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Determinants of health-related quality of life among outpatients with acute coronary artery disease after percutaneous coronary intervention

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Abstract

Aim: This study aimed to identify health-related quality of life (HRQoL) and its determinants in outpatients with acute coronary syndrome (ACS) after percutaneous coronary intervention.

Methods: A cross-sectional design was used and a total of 124 Korean participants was enrolled. The HRQoL (physical limitations, treatment satisfaction, and disease perception), symptom experience (frequency, severity, and distress), physiological (left ventricular ejection fraction and lipids), psychological (depression and anxiety), and situational (social support) factors were measured, selected on the basis of the theory of unpleasant symptoms. The HRQoL was assessed by using the Seattle Angina Questionnaire-Korean, designed to evaluate disease-specific health outcomes in patients with coronary artery disease. Descriptive statistics and multiple linear regression analyses were conducted.

Results: The mean age of the participants was 61.73 years. The HRQoL was moderate. Among the HRQoL domains, disease perception showed the lowest level. The most intense symptoms that were experienced by the participants were fatigue, shortness of breath, and chest discomfort. More than half of the participants had depression and anxiety. The determinants of worse HRQoL were severe symptom experience, higher depression, higher low-density lipoprotein cholesterol, a lower educational level, and lower social support.

Conclusion: This study proposes a comprehensive approach to health care that incorporates symptom experience, as well as the physiological, psychological, and situational aspects based on the theory of unpleasant symptoms, to improve the HRQoL among outpatients with ACS. Nurses should play a key role to help patients with ACS to deal with the symptoms, low-density lipoprotein cholesterol, and depression and to promote social support, particularly in less-educated patients, in order to improve their HRQoL.

Key words: acute coronary syndrome, health-related quality of life, outpatient, percutaneous coronary intervention.

INTRODUCTION

Cardiovascular disease is the second-leading cause of death in South Korea (Shin *et al.*, 2016) and it has become a major public health problem involving high social costs. Acute coronary syndrome (ACS), including unstable angina, non-ST elevation myocardial infarction (MI), and ST elevation MI, share a widely common pathophysiological substrate that results in myocardial underperfusion (Falk, Nkano, Bentzon, Finn, & Virmani, 2013). Percutaneous coronary intervention (PCI) is the treatment of choice in patients with ACS (Levine *et al.*, 2013; Smith, Negrelli, Manek, Hawes, & Viera, 2015). It establishes consistent and predictable revascularization in multivessel coronary artery disease and reduces recurrent ischemia (Falk et al., 2013; Levine

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et al., 2013). After the acute stage of ACS, the conventional management of patients with ACS who are treated with PCI mainly focuses on extending their life by reducing recurrent ischemic events and improving their health status and functional outcomes (De Smedt *et al.*, 2013).

Health-related quality of life in patients with acute coronary syndrome

Health-related quality of life (HRQoL) is a subjective measure of overall well-being, reflecting how a disease and its symptoms are perceived by patients through an evaluation of their health, treatment, and prospects for the future (De Smedt *et al.*, 2013). A disease-orientated approach to ACS management has led to the neglect of HRQoL as an important outcome measure (Li *et al.*, 2012). The HRQoL has been increasingly relevant in the management of patients with ACS because it is related to the severity of coronary artery disease and predicts the long-term clinical outcomes (Ekici, Ercan, Cehreli, & Töre, 2014; Schweikert *et al.*, 2009). Physical limitations, a domain of HRQoL, has been identified as a significant predictor of 1 year mortality and ACS admission (Spertus, Jones, McDonell, Fan, & Fihn, 2002). Therefore, after the acute stage of ACS, the conventional management of patients with ACS who have been treated with PCI mainly focuses on extending their life by reducing recurrent ischemic events and improving their health status and quality of life (De Smedt *et al.*, 2013; Ekici *et al.*, 2014; Spertus, Salisbury, Jones, Conaway, & Thompson, 2004).

Researches have demonstrated that the levels of HRQOL in patients with ACS are diverse. One study reported that the QoL was moderate in elderly patients with ACS after PCI treatment (Li *et al.*, 2012). Another study showed that the HRQoL was high after primary PCI in patients with ACS (Yeng, Gallagher, & Elliott, 2016). Moreover, it was demonstrated in other study that the HRQoL in patients with ACS was low to high, according to the domains of the HRQoL; the domain at the highest level was treatment satisfaction (de Jong-Watt & Sherifi, 2011). However, most studies have focused on HRQoL in the acute stage of inpatients with ACS (Bucholz *et al.*, 2011; de Jong-Watt & Sherifi, 2011) or outpatients during a short-term follow-up of within 6 months (Kim *et al.*, 2015; Li *et al.*, 2012; Yeng *et al.*, 2016). Little is known about HRQoL during the follow-up treatment of Korean outpatients with ACS who have been treated with PCI.

Factors that influence health-related quality of life in patients with acute coronary syndrome

Patients with ACS experience a variety of symptoms on the onset of the coronary event (Canto, Goldberg, & Sopko, 2012a). Although chest pain or discomfort are the most common symptoms of ACS, patients experience a wide variety of other symptoms, such as fatigue, shortness of breath, nausea, or back pain (DeVon *et al.*, 2017; Wikman *et al.*, 2012) and these symptoms are linked to clinical outcomes, such as the mortality rate or quality of life (El-Menyar *et al.*, 2011; Spertus *et al.*, 2004). Most studies have focused on the symptoms among patients with ACS during acute cardiac events and symptom differences according to age and sex (Canto *et al.*, 2012b; DeVon *et al.*, 2017; Fennessy *et al.*, 2010; Rosenfeld *et al.*, 2015). Hence, it is necessary to identify the symptom experience and its relationship with the HRQoL in outpatients with ACS during follow-up treatment.

Physiological factors, such as left ventricular ejection fraction and lipid levels, affect the occurrence of adverse cardiac events in patients with coronary artery disease. Patients with cardiovascular disease have a low left ventricular ejection fraction (Kundadian, Pugh, Zamna, & Qiu, 2012) and it is an important prognostic marker of mortality in patients with coronary artery disease (De Silva *et al.*, 2012). Dyslipidemia, including an elevated low-density lipoprotein cholesterol level, decreased high-density lipoprotein cholesterol level, elevated triglycerides, and elevated total cholesterol, is considered as a major risk factor for cardiovascular disease (Falk *et al.*, 2013).

Depression and anxiety have been identified in patients with ACS, reaching a prevalence of 25–50% (Dickens, Cherrington, & McGowan, 2012; Kim *et al.*, 2015). Despite the high prevalence, these psychological disorders are often unrecognized and can persist for months to years (Kim *et al.*, 2015). Several studies report that depression and anxiety are associated with increased cardiac mortality and poor HRQoL among patients with ACS (Dickens *et al.*, 2012; Lichtman *et al.*, 2014).

Social support has been shown to be significantly correlated with HRQoL among patients with cardiovascular disease, with those with better social support experiencing greater treatment satisfaction and a higher HRQoL (de Jong-Watt & Sherifi, 2011; Greco *et al.*, 2014).

In addition, age, sex, education, current smoking status, lack of exercise, diagnosis of ACS, and the number

of stents have been shown to be associated with HRQoL in patients with cardiovascular disease (De Smedt *et al.*, 2013; Li *et al.*, 2012; Schweikert *et al.*, 2009; Yeng *et al.*, 2016). However, there is a lack of consistency in the level of HRQoL and its relationship with sociodemographic and clinical characteristics in patients with ACS.

Theoretical framework

The theory of unpleasant symptoms (TOUS) is composed of three major components and there are correlations among them: (i) symptoms; (ii) physiological (i.e. pathologic problems), psychological (i.e. mood status), and situational factors (i.e. social and physical environment) influencing the symptoms; and (iii) the consequences of the symptoms (i.e. quality of life) (Lenz, Pugh, Milligan, Gift, & Suppe, 1997). According to TOUS, these components interact and influence one another. Little is known about the impact of symptoms, decreased left ventricular ejection fraction and dyslipidemia, mood status, and social support on the HRQoL of patients with ACS. There is a lack of evidence on the application of the key concepts of TOUS to explore the HRQoL among patients with ACS during follow-up treatment. Therefore, the identification of the determinants of HRQoL is necessary in order to establish a comprehensive nursing care model to improve the HRQoL in patients with ACS.

METHODS

Purpose

In the current study, it was assumed that HRQoL was influenced by the symptom experience (frequency, severity, and distress) and physiological (left ventricular ejection fraction and lipid levels), psychological (depression and anxiety), and situational factors (social support), selected based on the TOUS, and by the sociodemographic and clinical characteristics of the patients (Fig. 1). Therefore, the purpose of this study was to identify the determinants of HRQoL in outpatients with ACS after a PCI.

Study design, participants, and setting

This study used a descriptive, cross-sectional design. The participants were recruited from a cardiology outpatient clinic at a national university hospital in South Korea. The inclusion criteria were: (i) age ≥ 18 years; (ii) outpatients diagnosed with unstable angina or acute

MI; (iii) at least 1 month after being treated with a PCI; (iv) receiving medication treatment (i.e. antiplatelet agents, anticoagulants) for reducing recurrent ischemic events; and (v) no history of psychiatric or cognitive disorders. Patients with other cardiovascular or pulmonary disease (i.e. atrial fibrillation, congestive heart failure, or chronic obstructive pulmonary disease) were excluded because these diseases might influence the ACS symptom experience. Thus, 135 participants' questionnaires were collected and nine were excluded because of incomplete data. In total, 124 participants ultimately were included for analyzing the data.

Ethical considerations

This study was conducted after obtaining approval from the Chonbuk National University Hospital Institutional Review Board (CUH 2014-11-024). The participants were provided with a written consent form. It was emphasized that participation was voluntary and confidential and that the participants could withdraw at any time.

Data collection

The data were collected at the cardiology outpatient clinic of C national university hospital, which is a 1102 bed teaching hospital that provides acute and tertiary care, with a comprehensive range of medical and surgical specialties in J city in South Korea. After cardiologists and nurses identified the patients who met the inclusion criteria, the researchers informed the eligible participants of the purpose and procedures of the study before or after their outpatient appointment. When informed consent had been obtained from the participants, the data were collected. The average time for administering the structured questionnaire was 20–30 min. The medical data were obtained from the participants' medical records. The period of the survey was conducted from September, 2015 to February, 2016.

Instruments

The HRQoL was assessed with the Seattle Angina Questionnaire-Korean version. The Seattle Angina Questionnaire, a disease-specific health status instrument, can detect small changes in the HRQoL that often are missed by general instruments and its validity and reliability are well established for patients with coronary artery disease after PCI treatment (de Jong-Watt & Sherifi, 2011; Longmore *et al.*, 2011; Spertus *et al.*, 1995, 2004; Yeng *et al.*, 2016). This tool is a 19 item scale with five dimensions and each scale monitors a
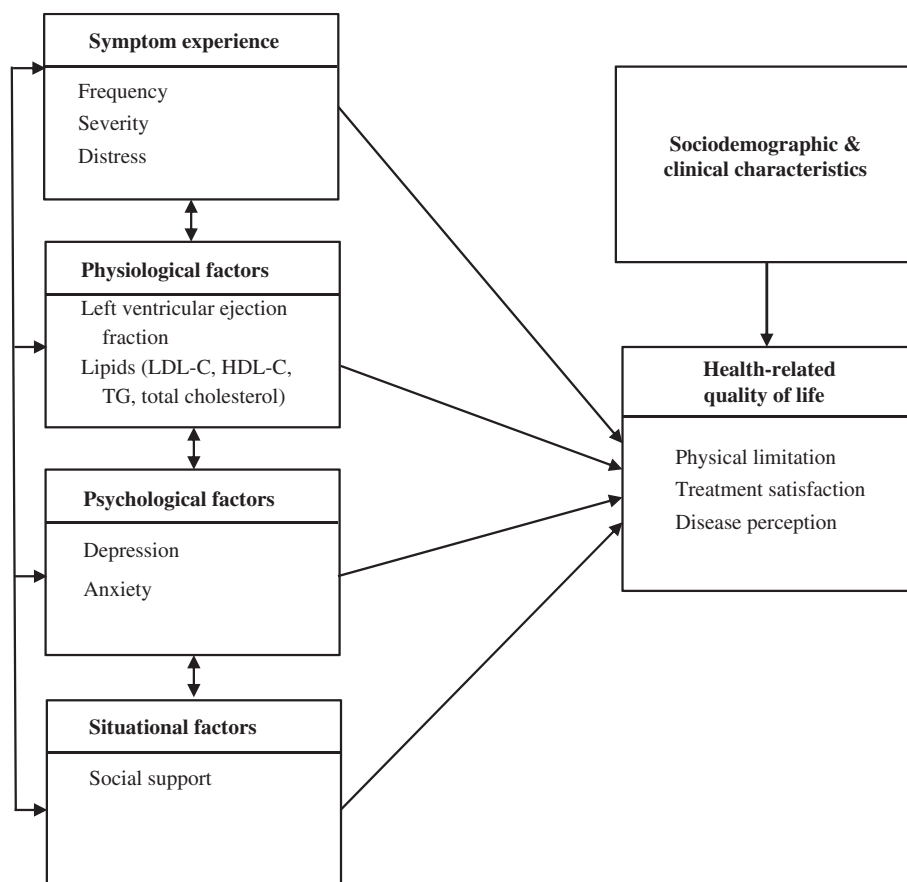
Figure 1 Conceptual framework of the study. HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; TG, triglycerides.

unique dimension of coronary artery disease (Spertus *et al.*, 1995). This study included three domains of the HRQoL: the physical limitations caused by the disease (nine items), treatment satisfaction (four items), and the degree to which the patients perceived their disease to affect their quality of life (three items) (Spertus *et al.*, 1995). The other two domains of HRQoL were angina stability (one item) and angina frequency (two items), which were excluded because these domains contained items that were similar to the symptom experience checklist that was used in this study. It is rated on a five- or six-point Likert scale and the scores on each domain are transformed into a range from 0 to 100. Higher scores indicate better function (i.e. less physical limitations, higher treatment satisfaction, and better disease perception). In this study, the Cronbach's α for the physical limitations, treatment satisfaction, and disease perception domains was 0.88, 0.71, and 0.68, respectively.

The experience of symptoms was measured by using the ACS symptom checklist that was developed by the researchers, based on an extensive review of the literature (Alsén, Brink, Persson, Brändström, & Karlson, 2010; Canto *et al.*, 2012a; DeVon, Rosenfeld, Steffen, & Daya, 2014; Wikman *et al.*, 2012). This tool has 14 items reflecting common symptoms of ACS and includes three dimensions: frequency, severity, and distress within the past month. Each item is rated on a four-point Likert scale and the total score ranges from 0 to 42. Higher scores indicate higher symptom experience. To evaluate the construct validity of the ACS symptom checklist, a principal component analysis was conducted and four factors with Eigenvalues >1 were extracted. The sums of squared loadings from the four components had a cumulative value of 60.09% in explaining the total variance in the data. The Cronbach's α of each factor ranged from 0.60 to 0.76. Both the Kaiser–Meyer–Olkin test (0.76) and Bartlett's test of sphericity ($P < 0.001$) were used to evaluate the appropriateness of the factor analysis and indicated significance. The content validity of the scale was tested among two cardiologists, three cardiology nurses, and two nursing professors. The content validity index of the scale was 0.84. In this study, the

Cronbach's α was 0.81 for the symptom experience scale and 0.80, 0.76, and 0.81 for the symptom frequency, severity, and distress subscales, respectively.

Depression and anxiety were measured by using the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983), consisting of seven items to measure anxiety and seven to measure depression. Each item is rated on a four-point scale, with total scores ranging from 0 to 21 on each domain. Higher scores indicate higher depression or anxiety and scores ≥11 indicate a probable mood disorder. The Cronbach's α for the scale was 0.84 for depression and 0.88 for anxiety in this study.

Social support from family members, friends, and significant others was assessed by using the Multidimensional Scale of Perceived Social Support Survey (Zimet, Powell, Farley, Werkman, & Berkoff, 1990). The scale consists of 12 items that are rated on a seven-point Likert scale. In this study, it was modified to a five-point Likert scale, with total scores ranging from 12 to 60, in order to further help the participants to understand the responses. Higher scores indicate higher social support. The Cronbach's α was 0.98 in this study. To analyze the physiological factors, such as left ventricular ejection fraction and the lipid profile, the researchers reviewed the participants' medical records at the time of the survey.

Data analysis

The data were analyzed by using IBM SPSS (v. 21.0; IBM Corporation, Armonk, NY, USA). Descriptive statistics were used to analyze the sociodemographic and clinical characteristics, HRQoL, and its associated variables. To identify the determinants of the HRQoL, stepwise multiple linear regression analyses were conducted. The selected independent variables, which had statistical significance at the univariate level, were entered into the multiple regression model. Multicollinearity issues were considered by using the variance inflation factor (VIF) and condition index (CI). The unique contribution of each independent variable was defined as the change in the R^2-value in the regression equation. The level of statistical significance was set at $P < 0.05$.

RESULTS

Sociodemographic and clinical characteristics of the participants

The sociodemographic and clinical characteristics of the participants are presented in Table 1. The mean age

Table 1 Sociodemographic and clinical characteristics of the participants ($n = 124$)

Variable	N (%)	Mean (SD)
Sociodemographic characteristics		
Age (33–88 years)		61.73 (10.88)
<65	77 (62.1)	
≥65	47 (37.9)	
Sex		
Male	98 (79.0)	
Female	26 (21.0)	
Living status		
Alone	19 (15.3)	
With family	105 (84.7)	
Education		
<High school	57 (45.8)	
≥High school	67 (54.2)	
Economic status		
Low	48 (38.7)	
Middle	39 (31.5)	
High	37 (29.8)	
Smoking		
Never smoked	34 (27.4)	
Past smoking	63 (50.8)	
Current smoking	27 (21.8)	
Exercise (for >30 min 1–2 times/week)		
Yes	72 (58.1)	
No	52 (41.9)	
Clinical characteristics		
Disease type		
Unstable angina	57 (41.9)	
Non-ST elevation MI	24 (19.4)	
ST-elevation MI	43 (34.7)	
Frequency of PCI		
1	99 (79.8)	
2–3	25 (20.2)	
Number of obstructive vessels		
1	60 (48.4)	
2–3	64 (51.6)	
Hypertension		
Yes	58 (46.8)	
No	66 (53.2)	
Diabetes mellitus		
Yes	44 (35.5)	
No	80 (64.5)	

MI, myocardial infarction; PCI, percutaneous coronary intervention; SD, standard deviation.

was 61.73 ± 10.88 years. A total of 79% of the participants was male, 84.7% lived with their family, 54.2% had completed at least high school education, and 70.2% had a low or middle economic status. The most

Table 2 Descriptive statistics of the study's variables (*n* = 124)

Variable	N (%)	Mean (SD)
Health-related quality of life		
Total	–	67.85 (16.05)
Physical limitations (range: 0–100)	–	84.21 (18.77)
Treatment satisfaction (range: 0–100)	–	77.27 (19.83)
Disease perception (range: 0–100)	–	42.07 (22.34)
Symptom experience		
Total	–	7.60 (6.70)
Frequency (range: 0–42)	–	8.12 (7.17)
Severity (range: 0–42)	–	7.35 (6.40)
Distress (range: 0–42)	–	7.33 (6.93)
Symptom experience (items)		
Fatigue (range: 0–9)	–	3.19 (3.32)
Shortness of breath (range: 0–9)	–	2.82 (3.18)
Chest discomfort (range: 0–9)	–	2.09 (2.94)
Chest pain (range: 0–9)	–	2.04 (2.77)
Dizziness (range: 0–9)	–	1.83 (2.68)
Arm and shoulder pain (range: 0–9)	–	1.70 (2.73)
Sleep disturbance (range: 0–9)	–	1.56 (2.91)
Sweating (range: 0–9)	–	1.34 (2.65)
Palpitations (range: 0–9)	–	1.33 (2.57)
Loss of appetite (range: 0–9)	–	1.30 (2.56)
Indigestion (range: 0–9)	–	1.15 (2.33)
Back pain (range: 0–9)	–	1.10 (2.30)
Neck pain (range 0–9)	–	0.88 (2.14)
Nausea or vomiting (range: 0–9)	–	0.48 (1.46)
Physiological factors		
LVEF (%) (range: 15.9–70.0)	–	54.92 (8.17)
≥60 (normal)	33 (26.6)	
<60 (abnormal)	91 (73.4)	
LDL-C (mg/dL) (range: 29–222)	–	85.23 (35.19)
<130 (normal)	98 (79.0)	
≥130 (abnormal)	26 (21.0)	
HDL-C (mg/dL) (range: 25–97)	–	40.69 (10.18)
≥40 (normal)	66 (53.2)	
<40 (abnormal)	58 (46.8)	
TG (mg/dL) (range: 35–564)	–	142.30 (89.18)
<150 (normal)	85 (68.5)	
≥150 (abnormal)	39 (31.5)	
Total cholesterol (mg/dL) (range 72–268)	–	144.61 (35.90)
<201 (normal)	110 (88.7)	
≥201 (abnormal)	14 (11.3)	

Table 2 Continued

Variable	N (%)	Mean (SD)
Psychological factors		
Depression (range: 0–21)	–	13.90 (4.43)
0–10 (normal – borderline)	33 (26.6)	8.85 (0.94)
≥11 (mood disorder)	91 (73.4)	15.73 (3.72)
Anxiety (range: 0–21)	–	13.10 (5.03)
0–10 (normal – borderline)	47 (37.9)	8.17 (1.27)
≥11 (mood disorder)	77 (62.1)	16.10 (3.98)
Situational factor		
Social support (range: 0–5)	–	3.44 (0.95)

HDL-C, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol; LVEF, left ventricular ejection fraction; TG, triglycerides.

prevalent type of disease was unstable angina (41.9%), followed by ST elevation MI (34.7%) and non-ST elevation MI (19.4%). A total of 79.8% of the patients had undergone a PCI once and 51.6% had two- or three-obstructive vessel disease.

Health-related quality of life and its associated factors

The mean score of the overall HRQoL was 67.85 ± 16.05, indicating a moderate level. The mean scores of the HRQoL for the three domains were as follows: 84.21 ± 18.77 for physical limitations; 77.27 ± 19.83 for treatment satisfaction; and 42.07 ± 22.34 for disease perception. The mean score for the overall symptom experience was 7.60 ± 6.70, indicating a mild level. The mean scores for each domain were 8.12 ± 7.17 for symptom frequency, 7.35 ± 6.40 for symptom severity, and 7.33 ± 6.93 for symptom distress. The most intense symptom that was experienced by the participants was fatigue (3.19 ± 3.32), followed by shortness of breath (2.82 ± 3.18) and chest discomfort (2.09 ± 2.94). The mean left ventricular ejection fraction was 54.92 ± 8.17 and 73.4% of the participants had a reduced left ventricular ejection fraction. The descriptive analysis indicated that 21% of the participants showed an abnormal low-density lipoprotein cholesterol level (≥130 mg/dL) and 46.8% presented with an abnormal high-density lipoprotein cholesterol level (<40 mg/dL). About 32% of the participants had abnormal triglyceride levels (≥150 mg/dL) and 11.3% had abnormal total cholesterol levels (≥201 mg/dL).

Table 3 Sociodemographic and clinical characteristics that were associated with the health-related quality of life

Variable	Mean (SD)	Health-related quality of life	
		t/*F*	*P*-value (Scheffé)
Sociodemographic characteristics			
Sex		0.599	0.550
Male	68.29 (16.55)		
Female	66.17 (14.14)		
Age (years)		0.743	0.459
<65	68.69 (15.20)		
≥65	66.47 (17.42)		
Living status		−2.021	0.045*
Alone	61.09 (17.35)		
With family	69.07 (15.95)		
Education		−4.048	<0.001**
<High school	61.89 (15.95)		
≥High school	72.92 (14.40)		
Economic status		3.716	0.027*
Low[a]	63.74 (17.16)		
Moderate[b]	67.92 (14.16)		(a < c)
High[c]	73.10 (15.25)		
Smoking		0.010	0.990
Non-smoker	68.09 (14.65)		
Ex-smoker	67.64 (17.04)		
Current smoker	68.02 (15.92)		
Exercise (for >30 min (1–2 times/week)		−0.540	0.590
Yes	68.81 (15.03)		
No	66.93 (17.47)		
Clinical characteristics			
Disease type		0.268	0.765
Unstable angina	68.98 (17.70)		
Non-ST elevation MI	66.51 (15.93)		
ST-elevation MI	67.10 (13.93)		
Frequency of PCIs		0.259	0.796
1	68.04 (16.48)		
2–3	67.10 (14.50)		
Number of obstructive vessels		0.144	0.886
1	68.06 (16.55)		
2–3	67.65 (15.69)		
Hypertension		0.528	0.598
Yes	67.03 (16.49)		
No	68.56 (15.73)		
Diabetes mellitus		0.018	0.986
Yes	67.81 (14.96)		
No	67.87 (16.70)		

*$P < 0.05$ and **$P < 0.01$. MI, myocardial infarction; PCI, percutaneous coronary intervention.

The mean score for depression was 13.90 ± 4.43, indicating a moderate level of depression. Approximately 74% of the participants were categorized as having a depressive disorder (≥11 score). The mean score of anxiety was 13.10 ± 5.03, indicating a moderate level of anxiety. A total of 62.1% of the participants was categorized as having an anxiety disorder (≥11 score). The mean score of social support was 3.44 ± 0.95, indicating a moderate level of social support (Table 2).

Table 4 Relationship among the physiological, psychological, and situational factors and the health-related quality of life

Variable	Health-related quality of life r (P)	Symptom experience r (P)	LVEF r (P)	LDL-C r (P)	HDL-C r (P)	TG r (P)	Total cholesterol r (P)	Depression r (P)	Anxiety r (P)
Symptom experience	-0.696 (<0.001)**	1.000							
LVEF	-0.065 (0.473)	0.017 (0.853)	1.000						
LDL-C	-0.179 (0.046)*	0.048 (0.594)	0.178 (0.048)*	1.000					
HDL-C	0.009 (0.920)	-0.046 (0.612)	0.141 (0.119)	0.106 (0.239)	1.000				
TG	-0.044 (0.626)	0.040 (0.663)	-0.030 (0.741)	-0.069 (0.447)	-0.186 (0.039)*	1.000			
Total cholesterol	-0.168 (0.062)	0.043 (0.632)	0.082 (0.363)	0.776 (<0.001)**	0.270 (0.002)**	0.217 (0.016)*	1.000		
Depression	-0.592 (<0.001)**	0.621 (<0.001)**	-0.014 (0.876)	-0.065 (0.474)	0.066 (0.463)	0.042 (0.643)	0.048 (0.594)	1.000	
Anxiety	-0.586 (<0.001)**	0.691 (<0.001)**	-0.059 (0.512)	0.073 (0.421)	0.056 (0.535)	0.032 (0.721)	0.138 (0.127)	0.765 (<0.001)**	1
Social support	0.297 (0.001)**	-0.185 (0.045)*	-0.061 (0.502)	-0.008 (0.925)	-0.012 (0.895)	-0.012 (0.895)	0.024 (0.788)	-0.227 (0.011)*	-0.260 (0.003)**

*$P < 0.05$ and **$P < 0.01$. HDL, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol; LVEF, left ventricular ejection fraction; TG, triglycerides.

Sociodemographic and clinical factors that were associated with health-related quality of life

Living alone ($t = -2.021$, $P = 0.045$), a lower educational level ($t = -4.048$, $P < 0.001$), and lower economic status ($F = 3.716$, $P = 0.027$) were significantly associated with a worse HRQoL (Table 3).

Relationships among health-related quality of life and its associated factors

Pearson's correlation testing showed that the HRQoL was negatively correlated with the symptom experience ($r = -0.696$, $P < 0.001$), low-density lipoprotein cholesterol ($r = -0.179$, $P = 0.046$), depression ($r = -0.592$, $P < 0.001$), and anxiety ($r = -0.586$, $P < 0.001$). Also, the HRQoL was positively correlated with social support ($r = 0.297$, $P = 0.001$) (Table 4). Specifically, the symptom experience and mood status (depression and anxiety) were negatively correlated with all three HRQoL domains (physical limitations, treatment satisfaction, and disease perception) (all $P < 0.001$) and the low-density lipoprotein cholesterol was negatively correlated with treatment satisfaction ($r = -0.190$, $P = 0.034$) and disease perception ($r = -0.272$, $P = 0.002$). Social support was positively correlated with all three HRQoL domains (all $P < 0.05$).

Determinants of health-related quality of life

In order to identify the determinants of HRQoL, the sociodemographic and clinical factors that were found to be statistically significant in the univariate analysis (living status, education, and economic status) and the physiological, psychological, and situational factors, based on the conceptual framework (i.e. symptom experience, lipids, depression, anxiety, and social support) were included as covariates in a multivariate regression analysis. Additionally, the VIF ranged from 1.018 to 1.735 and the CI ranged from 2.886 to 16.990, indicating no multicollinearity. In the regression model, the statistical significance was found to be $P < 0.001$ for the overall HRQoL.

Five variables, including symptom experience, depression, low-density lipoprotein cholesterol, education, and social support, accounted for 58.3% of the variance in the overall HRQoL. Severe symptom experience (B = -1.093, $P < 0.001$), higher depression (B = -0.942, $P = 0.001$), higher low-density lipoprotein cholesterol (B = -0.078, $P = 0.004$), lower school education (B = 5.220, $P = 0.008$), and lower social support (B = 2.372, $P = 0.021$) determined a worse level of HRQoL (Table 5).

DISCUSSION

A decreased level of HRQoL might increase the recurrence of ACS and decrease the survival rate (De Smedt *et al.*, 2013; Schweikert *et al.*, 2009). For these reasons, accurate identification and improvement of the HRQoL in outpatients with ACS with follow-up treatment are important. But, there is little relevant research in exploring the determinants of HRQoL in Korean outpatients with ACS who are undergoing PCI, based on the TOUS. This study identified HRQoL levels and their determinants in outpatients with ACS who were treated with a PCI and found that the determinants of a worse level of HRQoL were severe symptom experience, higher depression, higher low-density lipoprotein cholesterol, lower social support, and a lower educational level.

In the current study, the overall HRQoL (physical limitations, treatment satisfaction, and disease perception), as measured by the Seattle Angina Questionnaire-Korean version, was moderate and it was similar to a previous study in a large, consecutive cohort of patients

Table 5 Determinants of health-related quality of life

Variable	B	SE	β	t	P	R	Adjusted R^2	VIF	CI
Health-related quality of life									
(Constants)	84.939	5.980	–	14.203	<0.001**	–	–	–	–
Symptom experience	−1.093	0.184	−0.456	−5.947	<0.001**	0.696	0.480	1.735	2.886
Depression	−0.942	0.274	−0.260	−3.436	0.001**	0.725	0.518	1.692	4.397
LDL-C	−0.078	0.027	−0.172	−2.922	0.004**	0.745	0.544	1.018	6.424
Education (ref: <high school)	5.220	1.942	0.163	2.687	0.008**	0.762	0.567	1.082	8.820
Social support	2.372	1.013	0.140	2.342	0.021*	0.775	0.583	1.059	16.990

*$P < 0.05$ and **$P < 0.01$.. Adjusted $R^2 = 0.583$, $F = 35.381$, and $P < 0.001$. Adjusted R^2, adjusted R^2-value or adjusted coefficient of determination; β, standardized coefficient; B, non-standardized coefficient; CI, condition index; LDL-C, low density lipoprotein cholesterol; SE, standard error; VIF, variance inflation factor.

with cardiovascular disease with a PCI (Spertus *et al.*, 2004). Thus, nurses try to improve the level of HRQoL and to identify if there is a change in the HRQoL during follow-up treatment in patients with ACS who have had a PCI. Meanwhile, this result was higher than for those of inpatients with ACS for acute treatment (de Jong-Watt & Sherifi, 2011; Li *et al.*, 2012). Compared to previously reported results, the better HRQoL scores could be explained by the fact that this study's participants were outpatients with ACS in the postacute phase who were undergoing follow-up treatment, such as drug therapy.

The participants of this study showed the lowest scores on disease perception in the HRQoL domain, with a 42.07 out of 100 score, which measured one's restriction in the enjoyment of life due to illness, satisfaction with the current health state, and the degree of fear or worry in relation to the recurrence of disease (Spertus *et al.*, 1995). The level of disease perception of the participants in this study was similar to, or lower than that of, hospitalized patients with ACS (Bucholz *et al.*, 2011; de Jong-Watt & Sherifi, 2011) and even lower than that of Australian outpatients with ACS at 6 months after a PCI (Yeng *et al.*, 2016). This result showed that Korean outpatients with ACS during follow-up had a negative disease perception and they had fear or worry about a recurrence of ACS and that their life was influenced by their disease state. An insufficient supportive care system in outpatient clinics might be a reason for the negative disease perception. According to prior studies, disease perception improves the health outcomes of patients with ACS with regard to the treatment effect and angina control significantly (Bucholz *et al.*, 2011; Longmore *et al.*, 2011; Spertus *et al.*, 2004). Thus, nurses need to provide sufficient and individual information about ACS, treatment effects, and the current status of patients not to be a reason to reduce possible activities due to worry about recurrence and uncertainty about the disease or treatment. In addition, the negative disease perception in this study might be attributed to the fact that more than half of the participants had a depressive and anxious mood. Therefore, it is required to investigate the negative feelings of patients with ACS about their disease and their level of fear and worry regarding a heart attack or sudden death by using in-depth interviews and to support and educate patients so that they can have a more positive disease perception.

Meanwhile, the HRQoL domain with the highest level was physical limitations and it meant that the participants in this study did not feel very constrained by

activities in their daily life and had a good physical function. These results are assumed to be related to the fact that over sixty percent of the participants were those aged <65 years old and outpatients with follow-up treatment. In a study by Spertus *et al.* (2004) who analyzed the quality of life 1 year after a PCI, the physical function improvements in the patients who complained of chest pain or chest discomfort after the PCI was found to be the most closely associated with QoL improvements 1 year after the PCI, which supports that nurses can indirectly identify the HRQoL in outpatients with ACS after the acute phase of treatment by checking physical limitations in the outpatients after a PCI. Therefore, in order to determine the long-term HRQoL in patients with ACS with follow-up treatment after a PCI, it is judged to be important to identify their physical limitations and related changing patterns.

The findings of this study illustrated that symptom experience was the most important determinant for the overall HRQoL. The patients with ACS who experienced the more severe symptoms had a worse HRQoL level. This result was similar to a systematic review report, which found that the HRQoL improved following a PCI, with relief of angina symptoms in older persons with coronary artery disease (Soo Hoo, Gallagher, & Elliott, 2014). Thus, this study highlights the need to target symptom management, considering the frequency, distress, and severity of symptoms in order to improve the HRQoL of outpatients with ACS with a PCI.

Fatigue was shown as the most severe symptom in this study, followed by shortness of breath and chest discomfort. According to previous studies, chest pain, chest discomfort, and shortness of breath were the main symptoms in hospitalized patients with ACS (DeVon *et al.*, 2014; El-Menyar *et al.*, 2011). Fatigued patients after cardiovascular disease tend to perceive their disease progression as more serious and have more negative emotional beliefs, resulting in a lower HRQoL (Alsén *et al.*, 2010). Fennessy *et al.* (2010) showed that patients with ACS reported moderate or high levels of fatigue after discharge. Accordingly, assessing the fatigue level after discharge and properly reducing it might contribute to enhancing the HRQOL of outpatients with ACS. In addition, because the patients were found to continuously complain of symptoms, such as shortness of breath and chest discomfort, during the acute treatment period or even after PCI treatment, it is required to continuously check the presence or absence and the severity of these symptoms and appropriate

management be instigated to control the symptoms, such as medication and also patient education, including the recommended route, timing, or side-effects (i.e. sublingual glycerine trinitrate), or lifestyle interventions for cardiovascular risk reduction as nursing interventions for outpatients with ACS. Meanwhile, in view of the fact that this study's participants were outpatients with ACS who were undergoing drug therapy, it is speculated that they reported symptom experiences that were not severe. Therefore, further studies are judged as necessary to analyze the changes in symptoms that patients with ACS experience over time after discharge.

Higher low-density lipoprotein cholesterol as a physiological factor was identified as the determinant of a worse HRQoL in this study. In particular, low-density lipoprotein cholesterol was associated with treatment satisfaction and disease perception. According to a previous study (Cho *et al.*, 2007), the QoL in a group that received lipid-lowering drugs was significantly higher, compared to a group receiving no lipid-lowering drugs. This result suggests that outpatients with ACS might have higher treatment satisfaction and more positive disease perception when they consider that they are adequately treated as a result of their normal low-density lipoprotein cholesterol level. Thus, the regular assessment and proper management of the low-density lipoprotein cholesterol level, such as patient education for medicine, exercise, or diet therapy, might contribute to enhancing the HRQoL of outpatients with ACS.

Depression as a psychological factor was identified as the determinant of a worse HRQoL in the current study. This is consistent with the finding that depression is a predictor of QoL and depression treatment is associated with QoL improvement (Kim *et al.*, 2015). In addition, depressed patients have a worse HRQoL, compared to undepressed patients (Mols, Martens, & Denollet, 2010). Depression after the onset of ACS has been reported as a risk factor for mortality (Lichtman *et al.*, 2014). Based on this finding, depression should be monitored as time passes after the acute onset of ACS. It is considered necessary to carry out depression screening for outpatients with ACS and to provide nursing intervention programs to reduce a depressive mood, such as cognitive behavior therapy or exercise, as measures to enhance patients' HRQoL.

In contrast, a systematic literature review that analyzed the association between depression and QoL in patients with coronary artery disease found that depression was predictive of the physical HRQoL that was directly related to physical health status (Dickens *et al.*, 2012). In the present study, depression was associated with physical limitations among the three domains of HRQoL. In addition, this study found that a high level of depression was associated with severe symptom experience and low perceived social support, but it was not associated with the left ventricular ejection fraction, which was similar to previous research that found that depression and anxiety were not significant determinants of the left ventricular ejection fraction (Chiavarino *et al.*, 2012). However, a systematic review reported that psychological distress, in the forms of depression, anxiety, stress, or hostility impacted unfavorably on recurrent cardiac events in patients with coronary artery disease (Khayyam-Nekouei, Neshatdoost, Yousefy, Sadeghi, & Manshaee, 2013). In view of the fact that previous studies that have analyzed the relationship between depression and physiological factors, such as the lipoprotein level, left ventricular ejection fraction, or inflammation indicators in patients with ACS after a PCI are scarce, further studies are considered to be necessary in the future.

Social support as a situational factor was a determinant of the overall HRQoL in the outpatients with ACS who were treated with a PCI in this study. This suggests that the participants reported a better HRQoL in their everyday life when they perceived higher levels of support from their family, friends, and/or meaningful persons (including healthcare professionals). This is similar to the finding that patients with ACS who perceive higher social support have a better QoL (Bucholz *et al.*, 2011; Cassar & Baldacchino, 2012) and higher treatment satisfaction (de Jong-Watt & Sherifi, 2011). Thus, interventions to establish patient-centered social support networks need to be designed as part of HRQoL enhancement. Social support can be provided in a variety of tangible ways: through counseling, patient and family teaching, moderating peer support groups, and public advocacy of ACS disease awareness. In the current study, social support was found to be negatively correlated with depression and anxiety, which can be assumed to mean that social support might affect the QoL by having a dampening effect on emotional factors (Greco *et al.* 2014). In addition, in a previous study that analyzed sex differences in the QoL of patients with ACS, social support for female patients with ACS was found to be correlated with physical limitations and was found to be an important variable for HRQoL in coronary artery disease patients (Leung Yinko *et al.*, 2014; Staniute, Brozaitiene, & Bunevicius, 2013). This seems to be because young women with less social support bear more roles in the workplace and at home, thus reporting more physical limitations than men. Therefore, further studies are considered as important

to determine the association between perceived social support by sex and HRQoL.

Education was identified as a determinant of HRQoL among the sociodemographic characteristics of the participants. This finding is similar to that of a previous study that indicated that patients with coronary artery disease with a lower education have a worse HRQoL (De Smedt *et al.*, 2013). There might be an association between higher education and proactive attempts to obtain information on how to manage the condition (Cassar & Baldacchino, 2012). Healthcare professionals need to pay more attention to lowly educated patients in relation to improving their HRQoL. Especially, misapprehensions about the effect of the PCI on health outcomes after the acute stage need to be identified and addressed, as patients might believe that the PCI has cured, rather than just treated, their cardiovascular problems (Cassar & Baldacchino, 2012). Healthcare providers need to educate patients who have been treated with a PCI on the follow-up treatment for managing their cardiovascular disease status and assess their cardiac risk factors and compliance with treatment.

A few aspects might limit the generalizability of the findings of this study. First, the participants were recruited by using convenience sampling from a university hospital in South Korea. Second, this study used a cross-sectional design and therefore future studies using a longitudinal design to explore the changes in HRQoL over the course of the disease are needed.

CONCLUSION

This study proposes a comprehensive approach to health care by incorporating symptom experience and the physiological, psychological, and situational aspects based on TOUS, in order to improve the HRQoL among outpatients with ACS who have been treated with a PCI. Therefore, this study provides a framework for developing an effective nursing care model to enhance the HRQoL of outpatients with ACS. Nurses should play a key role to help outpatients with ACS with a PCI to deal with the symptoms, low-density lipoprotein cholesterol, and depression and to promote social support, particularly in less-educated patients, in order to improve the HRQoL. Based on the results of this study, the overall HRQoL was at a moderate level and it should be regularly monitored and properly managed in outpatients with ACS. Disease perception is an integral domain of the HRQoL and it should be considered in supporting the needs of the patient, particularly

individual tailored health education about the disease status, treatment effect, or self-management during follow-up care. The symptoms should be adequately assessed and managed to improve the HRQoL, with a particular focus on fatigue, shortness of breath, and chest discomfort by using a symptom checklist in thte outpatients clinic. Managing low-density lipoprotein cholesterol levels (i.e. patient teaching for medication and diet control), decreasing depression (i.e. cognitive behavior therapy, exercise), and improving social support (i.e. counseling for patients and the family) might contribute to enhancing the HRQoL of patients with ACS who are undergoing follow-up care after a PCI. Also, interventions to improve the HRQoL need to focus particularly on less-educated patients in South Korea.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

AUTHOR CONTRIBUTIONS

H. S. K. and H. K. K. designed the study, analyzed the data, and drafted the manuscript; K. O. K. conducted the data collection and drafted the manuscript; Y. S. K. conducted the study and data collection. All the authors read and approved the final manuscript.

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