

## Psychosocial predictors of change in quality of life in patients after coronary interventions

Zuzana Škodová, PhD<sup>a,b,\*</sup>, Jitse P. van Dijk<sup>a,c</sup>, Iveta Nagyová, PhD<sup>a</sup>, Jaroslav Rosenberger, MD, PhD<sup>a,d</sup>, Daniela Ondušová, MD<sup>e</sup>, Berrie Middel, PhD<sup>f</sup>, Sijmen A. Reijneveld, MD<sup>c</sup>

<sup>a</sup> University of PJ Safarik, KISH-Kosice Institute for Society and Health, Kosice, Slovakia

<sup>b</sup> Comenius University, Jessenius Faculty of Medicine in Martin, Department of Non-Medical Study Programmes, Martin, Slovakia

<sup>c</sup> Department of Social Medicine, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands

<sup>d</sup> University of PJ Safarik, Faculty of Medicine, 1.Internal Clinic, Kosice, Slovakia

<sup>e</sup> East Slovakian Institute for Cardiac and Vascular Diseases, Kosice, Slovakia

<sup>f</sup> Department of Health Sciences, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands

### ARTICLE INFO

#### Article history:

Received 02 June 2009

Revised 20 November 2009

Accepted 10 December 2009

Online 14 May 2010

#### Keywords:

Coronary heart disease

Psychosocial factors

Health-related quality of life

Psychological well-being

Vital exhaustion

### ABSTRACT

**OBJECTIVE:** Health-related quality of life (HRQOL) after coronary interventions (coronary artery bypass grafting, percutaneous transluminal coronary angioplasty) usually improves in patients, but not in all patients. Some patients actually show a significant decline in HRQOL. Our aim was to explore the potential of psychologic well-being (anxiety, depression), vital exhaustion, Type D personality, and socioeconomic position as predictors of HRQOL in patients with coronary disease.

**METHODS:** A total of 106 patients scheduled for coronary angiography were interviewed before (baseline) and 12 to 24 months after coronary angiography. Socioeconomic status was evaluated by education. The General Health Questionnaire 28 was used for measuring psychologic well-being (anxiety, depression), the Maastricht interview was used for measuring vital exhaustion, and the Type D questionnaire was used for measuring personality. HRQOL was assessed using the Short Form-36 (physical and mental components) questionnaire. Functional status was assessed with a combination of New York Heart Association and Canadian Cardiovascular Society classifications. Linear regressions were used to analyze data.

**RESULTS:** A change in physical HRQOL was predicted by baseline psychologic well-being ( $\beta = -.39$ ; 95% confidence interval [CI],  $-1.00$  to  $-.16$ ) and baseline HRQOL ( $\beta = -.61$ ; 95% CI,  $-.83$  to  $-.34$ ). A change in mental HRQOL was predicted by (baseline) psychologic well-being ( $\beta = -.37$ ; 95% CI,  $-.99$  to  $-.09$ ), vital

This work was supported by the Slovak Research and Development Agency under Contract No. APVV-20-038305 and the Project "Centre for Excellent Research of Atherosclerosis and its Complications—Myocardial Infarction and Stroke," Operational Program of Research and Development financed by the European Fund for Regional Development.

\* Corresponding author: Zuzana Škodová, PhD, Jessenius Faculty of Medicine in Martin, Comenius University, Department of Non-Medical Study Programmes, Malá Hora 5, Martin, 036 45, Slovakia.

E-mail address: zuzanaskodova@yahoo.com (Z. Škodová).

0147-9563/\$ - see front matter © 2011 Elsevier Inc. All rights reserved.

doi:10.1016/j.hrtlng.2009.12.007

exhaustion ( $\beta = -.21$ ; 95% CI,  $-.69$  to  $-.03$ ), and baseline HRQOL ( $\beta = -.76$ ; 95% CI,  $-1.03$  to  $-.44$ ). Ejection fraction did not significantly predict HRQOL.

**CONCLUSION:** Psychosocial factors (psychologic well-being, vital exhaustion) seem to be more important predictors of change in HRQOL compared with some objective medical indicators (ejection fraction) among patients with coronary disease.

Cite this article: Škodová, Z., van Dijk, J. P., Nagyová, I., Rosenberger, J., Ondušová, D., Middel, B., & Reijneveld, S. A. (2011, JULY/AUGUST). Psychosocial predictors of change in quality of life in patients after coronary interventions. *Heart & Lung*, 40(4), 331-339. doi:10.1016/j.hrtlng.2009.12.007.

Although cardiac mortality has decreased in most high-income countries in recent years, coronary heart disease (CHD) is still the leading cause of morbidity and disability of the population. Moreover, the overall decline in CHD rates has been uneven when comparing the countries of western Europe and the United States, where the decreasing mortality trends are clearly visible, with the countries of Eastern and Central Europe, where decline in cardiac mortality is less pronounced, or the countries of the former Soviet Union, where trends in cardiac mortality are increasing or unstable.<sup>1,2</sup> Some of the decreases in mortality might be influenced by methodological issues. For instance, epidemiologic trends in the incidence of myocardial infarction (MI) could partially be due to an increased detection of small infarctions caused by the introduction of a troponin-based criterion into diagnostics.<sup>3</sup> However, the CHD rates in the countries of Eastern and Central Europe remain rather high compared with rates in Western European countries and the United States.

The focus of research on CHD is currently shifting toward quality of life among patients, and psychosocial factors are also becoming more important. This is partly because medically oriented treatment strategies have been developed over the past decades, and survival among patients with coronary disease has significantly improved. This has enabled many patients to live longer and better despite their disease. Quality of life has thus been increasingly considered as an important outcome measure in research focused on patients with CHD.<sup>4,5</sup>

A patient's quality of life is a complex, multidimensional construct comprising physical, mental, social, and economic components and can be influenced by various factors, including both medical and psychosocial parameters.<sup>6</sup> Because of the inconsistency in definition, it is often operationalized as perceived health status, self-rated health, or health-related quality of life (HRQOL). The present study used the Short Form-36 (SF-36) questionnaire as a measure of quality of life, which attempts to capture the subjective (self-perceived) health status of a patient as a reflection of his/her disease. The outcome parameter of the SF-36 is usually defined as HRQOL and can be used to evaluate the broad impact of a disease on a patient and the effectiveness of interventions aimed at mental and physical health.<sup>7,8</sup>

Recent research has shown HRQOL to be a construct of high clinical relevance, with HRQOL significantly predicting long-term mortality among patients with CHD<sup>9</sup> and short-term mortality after cardiac surgery, especially among older patients.<sup>10</sup> Long-term mortality, readmissions, and cardiovascular events after invasive coronary procedures (CABG or percutaneous transluminal coronary angioplasty [PTCA]) among patients with CHD or heart failure have all been predicted by HRQOL.<sup>11-13</sup>

Invasive coronary procedures (CABG or PTCA) usually lead to an improvement in both the physical and mental dimensions of HRQOL, but there is still a significant proportion of patients who do not improve or who even show a decline in HRQOL.<sup>14-16</sup> Hawkes and Mortensen<sup>16</sup> concluded that predicting in advance which patients will benefit from therapy or intervention and which will not by investigating clinically significant intra-individual change standards in HRQOL may therefore be a relevant step. Evidence regarding deterioration in HRQOL is scarce, however, and most studies focused on predicting HRQOL after invasive coronary procedures analyze medical factors; thus, data on psychosocial factors as predictors of HRQOL after surgery are lacking. Medical predictors of HRQOL among patients with CHD include the severity of the disease, type of the intervention received, and functional status, which is usually assessed using New York Heart Association (dyspnea classification), Canadian Cardiovascular Society (classification identifying severity of chest pain), or a more objective indicator (left ventricular ejection fraction). The history of neurologic and psychiatric diseases, and other comorbidities, including peripheral vascular disease, chronic obstructive pulmonary disease, hypertension, and diabetes,<sup>17-19</sup> are influencing HRQOL in patients with CHD. Sociodemographic predictors of lower HRQOL in CHD include female gender, increased age, lower occupational status, and living alone.<sup>15,17,20,21</sup>

From psychosocial factors, it might be expected that mood disturbances (depression, anxiety) in particular play an important role, because a strong association between depression and CHD is well established on the basis of numerous studies. Symptoms of depression not only increase the likelihood of CHD but also have independent adverse effects on later prognosis among patients who have already experienced a cardiac event.<sup>22,23</sup> MI is often followed by symptoms of

depression and anxiety, and the presence of post-MI depression is associated with increased risk of mortality and morbidity. Patients with high levels of post-MI depression are more likely to die of cardiac causes over the subsequent years and have a higher probability of nonfatal reinfarction and other cardiac complications.<sup>24–26</sup>

Other factors may also influence the prognosis of CHD. Vital exhaustion has been shown to be a predictor of increased risk for MI, coronary bypass surgery, need of revascularization, and cardiac death among patients with coronary disease.<sup>27</sup> In regard to personality traits, Type D personality was associated with a higher number of reinfarctions and higher mortality rates among patients with coronary disease, as well as impaired quality of life.<sup>28</sup>

Our aim was to identify psychosocial predictors of change in HRQOL among patients with CHD. The predictors of change in HRQOL were also assessed separately for any lack of improvement in HRQOL (ie, patients with a stable or worse HRQOL). We focused not only on the well-known characteristics traditionally associated with CHD, such as depression and anxiety (in our study represented by the term “psychologic well-being”), but also on the less commonly explored factors of vital exhaustion, Type D personality, and socioeconomic status (SES) (education).

## MATERIALS AND METHODS

### Study Participants and Procedure

The study sample included patients with CHD requiring coronary angiography (CAG); patients were referred for this invasive procedure according to the European Society of Cardiology guidelines by their local cardiologists. Both baseline and follow-up measurements were performed in the East Slovakian Institute for Cardiac and Vascular Diseases, a highly specialized medical center, where all patients with diagnosed or suspected cardiovascular problems from the entire East Slovakian region (~1.5 million inhabitants) are referred for diagnosis and treatment. The inclusion in our study started after admission to the medical center by inviting patients to participate in the study. At baseline all patients underwent the study interview during their hospitalization before CAG. The follow-up measurements were performed during regular control examinations; all patients were invited for these control visits to the East Slovakian Institute for Cardiac and Vascular diseases by postal mail (invitation sent 2–3 weeks in advance) and were contacted by phone (2–3 days in advance). At both baseline and follow-up, interviews with patients were performed by a trained psychologist, paper–pencil questionnaires were completed by patients after the interview, and medical information relevant for the study was retrieved from the medical records by a cardiologist.

General inclusion criteria at baseline were as follows: CHD in the medical history, age less than 75 years, no severe cognitive impairments, and no history of severe psychiatric disorder. Patients with serious comorbidity and cardiovascular problems other than CHD (eg, valve disease) were excluded. All participants were provided with information about the study and signed an informed consent letter. Ethical approval for this study was obtained from the Ethics Committee of the East Slovakian Institute for Cardiac and Vascular Diseases in Kosice.

### Measures

#### *Psychologic Well-being*

To assess psychologic well-being, the General Health Questionnaire 28 was used, which consists of 28 items divided into 4 subscales: physical symptoms, anxiety and insomnia, social dysfunction, and depression.<sup>29</sup> A total General Health Questionnaire 28 score is between 0 and 84, with a higher score indicating worse mental health status.<sup>30</sup> The psychometric properties of the Slovak version of this questionnaire have been shown to be acceptable.<sup>31</sup> In the present study, the Cronbach's alpha was .92.

#### *Health-related Quality of Life*

The SF-36 questionnaire<sup>7,32</sup> provides a subjective measure of 8 dimensions of HRQOL: bodily pain, physical functioning, physical role limitations, general health perceptions, vitality, emotional role limitations, mental health, and social functioning. The first 4 subscales can be summarized into a physical functioning component summary, and the last 4 subscales can be summarized into a mental functioning component summary. These latter 2 components were used as the outcome measures in this study. The summary score ranges from 0 to 100, with lower scores indicating worse HRQOL. Cronbach's alpha was .88 for the physical component of SF-36 in our study and .90 for the mental component of SF-36.

#### *Vital Exhaustion*

The structured Maastricht Interview for Vital Exhaustion was administered as an interview by a trained psychologist. This instrument was designed to measure feelings of vital exhaustion, a significant risk factor of CHD, by asking a patient a set of questions about tiredness, lack of energy, irritability, disrupted sleep, or difficulty in concentrating. The measure has been used in a number of studies in the general population showing that vital exhaustion is an independent risk factor in the cause and prognosis of CHD, especially for the first MI, for reinfarctions, and for the need of revascularization after coronary angioplasty.<sup>33</sup> The interview consists of 23 questions. We used the original scoring system from the Maastricht Questionnaire, with scores ranging from 0 to 46, and with a cutoff point of 17 or higher identifying a participant as “exhausted.”<sup>33</sup> The scale has been found to have

good psychometric properties.<sup>34</sup> In the present study, the Cronbach's alpha was .87.

#### Type D Personality

Type D personality was measured with the 14-item Type D Personality Scale (DS14), which was developed for use among patients with coronary disease. Type D personality is typified by a higher tendency to experience negative emotions and by less frequent expression of emotions in social interactions, that is, the tendency to repress emotional reactions in contact with other people. The DS14 consists of 2 subscales: negative affectivity and social inhibition. A score of 10 or more on both subscales denotes a person as having a Type D personality.<sup>35</sup> The Cronbach's alpha was .82 in the present study.

#### Functional Status

Ejection fraction was used as the indicator of functional status of patients. Ejection fraction is the measure of systolic function of the left ventricle indicated by echocardiography and may be reported as normal (>50%), borderline normal (40%-50%), or systolic dysfunction: mild (30%-39%), moderate (20%-29%), and severe (<20%).<sup>36</sup>

#### Socioeconomic Position

The socioeconomic position of participants was measured according to the level of education attained: basic education, middle education (lower secondary without school-leaving examinations and secondary with the graduation examinations), and high (university) education.

#### Analysis

We first analyzed the basic demographic, medical, and psychologic characteristics of patients according to the type of intervention indicated after CAG (CABG, PTCA/stent, and pharmacotherapy) and the SF-36 scores at baseline and follow-up. Second, we used *t* tests for repeated measurements to assess the statistical significance of changes in the physical and mental component of SF-36 between the baseline and the follow-up. The clinical relevance of the change in both components of the SF-36 was assessed using a distribution-based model.<sup>37</sup> We used effect sizes and a standard error of measurement (SEM)-based criterion. Effect sizes were considered as follows: trivial, 0 to .2; small, .2 to .5; moderate, .5 to .8; and large,  $\geq .8$ .<sup>37</sup> In regard to the definition of the SEM-based criterion of the clinically relevant change, we used 1.96 SEM as a reflection of the 95% confidence interval. We defined patients as improved in HRQOL when their increase in SF-36 score was  $>1.96$  SEM, patients who declined in HRQOL as having a decrease of  $>1.96$  SEM, and those remaining stable in HRQOL as having a change in score of  $\leq 1.96$  SEM.

To determine predictors for change in the physical and mental aspect of HRQOL, multiple linear

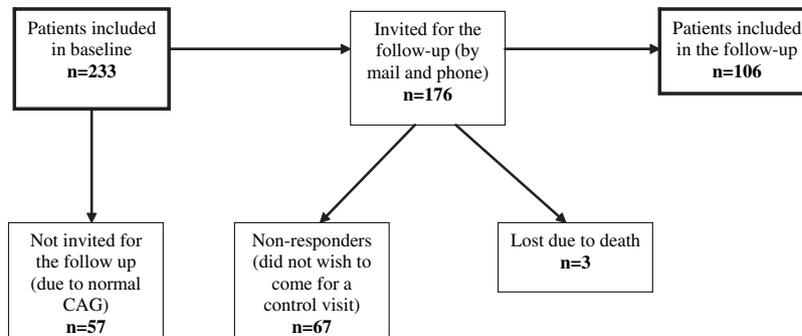
regression analyses were performed. Age, gender, functional status, and type of intervention were included in the regression models as possible confounding variables, and education, psychologic well-being, vital exhaustion, type D personality, and baseline HRQOL were included as expected predictors. Linear regressions were performed first for the total sample. In the next step, we also computed linear regression separately in the 2 groups: The first group consisted of patients who improved in HRQOL, and the second group consisted of patients who did not improve in HRQOL, that is, those whose conditions deteriorated or remained stable. Statistical analyses were performed using SPSS version 14.0 (SPSS Inc, Chicago, IL).

## RESULTS

The study sample consisted of 233 patients at baseline, included from November 2004 to December 2006. For the follow-up examination, we invited only those patients who were indicated (according to the results of CAG) for PTCA, coronary artery bypass grafting (CABG), or pharmaceutical treatment. Patients with a normal CAG (57) were excluded and not invited for the follow-up examination. Three patients died, and 67 patients were lost to follow-up (these patients were contacted but did not want to attend a control visit). A total of 106 participants were interviewed at follow-up 12 to 24 months after baseline from November 2005 to December 2007, a response rate of 61.3%. Responders and nonresponders at follow-up did not differ in age, gender, or disease severity (Figure 1).

The mean age of participants in our study was 57.4 years (standard deviation =  $\pm 6.7$ ), and 15.1% were women. Most of the patients had a middle education (54.7%), whereas 25.5% of the participants had a basic education and 19.8% had a higher education. These characteristics were similar in all subgroups according to the type of intervention. Basic psychologic and medical characteristics within the research groups are presented in Table 1. Additional demographic characteristics on ethnic stratification and occupational status were also obtained; there were no significant differences among the 3 subgroups with regard to these factors. In the total sample, 6% of patients reported Roma ethnicity, and the majority of patients were Caucasian (a normal ethnic distribution for the Slovak Republic), 44.8% of patients were employed, 6.7% of patients were unemployed, 19.0% of patients were disabled, and 29.5% of patients were retired.

Table 2 shows the SF-36 summary scores (physical and mental component) at baseline and the follow-up for the total sample and for each subgroup according to the type of the intervention after CAG. For the physical component of the SF-36, statistically significant improvements were found among all groups of



**Figure 1 – Data-collection details on responders and nonresponders at baseline and follow-up. CAG, coronary angiography.**

**Table 1 – Baseline characteristics of study patients**

Type of intervention after CAG	CABG	PTCA/stent	Pharmacotherapy	Total study sample
Total No.				
N (%)	41 (38.7%)	37 (34.9%)	28 (26.4%)	106 (100%)
Age, y				
Mean (SD)	59.4 (±5.4)	55.8 (±7.6)	56.8 (±6.4)	57.4 (±6.7)
Range	49-73	34-69	46-69	34-73
Gender				
Male	35 (85.4%)	30 (81.1%)	25 (89.3%)	90 (84.9%)
Female	6 (14.6%)	7 (18.9%)	3 (10.7%)	16 (15.1%)
Education				
Basic	8 (19.5%)	7 (18.9%)	12 (42.9%)	27 (25.5%)
Secondary	21 (51.2%)	23 (62.2%)	14 (50.0%)	58 (54.7%)
High	12 (29.3%)	7 (18.9%)	2 (7.1%)	21 (19.8%)
Functional status				
EF > 50%	16 (39.0%)	23 (74.2%)	13 (56.5%)	52 (54.7%)
EF 40%-50%	16 (46.3%)	6 (19.4%)	7 (30.4%)	32 (33.7%)
EF < 40%	9 (14.6%)	2 (44.4%) <sup>a</sup>	3 (13.0%) <sup>b</sup>	11 (11.6%)
Psychologic well-being				
Mean (SD)	27.7 (±9.9)	29.1 (±12.5)	25.4 (±13.2)	27.7 (±11.7)
Vital exhaustion				
Mean (SD)	18.4 (±8.8)	20.7 (±9.6)	21.6 (±12.4)	20.1 (±10.1)
Type D				
Type D	27 (34.1%)	20 (54.1%)	16 (57.1%)	63 (59.4%)
Non-Type D	14 (65.9%)	17 (45.9%)	12 (42.9%)	43 (40.6%)

CAG, coronary angiography; CABG, coronary artery bypass grafting; PTCA/stent, percutaneous transluminal coronary angioplasty with or without stent; EF, ejection fraction; SD, standard deviation.

<sup>a</sup> Data on functional status are missing for 6 patients.

<sup>b</sup> Data on functional status are missing for 5 patients.

patients, except for patients indicated for pharmacotherapy, and in the mental component, significant improvements were found among all groups of patients (as indicated by *P* values and effect sizes in Table 2).

Testing for a clinically relevant change in HRQOL by using the SEM-based criterion revealed that approximately 40% of patients improved in the physical component of the SF-36, one half of the participants (51%) remained stable, and approximately 9% of participants declined in this component of HRQOL. Results in the mental component of SF-36 were similar, with 36% of patients improving, 56% of patients remaining stable, and 8% of participants declining.

The linear regression model showed that significant baseline predictors for a change in the physical HRQOL were psychologic well-being and the baseline physical component of SF-36. Significant predictors of change in the mental HRQOL were psychologic well-being, vital exhaustion, and the baseline mental component of SF-36 (Table 3). SES and personality traits were not significant in predicting a change in HRQOL among our patients.

When linear regression was performed separately within the groups of patients with and without improved HRQOL, results showed that psychologic well-being was a significant predictor only among those with improved HRQOL. Within the group of participants

**Table 2 – Health-related quality of life (SF-36 scores) at baseline and follow-up**

Physical component of HRQOL								
Type of intervention	Baseline Mean (SD)	Follow-up Mean (SD)	<sup>a</sup> Change Mean (SD)	P value	<sup>b</sup> Effect size	Patients improved (%)	Patients stable (%)	Patients declined (%)
All (106)	48.3 (±18.5)	57.2 (±17.8)	9.1 (±18.4)	.001	-.68	40.6%	51.0%	8.3%
CABG (41)	46.6 (±14.7)	59.1 (±16.2)	11.4 (±17.3)	.001	-.94	42.1%	55.3%	2.6%
PTCA/stent (37)	45.8 (±20.6)	57.7 (±23.4)	10.1 (±19.8)	.008	-.72	38.7%	51.6%	9.7%
Pharmacotherapy (28)	50.6 (±21.2)	54.1 (±22.1)	4.5 (±17.9)	.207	-.35	40.7%	44.4%	14.8%
Mental component of HRQOL								
Type of intervention	Baseline Mean (SD)	Follow-up Mean (SD)	<sup>a</sup> Change Mean (SD)	P value	<sup>b</sup> Effect size	Patients improved (%)	Patients stable (%)	Patients declined (%)
All (106)	58.5 (±17.8)	65.2 (±18.2)	7.7 (±16.5)	.001	-.55	35.8%	52.6%	11.6%
CABG (41)	58.9 (±17.3)	65.9 (±16.9)	8.1 (±17.1)	.007	-.67	35.1%	54.1%	10.8%
PTCA/stent (37)	56.6 (±18.5)	62.1 (±19.4)	6.6 (±17.1)	.035	-.55	36.4%	48.5%	15.2%
Pharmacotherapy (28)	60.6 (±17.9)	68.1 (±18.6)	8.6 (±15.2)	.009	-.79	36.0%	56.0%	8.0%

CABG, coronary artery bypass grafting; HRQOL, health-related quality of life; PTCA/stent, percutaneous transluminal coronary angioplasty with or without stent; SD, standard deviation.

<sup>a</sup> Change between baseline and follow-up.

<sup>b</sup> Negative values for effect size between baseline and follow-up represent improved HRQOL; positive values represent decreased HRQOL.

without improved HRQOL, only the baseline HRQOL and education were significantly associated with the physical component of the SF-36 (Table 4).

## DISCUSSION

### Major Findings

Psychologic well-being (depression and anxiety), vital exhaustion (only for the mental component), and baseline HRQOL were identified as significant baseline predictors for a change in HRQOL. Only a few previous studies exploring predictors of HRQOL have focused on psychosocial variables as potential predictors. Symptoms of depression and anxiety have been found to predict short-term HRQOL (3 months after treatment) in a study by Höfer et al<sup>5</sup> and to be associated with the HRQOL among patients with coronary disease in a cross-sectional study.<sup>38</sup> Our results showed that psychologic well-being (depression and anxiety) significantly predicts both the mental and physical components of HRQOL over a long-term period (12–24 months after treatment) and that vital exhaustion is just as important as depression and anxiety in predicting HRQOL. Vital exhaustion, which is usually characterized by experiencing unusual fatigue not resulting from exercise or hard work, lack of energy, and increased irritability, was found to be an independent risk factor especially for the first MI and CHD onset in previous studies,<sup>27,39</sup> as well as a predictor of a worse prognosis. Vital exhaustion increases the risk

for next MI, coronary bypass surgery, need of revascularization, and cardiac death in patients with already diagnosed cardiac disease.<sup>40</sup> Our results support the assumption that vital exhaustion is a relevant factor to take into account, not only when studying the cause and prognosis of CHD but also when studying the associated quality of life. Vital exhaustion has some features similar to those of depression. However, depressed mood, a key symptom of depression, is almost always absent in vital exhaustion. Also, exhausted patients do not report cognitive distortions typical for depression, feelings of uselessness, auto-accusations, or suicidal tendencies.<sup>41</sup> It seems that with regard to quality of life among patients, it is useful to distinguish between the concepts of depression and vital exhaustion, because they both have their unique impact on quality of life.

However, it is necessary to take into account that the psychosocial factors mentioned were predicting HRQOL only among patients with improved quality of life. Approximately one half of patients remained stable with regard to both mental and physical components of HRQOL (they neither improved nor deteriorated) in the follow-up examination after CAG or subsequent treatment. It would be of use to focus on other possible predictors of HRQOL in this group of patients, because it seems that different pathway mechanisms apply among patients with improved HRQOL and patients with decreased HRQOL. One possible explanation why HRQOL did not change in some patients after interventions is that 54% of the participants had ejection fractions greater than 50%, and only 11.6% of the patients had a severely decreased ejection fraction. A sample with a larger proportion of

**Table 3 – Baseline predictors for change in health-related quality of life among participants**

	Physical component of HRQOL		Mental component of HRQOL	
	$\beta$ - value	95% CI	$\beta$ - value	95% CI
Age	-.01	(-.57 to .49)	-.07	(-.49 to .46)
Gender	.04	(-9.55 to 14.52)	.06	(-7.50 to 13.92)
Functional status	-.08	(-.53 to .24)	-.04	(-.43 to .29)
Intervention	.09	(-3.01 to 7.00)	-.04	(-5.65 to 4.01)
Education	.12	(-2.93 to 9.49)	.03	(-4.00 to 6.54)
Psychologic well-being	<b>-.35<sup>b</sup></b>	<b>(-.95 to -.13)<sup>b</sup></b>	<b>-.36<sup>a</sup></b>	<b>(-5.02 to -.07)<sup>a</sup></b>
Vital exhaustion	-.08	(-.57 to .27)	<b>-.19<sup>a</sup></b>	<b>(-.70 to -.07)<sup>a</sup></b>
Type D	.13	(-2.96 to 12.05)	.04	(-6.26 to 8.56)
Baseline HRQOL	<b>-.66<sup>c</sup></b>	<b>(-.88 to -.40)<sup>c</sup></b>	<b>-.78<sup>b</sup></b>	<b>(-1.08 to -.43)<sup>b</sup></b>
Total R <sup>2</sup> (adjusted)	.28		.21	

HRQOL, health-related quality of life; CI, confidence interval.

<sup>a</sup>P < .05, <sup>b</sup>P < .01, <sup>c</sup>P < .001. Statistically significant results are in bold.

**Table 4 – Baseline predictors for change in health-related quality of life among patients who did and did not improve**

	Physical component of HRQOL		Mental component of HRQOL	
	$\beta$ - value	95% CI	$\beta$ - value	95% CI
<b>Improved HRQOL</b>				
Age	-.05	(-.81 to .63)	.03	(-.40 to .52)
Gender	-.02	(-12.20 to 12.11)	-.09	(-13.26 to 9.17)
Functional status	-.02	(-.48 to .46)	-.17	(-.49 to .22)
Intervention	.13	(-4.34 to 7.51)	.14	(-3.94 to 7.07)
Education	-.13	(-7.44 to 7.06)	-.13	(-8.40 to 4.65)
Psychologic well-being	-.30	(-.85 to .26)	<b>-.60<sup>a</sup></b>	<b>(-1.13 to 8.02)</b>
Vital exhaustion	-.11	(-.70 to .46)	.11	(-.40 to 2.60)
Type D	.37	(-3.03 to 17.18)	-.07	(-9.27 to 6.78)
Baseline HRQOL	-.26	(-.56 to .19)	<b>-.76<sup>a</sup></b>	<b>(-.78 to -.07)</b>
Total R <sup>2</sup> (adjusted)	-.01		.12	
<b>Not improved HRQOL</b>				
Age	-.03	(-.53 to .44)	.03	(-.41 to .50)
Gender	-.07	(-18.44 to 11.44)	-.02	(-12.08 to 1.39)
Functional status	-.20	(-.61 to .11)	-.20	(-.56 to .14)
Intervention	.10	(-3.33 to 6.21)	-.14	(-5.94 to 2.58)
Education	<b>.38<sup>a</sup></b>	<b>(.88 to 13.09<sup>a</sup>)</b>	.24	(-1.73 to 8.50)
Psychologic well-being	-.22	(-.66 to .22)	-.06	(-.52 to .41)
Vital exhaustion	-.05	(-.43 to .31)	-.06	(-.38 to .27)
Type D	.23	(-1.61 to 12.96)	.10	(-4.40 to 8.48)
Baseline HRQOL	<b>-.54<sup>a</sup></b>	<b>(-.63 to -.08)<sup>a</sup></b>	-.43	(-.65 to .09)
Total R <sup>2</sup> (adjusted)	.19		-.07	

HRQOL, health-related quality of life; CI, confidence interval.

<sup>a</sup>P < .05.

patients with severely decreased functional status might have resulted in different results for HRQOL. Notably, HRQOL of most patients enrolled in the follow-up improved or remained stable, which is definitely a positive finding. However, patients who did not respond in our follow-up might have reported a lower HRQOL, which might have influenced our results.

Our study showed that psychologic characteristics were even more significant than functional status or type of treatment after CAG (indicating the seriousness of the disease) in predicting HRQOL among patients with CHD. Also, psychosocial characteristics

expressing mental health (anxiety, depression, vital exhaustion) were more important in predicting HRQOL than more stable personality traits (hostility, Type D personality), which might be of importance in planning psychologically oriented intervention strategies focusing on improving quality of life among patients with coronary disease.

Socioeconomic differences in the prognosis of CHD have been found in numerous studies showing that socioeconomic disadvantage is associated with a higher mortality and incidence of cardiac complications;<sup>42-44</sup> thus, it could be expected that a similar

effect would be present in HRQOL. However, the results of the present study suggest that a change in HRQOL was not significantly predicted by SES (as measured by education), with the exception of a physical component of HRQOL in patients who did not improve. It is probable that SES influences quality of life indirectly via psychologic factors. Thus, SES might have an effect on depression and anxiety, which might consequently influence quality of life. It is also possible that current SES has an impact only on current HRQOL but has only a limited effect on HRQOL in the future (after treatment). Another possible explanation might be the differences in the healthcare systems of the Slovak Republic and the United States. In the United States, SES inequalities are usually larger than were found in our study, which may be due to SES inequalities in the access to healthcare being less pronounced in Slovakia than in the United States. This is because the Slovakian healthcare system is based on a compulsory health insurance coverage, resulting in a rather equal access for every citizen to healthcare, a situation different from the US setting.

## STRENGTHS AND LIMITATIONS

The longitudinal design of the present study and the focus on the psychosocial predictors of HRQOL allowed us to contribute to this important but less explored field in CHD research. However, the relatively small number of participants is one limitation of the present study. As a result, we did not identify a sufficient number of patients with decreased HRQOL, and it was therefore not possible to explore psychosocial predictors specifically in patients with decreased HRQOL separately, but only among the group who did not improve in HRQOL, meaning those whose HRQOL remained stable or declined. Also, the inherent weaknesses of a single cohort prospective repeated-measures design need to be mentioned; in particular, other possible confounders that were not measured in our study may have an effect on the associations that were found, such as prior MI, presence or absence of angina post-interventions, and sociodemographic characteristics. With regard to the sample in our study, our results can be generalized only to patients who are referred for CAG and not to other patients with CHD. Definitive conclusions require replication in a larger, similarly diverse, cohort of patients with CHD.

## CONCLUSIONS

The present study showed that psychosocial factors, especially high psychologic well-being and low vital exhaustion, were predictors of a positive change in HRQOL in patients with coronary disease. More focus

on the management of these factors is needed, because improving them may have a significant beneficial effect on patients' quality of life. Nurses are in a unique position to identify patients with problems related to psychologic well-being (eg, depression, anxiety, and exhaustion) and to provide input to the entire multi-disciplinary team to arrange psychologic interventions for those patients who might benefit most. For future research efforts, it would be useful to replicate the present study in a larger, similarly diverse, cohort of patients and focus on the identification of predictors of HRQOL separately among patients with worsened or improved HRQOL, because different predictors may occur as significant in both groups.

## REFERENCES

1. Bobak M, Marmot M. Coronary heart disease in Central and Eastern Europe and former Soviet Union. In: Marmot MG, Elliott P, editors. *Coronary heart disease epidemiology: from aetiology to public health*. Oxford, England: Oxford University Press; 2005. p. 83-110.
2. Beard JR, Earnest A, Morgan G, Chan H, Summerhayes R, Dunn TM, et al. Socioeconomic disadvantage and acute coronary events: a spatiotemporal analysis. *Epidemiology* 2008;19: 485-92.
3. Studencan M. Nová univerzálna definícia infarktu myokardu v klinickej praxi (a new universal definition of myocardial infarction). *Kardiológia pre prax* 2008;6: 51-4.
4. Shephard RJ, Franklin B. Changes in the quality of life: a major goal of cardiac rehabilitation. *J Cardiopulm Rehabil* 2001;21:189-200.
5. Höfer S, Doering S, Rumpold G, Oldridg N, Benzer W. Determinants of health-related quality of life in patients with coronary artery disease. *Eur J Cardiovasc Prev Rehabil* 2006;13:398-406.
6. Spilker B. Introduction to the field of quality of life trials. In: Spilker B, editor. *Quality of life assessments in clinical trials*. New York: Raven Press; 1990. p. 3-10.
7. Ware JE, Kosinski M, Keller SD. SF-36 Physical and mental summary scales: a user's manual. Boston: The Health Institute; 1994.
8. Rumsfeld JS, Magid DJ, O'Brien M, McCarthy M, MaWhinney S, Shroyer AL, et al. Changes in health-related quality of life following coronary artery bypass graft surgery. *Ann Thorac Surg* 2001;72:2026-32.
9. Spertus JA, Jones P, McDonnell M, Fan V, Fihn SD. Health status predicts long-term outcome in outpatients with coronary disease. *Circulation* 2002; 106:43-9.
10. Ho PM, Masoudi FA, Peterson PN, Shroyer AL, McCarthy Jr M, Grover FL, et al. Health-related quality of life predicts mortality in older but not younger patients following cardiac surgery. *Am J Geriatr Cardiol* 2005;14:176-82.
11. Lenzen MJ, Scholte op Reimer WJM, Pedersen SS, Boersma E, Maier W, Widimsky P, et al. The additional value of patient-reported health status in predicting 1-year mortality after invasive coronary procedures:

- a report from the Euro Heart Survey on Coronary Revascularisation. *Heart* 2007;93:339-44.
12. Mejhert M, Kahan T, Persson H, Edner M. Predicting readmissions and cardiovascular events in heart failure patients. *Int J Cardiol* 2006;109:108-13.
  13. Murberg TA, Bru E, Svebak S, Tveteras R, Aarsland T. Depressed mood and subjective health symptoms as predictors of mortality in patients with congestive heart failure: a two-years follow-up study. *Int J Psychiatry Med* 1999;29:311-26.
  14. Hunt JO, Hendrata MV, Myles PS. Quality of life 12 months after coronary artery bypass graft surgery. *Heart Lung* 2000;29:401-11.
  15. Failde II, Soto MM. Changes in health related quality of life 3 months after an acute coronary syndrome. *BMC Public Health* 2006;6:18.
  16. Hawkes AL, Mortensen OS. Up to one third of individual cardiac patients have a decline in quality of life post-intervention. *Scand Cardiovasc J* 2006;40:214-8.
  17. Rumsfeld JS, Ho PM, Magid DJ, McCarthy MJ, Shroyer AL, MaWhinney S, et al. Predictors of health-related quality of life after coronary artery bypass surgery. *Ann Thorac Surg* 2004;77:1508-13.
  18. Bradshaw PJ, Jamrozik KD, Gilfillan IS, Thompson PL. Asymptomatic long-term survivors of coronary artery bypass surgery enjoy a quality of life equal to the general population. *Am Heart J* 2006;151:537-44.
  19. Herlitz J, Wiklund I, Caidahl K, Karlson BW, Sjolund H, Hartford M, et al. Determinants of an impaired quality of life five years after coronary artery bypass surgery. *Heart* 1999;81:342-6.
  20. Saur CD, Granger BB, Muhlbaier LH, Forman LM, McKenzie RJ, Taylor MC, et al. Depressive symptoms and outcome of coronary artery bypass grafting. *Am J Respir Crit Care Med* 2001;10:4-10.
  21. Jarvinen O, Julkunen J, Huhtala H, Tarkka MR, Saarinen T. Changes in health-related quality of life and functional capacity following coronary artery bypass graft surgery. *Eur J Cardiothorac Surg* 2003;24:750-6.
  22. Hata M, Yagi Y, Sezai A, Niino T, Yoda M, Wakui S, et al. Risk analysis for depression and patient prognosis after open heart surgery. *Circ J* 2006;70:389-92.
  23. Brummett BH, Boyle SH, Siegler IC, Williams RB, Mark DB, Barefoot JC. Ratings of positive and depressive emotion as predictors of mortality in coronary patients. *Int J Cardiol* 2005;100:213-6.
  24. Frasura-Smith N, Lesperance F. Reflections on depression as a cardiac risk factor. *Psychosom Med* 2005;67:S19-25.
  25. Kemp DE, Malhotra S, Franco KN, Tesar G, Bronson DL. Heart disease and depression: don't ignore the relationship. *Cleve Clin J Med* 2003;70:745-61.
  26. Pfiffner D, Hoffmann A. Psychosocial predictors of death for low-risk patients after a first myocardial infarction: a 7-year follow-up study. *J Cardiopulm Rehabil* 2004;24:87-93.
  27. Schuitemaker GE, Dinant GJ, Van Der Pol GA, Appels A. Assessment of vital exhaustion and identification of subjects at increased risk of myocardial infarction in general practice. *Psychosomatics* 2004;45:414-8.
  28. Pedersen SS, Theuns DAMJ, Muskens-Heemsker A, Erdman RAM, Jordaens L. Type-D personality but not implantable cardioverter-defibrillator indication is associated with impaired health-related quality of life 3 months post-implantation. *Europace* 2007;9:675-80.
  29. Goldberg DP, Hillier VF. A scaled version of the General Health Questionnaire. *Psychol Med* 1979;9:139-45.
  30. Goldberg DP, Williams P. A user's guide to the general health questionnaire. Windsor: NFER NELSON Publishing Company Ltd; 1988.
  31. Nagyova I, Krol B, Szilasiova A, Stewart R, Dijk van J, Heuvel van den W. General health questionnaire-28: psychometric evaluation of the Slovak version. *Stud Psychol* 2000;42:351-6.
  32. Failde I, Ramos I. Validity and reliability of the SF-36 Health Survey Questionnaire in patients with coronary artery disease. *J Clin Epidemiol* 2000;53:359-65.
  33. Meesters C, Appels A. An interview to measure vital exhaustion I. Development and comparison with the Maastricht questionnaire. *Psychol Health* 1996;11:557-71.
  34. Meesters C, Appels A. An interview to measure vital exhaustion II. Reliability and validity of the interview and correlations of vital exhaustion with personality characteristics. *Psychol Health* 1996;11:557-71.
  35. Denollet J. DS14. Standard assessment of negative affectivity, social inhibition, and type D personality. *Psychosom Med* 2005;67:89-97.
  36. McGowan JH, Cleland JGF. Reliability of reporting left ventricular systolic function by echocardiography: a systematic review of 3 methods. *Am Heart J* 2003;146:388-97.
  37. Wyrwich KW, Wolinsky FD. Identifying meaningful intra-individual change standards in health related quality of life measures. *J Eval Clin Pract* 2000;6:39-49.
  38. Ruo B, Rumsfeld JS, Hlatky MA, Liu H, Browner WS, Whooley MA. Depressive symptoms and health related quality of life. *J Am Med Assoc* 2003;290:215-21.
  39. Prescott E, Holst C, Gronbaek M, Schnohr P, Jensen G, Barefoot J. Vital exhaustion as a risk factor for ischaemic heart disease and all-cause mortality in a community sample: a prospective study of 4084 men and 5479 women in the Copenhagen City Heart Study. *Int J Epidemiol* 2003;32:990-7.
  40. Mendes de Leon CF, Kop WJ, de Swart HV, Bar FW, Appels A. Psychosocial characteristics and recurrent events after percutaneous transluminal coronary angioplasty. *Am J Cardiol* 1996;77:252-5.
  41. Appels A, Kop W, Schouten E. The nature of the depressive symptomatology preceding myocardial infarction. *Behav Med* 2000;26:86-90.
  42. Karlamangla AS, Singer BH, Williams DR, Schwartz JE, Matthews KA, Kiefe CI. Impact of socioeconomic status on longitudinal accumulation of cardiovascular risk in young adults: the CARDIA Study. *Soc Sci Med* 2005;60:999-1015.
  43. Yarnell J, Yu S, McCrum E, et al. Education, socioeconomic and lifestyle factors, and risk of coronary heart disease. *J Epidemiol* 2005;34:268-75.
  44. Everson SA, Siobhan CM, Lynch JW, Kaplan GA. Epidemiologic evidence for the relation between socioeconomic status and depression, obesity, and diabetes. *J Psychosom Res* 2002;53:891-5.