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Chapter 5

**Sense of coherence as a mediator between hostility and health-related
quality of life among coronary heart disease patients**

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Submitted

ABSTRACT

Aims: To explore the association between hostility and mental and physical HRQoL among CHD patients, and whether these associations are explained by SOC. Evidence has confirmed that a poor HRQoL negatively affects the prognosis of patients with CHD. Hostility has been shown in turn to negatively affect HRQoL. However, the mechanisms that link hostility and HRQoL in CHD patients remain unclear.

Methods: 509 CHD patients (mean age 58.8 ± 7.3 , 29.3% female) were examined. Hostility was measured using the 27-item Cook-Medley Scale; HRQoL using the SF-36, from which the PCS and MCS were calculated. SOC was measured using the 13-item OLQ. Data were examined using regression analyses and adjusted for age and sex.

Results: Hostility was associated with poorer MCS when adjusted for age and sex. Adding SOC into the model weakened the strength of the association between hostility and MCS. Additionally, this study confirmed indirect effect of SOC on MCS via hostility. Neither hostility nor SOC was associated with poorer PCS.

Conclusions: Our findings indicate that low SOC may partially explain the adverse effect of hostility on low mental HRQoL in CHD patients. If causal, our findings have considerable implications for prevention and are deserving of additional study to confirm them. Cardiovascular nurses might be able to use information on patients' hostility and SOC to improve HRQoL of CHD patients not only during the hospitalization but also during further recovery.

Key words

coronary heart disease, health-related quality of life, hostility, sense of coherence

Introduction

CHD remains the leading cause of death in the EU, especially in several eastern European countries (Allender et al., 2008; Levi et al., 2009; Piepoli et al., 2010). As the main goal of clinical care of CHD patients is to improve patients' functioning and well-being, HRQoL has become an important outcome in CHD patients (Myint et al., 2010; Schenkeveld et al., 2010). Thus increasing and maintaining of good HRQoL in CHD patients is an important target for nursing and allied professions interventions not only during the hospitalization but also during further follow-up (Kattainen et al., 2006). At present, increasing attention is paid to SOC as an important predictor of CHD outcomes in cardiovascular nursing research (Apers et al., 2012).

Background

Poor HRQoL has been shown to be independently associated with a higher risk of CHD (Myint et al., 2006), higher cardiac and total mortality (Mossey & Shapiro, 1982; Schenkeveld et al., 2010), more frequent hospitalisation among cardiac patients (Konstam et al., 1996) and a higher occurrence of chronic disabling conditions such as stroke (Myint et al., 2006). Many instruments have been developed to quantify patients' HRQoL, but the most frequently used instrument in cardiac patients is the SF-36 (Dougherty et al., 1998; Smith et al., 2000; Dempster & Donnelly, 2000; Zuluaga et al. 2010).

Hostility is a risk factor for CHD and also worsens the prognosis of CHD (Ormish et al., 1998; Gallo et al., 2004; Shen et al., 2006; Chida & Steptoe, 2009; Tindle et al., 2010; Albus, 2010; Low et al., 2010). In general, hostility may be characterised as a negative orientation toward interpersonal transactions and includes traits such as cynicism, anger, mistrust and aggression (Barefoot et al., 1989). Intervention research has shown that a decrease in levels of hostility leads to an increase of HRQoL among individuals after an acute heart attack and after cardiac surgery (Linden et al., 1996; Ormish et al., 1998; Shen et al., 2006). However, the mechanisms that link hostility and HRQoL in CHD patients are not clear (Ormish et al., 1998).

SOC may be one of the factors linking hostility and HRQoL (Kivimaki et al., 2002; Julkunen & Ahlstrom, 2006). According to Antonovsky (1979, 1987, 1993), high SOC enables a person to react with flexibility to demands and to activate the appropriate resources for specific situations. SOC is postulated to have three components: comprehensibility, manageability and meaningfulness. A link between hostility and HRQoL via SOC is likely, as the levels of SOC stabilise during adulthood and may be shaped by the levels of hostility which usually develop during childhood (Antonovsky, 1979, 1987, 1993). A study conducted among 841 females (Kivimaki et al., 2002) showed that hostility predicted low SOC at 3-years follow-up, which in turn predicted sickness absence (1 to 3 years later) and self-rated health (4 years later). Another study (Julkunen & Ahlstrom, 2006) conducted among

774 hypertensive participants showed that the association between cynicism, the cognitive component of hostility and HRQoL was totally accounted for by SOC.

The number of studies on hostility and SOC among CHD patients is limited, and studies on the mediating role of SOC in the link between hostility and HRQoL are almost entirely lacking (Kivimaki et al., 2002; Julkunen & Ahlstrom, 2006). Thus, this study aimed to explore the association between hostility and HRQoL among CHD patients, and whether this association is mediated by SOC crude and adjusted for potentially confounding sociodemographic variables. Potential confounders were age (Jarvinen et al., 2004; Pettersen et al., 2008; Bergman et al., 2009) and sex (Jarvinen et al., 2004; Brink et al., 2005).

Method

Sample and procedure

The study sample consisted of patients who had been referred by their cardiologist for CAG in accordance with the European Society of Cardiology guidelines (2006), and who had an abnormal CAG. The study was conducted at the East Slovakian Institute for Cardiac and Vascular Diseases in Kosice, where patients from the whole East Slovakia region (about 1.5 million inhabitants) are referred to for diagnosis and treatment. Patients were enrolled in the study between November 2004 and December 2012. The inclusion criteria were: being referred for CAG and age less than 75 years. Exclusion criteria were a diagnosis of severe cognitive impairments in the medical history, diagnosed psychiatric disorders in the medical history, cardiovascular problems other than CHD (e. g. valve disease), normal CAG and a serious co-morbidity (such as malign tumours and nervous system diseases) (Skodova et al., 2008, 2009; Silarova et al., 2012).

Sociodemographic data were collected via an interview conducted by a psychologist or trained research assistant with each participant during hospitalisation for the CAG. Medical data were retrieved from the medical records, and the day before the interview CHD patients also completed self-administered questionnaires on hostility, 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 the CAG and independently of participation in this study.

Between November 2004 and December 2012 approximately 5000 patients scheduled to undergo CAG, mostly living in eastern Slovakia, satisfied the inclusion criteria for this study. Out of these, we randomly selected 762 potential participants after pre-stratification by SES (measured by educational level: low, middle, high) to obtain equal numbers per stratum. Out of the selected participants, 729 (response rate: 95.7%) agreed to participate in this study. Subsequently, 220 (30.2%) patients were excluded due to having normal CAG. Thus, the sample consisted of 509 patients: 360 males (70.7%) and 149 females (29.3%), with ages ranging from 32 to 75 years (mean=58.77; SD=7.3).

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 all 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

Hostility was assessed using the 27-item version of the CMHS (Cook & Medley, 1954). The questionnaire consists of three sub-dimensions: cynicism, hostile affect and aggressive responding. Cynicism items are statements of belief; hostile affect items reflect emotional experiences; and aggressive responding items tap behaviour. Each item was rated on a dichotomised scale (1="true", 0="false"). The total sum score was calculated, with a higher score indicating a higher level of hostility. The validity and internal consistency of the CMHS are high (Barefoot et al., 1989). In the present study, Cronbach's alpha was 0.71.

SOC was assessed using the 13-item OLQ (Antonovsky 1979). The questionnaire consists of three sub-dimensions: meaningfulness (e.g., Do you have the feeling that you don't really care about what goes on around you?), comprehensibility (e.g., Do you have the feeling that you are in an unfamiliar situation and don't know what to do?) and manageability (e.g., How often do you have feelings that you're 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 (Antonovsky, 1993; Eriksson & Lindstrom, 2005). In the present study, Cronbach's α was 0.74.

HRQoL was measured with the SF-36. The SF-36 scale is used internationally as a generic measure of self-reported physical and mental HRQoL (Ware et al., 1994). 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 MCS and the PCS) were calculated using published algorithms (Ware et al., 1994) 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 U.S. population. Second, they were aggregated using weights from the general U.S. 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 (Failde & Ramos, 2005).

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 dyspnea symptoms (1994), and the CCS – 4 classifications identifying the severity of chest pain according to the Canadian Cardiovascular Society (Campeau, 1976). In both scales, a higher score represents worse functional status.

Age was divided in this study into two groups, using median age (59.0 years) as the cut-off: 32-59 and 60-75.

Statistical Analysis

All statistical analyses were performed using the statistical software IBM SPSS 18.0 for Windows. As a first step, we computed baseline statistics (prevalence rates and means) for the background characteristics, MCS-, PCS-, CMHS- and SOC- scores. Next, we performed hierarchical regression analyses and the Sobel test (Aroian version) (Baron & Kenny, 1986) to test whether the level of SOC mediates the relationship between hostility and MCS, PCS. We assessed three models. Model 1 tested the crude effect of hostility on MCS and PCS, and Model 2 tested the effect of hostility when controlling for sex and age. In Model 3, SOC was added as a mediator. Additionally, the association between hostility and SOC was tested using hierarchical regression analyses. According to Baron and Kenny (1986), the following conditions must be met in order to establish mediation: the independent variable (hostility) must affect the dependent variable (MCS, PCS); secondly, the independent variable must affect the mediator (SOC); and lastly, the mediator must affect the dependent variable.

In the present study only participants with non-missing variables were analysed. The missing data were for the variables of interest as follows: hostility 25.9% and SOC 17.1%. There were no significant differences regarding MCS (Mann-Whitney U test, $p=0.10$) and PCS (Student's t-test, $p=0.30$) between those with non-missing information on both hostility and SOC (344 participants, 67.6%) and those with missing information.

Results

The background characteristics and MCS-, PCS-, CMHS- and SOC-scores are presented in Table 5. 1. The majority of the sample comprised males (70.7%); 38% of the patients were treated with PCI, 31% with pharmacotherapy and 31% with CABG.

Sense of coherence as a mediator between hostility and health-related quality of life in coronary heart disease patients

Table 5.1 Sociodemographic and clinical background characteristics, hostility, Sense of Coherence and health-related quality of life components of the sample (percentages or mean scores)

Variable	N	% or mean
Sex		
Male	360	70.7%
Female	149	29.3%
Age		
32-59	237	46.6%
60-75	272	53.4%
NYHA classification		
Class I	129	25.3%
Class II	94	18.5%
Class III	104	20.4%
Class IV	11	2.2%
CCS classification		
Class I	77	15.1%
Class II	140	27.5%
Class III	166	32.6%
Class IV	47	9.2%
Type of intervention		
Pharmacotherapy	160	31.4%
PCI	193	37.9%
CABG	156	30.6%
Coronary findings		
Nonsignificant stenosis (<50%)	7	1.4%
One-vessel disease	165	32.4%
Two-vessel disease	161	31.6%
Three-vessel disease	155	30.5%
Normal	4	0.8%
Hostility: mean (range)	377	14.60 (4-26)
Sense of Coherence: mean (range)	422	64.60 (30-91)
HRQoL at baseline		
Mental Component Summary SF36: mean (range)	443	47.27 (16.66-92.42)
Physical Component Summary SF36: mean (range)	443	36.39 (0.70-60.37)

Note: The percentage of missing values for each variable were: sex 0%; age 0%; NYHA 33.6%; CCS 15.5%; type of intervention 0%; coronary findings 3.3%; hostility 25.9%; Sense of Coherence 17.1%; MCS and PCS of SF36 13.1%

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

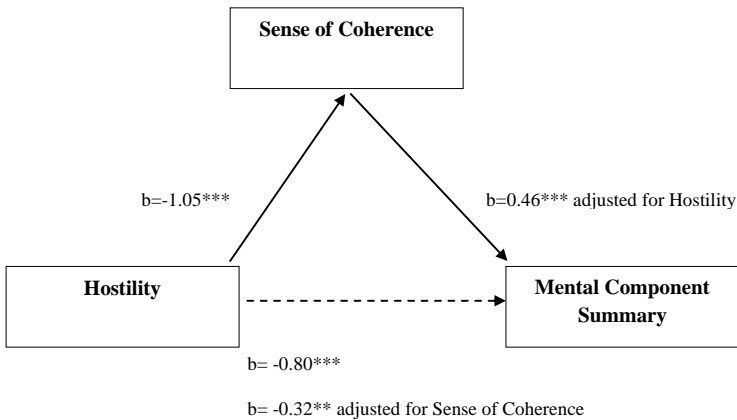
The mediating effect of SOC on the relationship between Hostility and PCS/MCS

Table 5. 2 shows that hostility was significantly associated with lower MCS-scores crude (Model 1) and also when adjusted for age and gender (Model 2). Hostility was significantly associated with lower SOC-scores crude (B=-1.05; [-1.34;-0.75]) and adjusted for age and gender (B=-1.05; [-1.34; -0.76]). Additionally, SOC was associated with higher MCS-scores and weakened the relationship between hostility and MCS-scores (Model 3). Additional adjustments for potential confounders such as disease severity and SES did not affect the direction and strength of these associations (results not shown).

Hostility as well as SOC were not significant predictors of PCS (Model 1, Model 2, Model 3).

The Sobel test (-5.94; $p < 0.001$) confirmed a statistically significant indirect effect of SOC on MCS via hostility (Figure 5. 1). The proportion mediated method showed that the effect of hostility on MCS was explained for 60.1% by SOC and for 39.9% by hostility.

Figure 5.1 Assessment of the mediating role of Sense of Coherence in the association between hostility and the Mental Component Summary of the Short Form Health Survey Questionnaire



Note: all associations are adjusted for gender and age

Table 5.2 Associations of hostility and Sense of Coherence with mental and physical Health-related quality of life among 336 coronary heart disease patients

	Model 1		Model 2		Model 3	
Mental Component Summary	B (95% CI)	smc	B (95% CI)	smc	B (95% CI)	smc
Hostility	-0.80 (-1.06, -0.53)***	***	-0.80 (-1.06, -0.54)***	***	-0.32 (-0.56, -0.07)**	***
Sense of Coherence ^a					0.46 (0.37, 0.54)***	
Physical Component Summary	B (95% CI)	smc	B (95% CI)	smc	B (95% CI)	smc
Hostility	-0.17 (-0.47, 0.12)		-0.18 (-0.47, 0.10)	***	-0.09 (-0.39, 0.22)	
Sense of Coherence					0.09 (-0.01, 0.20)	

Model 1: crude; Model 2 adjusted for age and gender; Model 3 adjusted for age, gender and hostility
R² in MCS: Model 1:0.10; Model 2: 0.10; Model 3: 0.33 ; R² in PCS: Model 1:0.004; Model 2: 0.07; Model 3: 0.08; R² change in MCS: Model 1:0.10; Model 2: 0.004;
Model 3: 0.23; R² change in PCS: Model 1:0.004; Model 2: 0.07; Model 3: 0.01

*p<0.05, **p<0.01, ***p<0.001;

a – Sobel test: -5.94; p<0.001

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

Discussion

The main aim of this study was to explore whether hostility was associated with both mental and physical HRQoL among CHD patients, and whether this association was mediated by SOC. Our most important finding was that high levels of hostility were strongly associated with a worse mental HRQoL and a low SOC in CHD patients, crude and when adjusted for age and sex. Additionally, a low SOC was associated with a worse mental HRQoL when adjusted for age and sex but not with physical HRQoL. Lastly, our results indicate that SOC mediated the association between hostility and mental HRQoL.

Our finding that SOC mediated the relationship between hostility and mental HRQoL confirms previous studies, (Kivimaki et al., 2002; Julkunen & Ahlstrom, 2006) but now with a stronger methodology. Our sample covered both males and females with established CHD and used standard psychosocial measures in our study. Approximately, 60% of the variation in mental HRQoL was explained via SOC. This may be interpreted as meaning that most of the adverse effect of hostility on low mental HRQoL runs via SOC. The remaining unexplained variation in mental HRQoL may be attributed to other mechanisms. These may concern the activation of stress response systems (autonomic dysfunction, inflammation, immunosenescence, thrombogenesis) and the continuation of unhealthy behaviours (e.g. smoking) (for review; see Ormish et al., 1998).

Next, neither hostility nor SOC was significantly associated with physical HRQoL. Regarding SOC, this finding is in line with the systematic review conducted by Eriksson and Lindstrom (2006), who concluded that the relation between SOC and the PCS of the SF-36 is much weaker than between SOC and the MCS. On the other hand, a 6-months longitudinal study (Julkunen & Ahlstrom, 2006) with hypertensive patients concluded that SOC predicted 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 manifests over the time and may be explained by the functional status of the CHD patients (Silarova et al., 2012). Thus further prospective research is needed to understand the exact mechanism in the association between SOC and PCS among patients with different functional cardiac conditions. Other psychological variables, such as depression, anxiety, and stress (Smith et al., 2000; Silarova et al., 2012) should be taken into account as possible determinants of physical HRQoL in CHD patients.

Strengths and limitations

The strengths of this study are its high response rate (95.7%) and the valid and reliable measurement of the relevant variables. However, in interpreting our data one has to consider certain limitations. One of these is a potential information bias regarding self-reported hostility, due to the tendency to provide socially acceptable answers (Davidson & Hall, 1997). Secondly, the cross-sectional nature of this study does not allow conclusions about causality in the relationships between hostility, SOC and

HRQoL. Next, 32.4% of participants provided an incomplete questionnaire on either SOC or hostility; however there were no significant differences between those with non-missing information and those with missing information regarding MCS ($p=0.10$) and PCS ($p=0.30$) which makes selection bias less likely. Lastly, in the present study, the data collection period was long due to the limited research capacity. As a result, patients were included at random when research capacity was available, i.e., independent of the clinical or mental status of patients, making bias due to the length of data collection less likely.

Implications

The results of our study indicate that most of the adverse effect of hostility on low mental HRQoL runs via SOC. Our study thus complements the previous evidence that SOC may be an important target in secondary prevention not only among CHD patients but also among other groups of cardiac patients (e.g. congenital heart disease) (Apers et al., 2013). Thus cardiovascular nurses might be able to use information on patients' SOC to improve several characteristics of CHD patients by concentrating on the three components of SOC: comprehension, manageability and meaningfulness not only during the hospitalization but also during further recovery at home (Kattainen et al., 2006; Apers et al., 2013). A significant increase in SOC could be gained by talk-therapy groups (Langeland et al., 2006), social exchanges, mindfulness-based stress reduction programmes (Forsberg et al., 2010) and individualised psychoeducational programmes based on dialogue (Wiesbecker et al., 2002).

In addition, feelings of hostility may be decreased by cognitive behavioural therapy (Seligman et al., 2005), group-based hostility-control interventions and behavioural modifications (Barefoot et al., 1989). Because studies assessing the predictive relationship between hostility, SOC and HRQoL are scarce, we recommend that our study be replicated with a larger sample from different hospital settings.

Conclusion

Our study indicated that both high levels of hostility and low levels of SOC are associated with poor mental HRQoL. Low SOC may thus be an important factor partially explaining the adverse effect of hostility on low mental HRQoL in CHD patients. However, our findings need to be confirmed. The knowledge gained could help to develop strategies that help patients cope with CHD, and in turn, improve their HRQoL.

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