The following publication Siow, E., Leung, D. Y. P., Wong, E. M. L., Lam, W. H., & Lo, S. M. (2018). Do depressive symptoms moderate the effects of exercise self-efficacy on physical activity among patients with coronary heart disease?. Journal of Cardiovascular Nursing, 33(4), E26-E34 is available at https://doi.org/10.1097/JCN.0000000000000491.

Does depressive symptoms moderate the effects of exercise self-efficacy on physical activity among patients with coronary heart disease?

Background

Considered as one of the leading causes of cardiovascular-related deaths,[1] the poor management of coronary heart disease (CHD) can result in complications such as heart failure, acute myocardial infarction, and even death.[2] There is clear evidence that the promotion of physical activity plays a vital role in health maintenance as well as in reducing the complications and risks of cardiovascular diseases associated with CHD.[3] (cite WHO)

Physical activity refers to the movement of skeletal muscles that uses energy expenditure that individuals engage as part of leisure activity (e.g. walking and swimming) (WHO, 2010). On the other hand, exercise refers to the participation in a planned, repetitive, and structured type of physical activity with the purpose of improving cardiopulmonary fitness (McAuley & Rudolp, 1995). To achieve cardiovascular fitness, current guidelines recommend at least 150 minutes per week of moderate physical activity or 75 minutes per week of vigorous physical activity or a combination of both (AHA, xxxx).

Exercise self-efficacy, defined as the individual's perception of his or her confidence in carry out physical activity is an important predictor in the initiation and adherence in an exercise regimen among CHD patients.[4-8] Adhering to a regimen is vital in helping patients improve their overall cardiovascular health and fitness. Individuals with higher self-efficacy are more likely to participate in physical activity (Resnick et al. 2000; McAuley et al. 2003, 2002). Engaging in higher levels of physical activity allows patients to engage actively and independently in their self-care activities, which is likely, in turn, to reduce the risk of cardiac events and improve quality of life.[9] It is important to examine the self-efficacy-physical activity relationship in CHD patients as self-efficacy could be amenable to manipulation to encourage patients to initiate and maintain physical activity.[5,7]

CHD patients with depression have an increased risk of adverse cardiac events, poor general physical health, negative perceptions of their quality of life, and an increased mortality risk.[10-15] In addition, CHD patients with greater cardiac risk factors are more likely to develop depression over time (cite), suggesting a cyclical relationship between CHD and depression. In past studies, rates of depression in CHD patients ranged from 19% to 37% (Ruo et al. 2003; Azevedo Da Silva et al. 2012; Peterson et al. 2014; Sarkar et al. 2009; Allan et al. 2007). Episodes of negative mood, apathy,[16] and social isolation[17] may be underlying reasons why depressed patients are less inclined to engage in exercise and vice versa.[18,19] Despite the fact that regular exercise could reduce or prevent the negative effects of depression[20], patients with moderate to severe depressive symptoms have shown a lower intention to exercise than those with no depressive symptoms,[21] suggesting that the severity of depression can have a considerable impact on self-efficacy and exercise behavior.

Despite the prevalence of depression among CHD patients, not much is known whether the relationship between self-efficacy and physical activity behavior could vary with the extent of the depression. Studies have examined this association among youths and adolescents,[22,23] as well as in healthy individuals.[16] However, findings of the overall literature remains mixed. Although studies found that self-efficacy levels were higher among individuals with low depressive symptoms who engage in regular exercise, [16,22] others have reported that the relationship between self-efficacy and physical activity was more apparent among individuals with more depressed symptoms.[23] Given the inconsistent findings, further investigation is needed to understand the role of exercise self-efficacy in maintaining physical activity among CHD patients and the condition under which this relationship can be sustained. Therefore, the purpose of this study is to examine the association between depressive symptoms, exercise self-efficacy, and physical activity among CHD patients, and whether depressive symptoms could affect the exercise self-efficacy and physical activity relationship.

Methods

Study design

We conducted a cross-sectional exploratory study of hospitalized adults with CHD from an emergency medicine unit and a general medical ward at two regional hospitals in Hong Kong. Participant recruitment occurred from May xx 2015 to August xx 2015. We received ethical approval to conduct this study (CREC reference no: 2013-170).

Participant recruitment and data collection

A convenience sample of 149 patients who met the following eligibility criteria were included: i) admitted with chest pains and diagnosed with CHD, ii) hemodynamically stable, iii) discharged to home with the ability to perform activities of daily living, iv) ethnic Chinese Hong Kong residents, and v) proficient in both spoken and written Cantonese. Patients were excluded if they had i) a diagnosis of heart failure or acute myocardial infarction, or required coronary artery bypass surgery, ii) cognitive impairment or psychiatric illness, and iii) a physical disability that limits ability to perform physical activity.

Prior to hospital discharge, a research assistant who is a Registered Nurse approached all eligible patients with details about the study and obtain a written informed consent. The survey consisted of questions about the individual's i) sociodemographic status (e.g., age, gender, marital status, income status, education level, living arrangement, and smoking habits), ii) extent of leisure-time physical activity, iii) exercise self-efficacy, and iv) depressive symptoms. The research assistant read the questions to patients who were unable to read Cantonese. The amount of time taken to complete the survey is approximately 20 minutes. Other clinical data such as medical diagnosis, the number of hospital admissions prior to this hospitalization, and BMI were retrieved from the hospital's medical records.

Measurement

1. Physical activity

The Chinese version of the Godin-Shephard Leisure-Time Physical Activity (GSLTPA) Questionnaire was used to assess the participant's perceptions about engaging, over a seven-day period, in physical activity resulting in a rapid heart rate.[24] We asked participants to recall their physical activity in the last 7 days prior to this hospital admission. The categories of physical activity listed were strenuous, moderate, and mild. For each category, the participants were asked to indicate, on average, how many times a week they exercised for more than 15 minutes during their free time. A total weekly GSLTPA score was calculated. A score of less than 14 indicates mild activity; scores ranging from 14 to 23 indicates moderate activity; and scores of 24 and greater indicates strenuous activity. The questionnaire is easy to administer, widely used in different populations, [25,26] and demonstrated acceptable test-retest reliability.[24]

2. Exercise self-efficacy

The Chinese version of the Self-Efficacy for Exercise (SEE-C) scale was used to measure exercise self-efficacy.[27] The SEE-C consists of nine questions measuring the participants' level of confidence, on a scale from '0' (not confident) to '10' (very confident), about their perceived ability to engage in regular exercise for 20 minutes three times per week under various circumstances. The final score was the sum of all responses and dividing it by the total number of responses. The SEE-C scores range from zero (the lowest level of self-efficacy) to ten (the highest level). The SEE-C demonstrated satisfactory psychometric properties.[27]

3. Depressive symptoms

The Chinese version of the short-form Centre for Epidemiological Studies-Depression-10 item (CES-D-10) questionnaire was used to measure depressive symptoms. The CESD-10 consists of ten questions that measures participant's perceptions on a four-point Likert scale of how they had felt or behaved during the past week. We calculated the total score by summing all items. The total scores ranged from zero (no depressive symptoms) to 30 (high depressive symptoms) and ten or more is indicative of high levels of depressive symptoms.[28] The CES-D-10 demonstrated good validity and reliability.[29,30]

Data analysis

Hierarchical regression models were used to study the moderating effect of depressive symptoms on the relationship between exercise self-efficacy and physical activity. The first model consisted of SEE-C and the covariates (age, gender, body mass index, marital status, education level, income level, living arrangement, smoking habit, number of chronic conditions, and number of times hospitalized). In the second model, CES-D-10 was added. Finally, the third model consisted the interaction term of SEE-C and CES-D-10. Additional analysis was conducted using the Johnson-Neyman technique in the Process macro for SPSS,[32] which allows for the evaluation of the moderator regions (low, moderate, or high with reference to values of moderator) to determine the significance of the effect of the independent variable on dependent variable along the continuum of dimension as measured by the moderator.[33] We constructed the moderator groups based on the mean value of CES-D-10, 1 standard deviation below and 1 standard deviation above the mean values (Cohen et al. 2003). All analyses were conducted using the IBM Statistical Package for the Social Sciences, software version 22.

Results

Participant characteristics

Table 1 summarizes the sample demographic characteristics. The mean age was 73 ± 13.5 years. Most participants were male, married, living with their families, and of relatively low socio-economic status. Around 50% of the participants had normal BMI, 41% were overweight and obese, and 9% were underweight. In the sample, 38% had at least two preexisting chronic conditions – diabetes mellitus and respiratory disease. Majority were either ex-smokers or non-smokers (87%) and the remaining 13% were current smokers. Most participants had around five years of formal education, which is equivalent to a fifth grade or primary level education.

The average SEE-C was 4.26 ±2.73 and the median GSLTPA was 12. In terms of physical activity, 6% of the participants reported doing strenuous exercise, 44% moderate exercise, and 50% mild to no exercise. Of the independent variables, only SEE-C was positively correlated with GSLTPA scores (see table 2). Participants with higher SEE-C were likely to engage in moderate to strenuous physical activity, compared to those with lower SEE-C. Approximately 26% of the sample presented with a CES-D-10 score of ten or more, which suggests the presence of depressive symptoms. Patients with depressive symptoms were likely to be living alone, had lower median GSLTPA scores, and lower mean SEE-C scores.

Relationship between depressive symptoms, exercise self-efficacy, and physical activity

Table 2 summarizes the relationship between depressive symptoms, exercise self-efficacy, and physical activity among patients with CHD. In model 1, the inclusion of all independent variables accounted for 6% of the variance explained by the model. We found that a one-unit increase in SEE-C score was associated with a 1.48-unit increase in GSLTPA scores ($b = 1.48$, $t = 3.78$; $p < 0.001$). In model 2, we included CES-D-10 scores and the adjusted r-square was 6%. The inclusion of CES-D-10 did not add significantly to the fit of the model (R^2 change = 0.003, $F(1, 127) = 0.47$; $p = 0.50$). The association between CES-D-10 and GSLTPA was not statistically significant ($b = 0.12$, $t = 0.68$; $p = 0.50$). Among the independent variables, only SEE-C showed a significant association with physical activity (b = 1.54, t = 3.83; $p < 0.001$).

Moderating effect of depressive symptoms on exercise self-efficacy and physical activity

In the final model, we added the interaction term (CES-D-10 * SEE-C), which accounted for 8% of the variance that was explained by the model. This addition contributed significantly to the fit of the model (R^2 change = 0.03, F (1, 126) = 3.97; p = 0.048). We found that SEE-C was no longer a significant predictor of GSLTPA. However, there was a significant interaction between CES-D-10 and SEE-C in predicting GSLTPA (b = 0.14, t = 1.99; p = 0.043). We conducted additional analysis on the interaction effects to examine the slope coefficients of SEE-C in predicting GSLTPA among patients with low (-1SD from mean), average, and high (+1SD from mean) depressive symptoms. In the high depressive symptoms group, higher SEE-C was an independent predictor of GSLTPA (b = 2.35, t = 4.07; p = 0.001). This relationship was not statistically significant in the low depressive symptoms group (b= 0.80, t = 1.48; p = 0.14). Figure 1 shows that depressive symptoms as a moderator significantly changes the strength of the relationship between SEE-C and GSLTPA. The variance inflation factor in all regression models ranged from 1.12 to 4.21, indicating an absence of multicollinearity.

Discussion

In this study, we examined the association between exercise self-efficacy and physical activity among patients with CHD, as well as the moderating effect of depressive symptoms on this association. With regard to the association between exercise self-efficacy and physical activity, we found a significant positive association after controlling for depressive symptoms and other covariates. This finding is consistent with prior literature, where self-efficacy reflects the cognitive aspect of exercise, is a strong intention to and a predictor of exercise behavior.[8,34] Higher exercise self-efficacy reflected a greater confidence in the commitment to engage in regular exercise, and this in turn was associated with better health status.[4,35,36] In the same way, patients with higher exercise self-efficacy are more likely to engage in exercise that could have a positive impact on their mood and emotions,[37] which might in turn improve their outlook on life.

We sought to examine whether presence of depressive symptoms could affect the strength of the self-efficacy-physical activity relationship. To our knowledge, no studies have examined this relationship in the CHD population. Studying the moderation effect could allow us to determine whether the relationship between important predictor and outcome variable might be stronger in some groups than in others.[38] Testing the moderation effect of depressive symptoms on the relation between self-efficacy and physical activity could be informative about where (e.g., the sub-group of CHD patients with depressive symptoms) future intervention would have the greatest impact.[39]

Our finding revealed that the positive association between self-efficacy and physical activity was stronger for the group of patients with more depressive symptoms. However, self-efficacy was not significantly associated with physical activity for patients with less depressive symptoms. Similar to our findings, Shields[23] found that self-efficacy had a stronger positive relationship with physical activity among more depressed adolescents. It is important to note that a two-item measure was used to evaluate psychological and somatic indicators of depressive symptoms, which might not be reflective of clinical depression. In addition, they studied a population of healthy adolescents where variations of depressive symptoms and physical activity could be a normal process of developmental growth.

Prior studies have indicated that CHD patients with depressive symptoms are likely to have lower self-efficacy and lower physical activity levels.[5,21] It is believed that depressive symptoms may weaken the positive association between self-efficacy and physical activity because individuals who are more depressed typically lacked the motivation to participate in exercise[7] and are less likely to adhere to regular exercise regime.[18] In addition, depressed individuals face difficulty and are less likely to respond well to attempts to enhance self-efficacy. This argument implies that increasing self-efficacy may not be a useful strategy for promoting physical activity among depressed individuals.

Another plausible argument is that self-efficacy may be more important in encouraging individuals with depressive symptoms to exercise because these individuals generally lack the confidence to engage in physical activit especially for the elderly. Depressive symptoms are common among older adults. In our study, majority of the sample were older adults and 26% of them had high depressive symptoms. Their Physiological changes or physical condition with co-existing diseases could pose as barriers to physical mobility among older adults (cite), making them less likely to engage in physical activity. Hence, one might expect that CHD patients with relatively higher depressive symptoms within the group of older adults would require more confidence to increase their physical activity. A previous study have observed that depressed individuals enrolled in the chronic disease self-management program demonstrated greater improvements in exercise self-efficacy than those with lower levels of depressive symptoms.[40] In other words, intervention, in terms of instilling confidence, is going to have a greater effect when applied to situations where confidence is lacking.

Our findings add to the body of literature that depressive symptoms may moderate the relationship between self-efficacy and physical activity among CHD patients. We found that among patients with depressive symptoms, those with higher self-efficacy are engaging in physical activity. This finding have important implications for clinicians to consider in terms of lifestyle interventions to promote physical activity among CHD patients with depressive symptoms. For instance, adopting home-based programs to enhance physical activity may be more achievable and could improve overall exercise capacity than formal exercise programs.[41] Given that building patients' confidence to exercise is important especially for depressed patients, there may be periods of opportunity where clinicians could provide more assistance. In addition, understanding the perceived barriers to physical activity could help older adults with CHD to initiate or maintain physical activity. Therefore, future work could explore the routine screening of CHD patients (for depressive symptoms and exercise self-efficacy) and the use of innovative interventions that could allow for the early detection and targeted treatments to improve the health outcomes in this population.

Limitations

We presented evidence that depressive symptoms might not negatively affect the self-efficacy and activity relationship in the CHD population. There are several limitations to consider. First, we conducted a survey that yielded descriptive data at a single point in time. Because patients at different stages of CHD vary in terms of their needs and symptom presentation, this data might not provide a holistic picture of their illness. For instance, we do not know the relationship between depressive symptoms, self-efficacy, and physical activity the months after the coronary event. Nonetheless, this survey presents useful preliminary data that enhances our understanding of CHD patients.

Second, the SEE-C and GSLTPA questionnaire like most self-reported psychosocial measurements could be subjected to inaccuracies, social desirability bias, and recall bias. The GSLTPA questionnaire measures the degree of activity performed during leisure-time[24] and this does not reflect the participation of purposeful structured exercise regimen to improve cardiovascular fitness. In addition, using GSLTPA did not know the purpose of exercise (intentional or scheduled) which how exercise efficacy relates to physical activity is unclear .Despite the lack of an objective measure, the use of questionnaires provides a convenient way to assess the level of physical activityMore consideration may be required in the future study or a qualitative study may be recommended to enhance more understanding in this aspect.

Third, the adjusted r-square values across the models were small. While the addition of the interaction term resulted in a slight improvement, the low values suggest that other explanatory variables were not included into the regression models. For instance, we did not measure the extent of social support and medication use that could potentially influence the effects of depressive symptoms, self-efficacy, and exercise behavior.

Lastly, we selected a sample of patients with milder CHD symptoms who are likely to have a better exercise capacity. More depressed patients who are physically inactive may be less inclined to participate in this study. It could be possible that some patients may have undergone cardiac rehabilitation programs prior to this hospital admission. Our data were based on a homogenous convenience sample of older adults with CHD. The findings may not be representative of all older adults without CHD and the younger population of CHD patients. Hence, it is important to exercise caution when generalizing the results. Future research should include a broader sample of CHD patients.

Conclusion

Exercise self-efficacy was positively associated with physical activity. However, when depressive symptoms was added as a moderator, the relationship between self-efficacy and physical activity was stronger among CHD patients, suggesting that exercise self-efficacy might be important in encouraging depressed individuals to engage in physical activity. While our study provides preliminary evidence to support the need to build more self-efficacy among depressed individuals with CHD, further work is needed to study this relationship in greater depth, in particular, to explore at which stage of the disease process would be the best time to boost the individual's exercise self-efficacy. Thus, longitudinal studies are needed to develop meaningful insights into the underlying mechanisms with regard to self-efficacy and physical activity across different trajectories of CHD.

References

1. World Health Organization. *World health organization library cataloguing-in-publication data. global status report on non-communicable diseases.* ; 2014. http://apps.who.int/iris/bitstream/10665/148114/1/9789241564854_eng.pdf?ua=1.

2. Lerner DJ, Kannel WB. Patterns of coronary heart disease morbidity and mortality in the sexes: A 26-year follow-up of the framingham population. *Am Heart J*. 1986;111(2):383-390.

3. Barengo NC, Antikainen R, Borodulin K, Harald K, Jousilahti P. Leisure-Time physical activity reduces total and cardiovascular mortality and cardiovascular disease incidence in older adults. *J Am Geriatr Soc*. 2017;65(3):504-510.

4. Carlson JJ, Norman GJ, Feltz DL, Franklin BA, Johnson JA, Locke SK. Self-efficacy, psychosocial factors, and exercise behavior in traditional versus modified cardiac rehabilitation. *J Cardiopulm Rehabil*. 2001;21(6):363-373.

5. LaPier TK, Cleary K, Kidd J. Exercise self-efficacy, habitual physical activity, and fear of falling in patients with coronary heart disease. *CARDIOPULM PHYS THER J (AM PHYS THER ASSOC CARDIOPULM SECT)*. 2009;20(4):5-11.

6. Maeda U, Shen B, Schwarz E, Farrell K, Mallon S. Self-efficacy mediates the associations of social support and depression with treatment adherence in heart failure patients. *Int J Behav Med*. 2013;20(1):88-96.

7. Alharbi M, Gallagher R, Neubeck L, et al. Exercise barriers and the relationship to self-efficacy for exercise over 12 months of a lifestyle-change program for people with heart disease and/or diabetes. *European Journal of Cardiovascular Nursing*. 2017;16(4):309-317.

8. Slovinec D'Angelo ME, Pelletier LG, Reid RD, Huta V. The roles of self-efficacy and motivation in the prediction of short-and long-term adherence to exercise among patients with coronary heart disease. *Health Psychology*. 2014;33(11):1344.

9. Lichtman JH, Jr BJ, Blumenthal JA, et al. AHA science advisory. depression and coronary heart disease recommendations for screening, referral, and treatment: A science advisory from the american heart association prevention committee of the council on cardiovascular nursing, council on clinical cardiology, council on epidemiology and prevention, and interdisciplinary council on quality of care and outcomes research. *Prog Cardiovasc Nurs*. 2009;24(1):19-26.

10. Allan JL, Johnston DW, Johnston M, Mant D. Depression and perceived behavioral control are independent predictors of future activity and fitness after coronary syndrome events. *J Psychosom Res*. 2007;63(5):501-508.

11. 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 randomized trial. *JAMA*. 2012;308(5):465-474.

12. Lichtman J, Froelicher E, Blumenthal J, et al. Depression as a risk factor for poor prognosis among patients with acute coronary syndrome: Systematic review and recommendations: A scientific statement from the american heart association. *Circulation*. 2014;129(12):1350-1369.

13. Ruo B, Rumsfeld JS, Hlatky MA, Liu H, Browner WS, Whooley MA. Depressive symptoms and health-related quality of life: The heart and soul study. *JAMA*. 2003;290(2):215-221.

14. Spertus JA, McDonell M, Woodman CL, Fihn SD. Association between depression and worse disease-specific functional status in outpatients with coronary artery disease. *Am Heart J*. 2000;140(1):105-110.

15. Sullivan MD. Self-efficacy and self-reported functional status in coronary heart disease: A six-month prospective study. *Psychosom Med*. 1998;60(4):473.

16. Kangas JL, Baldwin AS, Rosenfield D, Smits JA, Rethorst CD. Examining the moderating effect of depressive symptoms on the relation between exercise and self-efficacy during the initiation of regular exercise. *Health psychology*. 2015;34(5):556 - 565.

17. Kaplan GA, Lazarus NB, Cohen RD, Leu D. Psychosocial factors in the natural history of physical activity. *Am J Prev Med*. 1991.

18. Ziegelstein RC, Fauerbach JA, Stevens SS, Romanelli J, Richter DP, Bush DE. Patients with depression are less likely to follow recommendations to reduce cardiac risk during recovery from a myocardial infarction. *Arch Intern Med*. 2000;160(12):1818-1823.

19. Alharbi M, Gallagher R, Neubeck L, et al. Exercise barriers and the relationship to self-efficacy for exercise over 12 months of a lifestyle-change program for people with heart disease and/or diabetes. *European Journal of Cardiovascular Nursing*. 2017;16(4):309-317.

20. DiLorenzo T, Bargman E, Stucky Ropp R, Brassington G, Frensch P, LaFontaine T. Long-term effects of aerobic exercise on psychological outcomes. *Prev Med*. 1999;28(1):75-85.

21. Prugger C, Wellmann J, Heidrich J, et al. Regular exercise behaviour and intention and symptoms of anxiety and depression in coronary heart disease patients across europe: Results from the EUROASPIRE III survey. *Eur J Prev Cardiol*. 2017;24(1):84-91.

22. Neissaar I, Raudsepp L. Changes in physical activity, self-efficacy and depressive symptoms in adolescent girls. *Pediatric exercise science*. 2011;23(3):331-343.

23. Shields C, Spink K, Chad K, Odnokon P. The confidence to get going: The moderating effects of depressive symptoms on the self-efficacy–activity relationship among youth and adolescents. *Psychology and Health*. 2010;25(1):43-53.

24. Godin G, Shephard RJ. A simple method to assess exercise behavior in the community. *Can J Appl Sport Sci*. 1985;10(3):141-146.

25. Amireault S, Godin G. The godin-shephard leisure-time physical activity questionnaire: Validity evidence supporting its use for classifying healthy adults into active and insufficiently active categories. *Perceptual and Motor Skills*. 2015;120(2):604-622.

26. Slattery ML, Jacobs DR,Jr, Nichaman MZ. Leisure time physical activity and coronary heart disease death. the US railroad study. *Circulation*. 1989;79(2):304-311.

27. Lee L, Perng S, Ho C, Hsu H, Lau S, Arthur A. A preliminary reliability and validity study of the chinese version of the self-efficacy for exercise scale for older adults. *Int J Nurs Stud*. 2009;46(2):230-238.

28. Peterson JC, Charlson ME, Wells MT, Altemus M. Depression, coronary artery disease, and physical activity: How much exercise is enough? *Clin Ther*. 2014;36(11):1518-1530.

29. Boey KW. Cross-validation of a short form of the CES-D in chinese elderly. *Int J Geriatr Psychiatry*. 1999;14(8):608-617.

30. Cheng S, Chan A. The center for epidemiologic studies depression scale in older chinese: Thresholds for long and short forms. *Int J Geriatr Psychiatry*. 2005;20(5):465-470.

31. Hayes AF. *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach.* Guilford Press; 2013.

32. Hayes AF. PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling. Retrieved from http://www.afhayes.com/ public/process2012.pdf. Updated 2012.

33. McAuley E. Self-efficacy and the maintenance of exercise participation in older adults. *J Behav Med*. 1993;16(1):103-113.

34. Alsaleh E, Windle R, Blake H. Behavioural intervention to increase physical activity in adults with coronary heart disease in jordan. *BMC Public Health*. 2016;16(1):643.

35. Sarkar U, Ali S, Whooley M. Self-efficacy and health status in patients with coronary heart disease: Findings from the heart and soul study. *Psychosom Med*. 2007;69(4):306-312.

36. Karademas EC. Self-efficacy, social support and well-being: The mediating role of optimism. *Personality and individual differences*. 2006;40(6):1281-1290.

37. Baron RM, Kenny DA. The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *J Pers Soc Psychol*. 1986;51(6):1173.

38. Frazier PA, Tix AP, Barron KE. Testing moderator and mediator effects in counseling psychology research. *Journal of counseling psychology*. 2004;51(1):115.

39. Jerant A, Kravitz R, Moore-Hill M, Franks P. Depressive symptoms moderated the effect of chronic illness self-management training on self-efficacy. *Med Care*. 2008;46(5):523-531.

40. Claes J, Buys R, Budts W, Smart N, Cornelissen VA. Longer-term effects of home-based exercise interventions on exercise capacity and physical activity in coronary artery disease patients: A systematic review and meta-analysis. *European journal of preventive cardiology*. 2017;24(3):244-256.