serious co-morbidity (such as malign tumours and nervous system diseases) were excluded, as well as patients with a normal CAG [36, 37]. Data collection consisted of two measurements: a baseline measurement (the day preceding the CAG) and a follow-up examination (performed 12–28 months after the CAG). The baseline measurement consisted of an interview conducted with each participant during hospitalisation for the CAG by a psychologist or trained research assistant to obtain information about sociodemographic characteristics. Furthermore, during baseline examination, medical data were retrieved from the medical records, and the day before CAG, patients also completed self-administered questionnaires on SOC and HRQoL. The type of therapeutic intervention following the CAG–PCI, CABG or pharmaceutical treatment was determined by cardiologists based on the results of CAG independently from participants in this study.

For the follow-up examination, patients were invited individually via postal mail. The follow-up examination consisted of a personal interview, the self-administered SOC and HRQoL questionnaires, and a medical examination (e.g. blood tests and electrocardiography).

Between November 2004 and January 2009, approximately 2,000 patients scheduled to undergo CAG, mostly living in eastern Slovakia, satisfied all the inclusion criteria for this study. Out of these, 523 patients, based on prestratified random sampling, were selected by the research team during their hospitalisation in order to include patients representative of the range of age, the proportion of male-to-female and the socio-economical status from the population scheduled for CAG. The pre-stratification criterion was the level of education. 121 patients were subsequently excluded due to having normal CAG, and 8 (2%) patients refused to participate in the baseline examination. In addition, 73 patients provided incomplete questionnaires. Thus, the baseline sample consisted of 321 patients: 245 men (76.3%) and 76 women (23.7%), with ages ranging from 37 to 74 years (mean age = 56.93; SD = 6.90). Of these, 179 (58.30%) were measured at follow-up, 149 of whom were men (83.2%). Ages ranged from 39 to 73 years, with a mean age of 58.28 (SD = 6.52) at follow-up (Fig. 1). There were no statistically significant differences in terms of age, functional status, type of intervention and SOC between those who participated in the follow-up and those who declined. However, there were differences in gender (Cramer′s $V = 0.13$, $P = 0.02$), with more men than women (62.9% vs. 47.4%) willing to participate at follow-up, but according to Cohen [38], these differences were trivial.

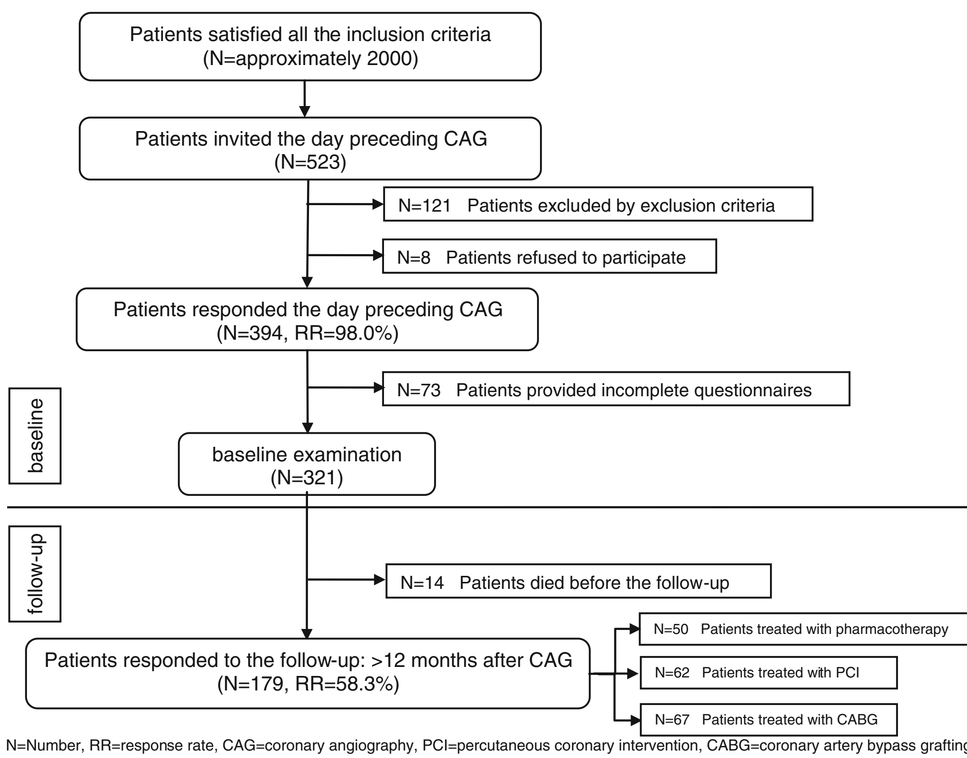
The study was approved by the Ethics Committee of the East Slovakian Institute for Cardiac and Vascular Disease in Kosice in November 2004. All participants were provided with information about the study and signed an informed consent statement prior to the study. Participation in the study was fully voluntary and anonymous, with no incentives provided for participation.

Measures

Sense of coherence was assessed using the 13-item Orientation to Life Questionnaire (OLQ) [15]. The questionnaire consists of three sub-dimensions: meaningfulness (e.g., do you have the feeling that you do not really care about what goes on around you?), comprehensibility (e.g., do you have the feeling that you are in an unfamiliar situation and do not know what to do?) and manageability (e.g., how often do you have feelings that you are not sure you can keep under control?). Each item was rated on a 7-point scale (1 = never, 7 = always). Negatively worded items were reverse-coded. The total sum score was calculated, with a higher score indicating a stronger SOC. The validity and internal consistency of the OLQ are high [16, 39–41]. In the present study, the internal consistency was adequate (Cronbach's $\alpha = 0.78$ at baseline and 0.79 at follow-up).

Health-related quality of life was measured with the Short Form Health Survey Questionnaire (SF-36). The SF-36 scale is used internationally as a generic measure of self-reported physical and mental HRQoL [42]. It consists of 36 items covering eight primary dimensions of subjective health perceptions. These include physical functioning, role limitations due to physical problems, bodily pain, general health perceptions, vitality, social functioning, role limitations due to emotional problems and mental health. Subscale scores and summary scores (the mental component

Fig. 1 Flow-chart diagram of the participants



summary—MCS and the physical component summary—PCS) were calculated using published algorithms [42] in which higher scores indicate better functioning. The algorithms included the following standardised three-step procedure. First, all eight subscale scores (range = 0–100) were standardised using means and standard deviations from the general US population. Second, they were aggregated using weights from the general US population. Finally, aggregate PCS- and MCS-scores were standardised using a linear *T*-score transformation (mean, 50, SD = 10). The SF-36 scale has been well tested and has been proven to have satisfactory psychometric properties and international comparability, also among cardiac patients [43].

The severity of coronary disease was defined by functional status and the type of therapeutic intervention. Functional status was assessed by a cardiologist based on 2 scales: the NYHA—4 classifications according to the New York Heart Association classification of dyspnoea symptoms [44], and the CCS—4 classifications identifying the severity of chest pain according to the Canadian Cardiovascular Society [45]. In both scales, a higher score represents worse functional status. In this study, functional status was calculated using both scales in such a way that the worst score on one of these two scales was used to define the severity of CHD. The type of therapeutic intervention that followed the CAG—whether PCI, CABG or pharmaceutical treatment—was determined by cardiologists based on the results of the CAG.

The *socioeconomic status* of participants was measured by family income, which was evaluated at three levels: 1—low income (lower than the 'minimum wage', i.e. under the poverty line), 2—middle income (at least 'minimum wage' but less than double the minimum wage), and 3—high income (twice the 'minimum wage' or higher). 'Minimum wage' is an indicator of financial situation that is adjusted for the income of all family members according to the Slovak Ministry of Social Affairs, Act No. 252/2009 Governmental Regulation of Minimum Wage [46].

Age was divided in this study into two groups, using median age (59.0 years) as the cut-off: 39–59 and 60–73.

Statistical analysis

As a first step, we computed baseline statistics (prevalence rates and means) for the background characteristics, MCS-, PCS- and SOC-scores. Next, hierarchical linear models (the enter method) were employed to examine the effect of SOC on the MCS and PCS. We used five models to explore the effect of SOC at baseline on the MCS and PCS at follow-up 12–28 months after CAG, yielding regression unstandardised coefficients (B) and 95% confidence intervals (CI). Model 1 tested the crude effect of SOC on the MCS and PCS, and Model 2 tested the effect of SOC when controlling for gender and age. In Model 3, socioeconomic status was added, and Model 4 contained all variables from Model 3 plus functional status, and finally, in Model 5, the type of intervention was added. All analyses were performed using the statistical software SPSS 16.0 for Windows.

Results

The background characteristics and MCS-, PCS- and SOC-scores are presented in Table 1. The majority of our sample concerned men (83.2%) having a middle income (60.3%).

Exploring the effects of SOC and covariates on SF-36 physical and mental component summary measures

Table 2 shows that SOC at baseline was a significant predictor of MCS- and PCS-scores measured at follow-up 12–28 months after CAG when not adjusted for possible confounding sociodemographic and medical variables (Model 1). Adding gender, age, family income and severity of CHD did not affect the association between SOC- and MCS-scores (Models 2, 3, 4 and 5). Regarding PCS, adding gender and age did not affect the association between SOC- and PCS-scores (Model 2). Adjustment for family income weakened the association between SOC and PCS (Model 3), and this association disappeared when the severity of CHD (Models 4 and 5) was added.

Discussion

The present study explored whether SOC at baseline predicts HRQoL at 12–28-month follow-up among patients with CHD, and whether it does so when adjusted for sociodemographic and medical variables. The study thus adds evidence to a rarely investigated topic in the field of CHD. The most important finding is that baseline SOC was a strong independent predictor of both MCS- and PCS-scores measured at 12–28-month follow-up after CAG, both crude and after adjustment for sociodemographic characteristics, and in case of MCS also after adjustment for medical characteristics. Furthermore, the pattern of associations between SOC and MCS/PCS (results not shown) is similar, independent of the time when SOC was measured (the day preceding CAG or 12–28 months after CAG). Thus, the present finding strengthens evidence from scarce earlier studies on specific subgroups of CHD patients using different measures for HRQoL [17, 18, 24, 27] that those who found life more comprehensible, manageable and meaningful tended to evaluate their HRQoL as better.

The next important contribution of this study is the pattern of associations observed between SOC and MCS

Table 1 Background characteristics, SF-36 components and sense of coherence mean score of the sample

Variable	*n*	% Or mean
Gender		
Male	149	83.2%
Female	30	16.8%
Age at follow-up		
39–58	88	49.2%
59–73	87	48.6%
NYHA baseline versus follow-up		
Class I	36 versus 60	20.2% versus 33.7%
Class II	25 versus 66	14.0% versus 37.1%
Class III	24 versus 29	13.5% versus 16.3%
Class IV	3 versus 0	1.7% versus 0.0%
CCS baseline versus follow-up		
Class I	21 versus 86	11.8% versus 48.3%
Class II	51 versus 38	28.7% versus 21.3%
Class III	62 versus 11	34.8% versus 6.2%
Class IV	12 versus 0	6.7% versus 0%
Functional status: baseline versus follow-up		
Class I	18 versus 51	10.0% versus 28.5%
Class II	58 versus 56	32.6% versus 31.3%
Class III	75 versus 31	42.1% versus 17.3%
Class IV	13 versus 0	7.3% versus 0.0%
Type of intervention		
Pharmacotherapy	50	27.9%
PCI	62	34.6%
CABG	67	37.4%
Sense of coherence at baseline	179	64.62 (38–91)
HRQoL at baseline		
Mental summary component SF36	167	46.87 (16.66–65.94)
Physical summary component SF36	167	37.01 (13.78–58.56)
HRQoL at follow-up		
Mental summary component SF36	178	48.33 (23.04–64.06)
Physical summary component SF36	178	40.49 (14.28–59.03)

The missing cases for each variable are as follows: gender, 0%; age, 2.2%; NYHA at baseline, 50.6%; NYHA at follow-up, 12.9%; CCS at baseline, 18.0%, CCS at follow-up, 24.2%; functional status, 7.9% versus 22.9%; type of intervention, 0%; sense of coherence, 0%; MSC and PSC of SF36 at baseline, 6.7%; MSC and PSC of SF36 at follow-up, 0.6%

NYHA New York Heart Association classification, *CCS* Canadian Cardiovascular Society classification, *PCI* percutaneous coronary intervention, *CABG* coronary artery bypass grafting

and PCS after adjusting for socioeconomic position. In our study, a lower socioeconomic position was a predictor of a poorer PCS and weakened the effect of SOC on PCS, but not on MCS. This particularly confirms the findings of Failde and Ramos [43], who found in a study on 185 patients hospitalised for ischaemic cardiomyopathy that worse socioeconomic status was associated with worse MCS and PCS. Socioeconomic status was also found to be an important predictor of the post-operative SF-36 scores in a 1-year longitudinal study among patients following CABG [32]. On the other hand, the effect of socioeconomic position on PCS and MCS was small among patients with angina pectoris [20]. These inconsistent findings thus need further exploration among different populations of patients with CHD. Such studies should be concerned with the role of socioeconomic position in the associations between SOC and MCS/PCS among patients with different functional cardiac conditions.

Another important contribution of the study is related to the severity of CHD. Functional status was an important predictor of poor PCS. Furthermore, after adjustment for the severity of CHD, the associations between SOC and PCS disappeared. This is in line with a previous study among older women with diverse chronic illnesses, which showed that physical health limitations negatively influenced HRQoL [47]. On the other hand, SOC remained a predictor of mental HRQoL even when controlled for medical conditions. The relationship between SOC, MCS, PCS and functional status among patients with CHD is a new research area. Based on our results, we suggest that SOC might offer protection regarding mental HRQoL despite the health limitations that often accompany CHD patients.

Table 2 Associations of sense of coherence with MCS and PCS: regression unstandardised coefficients (*B*) and 95% confidence intervals (CI), crude and after inclusion of covariates

	Model 1		Model 2		Model 3		Model 4		Model 5	
	n = 178, B (95% CI)	smc	*n* = 178, *B* (95% CI)	smc	*n* = 178, *B* (95% CI)	smc	*n* = 178, *B* (95% CI)	smc	*n* = 178, *B* (95% CI)	smc
Mental component summary										
Sense of coherence	0.29 (0.17, 0.41) ***	***	0.29 (0.17, 0.41)***	ns	0.29 (0.16, 0.41)***	ns	0.26 (0.14, 0.39)***	*	0.26 (0.13, 0.39)***	ns
Gender (male vs female[a])			−0.73 (−4.40, 2.94)		−0.79 (−4.50, 2.92)		−1.05 (−4.72, 2.61)		−1.11 (−4.81, 2.60)	
Age (39–58 vs. 59–73[a])			−1.52 (−4.27, 1.22)		−1.60 (−4.36, 1.17)		−1.18 (−3.93, 1.57)		−1.07 (−3.85, 1.72)	
Family income[a]										
Low					−3.33 (−11.70, 5.05)		−2.08 (−10.49, 6.33)		−1.98 (−10.47, 6.52)	
Middle					−0.35 (−3.30, 2.59)		0.13 (−2.81, 3.07)		0.02 (−2.95, 2.99)	
Functional status[a]										
Class I							3.44 (−0.002, 6.88)		3.30 (−0.18, 6.78)	
Class II							−1.06 (−4.25, 2.14)		−1.12 (−4.33, 2.10)	
Type of therapeutic intervention[a]										
Pharmacotherapy									0.37 (−3.02, 3.75)	
PCI									−0.98 (−4.22, 2.27)	
Physical component summary										
Sense of coherence	0.18 (0.06, 0.31)**	**	0.18 (0.06, 0.31)**	ns	0.13 (0.001, 0.26)*	**	0.07 (−0.05, 0.19)	***	0.07 (−0.05, 0.19)	ns
Gender (male vs female[a])			−1.13 (−5.00, 2.75)		−1.89 (−5.67, 1.89)		−2.38 (−5.87, 1.11)		−2.46 (−5.96, 1.04)	
Age (39–58 vs. 59–73[a])			−2.13 (−5.02, 0.77)		−2.38 (−5.19, 0.44)		−1.37 (−3.99, 1.25)		−1.49 (−4.12, 1.14)	
Family income[a]										
Low					−8.50 (−17.04, 0.04)		−4.93 (−12.94, 3.08)		−4.73 (−12.76, 3.30)	
Middle					−5.19 (−8.19, −2.19)**		−3.97 (−6.77, −1.17)**		−3.85 (−6.65, −1.04)**	
Functional status[a]										
Class I							8.81 (5.53, 12.08)***		8.97 (5.68, 12.26)***	
Class II							0.68 (−2.36, 3.72)		0.83 (−2.21, 3.87)	
Type of therapeutic intervention[a]										
Pharmacotherapy									−2.08 (−5.28, 1.12)	
PCI									0.74 (−2.33, 3.80)	

R^2 in MCS: Model 1, 0.12; Model 2, 0.12; Model 3, 0.13; Model 4, 0.16; Model 5, 0.16

R^2 in PCS: Model 1, 0.04; Model 2, 0.06; Model 3, 0.13; Model 4, 0.27; Model 5, 0.28

R^2 change in MCS: Model 1, 0.12; Model 2, 0.01; Model 3, 0.00; Model 4, 0.03; Model 5, 0.00

R^2 change in PCS: Model 1, 0.04; Model 2, 0.02; Model 3, 0.07; Model 4, 0.14; Model 5, 0.01

smc Significance of model change for the added variable(s); Improvement of fit of the model due to the addition of the variable concerned the *F* change test

[a] Reference category: high family income was set as the reference category; class III was set as the reference category; CABG was set as the reference category

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

A final key finding is that the influence of SOC on MCS and PCS changed after adjusting for potential confounders, with the particular role of the severity of CHD as a predictor of PCS. This finding seems to be in line with a systematic review by Eriksson and Lindstrom [48], who concluded that the relation between SOC and the PCS of the SF-36 is much weaker than that between SOC and the MCS. In addition, according to Cohen [38], the strength of the association between SOC and HRQoL varies, from medium (0.12) in MCS to small (0.04) in PCS. On the other hand, a two-year cross-lagged study [23] in patients with chronic illnesses such as diabetes, CHD or chronic obstructive pulmonary disease concluded that SOC enhanced the levels of PCS. One possible explanation for the inconsistency in the above studies could be that the strength of the associations between SOC and PCS is limited by the presence of many factors that influence health, such as functional status in our sample. Regarding MCS, previous studies have shown significant positive associations between strong SOC and good MCS [49, 50]. It can be argued that the significant association between strong SOC and good MCS might be due to a content overlapping between these constructs. However, the overview study conducted by Eriksson and Lindstrom [51] indicated that this is unlikely. Despite the fact that terms such as mental health, well-being and happiness are close to SOC, the theoretical basis of these constructs can be clearly distinguished.

Strengths and limitations

This study was based on a sample covering a wider range of patients regarding gender (both men and women) [24, 25], age range (39–73) [17, 25] and type of intervention following CAG (PCI, CABG or pharmaceutical treatment) [17, 18, 27] than other studies in this research area and with a high response rate at baseline (98.0%). However, in interpreting our data, one has to consider certain limitations. First, selection bias may have occurred as the response rate at follow-up was only 58.3%. Respondents and non-respondents did not differ regarding SOC ($t = -0.20$, $P = 0.84$), however, which makes selection bias less likely. A second limitation may be the variation in time to follow-up between subjects. However, the time to follow-up did not depend on the clinical or mental status of patients but was merely due to logistical variation, making bias due to this variation less likely. Finally, in this study, the SOC summary score was treated as a continuous variable, in line with previous studies exploring the topic of SOC in the field of CHD [27, 30, 49]. Despite the fact, that several previous studies have divided SOC into categories (weak, moderate, strong), there is no agreement in clear cut-off points [39]. Thus, we agree with Norekval et al. [25, p. 829], who state that 'researchers should use an agreed cut-off point' to increase the possibility of comparing studies.

Implications

We found that SOC is a predictor of both MCS and PCS at 12–28-month follow-up after CAG, crude and also after adjustment for sociodemographic and medical variables.

The main goal of clinical care of CHD patients is to improve patients' functioning and well-being. Therefore, identifying and understanding various predictors of HRQoL and their relationships are critical. The three-item SOC instrument is a good alternative for daily practice rather than the relatively lengthy 13-item OLQ [39]. Health care professionals might be able to use information on patients' SOC to improve their HRQoL by concentrating on changing one or more of the three components of the SOC: comprehension, manageability and meaningfulness, not only during the hospitalisation but also during further recovery at home [18]. Furthermore, a significant increase in SOC could be gained by talk-therapy groups [52], social exchanges [53], mindfulness-based stress reduction programmes [54] and individualised psychoeducational programmes based on dialogue [55]. This could increase the self-care of patients with CHD and thus prevent the risk of recurrences. Furthermore, according to Norekval et al. [25], decreasing further cardiac recurrences through patient education, self-management and enhancement of personality resources could be a good alternative to, for example, repeated hospital admissions. Because studies assessing the predictive relationship between SOC and HRQoL are scarce, we recommend that our study should be replicated with a larger sample from different hospital settings. The specific topic should be a mechanism underlying the relationship between SOC and HRQoL. The knowledge gained could help to develop strategies that help patients cope with CHD, and in turn, improve their HRQoL.

Conclusion

Our study indicated that SOC is a predictor of the mental and physical components of HRQoL at 12–28-month follow-up, crude and also after adjustment for sociodemographic and medical variables. Patients undergoing CAG with low SOC thus deserve particular attention in regard to the maintenance and improvement of their HRQoL.

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