Research Article

Relationships of Factors Affecting Self-care Compliance in Acute Coronary Syndrome Patients Following Percutaneous Coronary Intervention

Eun Suk Shin, RN, PhD,1 Seon Young Hwang, RN, PhD,2,* Myung Ho Jeong, MD, PhD,3 Eun Sook Lee, RN, PhD4

1 Department of Infection Control, Chonnam National University Hospital, Gwangju, South Korea
2 Department of Nursing, Hanyang University, Seoul, South Korea
3 Heart Research Center, Chonnam National University Hospital, Gwangju, South Korea
4 College of Nursing, Chonnam National University, Gwangju, South Korea

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Purpose: This study was conducted to identify direct and indirect factors influencing self-care compliance in patients with first acute coronary syndrome through examining the relationship among multidimensional factors.

Methods: Outpatients who made hospital visits to receive a follow-up care at more than 6 months after percutaneous coronary intervention were recruited at a national university hospital in Korea. Data of 430 participants were collected through self-administered questionnaires and analyzed using AMOS version 7.0. The fitness of the hypothetical model and the degree of significance of direct and indirect paths were analyzed.

Results: Three paths were found to have a significant effect on self-care compliance in the modified model. Social support indirectly influenced self-care compliance through enhancing self-efficacy, reducing anxiety and increasing perceived benefit. In addition, social support and body function indirectly influenced self-care compliance through reducing depression which affected self-efficacy. Self-efficacy was the most influential factor and played an important role as a mediating variable.

Conclusion: Results of this study suggest that nurses’ counselling and education as a form of social support should be encouraged to enhance self-efficacy and self-care compliance among outpatients during follow-up care after percutaneous coronary intervention.

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Introduction

The prevalence of acute coronary syndrome (ACS) in Korea has increased by more than 5-fold in the last 10 years, while the overall death rate from heart disease has increased by more than 3-fold, from 13.0 per 100,000 people in 1996 to 43.4 per 100,000 people in 2009 (Korea Center for Disease Control and Prevention, 2010). According to the Korean Acute Myocardial Infarction (AMI) Registry, 21% of 8,425 AMI patients who had percutaneous coronary intervention (PCI) suffered a major adverse cardiac event such as cardiac or noncardiac death, restenosis, or recurrence of AMI within 1 year (Sim, Kim, & Jeong, 2009). Furthermore, readmission and treatment owing to recurrence caused by PCI failure in patients with coronary artery disease can lead to higher medical costs, leading to heavy financial burdens and lower quality of life.

Although the PCI shows very high success rate in ACS patients, the patients need to comply with self-care regimens for life such as smoking cessation, regular hospital visits, regular medication, dietary management, adequate exercise, and weight control to prevent a secondary attack or another major adverse cardiac event (American Heart Association, 2006). According to an international multicenter trial among 18,000 patients with ACS, those who reported persistent smoking and nonadherence to dietary control and exercise for 6 months after discharge exhibited 3.8-fold increased risk of AMI, stroke and death compared with non-smokers who modified diet and exercise (Chow et al., 2010). A cohort study also reported that smoking cessation in patients after coronary events was associated with reduced recurrence of AMI (Rea et al., 2002).
A previous study reported that 39.1% of the patients with first follow-up angiogram, which was routinely conducted within 6–9 months after PCI, had a restenosis. Among them, low compliance with self-care was more often reported by those at less than 1 year compared to those at over 1 year following PCI (Choi, Jeong, & Hwang, 2011). Most patients have a tendency to maintain health behaviors for about a month after discharge but then gradually comply less, starting at 6 months after discharge (Haskell, 2003).

Therefore, prevention of fatal complications and side effects depends on persistent and effective self-care for more than 6 months after PCI. In this regard, identification of factors affecting self-care compliance is very important (Haskell). Previous studies in ACS patients have found the following factors affecting self-care compliance: functional state of the body (Mittag et al., 2006), social support from family and healthcare providers (Choi & Cho, 2007; Haskell; Mittag et al.), depression and anxiety (Bhattacharyya, Perkins-Porras, Whitehead, & Steptoe, 2007; Flynn, Cafarelli, Pettrakos, & Chirtophersen, 2007; Székely et al., 2007), disease-related knowledge as a motivation to embrace behavioral changes in addition to dietary control, smoking cessation, and regular exercise (Choi & Cho; Kim & Park, 2009), perceived benefits and barriers (Han, Lee, & Kim, 2007) and increased self-efficacy (Choi, Song, & Choi-Kwon, 2007; Han et al.). Moreover, compliance with health behaviors is not solely influenced by external support (i.e., social support from family & healthcare workers); the extent of self-care compliance is also impacted by internal factors such as a person’s beliefs or emotional state (Choi & Cho; Flynn et al.; Senuzun, Fadiloglu, Burke, & Payzin, 2006). However, the reported factors were not measured by integration of physical, social, and emotional aspects.

Therefore, this study had the following research objectives: (a) to identify the causal relationships of factors affecting self-care compliance in ACS patients with follow-up after PCI, and (b) to develop an explanatory model for self-care compliance for a comprehensive understanding of ACS patients.

Conceptual framework and hypothetical model

The conceptual framework of this study was established based on the integration of the concepts of the health belief model with self-efficacy supporting individual’s long-term lifestyle changes (Champion & Skinner, 2008, pp. 45–65), and the variables found in previous studies (Choi & Cho, 2007; Kim & Park, 2009; Mittag et al., 2006; Székely et al., 2007). We hypothesized that the likelihood of action, patients’ compliance would be affected by individual knowledge of disease and self-efficacy that explain the perceived ability to carry out the recommended health action, the cognitive perception to have expected outcome, and the environmental cues to action. Individual variables included in this model were self-efficacy (Choi et al., 2007), disease-related knowledge (Kim & Park, 2009), body function implying activities of daily living (Mittag et al.), and anxiety and depression as psychological variables (Flynn et al., 2007; Székely et al.). Cognitive perceptions were regarded as perceived barriers and perceived benefit of taking health behaviors (Han et al., 2007). In addition, social support as an environmental variable, such as provision and guidance from family and health professionals was included as cues to action strengthening self-efficacy (Choi & Cho). Individual’s knowledge, physical body function, and situational social support have an influence on individual emotions and cognitive perceptions, which then influence self-care compliance of individuals through self-efficacy. In this study, social support, disease-related knowledge and body function were regarded as exogenous factors, while depression, anxiety, perceived benefits and barriers, and self-efficacy as a motivating factor were regarded as endogenous factors. The hypothetical model showing the relationships between the three extraneous variables and six endogenous variables is presented in Figure 1.

Methods

Study design

The study employed a cross-sectional descriptive design to examine direct and indirect pathways among factors by structural equation modelling. It integrates various factors affecting self-care compliance among patients seeking follow-up care for more than 6 months.

Setting and sample

Participants were recruited from the outpatient department of a national university hospital in a city in Korea. The hospital does not currently have a cardiac rehabilitation program for ACS patients. The participants met the following eligibility criteria: (a) cognitively intact; (b) receiving follow-up treatment for at least 6 months after PCI with first-time ACS; (c) exhibiting no complications such as heart failure and arrhythmia; and (d) understood the purpose of the study and consented to participate. Confidentiality of personal information and the purpose of the study were fully explained to all participants who voluntarily signed the participation agreements after approval of the study by the hospital ethics committee (1-2008-05-059). Of the 450 patients who agreed to participate, 430 completed the questionnaires. Data from 20 patients were incomplete and deleted from the analysis. The sample size of this study was satisfied by the rule of thumb for a structural equation modelling which states that the sample size should be 200 as determined by maximum likelihood or should have 10–20 times more observations than variables (Bae, 2007).

Measurement

Social support
An 11-item Likert scale, consisted of 7 items assessing family support and 4 items assessing support from healthcare providers, was modified from an instrument developed by Tae (1985). From a pilot test of 48 patients with the original scale, 3 items assessing the support of healthcare providers where the loadings in the rotated

![Figure 1. Conceptual framework of this study.](image-url)
factor matrix were lower than 0.40 and had a content validity index lower than 80% by expert discussion were discarded in this study. Responses were rated on a 4-point scale, ranging from 1 (strongly disagree) to 4 (strongly agree); the higher the total score, the higher the social support. Cronbach’s alpha for family support and healthcare provider support was .96 and .90 respectively in this study. Cronbach’s alpha for the whole social support including both was .94.

**Disease-related knowledge**

An instrument developed by Kim and Park (2009) was used to measure disease-related knowledge. Questions required true or false responses. The instrument was composed of 33 items (4 disease characteristics items, 8 risk factors items, 7 dietary management items, 7 medications items, 7 exercise & daily life items). One point was given for correct responses and 0 point for any other response (false or not sure); the higher the score, the greater the disease-related knowledge. Cronbach’s alpha was .83 in this study.

**Functional state of the body**

A 15-item Korean Activity Scale/Index developed by Sung et al. (2000) was used as the measurement instrument for the functional state of the body. This instrument was adapted from the Duke Activity Status Index for the purpose of identifying treatment effects in coronary artery patients. Scores ranging from 0 to 79 were weighted according to the grading guidelines and summed; the higher the score, the better the physical state. Cronbach’s alpha was .86 in this study.

**Depression and anxiety**

A 14-item 4-point Likert scale (7 depression items, 7 anxiety items), validated by Oh, Min, and Park (1999) and originally developed by Zigmond and Snaith (1983) for use in nonpsychiatric patients was used. Responses were assigned numeric scores ranging from 0 (strongly disagree) to 3 (strongly agree); the higher the score, the higher the level of anxiety and depression. Cronbach’s alphas for the anxiety scale and the depression scale were .85 and .92 respectively in this study.

**Perceived benefits and barriers**

Perceived benefits and barriers were measured by using 6-item and 5-item 4-point Likert scales, respectively. The instruments were developed for patients with ischemic heart disease by Lee (2001). Responses were assigned numeric scores ranging from 1 (strongly disagree) to 4 (strongly agree); the higher the score, the greater the perceived benefits and barriers. In this study, Cronbach’s alphas were .92 for perceived benefits and .70 for perceived barriers.

**Self-efficacy**

A 19-item 4-point Likert scale (5 medicine-taking items, 5 dietary management items, 4 exercise items, 5 nonsmoking items) developed by Song (2003) was used to assess the lifestyle risk index of patients with coronary artery disease. Content validity was measured in the Song’s study. Responses were assigned numeric scores ranging from 1 (strongly disagree) to 4 (strongly agree), and the scores were summed; the higher the score, the higher the self-efficacy. Cronbach’s alpha was .89 in this study.

**Compliance with self-care**

A 16-item 4-point Likert scale developed by Park (2003) was used to measure compliance with self-care. Items assessed the following factors: dietary management (3), exercise (2), medicine-taking (2), favorite food limitation (2), hospital visit (1), weight control (1), and physical and emotional stability (5). Content validity was measured for patients with coronary artery disease by Park. Responses were assigned numeric scores ranging from 1 (not at all likely) to 4 (very likely), and the scores were summed; the higher the score, the better the self-care compliance. Cronbach’s alpha was .75 in this study.

**Data collection**

To have validity of the measurement instruments, three nursing professors reviewed all of the scales. In addition, pilot test was conducted in April 2008, which aimed at increasing feasibility and applicability of the study methods. It was carried out in 48 patients who made outpatient visits to receive follow-up at least for more than 6 months. The pretested questionnaire consisted of 140 items; 3 items regarding social support were deleted from the questionnaire, yielding a final version of the questionnaire with 137 items. Two nurse research assistants were trained by the principal investigator concerning the content of the questionnaire and methods of accurate data collection. Data were collected by the research assistants through one-on-one interviews at the outpatient department from June to August 2008. The average time required to complete the questionnaire was about 40 minutes.

**Data analysis**

Data were analyzed using SPSS/WIN 15.0 and AMOS 7.0 software (SPSS Inc., Chicago, IL, USA) packages. A professional statistician was consulted on data analysis using AMOS software. The correlation between demographic and disease-related characteristics of the participants and specific variables was analyzed using descriptive statistics. A structural equation model analysis using maximum likelihood estimation was performed to calculate the direct and indirect pathways among various factors. To test the overall fitness of the hypothetical and modified models, $\chi^2$ goodness of fit index (GFI) and adjusted goodness of fit index (AGFI) were used with the values of .90 or greater indicating a well-fitting model. Root mean square error of approximation (RMSEA) used the range of .05—.10 and indicated fair fit. Normed fit index (NFI), non-normed fit index, confirmatory fit index (CFI), and Parsimonious normed fit index (PNFI) were used.

**Results**

**Sample characteristics**

Men formed a larger proportion of the participants (65.8%). The average age was 62.86 ± 10.51 years. The age distribution revealed a predominance of patients in their sixties (36.7%), followed by those in their seventies and fifties. More than half (51.2%) of the participants had unstable angina pectoris and 95.3% underwent stent placement. A majority (57.8%) had hypertension, 32.1% had diabetes, and 47.2% continued to smoke. Less than half (44.4%) of the participants reported they had not exercised in the 6 months after treatment (Table 1). The skewness and kurtosis of research variables were less than the absolute value of 2, justifying the assumption of a normal distribution (Table 2).
Correlations and multicollinearity among research variables

The correlation among research variables was analyzed before hypothesis testing. Correlation analysis revealed that self-care compliance was positively correlated with social support (r = .43, p < .001), knowledge (r = .11, p < .005), functional status (r = .15, p < .005), perceived benefits (r = .25, p < .010), and self-efficacy (r = .54, p < .001), but was inversely correlated with depression (r = -.19, p < .001), anxiety (r = -.16, p < .001), perceived barriers (r = -.14, p < .001). The absolute values of correlation coefficients among research variables were less than .85, suggesting that multicollinearity did not exist.

Structural equation modeling

An analysis of hypothetical model was performed using maximum likelihood estimation assuming multivariate normal distribution. In the analysis of the fitness of a hypothetical model, the fit index was found to be satisfactory with the measures of fit using $\chi^2 = 26.86$ (df = 7, p < .001), normed $\chi^2$ (df) = 3.84, GFI = .98, AGFI = .91, RMSEA = .08, NFI = .95, PNFI = .25 and CFI = .96. However, the model was modified through the deletion of the two paths from knowledge and body function to self-care compliance in order to improve the fit of the model. In the analysis of the fitness of the modified model, the modified model turned out to fit better than the hypothetical model with $\chi^2 = 31.67$ (df = 13, p < .005), normed $\chi^2$ (df) = 2.64, GFI = .99, AGFI = .94, RMSEA = .06, NFI = .95, PNFI = .15, and CFI = .96. As a result, the modified model was adopted as the final model.

The results of modified model testing showed that 10 of the 29 paths drawn from research hypothesis were statistically significant. The paths found to be statistically significant in the modified model were as follows: the path from social support to depression ($\gamma = -.25$, critical ratio [CR] = -3.16); from depression to self-efficacy ($\beta = -.12$, CR = -2.10); from self-efficacy to compliance with self-care ($\beta = .44$, CR = 7.48); from social support to anxiety ($\gamma = -.22$, CR = -2.68); from anxiety to compliance with self-care ($\beta = -.08$, CR = -1.99); from social support to self-efficacy ($\gamma = .50$, CR = 3.52); from social support to perceived benefits ($\gamma = .50$, CR = 5.11); from perceived benefits to compliance with self-care ($\beta = .08$, CR = 2.01); from body function to depression ($\gamma = -.34$, CR = -6.96); and from body function to perceived barriers ($\gamma = -.20$, CR = -3.94). Self-efficacy, anxiety, perceived benefit (direct effects) and social support (indirect effect) accounted for 32% of the total variance in the overall compliance with self-care (Table 3, Figure 2).

Discussion

Self-efficacy was found as the most powerful factor with direct effect on self-care compliance among patients who had PCI in this study. This finding is consistent with the results of previous studies; higher perceived self-efficacy is indicative of higher adherence to therapeutic regimens in patients with hypertension (Roh, 2005). The increased self-efficacy is an affecting factor on smoking cessation and healthy diet compliance in patients with coronary
artery disease (Choi et al., 2007; Han et al., 2007). In addition, this study is supported by the fact that a workout program can lead to enhanced self-efficacy, which, in turn, improves compliance with exercise and reduces blood lipids (Senuzun et al., 2006). Social support was a factor having an indirect effect on compliance with self-care by increasing self-efficacy. However, this study did not support the direct effects of social support on self-care compliance. Social support from family and healthcare providers enhanced the patients’ perceived self-efficacy, thereby leading to a higher degree of self-care compliance. In addition, the findings confirm results from a previous study indicating that social support enhances coronary artery patients’ compliance in medicine taking (Molley, Perkin-Porras, Strike, & Steptoe, 2008). Because most patients who have undergone PCI are aware of the possibility of a second attack such as a re-infarction, providing patients with health information as well as special attention from family and healthcare providers is particularly important (Mittag et al., 2006). Thus, nursing intervention is needed to enhance patients’ self-care for health management.

Anxiety was a mediating variable and had a direct effect on compliance with self-care. Further, it was decreased by social support in this study. The finding in which participants with higher levels of anxiety exhibited lower levels of self-care compliance is consistent with the findings by Moser et al. (2007). This indicated that levels of anxiety were mitigated and that compliance with health behavior was increased in AMI patients through a cardiac rehabilitation program. According to Bhattacharyya et al. (2007), 65–70% of patients with ACS were anxious about everyday life events and about resuming work. Moser et al. found that anxiety was 4.9-fold more likely to increase the rate of re-infarction and ventricular arrhythmia after coronary artery revascularization, and more likely to increase the mortality rate from recurrence. This is supported by a study where patients who received social support such as a nursing intervention during the first year after occurrence of AMI reported less anxiety, whereas patients who received no social support experienced worsened anxiety (Mendes de Leon et al., 2006). Similarly, the morbidity and mortality rates of patients with ACS increased owing to perceived pressure and anxiety about disease when a low level of social support was provided (Brookhart et al., 2007). Previous studies have suggested that depression after treatment of ACS weakens social coping skills and leads to a poorer prognosis by negatively impacting patients’ body and emotions (Bhattacharyya et al., 2007). Depression was significantly associated with the occurrence of complications such as recurrence of coronary artery disease and heart failure (Orth-Gomer, 2007). In this study, social support influenced self-efficacy through decreased depression. Therefore, it is imperative that patients’ level of depression and anxiety be assessed regularly; the assessment results could be reflected in a nursing intervention program designed to improve self-care compliance in follow-up ACS patients.

Perceived benefit had a direct influence on self-care compliance. In addition, it was a mediating factor for social support: the higher the social support from family and healthcare providers, the greater the perceived benefit. These findings are consistent with those of previous studies showing that social support from family and healthcare providers heightened perceived benefit among health beliefs (Han et al., 2007), and that perceived benefit increased

Figure 2. Path diagram for the final model. *p < .05. **p < .001.
compliance with dietary management and health behavior in patients with ACS (Han et al., Lee, Kim, & Cho, 2002). ACS patients should be regularly monitored during recovery and be educated regarding self-care compliance until they reach a stabilization phase to enhance the direct impact of perceived benefit on self-care compliance.

Reduced body function, an important factor representing physical ability or the severity of disease (Sung et al., 2000), had a significant effect on depression and perceived barriers. Such findings are consistent with the findings reported by Lee et al. (2002), suggesting that perceived barriers among patients with coronary artery disease who underwent surgical treatment were heightened owing to reduced functional state of the body. However, the results are less consistent with the findings of a meta-analysis of health-related behaviors among Koreans showing that a lower level of perceived barriers is the most important factor affecting behavior performance associated with improved health behaviors (Cho, Kim, Lee, & Jeong, 2004). Perceived barriers among participants in this study were low probably because required activities for restoration and promotion of their health after PCI involved healthy lifestyle choices recommended for the general public such as weight control and smoking cessation.

Disease-related knowledge was found to have no significant effects on patients’ emotional perceptions like anxiety, depression, or perceived benefits and barriers in this study. This means that even though patients are knowledgeable on lifestyle modification, the level of knowledge itself at the time of 6–9 months after the first cardiac event does not decrease anxiety or increase perceived benefits which might directly affect self-care compliance. In addition, there were no direct relationships between knowledge and self-efficacy, and knowledge and self-care compliance. This result was not consistent with the previous studies that knowledge influenced patients' behavioral changes (Choi & Cho, 2007; Kim & Park, 2009). Further study is needed to identify social support as a coping resource mediating knowledge and self-care compliance.

This study had some limitations. The participants were sampled from a hospital located in a province in which many rural elderlies reside. Thus, the sample is not representative of all ACS patients in Korea. In addition, the study was a cross-sectional survey using self-reported questionnaires. In particular, compliance, which was a dependent variable, was subjectively measured and showed a low reliability in this study. Accordingly, the findings cannot be used to determine causal relationships between cause and effect. Further studies are needed to observe more reliable outcomes including physiological health parameters.

Conclusion

The three patterns of paths affecting the participants' self-care compliance were found among outpatients who made hospital visits at more than 6 months after PCI. Enhanced self-efficacy through social support encouraged the participants to comply with self-care; increased perceived benefits and reduced anxiety through social support encouraged the participants to comply with self-care; reduced depression and enhanced self-efficacy through social support and good body function encouraged the participants to comply with self-care. Self-efficacy was the most influential factor and played an important role as a mediating variable affecting self-care compliance through the mediation of depression and social support. Further, anxiety and perceived benefits were mediating variables affecting self-care compliance through the mediation of social support. The present study underscores the importance of social support as a nursing intervention to enhance self-efficacy in practice. To maintain self-care compliance long term, social support especially from healthcare providers is continuously needed during follow-up visits to decrease anxiety and depression, and to increase health benefits and self-efficacy. In particular, there is an emergent need to equip specialized cardiovascular nurses and to establish their central role in providing tailored education designed to enhance the self-efficacy of patients on follow-up outpatient visits after PCI.

Conflict of interest

The authors declare no conflict of interest.

References

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