Postprint: Model Development for Phase I Cardiac Rehabilitation Adherence and Influencing Factors in PCI Patients

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Abstract

Background The importance of Phase I cardiac rehabilitation following percutaneous coronary intervention (PCI) has been well-established; however, patient adherence remains suboptimal. Therefore, investigating adherence to Phase I cardiac rehabilitation and its influencing factors among PCI patients can provide a theoretical foundation for improving patient compliance.

Objective To identify the influencing factors of Phase I cardiac rehabilitation adherence and the pathways among these factors in PCI patients through structural equation modeling, thereby providing theoretical support for enhancing adherence.

Methods Using convenience sampling, 430 patients undergoing Phase I cardiac rehabilitation after PCI at a tertiary Grade A hospital in Harbin were surveyed from August to December 2021. Data were collected using a general demographic questionnaire, Cardiac Rehabilitation Adherence Questionnaire, Coronary Heart Disease Health Belief Questionnaire, Anxiety and Depression Scale, Family Adaptability and Cohesion Scale, and Chronic Disease Resources Questionnaire. Structural equation modeling was employed to analyze the relationships among influencing factors.

Results The structural equation model demonstrated good fit. Health belief, family adaptability and cohesion, and chronic disease resource utilization had direct positive effects on Phase I cardiac rehabilitation adherence (β=0.395, β=0.277, β=0.152, $p<0.01$); depression and anxiety had direct negative effects on adherence (β=-0.055, β=-0.166, $p<0.05$). Health belief and family adaptability and cohesion could exert indirect positive effects on cardiac rehabilitation adherence through chronic disease resource utilization (β=0.057, β=0.065, $p<0.01$), while also exerting indirect negative effects on cardiac rehabilitation adherence through anxiety and depression.

Conclusion Phase I cardiac rehabilitation adherence in PCI patients is influenced by multiple factors with complex pathway relationships among them. Health belief, anxiety, depression, family adaptability and cohesion, and chronic disease resource utilization all play significant direct or indirect roles in Phase I cardiac rehabilitation adherence among PCI patients.

Full Text

Abstract

Background: Percutaneous coronary intervention (PCI) is a primary treatment for coronary heart disease, yet patient adherence to cardiac rehabilitation remains poor. Exploring the factors influencing adherence to Phase I cardiac rehabilitation among PCI patients can provide a theoretical basis for improving patient compliance.

Methods: This study employed a structural equation model to clarify the influencing factors of adherence to Phase I cardiac rehabilitation in PCI patients and the action pathways between these factors, providing theoretical support for improving adherence.

Results: The structural equation model revealed that [MATH_{0001}] factors significantly influenced adherence to cardiac rehabilitation after PCI at a grade of [MATH_{0002}]. The model demonstrated good fit indices: [MATH_{0003}] and [MATH_{0004}] < 0.05, indicating acceptable model fit.

Conclusion: The adherence of PCI patients to Phase I cardiac rehabilitation is influenced by multiple factors. The structural equation model elucidates the relationships between these influencing factors and adherence, as well as the action pathways among the factors, providing theoretical support for improving cardiac rehabilitation adherence in PCI patients.

1. Methods

1.1 Study Design and Participants

This cross-sectional study was conducted among PCI patients. Using convenience sampling, we recruited patients who underwent PCI at a tertiary hospital in Daqing City, Heilongjiang Province between September 2021 and December 2021. Inclusion criteria were: (1) diagnosis of coronary heart disease and first-time PCI treatment; (2) age $\geq$ 18 years; (3) stable condition with clear consciousness and ability to communicate; (4) provision of informed consent. Exclusion criteria included: (1) combined with other severe organic diseases or malignant tumors; (2) mental illness or cognitive impairment; (3) inability to complete the questionnaire independently.

A total of 356 PCI patients were surveyed. After excluding 12 invalid questionnaires, 343 valid responses were collected, yielding an effective response rate of

96.3%. The sample size satisfied the requirement of 5-10 times the number of observed variables for structural equation modeling.

1.2 Measurement Instruments

The survey instruments included: (1) General Information Questionnaire: covering demographic data, disease characteristics, and PCI treatment; (2) Coronary Heart Disease Health Belief Questionnaire: assessing patients' health beliefs regarding coronary disease; (3) Family APGAR Index: evaluating family support; (4) Patient Health Questionnaire Depression Scale (PHQ-9): a 9-item depression screening tool developed by Kroenke et al. [11]; (5) Generalized Anxiety Disorder Scale (GAD-7): a 7-item anxiety assessment tool developed by Spitzer et al. [12]; (6) Family Adaptability and Cohesion Evaluation Scales (FACES): measuring family functioning; and (7) Chronic Illness Resources Survey: assessing social support resources.

2. Results

The structural equation model analysis revealed that disease knowledge, family support, anxiety/depression, and self-efficacy were key factors influencing adherence to Phase I cardiac rehabilitation in PCI patients. The model demonstrated good fit with ^{2}/df = 1.85, RMSEA = 0.049, CFI = 0.968, and TLI = 0.961.

[FIGURE 1] shows the model paths and standardized regression coefficients of factors influencing cardiac rehabilitation adherence in PCI patients. Disease knowledge (β = 0.395, p < 0.001), family support (β = 0.277, p < 0.001), and self-efficacy (β = 0.152, p < 0.05) positively predicted adherence, while anxiety/depression negatively predicted adherence (β = -0.116, p < 0.05).

[TABLE 5] presents the path analysis of factors affecting cardiac rehabilitation adherence in PCI patients. The total effect of disease knowledge on adherence was 0.414, with a direct effect of 0.395 and an indirect effect of 0.019 through self-efficacy. Family support showed a total effect of 0.291 (direct effect: 0.277; indirect effect: 0.014). Anxiety/depression demonstrated a negative total effect of -0.126 (direct effect: -0.116; indirect effect: -0.010).

[TABLE 6] displays the standardized effects of factors on cardiac rehabilitation adherence. The results indicate that disease knowledge had the strongest influence (standardized effect = 0.395), followed by family support (0.277), self-efficacy (0.152), and anxiety/depression (-0.116).

3. Discussion

3.1 Influence of Disease Knowledge on Cardiac Rehabilitation Adherence

This study found that disease knowledge significantly and positively predicted adherence to Phase I cardiac rehabilitation in PCI patients (β = 0.395, p <

0.001), accounting for 91.8% of the variance in adherence. This suggests that patients with better understanding of coronary disease demonstrate higher rehabilitation adherence, consistent with previous research [17]. Health beliefs and perceived benefits of rehabilitation also positively influenced adherence, with 30.7% and 31.2% of patients reporting high levels of these factors, respectively.

Health beliefs reflect patients' subjective judgment about disease threat and rehabilitation benefits. Patients with stronger health beliefs exhibit better rehabilitation compliance [18]. This study further confirms that disease knowledge influences adherence both directly and indirectly through health beliefs. Healthcare providers should strengthen patient education about coronary disease and rehabilitation benefits, particularly emphasizing the importance of Phase I cardiac rehabilitation to enhance adherence.

3.2 Influence of Family Support, Anxiety/Depression, and Self-Efficacy on Adherence

Family support significantly positively predicted adherence (β = 0.277, p < 0.001), while also influencing adherence indirectly through self-efficacy and anxiety/depression. This finding aligns with existing research [19]. Family support represents an important external resource that provides emotional and material assistance, helping patients overcome rehabilitation barriers [20]. For PCI patients, family involvement in the rehabilitation process and provision of supportive environments can significantly improve adherence.

Anxiety/depression negatively predicted adherence (β = -0.116, p < 0.05), consistent with previous studies [21]. PCI patients often experience psychological distress due to disease threat and treatment concerns, which may reduce rehabilitation motivation and adherence [22]. Effective psychological support and intervention are crucial for improving adherence in this population.

Self-efficacy positively predicted adherence (β = 0.152, p < 0.05). Patients with higher self-efficacy possess greater confidence in managing their disease and completing rehabilitation, leading to better adherence [23]. Self-efficacy also mediated the relationship between family support and adherence, suggesting that family support enhances patients' confidence in rehabilitation, thereby improving compliance.

3.3 Influence of Anxiety and Depression on Adherence

This study demonstrated that anxiety and depression significantly negatively influenced adherence to Phase I cardiac rehabilitation in PCI patients. Anxiety and depression are common psychological comorbidities in coronary patients, with prevalence rates of 23.2% and 16.7% respectively in this sample. These conditions can reduce patients' energy levels, motivation, and ability to engage in rehabilitation activities [24].

Healthcare providers should routinely screen for anxiety and depression in

PCI patients and provide appropriate psychological interventions. Cognitive-behavioral therapy, mindfulness-based stress reduction, and social support groups may help alleviate psychological distress and improve rehabilitation adherence [25]. Additionally, family support plays a protective role against anxiety and depression, further highlighting the importance of family involvement in the rehabilitation process.

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Data Availability Statement

The datasets generated and analyzed during this study are available in the ScienceDB repository (DOI: 10.57760/sciencedb.j00150.00027; CSTR: 31253.11.sciencedb.j00150.00027). The data can be accessed at: https://www.scidb.cn/s/YNjINv or https://www.scidb.cn/anonymous/WU5qSU52.

References

1. Lawton JS, Tamis-Holland JE, Bangalore S, et al. 2021 ACC/AHA/SCAI Guideline for Coronary Artery Revascularization: Executive Summary: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. [J]. Circulation. 2022 Jan 18;145(3):e4-e17. DOI:10.1161/CIR.0000000000001039.
2. SABOURET P, RUSHTON-SMITH S K, KERNEIS M, et al. Dual antiplatelet therapy: optimal timing, management, and duration[J]. European Heart Journal-Cardiovascular Pharmacotherapy, 2015, 1(3): 198-204. DOI:10.1093/ehjcvp/pvv015.
3. AACVPR. Guidelines for cardiac rehabilitation programs[M]. 6th ed. Champaign: Human Kinetics, 2021.
4. Foroughinia F, Foroozmehr M. Effect of pretreatment with omega-3 supplement on cardiac necrosis markers in chronic kidney disease patients undergoing elective percutaneous coronary intervention[J]. Journal of Research in Pharmacy Practice, 2017, 6(2): 94-99. DOI:10.4103/jrpp.JRPP_{17}_{24}.
5. Premkumar S, Ramamoorthy L, Pillai AA. Impact of nurse-led cardiac rehabilitation on patient' s behavioral and physiological parameters after a

coronary intervention: A pilot randomized controlled trial[J]. Family Community Med. 2022; 29(1): 17-23. DOI:10.4103/jfcm.jfcm_{315}_{21}.

6. Sumner J, Grace SL, Doherty P. Predictors of cardiac rehabilitation utilization in England: Results from the national audit[J]. J Am Heart Assoc, 2016, 5(10): e3903-e3910. DOI:10.1161/JAHA.116.003903.
7. WU Y N, WANG R, LUAN C H. Early cardiac rehabilitation nursing based on 5A mode for patients with acute myocardial infarction treated by percutaneous coronary intervention[J]. Journal of Nursing Science, 2021, 36(5): 5-9, 39. DOI:10.3870/j.issn.1001-4152.2021.05.005.
8. [Reference text in Chinese - retained as original]
9. [Reference text in Chinese - retained as original]
10. ZHANG M, WANG Y X, JIN C D. Coronary Artery Disease Health Belief Scale: development and testing of reliability and validity[J]. Chin J Prac Nurs, 2014, 30(29): 40-43. DOI: 10.3760/cma.j.issn.1672-7088.2014.29.013.
11. Kroenke K, Spitzer RL, Williams JB, et al. The PHQ-9: validity of a brief depression severity measure[J]. Gen Intem Med, 2001, 16(9): 606–613. DOI: doi: 10.1046/j.1525-1497.2001.016009606.x.
12. Spitzer RL, Kroenke K, Williams JB, et al. A brief measure for assessing generalized anxiety disorder: the GAD-7[J]. Arch Intem Med, 2006, 166(10): 1092-1097. DOI:10.1001/archinte.166.10.1092.
13. OLSON D H, RUSSELL C S, SPRENKLE D H. Circumplex model of marital and family systems: VI. theoretical update[J]. Fam Process, 2010, 22(1): 144-167. DOI:10.1111/j.1545-5300.1983.00069.x.
14. ZHANG S, LU X Q, DU L. Development and Application of FACES[J]. Chinese General Practice, 2010, 13(7): 725-728. DOI:10.3969/j.issn.1007-9572.2010.07.013.
15. Glasgow RE, Lisa A, Strycker, et al. A social-ecologic approach to assessing support for disease self-management: the Chronic Illness Resources Survey[J]. Journal of Behavioral Medicine, 2000, 23(6): 559-583. DOI: 10.1023/a:1005507603901.
16. ZHONG H Q, FAN L, SHAO Y. Reliability and Validity of Chronic Illness Resources Survey (Chinese Version) in Patients with Diabetes[J]. Chinese General Practice, 2014, 23(7): 2779-2782. DOI:10.3969/j.issn.1007-9572.2014.23.031.
17. [Reference text in Chinese - retained as original]
18. SHI S L, SUN S Y, CHEN L L. Analysis and Nursing Interventions for Hypertension Patients Failing to Follow the Diet Manage-

ment as Ordered[J]. Journal of Nursing Science, 2009, 24(1): 72-73. DOI:10.3870/hlxzz.2009.01.072.

19. Ge P, Liu ST, Xu SX, et al. The Influence of Parents on Medication Adherence of Their Children in China: A Cross-Sectional Online Investigation Based on Health Belief Model[J]. Front Public Health. 2022 Apr 14;10:845032. DOI: 10.3389/fpubh.2022.845032.

20. Kim JS, Kim GS, Kang SM, et al. Symptom experience as a predictor of cardiac rehabilitation education programme attendance after percutaneous coronary intervention: A prospective questionnaire survey[J]. Eur J Cardiovasc Nurs. 2021 Mar 1;20(3): 183–191. DOI:10.1177/1474515120940534.

21. Jones MI, Greenfield S, Jolly K, et al. BRUM Trial Steering Committee. Patients' experience of home and hospital based cardiac rehabilitation: a focus group study[J]. Eur J Cardiovasc Nurs. 2009 Mar;8(1): 9-17. DOI:10.1016/j.ejcnurse.2008.06.001.

22. Smith KM, Arthur HM, McKelvie RS, et al. Differences in sustainability of exercise and health-related quality of life outcomes following home or hospital-based cardiac rehabilitation[J]. Eur J Cardiovasc Prev Rehabil. 2004 Aug;11(4): 313-9. DOI:10.1097/01.hjr.0000136414.40017.10.

23. RUANO-RAVINA A, PENA-GIL C, ABU-ASSI E, et al. Participation and adherence to cardiac rehabilitation programs. A systematic review[J]. International Journal of Cardiology, 2016, 223: 436-443. DOI:10.1016/j.ijcard.2016.08.120.

24. Bourke A, Niranjan V, O' Connor R, et al. Barriers to and motives for engagement in an exercise-based cardiac rehabilitation programme in Ireland: a qualitative study[J]. BMC Prim Care. 2022 Feb 11;23(1): 28. DOI:10.1186/s12875-022-01637-7.

25. Arnett DK, Goodman RA, Halperin JL, et al. AHA/ACC/HHS strategies to enhance application of clinical practice guidelines in patients with cardiovascular disease and comorbid conditions[J]. J Am Coll Cardiol. 2014;64: 1851–6. DOI:10.1016/j.jacc.2014.07.012. Epub 2014 Sep 11.

26. Myers V, Gerber Y, Benyamini Y, et al. Post-myocardial infarction depression: Increased hospital admissions and reduced adoption of secondary prevention measures –a longitudinal study[J]. Psychosom Res 2012; 72: 5–10. DOI: 10.1016/j.jpsychores.2011.09.009.

27. Rao A, Zecchin R, Newton PJ, et al. The prevalence and impact of depression and anxiety in cardiac rehabilitation: A longitudinal cohort study[J]. Eur J Prev Cardiol. 2020 Mar;27(5): 478-489. DOI: 10.1177/2047487319871716. Epub 2019 Oct 9. PMID: 31597473.

28. Goodwin CL, Emery CF. Lower Experiential Avoidance Is Associated With Psychological Well-being and Improved Cardiopul-

monary Endurance Among Patients in Cardiac Rehabilitation[J]. Cardiopulm Rehabil Prev. 2016 Nov/Dec;36(6): 438-444. DOI: 10.1097/HCR.0000000000000182.

Note: Figure translations are in progress. See original paper for figures.