

The Journal of Cardiovascular Nursing

Adherence to treatment of female patients with coronary heart disease after a percutaneous coronary intervention

--Manuscript Draft--

Manuscript Number:	JCN-D-18-00330R2
Full Title:	Adherence to treatment of female patients with coronary heart disease after a percutaneous coronary intervention
Article Type:	Original Research
Keywords:	Coronary heart disease, percutaneous coronary intervention, adherence to treatment
Corresponding Author:	Outi Kähkönen, Ph.D University of Oulu Oulu, FINLAND
Corresponding Author Secondary Information:	
Corresponding Author's Institution:	University of Oulu
Corresponding Author's Secondary Institution:	
First Author:	Outi Kähkönen, Ph.D
First Author Secondary Information:	
Order of Authors:	Outi Kähkönen, Ph.D
	Terhi Saaranen, Ph.D, Docent
	Päivi Kankkunen, Ph.D, Docent
	Heikki Miettinen, MD, Docent
	Helvi Kyngäs, Professor
Order of Authors Secondary Information:	
Manuscript Region of Origin:	Europe
Abstract:	<p>Background: Adherence to treatment is a cornerstone regarding progression of coronary heart disease, which is the most common cause of death among females. Coronary heart disease in women has special characteristics: the conventional risk factors are more harmful to females than males, accumulation of risk factors is common, and the female gender is related to nontraditional risk factors such as gestational diabetes and preeclampsia. Additionally, worse outcomes, higher incidence of death, and complications after percutaneous coronary intervention have been reported more often among females than among male patients.</p> <p>Objective: To test a model of adherence to treatment among female patients with coronary heart disease after a percutaneous coronary intervention.</p> <p>Methods: A cross-sectional, descriptive and explanatory survey was conducted in 2013 with 416 CHD patients, of which 102 female patients were included in this sub-study. Self-reported instruments were used to assess female patient adherence to treatment. Data were analyzed using descriptive statistics and a structural equation model.</p> <p>Results: Motivation was the strongest predictor for female patients' perceived adherence to treatment. Informational support, physician support, perceived health, and physical activity were indirectly, but significantly, associated with perceived adherence to treatment via motivation. Furthermore, physical activity was positively associated with perceived health, while anxiety and depression were negatively associated with it.</p> <p>Conclusions: Secondary prevention programs and patient education have to take into account individual or unique differences. It is important to pay attention to issues that are known to contribute to motivation rather than to rely on education alone to improve adherence.</p>

Adherence to treatment of female patients with coronary heart disease after a percutaneous coronary intervention

Background: Adherence to treatment is essential to prevent progression of coronary heart disease, which is the most common cause of death among females. Coronary heart disease in women has special characteristics: the conventional risk factors are more harmful to females than males, accumulation of risk factors is common, and women have nontraditional risk factors such as gestational diabetes and preeclampsia. Additionally, worse outcomes, higher incidence of death, and complications after percutaneous coronary intervention have been reported more often among females than among male patients.

Objective: To test a model of adherence to treatment among female patients with coronary heart disease after a percutaneous coronary intervention.

Methods: A cross-sectional, descriptive and explanatory survey was conducted in 2013 with 416 CHD patients, of which the 102 female patients were included in this sub-study. Self-reported instruments were used to assess female patient adherence to treatment. Data were analyzed using descriptive statistics and a structural equation model.

Results: Motivation was the strongest predictor for female patients' perceived adherence to treatment. Informational support, physician support, perceived health, and physical activity were indirectly, but significantly, associated with perceived adherence to treatment via motivation. Furthermore, physical activity was positively associated with perceived health, while anxiety and depression were negatively associated with it.

Conclusions: Secondary prevention programs and patient education have to take into account individual or unique differences. It is important to pay attention to issues that are known to contribute to motivation rather than to rely on education alone to improve adherence.

Keywords: Coronary heart disease, percutaneous coronary intervention, adherence to treatment

Background

Coronary heart disease (CHD) is the most common cause of cardiovascular disease (CVD), which is the leading cause of death worldwide.¹⁻² Traditionally CHD has been understood as a male public health problem, thus the majority of the evidence is based on the male-based population studies. However, the prevalence of CHD is decreasing among men and is becoming an important chronic disease and major cause of death among women. The proportion of all deaths attributable to CHD is higher in women than in men, accounting for 49% of all deaths in women and 40% of all deaths in men in Europe.¹ This trend will continue in the future, because the life expectancy of women is higher than men, especially in developed countries. Consequently, the proportion of women with CHD will continue to grow and focus on older women.³

Females present with CHD approximately 10 years later than men. A potential explanation is assumed to be a protective effect from estrogens prior to menopause.⁴⁻⁵ Men over 65 years old have double and women triple the risk of CHD occurrence compared to those under 65 years of age.⁶⁻⁷

Considering the chronic nature of CHD, adherence to secondary prevention measures is essential to prevent CHD progression and improve prognosis. In this study, adherence to treatment was conceptualized according to the Kyngäs theory of adherence of people with chronic disease, which emphasizes an active, intentional and responsible process of care in which CHD patients after percutaneous coronary intervention (PCI) work to maintain their health in collaboration with healthcare professionals.⁹ Adherence includes adherence to medication and to a healthy lifestyle, such as diet, physical activity, and smoking cessation, when applicable, as well as reduced alcohol consumption.⁸⁻¹¹

Adherence to treatment, and in particular to a healthy lifestyle, of female CHD patients after PCI is important—it is associated with a significantly decreased risk of CHD among females with high genetic risk.¹² Additionally, conventional CHD risk factors, such as smoking, hypertension and dyslipidemia, have been found to be more harmful to women than to men regarding the development and progression of CHD. The accumulation of risk factors and an increasing prevalence of hypertension, obesity, and diabetes are more common in women than in men.¹²⁻¹³ Of concern is that females are often unaware of their risk for CHD.¹⁴ Additionally, women have unique risk factors such as gestational diabetes and preeclampsia,¹⁵ which are related to a 2- to 3-fold risk of CHD in advanced age females.¹⁵ Moreover, women diagnosed with CHD tend to have more co-morbidities, including diabetes, atrial fibrillation, chronic kidney disease, peripheral arterial disease and heart failure hypertension, at the time of the presentation of CHD compared to men.^{12,17}

The issues related with CHD pathophysiology, prognosis, conventional risk factors, and medication have been thoroughly studied.¹⁸⁻¹⁹ Additionally, the association between certain psychological factors and CHD has gained increased attention, especially in long-term chronic conditions where full recovery is unlikely.²⁰ In particular, perceived health²¹ and social support²² have been points of interest. Perceived health describes patients' perceptions of their own health and health-related quality of life.²¹ Poor perceived health is an independent predictor for mortality²³ and morbidity²⁴, as well as new cardiac events, for patients with CHD.²⁵ Women perceive their health as worse^{21,26} and report anxiety and depression more often compared to men after PCI.²⁷

Social support has been defined as a dynamic interpersonal process centered on the reciprocal exchange of information which changes across contexts. Social support is manifested between providers and recipients; depending on its context, social support might

appear multifaceted.²⁸ Low social support reduces good prognoses among patients with CHD and is related with higher mortality in patients with CHD.^{22,29}

PCI as a revascularization method has become the treatment of choice for CHD compared with coronary artery bypass grafting (CABG) in acute and elective care settings when it is medically possible and justified. PCI leads to a more rapid recovery and short-term improvements in overall health status.³⁰ However, worse outcomes, higher incidence of death, and several complications after PCI have been reported more often among females than males,³¹ and women have a higher mortality rate after primary PCI than men.³²

Because CHD in women has unique manifestations, it is important to identify how women adhere to secondary prevention recommendations and which factors are associated with adherence. Additionally, knowledge of coronary risk factors is relatively poor in women,³³ informational needs are different, and being a woman is a factor associated with non-participation in secondary prevention programs.³⁴

Adherence to treatment among CHD patients after PCI has been found to be associated with motivation, support from physicians and next of kin, informational support, results of care, perceived health, anxiety and depression, close relationships, alcohol consumption, previous PCI, the consumption of vegetables, physical activity and gender (Figure 1).³⁵

Evidence in respect to adherence to treatment of women with CHD after PCI is scant yet adherence to treatment is a key factor regarding better prognosis of CHD. Therefore, the major objective of this study was to examine explanatory factors for adherence to treatment among females with CHD after PCI. This study is based on an earlier study of adherence to treatment³⁵ with the aim of testing whether the empirical data from female patients with CHD after PCI would fit the proposed model of adherence to treatment after PCI

(Figure 1). The specific hypothesis was that the model of adherence to treatment of patients with CHD after PCI is suitable for assessing adherence to treatment and associated factors among female patients.

Methods

This cross-sectional explanatory and descriptive sub-study was part of a larger adherence study. Hospitalized adults aged 18 – 75 years with CHD were recruited from medical wards after PCI at two university hospitals and three central hospitals in Finland in 2013. The final response rate for the parent study was 80% (n = 416). Out of this total population, 102 were female and are the subject of the current sub-study. Both coronary angioplasty and coronary artery stenting procedure were included in the elective and acute settings. An exclusion criterion was a diagnosed memory disorder, e.g dementia or Alzheimer's disease.

Ethical approval to conduct this study was received (Kuopio University Hospital; ref no. 2013-170). A registered nurse evaluated patients' suitability for participation based on the inclusion and exclusion criteria, provided verbal and written information about the study, and asked patients if they were willing to participate in the study during the patients' hospitalization. The survey was conducted by postal questionnaire four months after PCI.

Measurements

The *adherence to treatment of patient with chronic disease (ACDI) instrument* is based on a theoretical model of chronically ill patients developed and tested by Kyngäs (1999). The ACDI includes 38 items measuring adherence to treatment. According to the original theory of adherence of people with chronic disease, adherence to treatment consisted of two mean sum

variables: adherence to medication and a healthy lifestyle. These two variables were composed of nine mean sum variables: responsibility, motivation, cooperation, results of care, fear of complications, sense of normality, support from next of kin, support from nurses and support from physicians.⁵ Earlier studies have found the validity and reliability of the instrument high. Cronbach's alpha has ranged from 0.69 to 0.91.^{8,10-11,36} Additionally, the adherence visual analogue scale (A-VAS) instrument developed by Kähkönen et al. (2018), wherein the respondent evaluates his/her adherence to treatment on a scale from 0 (the worst imaginable adherence to treatment) to 100 (the best imaginable adherence to treatment), was also used to evaluate the level of adherence to treatment. Statistical details have been previously presented.³⁵

The *Social Support of People with Coronary Heart Disease (SSCHD) instrument*⁴¹ was used to examine social support (informational, emotional and functional support) among patients with CHD after PCI. The SSCHD instrument is based on the Cohen and Wills' (1985) theory of social support. According to the theory, social support consists of three dimensions: informational, emotional and functional support.³⁸ The dimension of informational support consists of items about respondents' perceived information regarding CHD, knowledge of their own risk factors, advice on risk factors, advice on what to do in case of chest pain, information on medications, advice on physical activity after PCI, and information on the continuum of care and cardiac rehabilitation. The dimension of emotional support includes items regarding respondents' perceived support from family, friends, and other cardiac patients, and perceived importance to their next of kin. The items for the dimension of functional support are related to cooperation with healthcare professionals, opportunities to ask about issues of concern, and feeling supported and cared for. The construct validity of the instrument was verified with an explanatory factor analysis (EFA) using Principal axis factoring and Promax rotation. Three factors explained 59% of the total variance, communalities in all items were >0.30, and the factor loadings of

all variables varied between 0.34–0.86. Internal consistency of the mean sum variables was evaluated by Cronbach’s alpha values and was 0.78, indicating an acceptable value.³⁹ The complete SSCHD instrument has been previously presented.³⁷

The *EuroQoL five-dimensional scale (EQ-5D-5L)* and *EuroQoL visual analogue scale (EQ-VAS)* were used to examine the perceived health of CHD patients four months after PCI. The EQ-5D-5L and EQ-VAS are widely used validated instruments; they consist of five items addressing five dimensions of health: mobility, self-care, usual activities, pain/discomfort and anxiety/depression.⁴⁰⁻⁴¹

Data analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS 24) software for Windows, and Analysis of Moment Structures (AMOS) version 24. Descriptive statistics were used to describe the characteristics of the sample (mean, standard deviation [SD], ranges and median). The compatibility of the theoretical model of adherence to treatment was tested among female patients using structural equation modelling (SEM), which is a suitable method for testing the relationship between the theoretical description and the concepts. The SEM software programs provide several statistical indices to evaluate the fit of the model. However, there is lack of consensus on the best indices. The goodness of fit and the correspondence between the theoretical model and observed correlation matrix in this study were tested with generally used modification indices: chi-square tests and their derivatives, Hoelter's “critical N,” the root mean square error of approximation (RMSEA) and the comparative fit index (CFI) were employed. A sufficiently good model should have a CFI of 0.90 and RMSEA 0.06 – 0.07. The standardized estimates were reported with correlations (standardized covariance) and path coefficients. The effect of standardized estimates is

interpreted as weak if their values are < 0.10 . Estimates with a medium effect have values ~ 0.30 and estimates with a value > 0.50 are interpreted as having a major effect.⁴²

Results

Characteristics of the participants

The sample in the present study consists of 102 female patients (Table 1) with CHD four months after PCI. The mean age of the female respondents was 65.1 years (range 42 – 75, SD 7.4). Regarding health behavior, 13.7 % were smokers, 52.9% used alcohol more than two portions per day, 14.7% engaged in 30 minutes of physical activity at least three times a week, and 19.8% consumed vegetables in their diet, eating at least the recommended five deciliters per day.

The mean value of adherence to treatment among female respondents was 87.2 (range 40.0 – 100.0, SD 11.4), which was lower than adherence to treatment among the whole sample (87.8, range 40 – 100, SD 11.4). Although the difference in the level of adherence to treatment between the groups was not statistically significant, a different model explained perceived adherence to treatment among the female patients with CHD after PCI compared with the whole sample, in which both genders were represented (Figure 3).

To start, the original model of adherence to treatment was used with women's data using standardized regression weights (Figure 1). Direct positive associations between female respondents' adherence to treatment and motivation, support from physicians and support from next of kin were tested. Additionally, the indirect associations for female respondents' adherence to treatment—informational support, results of care and perceived health, anxiety and depression, marital status, alcohol consumption, previous PCI, gender, physical activity, and consumption of vegetables—were tested. In each step, error terms were

specifically related to the items to depict prospective measuring error. In the first step, the outlined structural equation model with standardized estimates indicated an unacceptable model fit: $\chi^2 = 1898.83$, $df = 933$, $p < 0.001$, $\chi^2/df = 1.94$, $TLI = 0.84$, $CFI = 0.87$, $RMSEA = 0.34$, indicating that the hypothesized model of adherence to treatment did not fit the empirical data from female respondents.⁴⁶

In the next step, based on the standardized estimates, statistically insignificant variables were removed from the model one by one. In the definitive model analysis, a direct positive relationship was found between female respondents' adherence to treatment and motivation. The standardized path coefficient indicated a major effect ($\beta = 0.7$) in terms of direct association between motivation and females' adherence to treatment. Furthermore, informational support and support from physicians were indirectly, but significantly, associated with motivation. Additionally, physical activity and perceived health were associated with motivation. Physical activity was positively associated with anxiety and depression, which were negatively associated with perceived health. Indirect path coefficients indicated a medium effect ($\beta = 0.2 - 0.4$). The definitive structural equation model with standardized estimates indicated an acceptable model fit: $\chi^2 = 888.59$, $df = 399$, $p < 0.001$, $\chi^2/df = 2.23$, $TLI = 0.90$, $CFI = 0.91$, $RMSEA = 0.40$. In this model, Hoelter's "critical N" test rejected the null hypothesis. However, the model would be acceptable with up to 5% of risk, if $n = 84$.⁴²

Discussion

To the best of our knowledge, the present study is the first to test females' post-PCI patient's adherence to treatment. Our findings indicated that female patients perceived their adherence to treatment to be high. However, there was a conflict between respondents' perceived adherence to treatment and the health behaviours they reported. Therefore, it is of

paramount importance to focus on the issues that are known to contribute to females' adherence to treatment, rather than informational support or knowledge only.

In the present study, the strongest explanation for females' adherence to treatment was motivation, as has been the case in several previous studies related to adherence to treatment of chronically ill patients.^{8-11,35-36} A new finding from our study is that females' motivation for adherence was explained by support from physicians, informational support, assessment and counseling related to self-care for risk factors, identification of symptoms, medication, physical activity, follow-up treatment and rehabilitation. Commonly, patients with CHD face the need to change multiple behaviors; therefore, identifying the behavior that is most important to the patient is a useful strategy.⁴³ Although informational support has a mediation association to adherence via motivation, it is of paramount importance to include individual and patient-centered motivational elements, such as assessment, counselling, prescribed and supervised exercise training, risk factor control and psychosocial support.⁴⁴⁻⁴⁵

Insufficient informational support as a form of counseling is a major reason for a reduced understanding of risk factors and the seriousness of CHD, which leads to reduced motivation for self-care.¹⁴ The motivational interviewing approach as a tool for professionals is a useful method for counseling and support for behavior change.⁴⁶ Because the key factors that promote motivation are within nurses' scopes of practice, there is a need for appropriate training of nurses so that they can provide appropriate counseling using motivation promoting approaches. However, while the evidence of the benefits of motivational interviewing is strong, the evidence about the long-term effects on clinical and psychological outcomes is limited and further research is needed.⁴³

Women's motivation to adhere to treatment was also explained by perceived health. According to the current view, perceived health is a strong predictor of long-term

clinical outcomes in patients with CHD,²⁰ which highlights the importance of including patients' subjective experiences of their perceived health as part of an overall strategy for enhancing clinical management to reduce the risk of adverse events.²¹

In this study, anxiety and depression were predictors of worse perceived health. Anxiety and depression are associated with increased risk for new cardiac events, poor prognosis and mortality,⁴⁷ worse self-care, and worse functional capacity among CHD patients.^{19,48} Thus, it is important to put effort into the identification of anxiety and depression among post-PCI patients.⁴⁹ The results in this study confirmed the association between physical activity and anxiety and depression, which has been widely demonstrated previously: physical activity may alleviate depressive symptoms in patients with CHD and reduces mortality risk.⁴⁹

In this study, support from nurses did not predict adherence to treatment directly. This emphasizes the importance of the therapeutic relationship between patients and physicians in the acute phase after PCI.⁵⁰ Nurses' support in this study was provided through informational support. Direct support from nurses may be highlighted in follow-up care promoting secondary prevention, which is often arranged by nurses.

The present study has some methodological limitations. The cross-sectional design of the study may be a limitation, because causality and generalizability can't be assumed. The recruitment process is also a potential limitation, because patients usually are discharged 24 hours after PCI. There is a risk that because of this rapid turnover, patients who met the inclusion criteria for the study were not included. Finally, in self-reported data collection methods, there is always a risk of the social desirability effect, in which patients provide answers they think are favourable instead of saying what they actually do or think.

Conclusion. Motivation was the strongest predictor of female patients'

adherence to secondary prevention strategies after PCI. Female patients' adherence to treatment was not associated with close relationships or the support of next of kin.

Additionally, previous PCI or consumption of vegetables was not associated with adherence to treatment, and the role of support from physicians was different among female patients compared to the general model of adherence to treatment.³⁵ Informational support, physician support, perceived health, and physical activity were indirectly, but significantly, associated with perceived adherence to treatment via motivation. These findings support the evidence that secondary prevention programs and patient education have to take into account individual or unique differences. It is important to pay attention to issues that are known to contribute to motivation rather than to rely on education alone to improve adherence.

References

1. European Cardiovascular Disease Statistics 2017 edition.
<http://www.ehnheart.org/cvd-statistics/cvd-statistics-2017.html>
2. Benjamin EJ, Virani SS, Callaway CW, et al. on behalf of the American Heart Association Council on Epidemiology and Prevention Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2018 update: a report from the American Heart Association [published online ahead of print January 31, 2018]. *Circulation*. 2018; DOI: 10.1161/CIR.0000000000000558.
3. Hamill S, Ingram N. Gender disparities: assessment and treatment of coronary heart disease. *Br J Card Nurs*. 2015; 10(10):494-502.
4. Haapalahti P, Mikkola T. Health of the blood vessels of an aging woman. *Duodecim*. 2015; 131:1493–1498.
5. Maas AH, Appelmale YE. Gender differences in coronary heart disease. *Neth Heart J*. 2010; 18(12):598–606.
6. Global, regional, and national age-sex specific all-cause and causes specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2015; 385(9963):117–171.
7. Claassen M, Sybrandy KC, Appelmale YE, Asselbergs FW. Gender gap in acute coronary heart disease: Myth or reality? *World J Cardiol*. 2012; 4(2):36-47.
8. Kyngäs HA. Theoretical model of compliance in young diabetics. *J Clin Nurs*. 1999; 8(1):73–80.
9. Kähkönen O, Kankkunen P, Saaranen T, Miettinen H, Kyngäs H, Lamidi ML. Motivation is a crucial factor for adherence to a healthy lifestyle among people with coronary heart disease after percutaneous coronary intervention. *J Adv Nurs*. 2015; 71(10):2364 – 2373.

10. Oikarinen A, Engblom J, Kääriäinen M, Kyngäs H. Risk factor-related lifestyle habits of hospital-admitted stroke patients – an exploratory study. *J Clin Nurs*. 2015; 24(15–16):2219–2230.
11. Kähkönen O, Saaranen T, Kankkunen P, Lamidi ML, Kyngäs H, Miettinen H. Predictors of adherence to treatment by patients with coronary heart disease after percutaneous coronary intervention. *J Clin Nurs*. 2018; 27(5-6):989–1003.
12. Tairova MS, Graciolli LO, Tairova OS, De Marchi T. Analysis of cardiovascular disease risk factors in females. *Open Access Maced J Med Sci*. 2018; 146(8):1370 – 1375.
13. Garcia M, Mulvagh SL, Merz NB, Buring JE, Maleson JE. Cardiovascular disease in women: clinical perspectives. *Circ Res*. 2016; 118(8):1273–1293.
14. Lauck S, Johnson JL, Ratner PA. Self-care behaviour and factors associated with patient outcomes following same-day discharge percutaneous coronary intervention. *Eur J Cardiovasc Nurs*. 2009; 8(3):190 – 199.
15. Patel AR, Kramer CM. Assessing cardiovascular risk in females: a growing body of evidence. *J Am Coll Cardiol*. 2013; 62(20):1866 – 1879.
16. Fraser R, Whitley GS, Johnstone AP, et. al. Impaired decidual natural killer cell regulation of vascular remodelling in early human pregnancies with high uterine artery resistance. *J Pathol*. 2012; 228(3):322–332.
17. Alfredsson J, Stenestrand U, Wallentin L, et al. Gender differences in management and outcome in non-ST-elevation acute coronary syndrome. *Heart*. 2007; 93:1357–1362.
18. Perk J, Hambræus K, Burell G, Carlsson R, Johansson P, Lisspers J. Study of Patient Information after percutaneous coronary intervention (SPICI): should prevention programmes become more effective? *Eurointervention*. 2015; 10(11):1–7.

19. Piepoli MF, Hoes AW, Agewall S, et al. 2016 European guidelines on cardiovascular disease prevention in clinical practice. The Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of 10 societies and by invited experts). Developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR). *Eur Heart J*. 2016; 37(29):2315–2381.
20. Cepeda-Valery B, Cheong AP, Lee A, Yan BP. Measuring health related quality of life in coronary heart disease: The importance of feeling well. *Int J Cardiol*. 2011; 149(1):4–9.
21. De Smedt D, Clays E, Annemans L, et al. Health related quality of life in coronary patients and its association with their cardiovascular risk profile: Results from the EUROASPIRE III survey. *Int J Cardiol*. 2013; 168(2):898–903.
22. Barth J, Schneider S, von Kanel R. Lack of social support in the etiology and the prognosis of coronary heart disease: A systematic review and meta-analysis. *Psychosom Med*. 2010; 72(3):229 – 238.
23. Schenkeveld L, Pedersen SS, van Nierop JW, et al. Health-related quality of life and long-term mortality in patients treated with percutaneous coronary intervention. *Am Heart J*. 2010; 159:471–476.
24. Grool AM, van der Graaf Y, Visseren FL, et al. Self-rated health status as a risk factor for future vascular events and mortality in patients with symptomatic and asymptomatic atherosclerotic disease: The SMART study. *J Intern Med*. 2012; 272(3):277–286.

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
25. Rumsfeld JS., Alexander KP, Goff DC, et al. Cardiovascular health: the importance of measuring patient-reported health status: a scientific statement from the American Heart Association. *Circulation*. 2013; 127(22):2233–2249.
26. Kähkönen O, Saaranen T, Lamidi ML, Miettinen H, Kankkunen P. Perceived health among patients with coronary heart disease four months after a percutaneous coronary intervention. *Int J Caring Sciences*. 2017; 10:54–66.
27. Olsen SJS, Schirmer H, Wilsgaard T, et al. Cardiac rehabilitation and symptoms of anxiety and depression after percutaneous coronary intervention. *Eur J Prev Cardiol* 2018; 25:1017–1025.
28. Finfgeld-Connett D. Clarification of social support. *J Nurs Scholarship* 37, 4–9.
29. Compare A, Zarbo C, Manzoni GM, et al. Social support, depression, and heart disease: A ten years literature review. *Front Psychol*. 2013; 4:384.
30. Roffi M, Patron, Collet JP, et al. 2015 ESC guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation: Task Force for the Management of Acute Coronary Syndromes in Patients Presenting without Persistent ST-Segment Elevation of the European Society of Cardiology (ESC). *Eur Heart J*. 2016; 37(3):267–315.
31. Alfonso F, Hernández R, Bañuelos C, et al. Initial results and long-term clinical and angiographic outcome of coronary stenting in female. *Am J Cardiol*. 2018; 86(12):1380–138329.
32. Birkemeyer R, Schneider H, Rillig A, et al. Do gender differences in primary PCI mortality represent a different adherence to guideline recommended therapy? A multicenter observation. *BMC Cardiovasc Disord*. 2014; 14:71.

33. Tchicaya A, Lorentz N, Demarest S, Beissel J. Persistence of socioeconomic inequalities in the knowledge of cardiovascular risk factors five years after coronary angiography. *Eur J of Cardiovasc Nurs* 2018; 17(2):136–147
34. Ruano-Ravina A, Pena-Gil C, Abu-Assi E, et al. Participation and adherence to cardiac rehabilitation programs. A systematic review. *Int J Cardiol.* 2016; 223:436–443.
35. Kähkönen O. *Adherence to treatment of patients with coronary heart disease after a percutaneous coronary intervention.* Publications of the University of Eastern Finland. Dissertations in Health Sciences. Number 440. 2017.
36. Kääriäinen M, Paukama M, Kyngäs H. Adherence with health regimens of patients on warfarin therapy. *J Clin Nurs.* 2013; 22(1–2):89–96.
37. Kähkönen O, Kankkunen P, Miettinen H, et al. Perceived social support following percutaneous coronary intervention is a crucial factor in patients with coronary heart disease. *J Clin Nurs.* 2017; 26:1264–1280.
38. Cohen S, Wills, TA. Stress, social support, and the buffering hypothesis. *Psychological Bulletin.* 1985; 98:310–357.
39. Burns N, Grove SK. *The practise of nursing research. Conduct, critique & utilization.* 2nd edition. Philadelphia: WB Saunders Company; 2009.
40. Rabin R, de Charro F. EQ-5D: A measure of health status from the EuroQoL Group. The Finnish Medical Society Duodecim. *Ann Med.* 2001; 33(5):337–343.
41. Janssen MF, Birnie E, Haagsma JA, et al. Comparing the standard EQ-5D three-level system with a five-level version. *Value Health.* 2008; 11(2):275–284.
42. Schumacker RE, Lomax RG. *Beginner's Guide to Structural Equation Modelling.* 2nd edition. Mhwah, CA: Lawrence Erlbaum Associates; 200
43. Mesters I. Motivational interviewing: hype or hope? *Chronic Illn.* 2009; 5(1):3–6.

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
44. Kachur S, Menezes AR, De Schutter A, et al. Significance of comorbid psychological stress and depression on outcomes after cardiac rehabilitation. *Am J Med.* 2016; 129(12):1316–1321.
45. Chauvet-Gelinier JC, Bonin B. Stress, anxiety and depression in heart disease patients: A major challenge for cardiac rehabilitation. *Ann Phys Rehabil Med.* 2017; 60(1): 6–12.
46. Thompson DR, Chair SY, Chan SW, et al. Motivational interviewing: a useful approach to improving cardiovascular health? *J Clin Nurs.* 2011; 20(9-10):1236–44.
47. Kazukauskienė N, Burkauskas J, Macijauskienė J, et al. Distress factors and exercise capacity in patients with coronary artery disease attending cardiac rehabilitation program. *Int J Behav Med.* 2018; 25(1):38–48.
48. Nedeljkovic I. Assessment of depression and anxiety in patients before and after percutaneous coronary intervention: A step forward in cardiac rehabilitation? *Eur J Prev Card.* 2018; 25(10):1015–1016.
49. Blumenthal JA, Babyak MA, O'Connor C, et al. Effects of exercise training on depressive symptoms in patients with chronic heart failure the HF-ACTION *JAMA.* 2012; 308(5):465–474.
50. Du L, Don P, Jia J, et al. Impacts of intensive follow-up on the long-term prognosis of percutaneous coronary intervention in acute coronary syndrome patients - a single center prospective randomized controlled study in a Chinese population. *Eur J of Prev Cardiol.* 2016; 23:1077–1085.

Dear Reviewers,

Thank you very much for your valuable comments to help improve this manuscript. The corrections have been marked in red and highlighted in yellow colour. The page and line numbering of the corrections have been marked below your original comments.

Reviewer Comments:

Reviewer #1: Thank you for giving me the chance to read an excellent paper. the manuscript is well written, informative and concise. Congratulations.
I have two minor suggestions for the improvement of the manuscript.

1. corrections in figure 1. there are some typos in the figure. e.g. support fomr next of kin instead of from next of kin and physical exersice instead of physical exercise.

○ Typos have been corrected in the Figure 1.

2. discussion:
the limitation at the very end of the discussion part are all valuable contributions. However, i recommend to finish the article with the conclusions that the authors have mentioned in the paragraph above. my suggestion is to rearrange the last two paragraphs of the manuscript.

○ Discussion section: The last two paragraphs have rearranged according to the reviewer's suggestion; page 12, line 12-35.

Reviewer #2: This is a secondary analysis (or substudy) of a larger parent study that examined adherence to the treatment regimen post PCI.
This study reported data from the women in the larger study that had undergone either primary PCI or an elective PCI. The data were cross sectional and were obtained 4 months post PCI.

Secondary prevention is very important, especially for women who are at risk for readmission post PCI. Thus, adherence to the treatment regimen (medication and life style modifications) is important. Based on the author(s)' conceptual model used adherence is defined as a patient's responsible, intentional, and active role in self-care, taken to maintain his or her health in collaboration with healthcare personnel. This does not account for unintentional non-adherence (which is about half of the non-adherence reported in the literature). In the conceptualization (that was referenced) there are cognitive-emotional and motivational factors (knowledge; personal meaning of illness and motivation), psychological well being factors, and the role of others (social support from family and quality of interactions with health care providers).
Notably, the authors use social support as a variable (as part of the model being tested) and uses perceived health (perceptions of their own health and health-related quality of life) as a psychological factor (likely part of the cognitive-emotional/motivational factors in the referenced conceptualization).

Below are questions/concerns that I have after reviewing the article followed by specific suggestions for revision:

1. Need to make a better case for why women only were in need of study. It is true that women have additional risk factors, different symptom experiences, and worse outcomes including complications post-PCI. However, the case needs to be made for why adherence may be different conceptually to render a sub-study beyond the combined parent study (of both genders).

- In this study, the authors will emphasize adherence to treatment especially in female aspect based on the aspects presented in the background section; page 2, lines 17-24, 29-36, page 4, lines 35-40.

2. The variable "physician support" reduces the providers only to MDs as written. Is this the intent? Or the way the question items were written? Or should it be more inclusive to advanced practice registered nurses" - if those are roles in your country. If this is exclusive to MDs then suggest to add to the discussion that implications may extend to other providers - or that future research should consider the role of other providers/clinicians beyond MDs alone.

- There were three separate sumvariables, which measured support from health care professionals or next of kin in this study:
 - ✓ The first sumvariable measured support from next of kin
 - ✓ The second sumvariable measured support from nurses (In Finland were don't have systematically advanced nursing practise in medical wards or cardiac care units),
 - ✓ The third sumvariable measured support from physicians.
- Support from physicians and informational support as a part of social support were only statistically significant forms of support in the theoretical model presented in this study.
- Added to discussion: "Support from physicians was directly associated with adherence to secondary prevention treatment. The therapeutic relationship between patients and physicians is an important predictor for adherence to treatment in the acute phase after PCI.⁵⁵ ; page 11, lines 35-45.

3. At the end of the text (after limitations): Need a final conclusion; just left the reader hanging after the limitations.

- This section has been rearranged according to the reviewer's suggestion; page 12, line 13-35.

Specific suggestions to sections:

Abstract:

1. Second sentence: Instead of "Female patients' coronary heart disease has special..." make it "Coronary heart disease in women has special ..."

- The second sentence has been rewritten according to reviewer's suggestion. Page 1, lines 13-14.

2. Third sentence: "several" complications is vague.

- Word "several" has been removed

3. Methods: in the abstract not as clear that this is a substudy of the 416 parent study.

- The sentence in the method section has been improved: page 1, line 37.

4. Conclusion next to last sentence - end of it - is worded awkwardly "have to be individually planned" (do you mean take into account individual or unique differences).

- This sentence has been rewritten according to reviewer's suggestion; page 2, lines 1 –3.

5. Conclusion last sentence - change "rather than to rely on only the sharing information" to say something like "rather than to rely on education alone to improve adherence" (you still need to provide individualized education to improve adherence).

- This sentence has been rewritten according to reviewer's suggestion; page 2, line 5.

Body of the paper:

6. Background: first sentence in that section: need a reference.

1. The references have been added, page 2, line 16. The original reference: Townsend N, Wilson L, Bhatnagar P, et al. Cardiovascular disease in Europe: epidemiological update 2016. *Eur Heart J*. 2016; 37(42):3232–3245 has been changed newer according to reviewer's comment 44 b.

7. Line 41, adherence to secondary prevention treatment

- This sentence has been rewritten according to reviewer's suggestion; page 2, line 50.

8. Line 43, should be "adherence to treatment is conceptualized according to the Kyngas theory..."

- This sentence has been rewritten according to reviewer's suggestion; page 2, line 55.

9. Line 48: spell out PCI first time

- This sentence has been rewritten according to reviewer's suggestion; page 2, line 59.

10. Line 53 and throughout paper: you go back and forth with "physical exercise" and "physical activity". Likely you mean "physical activity". Need consistency with terms.

- The term "physical activity" has corrected systematically throughout the manuscript.

11. Also line 56: better to say "and smoking cessation, when applicable, as well as reduced alcohol consumption"

- This sentence has been rewritten according to reviewer's suggestion; page 3, lines 3 – 5.

12. Page 3, line 9: dyslipidemia (instead of "hypercholesterolemia").

- This sentence has been rewritten according to reviewer's suggestion; page 3, line 15.

13. Line 26: chronic kidney disease instead of chronic renal insufficiency. remove "congestive" in front of "heart failure"

- This sentence has been rewritten according to reviewer's suggestion; page 3, line 35.

14. Line 51: typo "compered" should be "compared"

- The typo corrected; page 3, line 55.

15. Page 4, line 4: this statement worded awkwardly "low level of social support reduces good prognoses..."

- This sentence has been rewritten "Low social support...."; page 4, line 7.

16. line 9-11: when you say PCI is the treatment of choice, as compared to what? CABG? medication? And would this be for Primary revascularization for a STEMI indication or for elective cases? This needs clarification since it is patient specific (and trial specific indications that you site).

- This sentence has been clarified; page 4, lines 13-18.

17. Line 27: does "secondary prevention" go with "adherence to secondary prevention treatment"

- Authors think, that "adherence to secondary prevention treatment" could be also suitable, but the concept *adherence to treatment* is according to the original definition in the Theory of adherence of patients with chronic disease. Additionally, this concept has been systematically used in other studies regarding this theory. So, we prefer to keep concept *adherence to treatment* also in this study.

18. Line 32: see earlier comment about providers versus physicians

- Please, see the answer number 2.

19. Line 49: see earlier comment on why would it be different than the parent study with men and women. Need to make a better case.

- Please, see the answer number 1

20. Page 5, line 22: The final response rate was 80% (n=416). Add "for the parent study" to the end of that sentence.

- This sentence has been rewritten according to reviewer's suggestion; page 5, line 36.

21. line 25: add "coronary" in front of angioplasty and "coronary artery stenting procedure" in the next part.

- This sentence has been rewritten according to reviewer's suggestion; page 5, line 38-43.

22. Line 27: how was "a diagnosed memory disorder" determined? (or can you give an example).

- The nurse recruiting patients familiarized herself with the patient's medical record and health records. If there was no diagnosis or suspicion of memory disease (e.g dementia, Alzheimer), the patient could be accepted for the study.; page 5, lines 40-43.
- An example has been added; page 5, line 40-43.

23. Page 6, line 11: with "0" meaning what as compared to "100" in that scale.

- 0 = the worst imaginable adherence to treatment, 100 = the best imaginable adherence to treatment. Added to the text; page 6, lines 25-27.

24. Line 31: did the questions include other symptoms beyond what to do for chest pain?

- This question was formatted as follows: "I have received information on how should I do if I experience chest pain"

- Another question was whether patients have been informed of coronary artery disease and the symptoms of CHD. It is assumed that in this context they should be told the different types of the symptoms of CHD.

25. Line 34: should it be "physical activity" versus "physical exercise"?

- The term "physical activity" has corrected systematically throughout the manuscript.

26. Line 36: add "cardiac" in front of rehab

- This sentence has been rewritten according to reviewer's suggestion; page 6, line 52.

27. Page 7, line 9: confusing that these statement says "five years after PCI" and your study is 4 months post-PCI. Do you mean the five years part for when the instrument was originally developed? Need to clarify.

- I am sorry, this is mistake, which has been corrected; page 7, line 23.

28. Page 8, line 59: not says "physical activity" (need to be consistent)

- The term "physical activity" has corrected systematically throughout the manuscript.

29. Page 9, line 9: was odd that it says ' $0.001 < p$ ' (is that backwards?)

- The spelling mistake has been corrected: $p < 0.001$, page 9, line 17.

30. Line 55, add "post-PCI at the end of the first sentence under discussion.

- The term post-PCI' has been added; page 10, lines 1-2.

31. Line 60: last part of that line "assumed their adherence to treatment was.." was this measured? Is this an assumption on the authors' part?

- The original sentence is reformulated. The purpose is to say so that that female patients perceived adherence to treatment was at a high level. However, there was a significant conflict between respondents' perceived adherence to a healthy lifestyle and the health behaviours they reported; page 10, line 2-7.

32. Page 10: line 4: end of that statement "rather than to only share information" can be revised to say "rather than informational support/knowledge only" (or something like that). Seems you are trying to say that information alone is not enough but you can not go without it.

- This sentence has been rewritten according to reviewer's suggestion; page 10 line 12.

33. Line 19: physical activity or exercise? (not the same)

- The term "physical activity" has corrected systematically throughout the manuscript.

34. Line 34: "i.e. to do much more than just share information" awkwardly stated. See suggestions from comments about abstract.

- This sentence has been rewritten according to reviewer's suggestion; page 10, line 12.

35. Line 42: do you mean "motivational interviewing approach"

- The term "motivational interviewing approach" has been corrected; page 10, line 50.

36. Line 46: could say "motivational effort are within nurses' scope of practice, there is a need..."

- The expression has been rewritten according to reviewer's suggestion; page 10, line 55.

37. Line 49: and evaluation for who?

- Word "evaluation" has been removed.

38. Line 49: benefits of motivational working. Do you mean "benefits of motivational interviewing"?

- The expression has been rewritten according to reviewer's suggestion; page 10, line 60.

39. Page 11: line 7: take out "strongly" in front of "documented".

- This sentence has been rewritten according to reviewer's suggestion, word "strongly" has been removed.

40. Line 15: Change "Evidently" to "Thus, it is important to screen for anxiety and depressions..."

- This sentence has been rewritten according to reviewer's suggestion; "thus" has been added and "evidently" removed; page 11, line 23.

41. Line 22: ? physical activity?

- The term "physical activity" has corrected systematically throughout the manuscript

42. Line 60 (last line): should be "because patients are discharged generally.."

- This sentence has been rewritten according to reviewer's suggestion; page 12, line 1.

43. Page 12: (last page of text): line 1: change to "because of this rapid turnover, patients..."

- This sentence has been rewritten according to reviewer's suggestion; page 12, line 2.

44. References:

ref 1. anything newer than 2016?

- Newer reference has been added.

ref 8. any newer reconceptualization of the model (this is nearly 20 years old and was with youth). Likely adherence conceptualizations have been dynamic in the past two decades.

- Kyngäs developed the Theory of Adherence of People with Chronic Disease originally in 1999, where she states the factors associated with adherence among young diabetics.
- The theory has been modified and used among different patient groups during the past decades among different patient groups, which differ according to disease and the patient's

age. The modifications concern the disease-associated self-care demands, such as medication and support factors.

- References 9-11, have been added.

Clinical Pearls: First bullet: "adequate support" is vague. Which type of support (since there were three types in the conceptualization).

- Corrected

Figure 1: why the two different colors?

- The light green color describes the connections of the background variables to females adherence to treatment.

Typo: fomr is not spelled correctly perhaps

- Typos have been corrected in the Figure 1.

Figure 2: typo: physicians seems not spelled correctly

- Typo has been corrected in the Figure 1.

Table 1: refers to physical activity so you likely mean that throughout the paper versus physical exercise.

- The term "physical activity" has corrected systematically throughout the manuscript

Thank you for the opportunity to review your paper on an important topic.

Title page

Title: Adherence to treatment of female patients with coronary heart disease after a percutaneous coronary intervention

Authors:

Kähkönen Outi, PhD, RN, Department of Nursing Science, University of Eastern Finland,
outi.kahkonen@uef.fi Tel. +35840866956 (Corresponding author)

Saaranen Terhi, PhD, RN, PHN, Docent, Department of Nursing Science, University of Eastern
Finland, terhi.saaranen@uef.fi Tel. +358500940242

Kankkunen Päivi, PhD, RN, Docent, Department of Nursing Science, University of Eastern
Finland, paivi.kankkunen@uef.fi, Tel. +358408211984

Miettinen Heikki, PhD, MD, Docent, Kuopio University Hospital, heikki.miettinen(at)kuh.fi, Tel.
+35844 711 3950

Kyngäs Helvi, PhD, RN, Professor, Department of Health Science, University of Oulu,
helvi.kyngas(at)oulu.fi, Tel. +3580294485604

Statistical supervision: Pertti Töttö, professor, Department of Social Science, University of
Eastern Finland, pertti.totto@uef.fi

Acknowledgment: We gratefully acknowledge the members of the PCICARE study group: M-L.
Paananen, RN and M. Kivi, RN, Central Finland Central Hospital ; P. Jussila, RN and I. Juntunen,
RN, North Karelia Central Hospital; M. Lehtovirta, RN and E. Pursiainen, RN, Päijät- Häme
Central Hospital; A. Ruotsalainen, RN and R-L. Heikkinen, RN, Kuopio University Hospital; K.
Peltomäki, RN and V. Räsänen, Heart Hospital Tampere. We also acknowledge professor Pertti
Töttö for statistical advice. Additionally, we would like to thank nurses and all the patients who
participated in the present study.

Ethical approval: Ethical review board of University Hospital of Kuopio: ref 74/2012.

Conflict of interest: No conflict of interest has been declared by the authors.

Funding source: The present study has no funding

Words: 2900 without abstract, figures, and tables

Figures: two

Tables: one

Keywords: coronary heart disease, percutaneous coronary intervention, adherence to treatment,
female patients

Figure 1

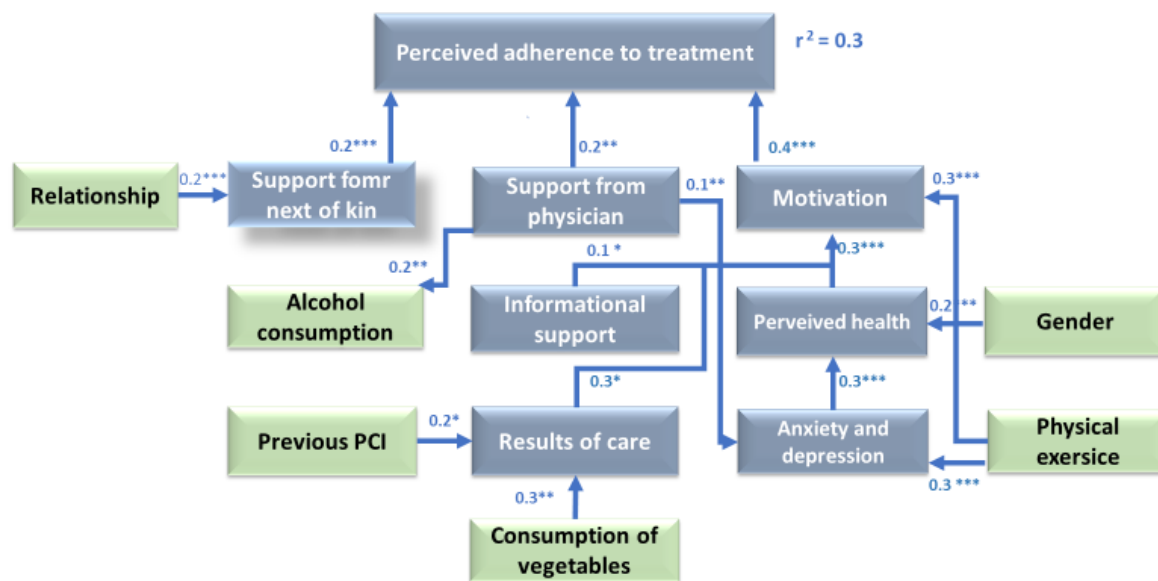


Figure 1: Model of adherence to treatment of patients with CHD after PCI (Note *p < 0.05, **p < 0.01, *** p < 0.001).

Adapted and modified based on the dissertation: Adherence of Patients with Coronary Heart Disease after a Percutaneous Coronary Intervention (Kähkönen 2017).

Figure 2

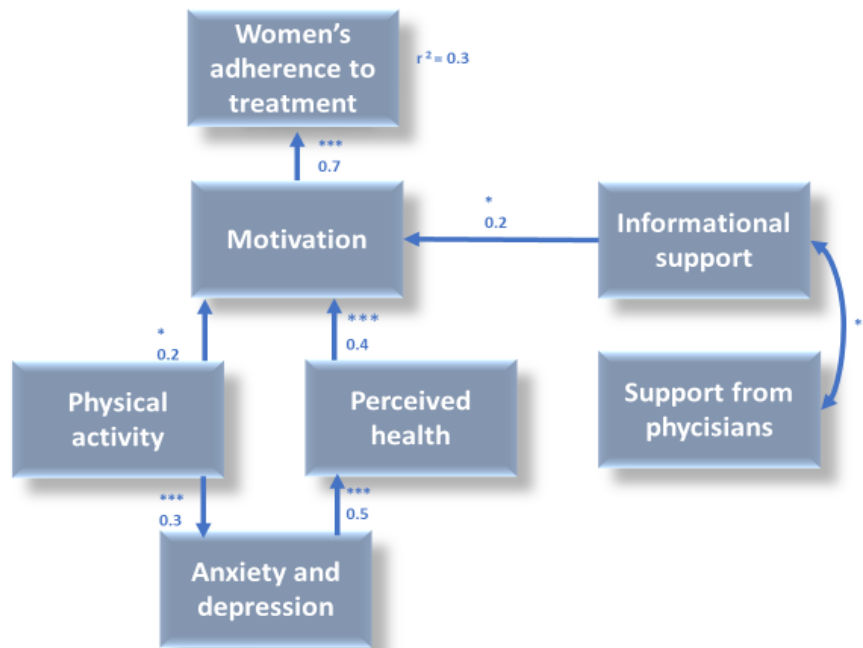


Figure 2. Females' adherence to treatment: the model of adherence to treatment of female patients with CHD after percutaneous coronary intervention. (Note * $p < 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$).

Table 1. Sociodemographic, health behavioural, and disease-specific background information of female patients with CHD after PCI: % (n), mean, median, range, standard deviation (SD), missing data %(n) (n = 102).

Factors	%(n)	Mean	Median	Range	SD	Missing %(n)
<i>Sociodemographic</i>						
Age (years)		65.1	65.5	42 – 75	7.5	2.0(2)
Marital status						0.0(0)
Relationship	67.6(69)					
No relationship	32.4(33)					
Length of education (years)		11.4	11.0	5 – 24	3.6	6.9(7)
Profession						0.0(0)
Worker	37.3(38)					
Clerical worker	22.5(23)					
Entrepreneur or farmer	18.9(19)					
Uneducated worker	21.6(22)					
Employment status						0.0(0)
Retired	79.4(81)					
Employed	15.7(16)					
Unemployed	4.9(5)					
<i>Health behavioural</i>						
Physical activity (30 min per day)						0.0(0)
High (>3 times per week)	42.2(43)					
Moderate (1–3 per week)	43.1(44)					
Occasionally	14.7(15)					
Vegetable consumption		3.0	3.0	0 – 5	1.4	0.0(0)
Alcohol consumption						0.0(0)
≤2 portions per day	24.5(25)					
>2 portions per day	52.9(54)					
Not at all	22.5(23)					

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65

Smoking		0.0(0)				
No	86.3(88)					
Yes	13.7(14)					
<i>Disease-specific</i>						
Systolic blood pressure		129.9	132.0	90 – 180	5.8	5.9(6)
Diastolic blood pressure		74.9	75.0	50 – 94	15.3	5.9(6)
Total cholesterol		4.0	3.9	2.4 – 6.6	0.8	29.4(30)
LDL-cholesterol		2.2	2.1	0.7 – 5.0	0.8	33.3(34)
History of CHD		3.5	0.6	0.3 – 28	5.8	8.8(9)
Previous AMI						1.0(0)
No	68.6(70)					
Yes	30.4(31)					
Previous PCI						0.0(0)
No	83.3(85)					
Yes	16.7(17)					
Previous CABG						1.0(1)
No	87.3(89)					
Yes	11.8(12)					

Abbreviations: CHD = coronary heart disease; AMI = acute myocardial infarction; PCI = percutaneous coronary intervention; CABG = coronary artery bypass grafting

1 **What's New and Important**

- 2 • Motivation, support from next of kin, and support from physicians are predictors
- 3 for female patients' perceived adherence to treatment.
- 4 • Secondary prevention programs and patient education should take into account
- 5 gender specific needs.
- 6 • It is important to emphasize physical activity as a part of secondary prevention,
- 7 because it associated with better perceived health and lower anxiety and
- 8 depression.

Adherence to treatment of female patients with coronary heart disease after a percutaneous coronary intervention

Background: Adherence to treatment is essential to prevent progression of coronary heart disease, which is the most common cause of death among females. Coronary heart disease in women has special characteristics: the conventional risk factors are more harmful to females than males, accumulation of risk factors is common, and women have nontraditional risk factors such as gestational diabetes and preeclampsia. Additionally, worse outcomes, higher incidence of death, and complications after percutaneous coronary intervention have been reported more often among females than among male patients.

Objective: To test a model of adherence to treatment among female patients with coronary heart disease after a percutaneous coronary intervention.

Methods: A cross-sectional, descriptive and explanatory survey was conducted in 2013 with 416 CHD patients, of which the 102 female patients were included in this sub-study. Self-reported instruments were used to assess female patient adherence to treatment. Data were analyzed using descriptive statistics and a structural equation model.

Results: Motivation was the strongest predictor for female patients' perceived adherence to treatment. Informational support, physician support, perceived health, and physical activity were indirectly, but significantly, associated with perceived adherence to treatment via motivation. Furthermore, physical activity was positively associated with perceived health, while anxiety and depression were negatively associated with it.

Conclusions: Secondary prevention programs and patient education have to take into account individual or unique differences. It is important to pay attention to issues that are known to contribute to motivation rather than to rely on education alone to improve adherence.

Keywords: Coronary heart disease, percutaneous coronary intervention, adherence to treatment

Background

Coronary heart disease (CHD) is the most common cause of cardiovascular disease (CVD), which is the leading cause of death worldwide.¹⁻² Traditionally CHD has been understood as a male public health problem, thus the majority of the evidence is based on the male-based population studies. However, the prevalence of CHD is decreasing among men and is becoming an important chronic disease and major cause of death among women. The proportion of all deaths attributable to CHD is higher in women than in men, accounting for 49% of all deaths in women and 40% of all deaths in men in Europe.¹ This trend will continue in the future, because the life expectancy of women is higher than men, especially in developed countries. Consequently, the proportion of women with CHD will continue to grow and focus on older women.³

Females present with CHD approximately 10 years later than men. A potential explanation is assumed to be a protective effect from estrogens prior to menopause.⁴⁻⁵ Men over 65 years old have double and women triple the risk of CHD occurrence compared to those under 65 years of age.⁶⁻⁷

Considering the chronic nature of CHD, adherence to secondary prevention measures is essential to prevent CHD progression and improve prognosis. In this study, adherence to treatment was conceptualized according to the Kyngäs theory of adherence of people with chronic disease, which emphasizes an active, intentional and responsible process of care in which CHD patients after percutaneous coronary intervention (PCI) work to maintain their health in collaboration with healthcare professionals.⁹ Adherence includes adherence to medication and to a healthy lifestyle, such as diet, physical activity, and smoking cessation, when applicable, as well as reduced alcohol consumption.⁸⁻¹¹

Adherence to treatment, and in particular to a healthy lifestyle, of female CHD patients after PCI is important—it is associated with a significantly decreased risk of CHD among females with high genetic risk.¹² Additionally, conventional CHD risk factors, such as smoking, hypertension and dyslipidemia, have been found to be more harmful to women than to men regarding the development and progression of CHD. The accumulation of risk factors and an increasing prevalence of hypertension, obesity, and diabetes are more common in women than in men.¹²⁻¹³ Of concern is that females are often unaware of their risk for CHD.¹⁴ Additionally, women have unique risk factors such as gestational diabetes and preeclampsia,¹⁵ which are related to a 2- to 3-fold risk of CHD in advanced age females.¹⁵ Moreover, women diagnosed with CHD tend to have more co-morbidities, including diabetes, atrial fibrillation, chronic kidney disease, peripheral arterial disease and heart failure hypertension, at the time of the presentation of CHD compared to men.^{12,17}

The issues related with CHD pathophysiology, prognosis, conventional risk factors, and medication have been thoroughly studied.¹⁸⁻¹⁹ Additionally, the association between certain psychological factors and CHD has gained increased attention, especially in long-term chronic conditions where full recovery is unlikely.²⁰ In particular, perceived health²¹ and social support²² have been points of interest. Perceived health describes patients' perceptions of their own health and health-related quality of life.²¹ Poor perceived health is an independent predictor for mortality²³ and morbidity²⁴, as well as new cardiac events, for patients with CHD.²⁵ Women perceive their health as worse^{21,26} and report anxiety and depression more often compared to men after PCI.²⁷

Social support has been defined as a dynamic interpersonal process centered on the reciprocal exchange of information which changes across contexts. Social support is manifested between providers and recipients; depending on its context, social support might

appear multifaceted.²⁸ Low social support reduces good prognoses among patients with CHD and is related with higher mortality in patients with CHD.^{22,29}

PCI as a revascularization method has become the treatment of choice for CHD compared with coronary artery bypass grafting (CABG) in acute and elective care settings when it is medically possible and justified. PCI leads to a more rapid recovery and short-term improvements in overall health status.³⁰ However, worse outcomes, higher incidence of death, and several complications after PCI have been reported more often among females than males,³¹ and women have a higher mortality rate after primary PCI than men.³²

Because CHD in women has unique manifestations, it is important to identify how women adhere to secondary prevention recommendations and which factors are associated with adherence. Additionally, knowledge of coronary risk factors is relatively poor in women,³³ informational needs are different, and being a woman is a factor associated with non-participation in secondary prevention programs.³⁴

Adherence to treatment among CHD patients after PCI has been found to be associated with motivation, support from physicians and next of kin, informational support, results of care, perceived health, anxiety and depression, close relationships, alcohol consumption, previous PCI, the consumption of vegetables, physical activity and gender (Figure 1).³⁵

Evidence in respect to adherence to treatment of women with CHD after PCI is scant yet adherence to treatment is a key factor regarding better prognosis of CHD. Therefore, the major objective of this study was to examine explanatory factors for adherence to treatment among females with CHD after PCI. This study is based on an earlier study of adherence to treatment³⁵ with the aim of testing whether the empirical data from female patients with CHD after PCI would fit the proposed model of adherence to treatment after PCI

(Figure 1). The specific hypothesis was that the model of adherence to treatment of patients with CHD after PCI is suitable for assessing adherence to treatment and associated factors among female patients.

Methods

This cross-sectional explanatory and descriptive sub-study was part of a larger adherence study. Hospitalized adults aged 18 – 75 years with CHD were recruited from medical wards after PCI at two university hospitals and three central hospitals in Finland in 2013. The final response rate for the parent study was 80% (n = 416). Out of this total population, 102 were female and are the subject of the current sub-study. Both coronary angioplasty and coronary artery stenting procedure were included in the elective and acute settings. An exclusion criterion was a diagnosed memory disorder, e.g dementia or Alzheimer's disease.

Ethical approval to conduct this study was received (Kuopio University Hospital; ref no. 2013-170). A registered nurse evaluated patients' suitability for participation based on the inclusion and exclusion criteria, provided verbal and written information about the study, and asked patients if they were willing to participate in the study during the patients' hospitalization. The survey was conducted by postal questionnaire four months after PCI.

Measurements

The *adherence to treatment of patient with chronic disease (ACDI) instrument* is based on a theoretical model of chronically ill patients developed and tested by Kyngäs (1999). The ACDI includes 38 items measuring adherence to treatment. According to the original theory of adherence of people with chronic disease, adherence to treatment consisted of two mean sum

variables: adherence to medication and a healthy lifestyle. These two variables were composed of nine mean sum variables: responsibility, motivation, cooperation, results of care, fear of complications, sense of normality, support from next of kin, support from nurses and support from physicians.⁵ Earlier studies have found the validity and reliability of the instrument high. Cronbach's alpha has ranged from 0.69 to 0.91.^{8,10-11,36} Additionally, the adherence visual analogue scale (A-VAS) instrument developed by Kähkönen et al. (2018), wherein the respondent evaluates his/her adherence to treatment on a scale from 0 (the worst imaginable adherence to treatment) to 100 (the best imaginable adherence to treatment), was also used to evaluate the level of adherence to treatment. Statistical details have been previously presented.³⁵

The *Social Support of People with Coronary Heart Disease (SSCHD) instrument*⁴¹ was used to examine social support (informational, emotional and functional support) among patients with CHD after PCI. The SSCHD instrument is based on the Cohen and Wills' (1985) theory of social support. According to the theory, social support consists of three dimensions: informational, emotional and functional support.³⁸ The dimension of informational support consists of items about respondents' perceived information regarding CHD, knowledge of their own risk factors, advice on risk factors, advice on what to do in case of chest pain, information on medications, advice on physical activity after PCI, and information on the continuum of care and cardiac rehabilitation. The dimension of emotional support includes items regarding respondents' perceived support from family, friends, and other cardiac patients, and perceived importance to their next of kin. The items for the dimension of functional support are related to cooperation with healthcare professionals, opportunities to ask about issues of concern, and feeling supported and cared for. The construct validity of the instrument was verified with an explanatory factor analysis (EFA) using Principal axis factoring and Promax rotation. Three factors explained 59% of the total variance, communalities in all items were >0.30, and the factor loadings of

all variables varied between 0.34–0.86. Internal consistency of the mean sum variables was evaluated by Cronbach’s alpha values and was 0.78, indicating an acceptable value.³⁹ The complete SSCHD instrument has been previously presented.³⁷

The *EuroQoL five-dimensional scale (EQ-5D-5L)* and *EuroQoL visual analogue scale (EQ-VAS)* were used to examine the perceived health of CHD patients four months after PCI. The EQ-5D-5L and EQ-VAS are widely used validated instruments; they consist of five items addressing five dimensions of health: mobility, self-care, usual activities, pain/discomfort and anxiety/depression.⁴⁰⁻⁴¹

Data analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS 24) software for Windows, and Analysis of Moment Structures (AMOS) version 24. Descriptive statistics were used to describe the characteristics of the sample (mean, standard deviation [SD], ranges and median). The compatibility of the theoretical model of adherence to treatment was tested among female patients using structural equation modelling (SEM), which is a suitable method for testing the relationship between the theoretical description and the concepts. The SEM software programs provide several statistical indices to evaluate the fit of the model. However, there is lack of consensus on the best indices. The goodness of fit and the correspondence between the theoretical model and observed correlation matrix in this study were tested with generally used modification indices: chi-square tests and their derivatives, Hoelter's “critical N,” the root mean square error of approximation (RMSEA) and the comparative fit index (CFI) were employed. A sufficiently good model should have a CFI of 0.90 and RMSEA 0.06 – 0.07. The standardized estimates were reported with correlations (standardized covariance) and path coefficients. The effect of standardized estimates is

interpreted as weak if their values are < 0.10 . Estimates with a medium effect have values ~ 0.30 and estimates with a value > 0.50 are interpreted as having a major effect.⁴²

Results

Characteristics of the participants

The sample in the present study consists of 102 female patients (Table 1) with CHD four months after PCI. The mean age of the female respondents was 65.1 years (range 42 – 75, SD 7.4). Regarding health behavior, 13.7 % were smokers, 52.9% used alcohol more than two portions per day, 14.7% engaged in 30 minutes of physical activity at least three times a week, and 19.8% consumed vegetables in their diet, eating at least the recommended five deciliters per day.

The mean value of adherence to treatment among female respondents was 87.2 (range 40.0 – 100.0, SD 11.4), which was lower than adherence to treatment among the whole sample (87.8, range 40 – 100, SD 11.4). Although the difference in the level of adherence to treatment between the groups was not statistically significant, a different model explained perceived adherence to treatment among the female patients with CHD after PCI compared with the whole sample, in which both genders were represented (Figure 3).

To start, the original model of adherence to treatment was used with women's data using standardized regression weights (Figure 1). Direct positive associations between female respondents' adherence to treatment and motivation, support from physicians and support from next of kin were tested. Additionally, the indirect associations for female respondents' adherence to treatment—informational support, results of care and perceived health, anxiety and depression, marital status, alcohol consumption, previous PCI, gender, physical activity, and consumption of vegetables—were tested. In each step, error terms were

specifically related to the items to depict prospective measuring error. In the first step, the outlined structural equation model with standardized estimates indicated an unacceptable model fit: $\chi^2 = 1898.83$, $df = 933$, $p < 0.001$, $\chi^2/df = 1.94$, $TLI = 0.84$, $CFI = 0.87$, $RMSEA = 0.34$, indicating that the hypothesized model of adherence to treatment did not fit the empirical data from female respondents.⁴⁶

In the next step, based on the standardized estimates, statistically insignificant variables were removed from the model one by one. In the definitive model analysis, a direct positive relationship was found between female respondents' adherence to treatment and motivation. The standardized path coefficient indicated a major effect ($\beta = 0.7$) in terms of direct association between motivation and females' adherence to treatment. Furthermore, informational support and support from physicians were indirectly, but significantly, associated with motivation. Additionally, physical activity and perceived health were associated with motivation. Physical activity was positively associated with anxiety and depression, which were negatively associated with perceived health. Indirect path coefficients indicated a medium effect ($\beta = 0.2 - 0.4$). The definitive structural equation model with standardized estimates indicated an acceptable model fit: $\chi^2 = 888.59$, $df = 399$, $p < 0.001$, $\chi^2/df = 2.23$, $TLI = 0.90$, $CFI = 0.91$, $RMSEA = 0.40$. In this model, Hoelter's "critical N" test rejected the null hypothesis. However, the model would be acceptable with up to 5% of risk, if $n = 84$.⁴²

Discussion

To the best of our knowledge, the present study is the first to test females' post-PCI patient's adherence to treatment. Our findings indicated that female patients perceived their adherence to treatment to be high. However, there was a conflict between respondents' perceived adherence to treatment and the health behaviours they reported. Therefore, it is of

paramount importance to focus on the issues that are known to contribute to females' adherence to treatment, rather than informational support or knowledge only.

In the present study, the strongest explanation for females' adherence to treatment was motivation, as has been the case in several previous studies related to adherence to treatment of chronically ill patients.^{8-11,35-36} A new finding from our study is that females' motivation for adherence was explained by support from physicians, informational support, assessment and counseling related to self-care for risk factors, identification of symptoms, medication, physical activity, follow-up treatment and rehabilitation. Commonly, patients with CHD face the need to change multiple behaviors; therefore, identifying the behavior that is most important to the patient is a useful strategy.⁴³ Although informational support has a mediation association to adherence via motivation, it is of paramount importance to include individual and patient-centered motivational elements, such as assessment, counselling, prescribed and supervised exercise training, risk factor control and psychosocial support.⁴⁴⁻⁴⁵

Insufficient informational support as a form of counseling is a major reason for a reduced understanding of risk factors and the seriousness of CHD, which leads to reduced motivation for self-care.¹⁴ The motivational interviewing approach as a tool for professionals is a useful method for counseling and support for behavior change.⁴⁶ Because the key factors that promote motivation are within nurses' scopes of practice, there is a need for appropriate training of nurses so that they can provide appropriate counseling using motivation promoting approaches. However, while the evidence of the benefits of motivational interviewing is strong, the evidence about the long-term effects on clinical and psychological outcomes is limited and further research is needed.⁴³

Women's motivation to adhere to treatment was also explained by perceived health. According to the current view, perceived health is a strong predictor of long-term

clinical outcomes in patients with CHD,²⁰ which highlights the importance of including patients' subjective experiences of their perceived health as part of an overall strategy for enhancing clinical management to reduce the risk of adverse events.²¹

In this study, anxiety and depression were predictors of worse perceived health. Anxiety and depression are associated with increased risk for new cardiac events, poor prognosis and mortality,⁴⁷ worse self-care, and worse functional capacity among CHD patients.^{19,48} Thus, it is important to put effort into the identification of anxiety and depression among post-PCI patients.⁴⁹ The results in this study confirmed the association between physical activity and anxiety and depression, which has been widely demonstrated previously: physical activity may alleviate depressive symptoms in patients with CHD and reduces mortality risk.⁴⁹

In this study, support from nurses did not predict adherence to treatment directly. This emphasizes the importance of the therapeutic relationship between patients and physicians in the acute phase after PCI.⁵⁰ Nurses' support in this study was provided through informational support. Direct support from nurses may be highlighted in follow-up care promoting secondary prevention, which is often arranged by nurses.

The present study has some methodological limitations. The cross-sectional design of the study may be a limitation, because causality and generalizability can't be assumed. The recruitment process is also a potential limitation, because patients usually are discharged 24 hours after PCI. There is a risk that because of this rapid turnover, patients who met the inclusion criteria for the study were not included. Finally, in self-reported data collection methods, there is always a risk of the social desirability effect, in which patients provide answers they think are favourable instead of saying what they actually do or think.

Conclusion. Motivation was the strongest predictor of female patients'

adherence to secondary prevention strategies after PCI. Female patients' adherence to treatment was not associated with close relationships or the support of next of kin.

Additionally, previous PCI or consumption of vegetables was not associated with adherence to treatment, and the role of support from physicians was different among female patients compared to the general model of adherence to treatment.³⁵ Informational support, physician support, perceived health, and physical activity were indirectly, but significantly, associated with perceived adherence to treatment via motivation. These findings support the evidence that secondary prevention programs and patient education have to take into account individual or unique differences. It is important to pay attention to issues that are known to contribute to motivation rather than to rely on education alone to improve adherence.

References

1. European Cardiovascular Disease Statistics 2017 edition.
<http://www.ehnheart.org/cvd-statistics/cvd-statistics-2017.html>
2. Benjamin EJ, Virani SS, Callaway CW, et al. on behalf of the American Heart Association Council on Epidemiology and Prevention Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2018 update: a report from the American Heart Association [published online ahead of print January 31, 2018]. *Circulation*. 2018; DOI: 10.1161/CIR.0000000000000558.
3. Hamill S, Ingram N. Gender disparities: assessment and treatment of coronary heart disease. *Br J Card Nurs*. 2015; 10(10):494-502.
4. Haapalahti P, Mikkola T. Health of the blood vessels of an aging woman. *Duodecim*. 2015; 131:1493–1498.
5. Maas AH, Appelmale YE. Gender differences in coronary heart disease. *Neth Heart J*. 2010; 18(12):598–606.
6. Global, regional, and national age-sex specific all-cause and causes specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2015; 385(9963):117–171.
7. Claassen M, Sybrandy KC, Appelmale YE, Asselbergs FW. Gender gap in acute coronary heart disease: Myth or reality? *World J Cardiol*. 2012; 4(2):36-47.
8. Kyngäs HA. Theoretical model of compliance in young diabetics. *J Clin Nurs*. 1999; 8(1):73–80.
9. Kähkönen O, Kankkunen P, Saaranen T, Miettinen H, Kyngäs H, Lamidi ML. Motivation is a crucial factor for adherence to a healthy lifestyle among people with coronary heart disease after percutaneous coronary intervention. *J Adv Nurs*. 2015; 71(10):2364 – 2373.

10. Oikarinen A, Engblom J, Kääriäinen M, Kyngäs H. Risk factor-related lifestyle habits of hospital-admitted stroke patients – an exploratory study. *J Clin Nurs*. 2015; 24(15–16):2219–2230.
11. Kähkönen O, Saaranen T, Kankkunen P, Lamidi ML, Kyngäs H, Miettinen H. Predictors of adherence to treatment by patients with coronary heart disease after percutaneous coronary intervention. *J Clin Nurs*. 2018; 27(5-6):989–1003.
12. Tairova MS, Graciolli LO, Tairova OS, De Marchi T. Analysis of cardiovascular disease risk factors in females. *Open Access Maced J Med Sci*. 2018; 146(8):1370 – 1375.
13. Garcia M, Mulvagh SL, Merz NB, Buring JE, Maleson JE. Cardiovascular disease in women: clinical perspectives. *Circ Res*. 2016; 118(8):1273–1293.
14. Lauck S, Johnson JL, Ratner PA. Self-care behaviour and factors associated with patient outcomes following same-day discharge percutaneous coronary intervention. *Eur J Cardiovasc Nurs*. 2009; 8(3):190 – 199.
15. Patel AR, Kramer CM. Assessing cardiovascular risk in females: a growing body of evidence. *J Am Coll Cardiol*. 2013; 62(20):1866 – 1879.
16. Fraser R, Whitley GS, Johnstone AP, et. al. Impaired decidual natural killer cell regulation of vascular remodelling in early human pregnancies with high uterine artery resistance. *J Pathol*. 2012; 228(3):322–332.
17. Alfredsson J, Stenestrand U, Wallentin L, et al. Gender differences in management and outcome in non-ST-elevation acute coronary syndrome. *Heart*. 2007; 93:1357–1362.
18. Perk J, Hambræus K, Burell G, Carlsson R, Johansson P, Lisspers J. Study of Patient Information after percutaneous coronary intervention (SPICI): should prevention programmes become more effective? *Eurointervention*. 2015; 10(11):1–7.

19. Piepoli MF, Hoes AW, Agewall S, et al. 2016 European guidelines on cardiovascular disease prevention in clinical practice. The Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of 10 societies and by invited experts). Developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR). *Eur Heart J*. 2016; 37(29):2315–2381.
20. Cepeda-Valery B, Cheong AP, Lee A, Yan BP. Measuring health related quality of life in coronary heart disease: The importance of feeling well. *Int J Cardiol*. 2011; 149(1):4–9.
21. De Smedt D, Clays E, Annemans L, et al. Health related quality of life in coronary patients and its association with their cardiovascular risk profile: Results from the EUROASPIRE III survey. *Int J Cardiol*. 2013; 168(2):898–903.
22. Barth J, Schneider S, von Kanel R. Lack of social support in the etiology and the prognosis of coronary heart disease: A systematic review and meta-analysis. *Psychosom Med*. 2010; 72(3):229 – 238.
23. Schenkeveld L, Pedersen SS, van Nierop JW, et al. Health-related quality of life and long-term mortality in patients treated with percutaneous coronary intervention. *Am Heart J*. 2010; 159:471–476.
24. Grool AM, van der Graaf Y, Visseren FL, et al. Self-rated health status as a risk factor for future vascular events and mortality in patients with symptomatic and asymptomatic atherosclerotic disease: The SMART study. *J Intern Med*. 2012; 272(3):277–286.

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
25. Rumsfeld JS., Alexander KP, Goff DC, et al. Cardiovascular health: the importance of measuring patient-reported health status: a scientific statement from the American Heart Association. *Circulation*. 2013; 127(22):2233–2249.
26. Kähkönen O, Saaranen T, Lamidi ML, Miettinen H, Kankkunen P. Perceived health among patients with coronary heart disease four months after a percutaneous coronary intervention. *Int J Caring Sciences*. 2017; 10:54–66.
27. Olsen SJS, Schirmer H, Wilsgaard T, et al. Cardiac rehabilitation and symptoms of anxiety and depression after percutaneous coronary intervention. *Eur J Prev Cardiol* 2018; 25:1017–1025.
28. Finfgeld-Connett D. Clarification of social support. *J Nurs Scholarship* 37, 4–9.
29. Compare A, Zarbo C, Manzoni GM, et al. Social support, depression, and heart disease: A ten years literature review. *Front Psychol*. 2013; 4:384.
30. Roffi M, Patron, Collet JP, et al. 2015 ESC guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation: Task Force for the Management of Acute Coronary Syndromes in Patients Presenting without Persistent ST-Segment Elevation of the European Society of Cardiology (ESC). *Eur Heart J*. 2016; 37(3):267–315.
31. Alfonso F, Hernández R, Bañuelos C, et al. Initial results and long-term clinical and angiographic outcome of coronary stenting in female. *Am J Cardiol*. 2018; 86(12):1380–138329.
32. Birkemeyer R, Schneider H, Rillig A, et al. Do gender differences in primary PCI mortality represent a different adherence to guideline recommended therapy? A multicenter observation. *BMC Cardiovasc Disord*. 2014; 14:71.

33. Tchicaya A, Lorentz N, Demarest S, Beissel J. Persistence of socioeconomic inequalities in the knowledge of cardiovascular risk factors five years after coronary angiography. *Eur J of Cardiovasc Nurs* 2018; 17(2):136–147
34. Ruano-Ravina A, Pena-Gil C, Abu-Assi E, et al. Participation and adherence to cardiac rehabilitation programs. A systematic review. *Int J Cardiol.* 2016; 223:436–443.
35. Kähkönen O. *Adherence to treatment of patients with coronary heart disease after a percutaneous coronary intervention.* Publications of the University of Eastern Finland. Dissertations in Health Sciences. Number 440. 2017.
36. Kääriäinen M, Paukama M, Kyngäs H. Adherence with health regimens of patients on warfarin therapy. *J Clin Nurs.* 2013; 22(1–2):89–96.
37. Kähkönen O, Kankkunen P, Miettinen H, et al. Perceived social support following percutaneous coronary intervention is a crucial factor in patients with coronary heart disease. *J Clin Nurs.* 2017; 26:1264–1280.
38. Cohen S, Wills, TA. Stress, social support, and the buffering hypothesis. *Psychological Bulletin.* 1985; 98:310–357.
39. Burns N, Grove SK. *The practise of nursing research. Conduct, critique & utilization.* 2nd edition. Philadelphia: WB Saunders Company; 2009.
40. Rabin R, de Charro F. EQ-5D: A measure of health status from the EuroQoL Group. The Finnish Medical Society Duodecim. *Ann Med.* 2001; 33(5):337–343.
41. Janssen MF, Birnie E, Haagsma JA, et al. Comparing the standard EQ-5D three-level system with a five-level version. *Value Health.* 2008; 11(2):275–284.
42. Schumacker RE, Lomax RG. *Beginner's Guide to Structural Equation Modelling.* 2nd edition. Mhwh, CA: Lawrence Erlbaum Associates; 200
43. Mesters I. Motivational interviewing: hype or hope? *Chronic Illn.* 2009; 5(1):3–6.

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
44. Kachur S, Menezes AR, De Schutter A, et al. Significance of comorbid psychological stress and depression on outcomes after cardiac rehabilitation. *Am J Med.* 2016; 129(12):1316–1321.
45. Chauvet-Gelinier JC, Bonin B. Stress, anxiety and depression in heart disease patients: A major challenge for cardiac rehabilitation. *Ann Phys Rehabil Med.* 2017; 60(1): 6–12.
46. Thompson DR, Chair SY, Chan SW, et al. Motivational interviewing: a useful approach to improving cardiovascular health? *J Clin Nurs.* 2011; 20(9-10):1236–44.
47. Kazukauskienė N, Burkauskas J, Macijauskienė J, et al. Distress factors and exercise capacity in patients with coronary artery disease attending cardiac rehabilitation program. *Int J Behav Med.* 2018; 25(1):38–48.
48. Nedeljkovic I. Assessment of depression and anxiety in patients before and after percutaneous coronary intervention: A step forward in cardiac rehabilitation? *Eur J Prev Card.* 2018; 25(10):1015–1016.
49. Blumenthal JA, Babyak MA, O'Connor C, et al. Effects of exercise training on depressive symptoms in patients with chronic heart failure the HF-ACTION *JAMA.* 2012; 308(5):465–474.
50. Du L, Don P, Jia J, et al. Impacts of intensive follow-up on the long-term prognosis of percutaneous coronary intervention in acute coronary syndrome patients - a single center prospective randomized controlled study in a Chinese population. *Eur J of Prev Cardiol.* 2016; 23:1077–1085.