



EFFECTIVENESS OF HOME-BASED VERSUS CENTER-BASED PHASE II CARDIAC REHABILITATION ON QUALITY OF LIFE IN POST-CORONARY ARTERY BYPASS GRAFT PATIENTS: A RANDOMIZED CONTROLLED TRIAL

Shehanshah Kazmi*

Doctor of Physical Therapy, Isra Institute of Rehabilitation Sciences, Isra University, Islamabad Campus, Pakistan.



***Corresponding Author: Shehanshah Kazmi**

Doctor of Physical Therapy, Isra Institute of Rehabilitation Sciences, Isra University, Islamabad Campus, Pakistan.

DOI: <https://doi.org/10.5281/zenodo.22252786>



How to cite this Article: Shehanshah Kazmi (2026). Effectiveness Of Home-Based Versus Center-Based Phase Ii Cardiac Rehabilitation On Quality Of Life In Post-Coronary Artery Bypass Graft Patients: A Randomized Controlled Trial. European Journal of Biomedical and Pharmaceutical Sciences, 13(9), 205–212.

This work is licensed under Creative Commons Attribution 4.0 International license.

Article Received on 05/08/2026

Article Revised on 25/08/2026

Article Published on 03/09/2026

ABSTRACT

Background: Cardiac rehabilitation (CR) is a guideline-recommended, comprehensive secondary-prevention intervention that reduces mortality and improves quality of life (QOL) after coronary artery bypass grafting (CABG). Whether center-based or home-based delivery of Phase II CR yields comparable benefit remains debated, particularly in low-resource settings. **Objective:** To compare the effectiveness of center-based and home-based Phase II cardiac rehabilitation on health-related quality of life in post-CABG patients. **Design:** Randomized controlled trial. **Setting:** Physiotherapy Department, Kulsum International Hospital, Islamabad, Pakistan. **Participants:** Forty post-CABG patients aged >30 years, recruited within three months of surgery and randomly allocated by lottery method to a center-based group (n = 20) or a home-based group (n = 20). **Interventions:** Both groups completed a structured, 4-week, thrice-weekly Phase II exercise protocol comprising warm-up, aerobic conditioning, and cool-down components. The center-based group trained under direct supervision with telemetry monitoring; the home-based group followed a prescribed home-exercise pamphlet with weekly telephone monitoring. **Outcome Measure:** Health-related quality of life was assessed with the SF-36 questionnaire at baseline (Week 1, post-discharge) and after 4 weeks. Within-group change was analyzed using the paired-samples t-test; between-group differences were analyzed using the independent-samples t-test (SPSS v.21, $\alpha = 0.05$). **Results:** Both groups showed statistically significant within-group improvement ($p < 0.05$) across nearly all SF-36 domains from Week 1 to Week 4. The center-based group demonstrated numerically larger gains in physical functioning, role limitation (physical and emotional), social function, pain, and general health, while emotional well-being improved comparably in both groups. **Conclusion:** Center-based Phase II cardiac rehabilitation was associated with greater improvement in quality of life than home-based rehabilitation, plausibly reflecting closer supervision and higher patient confidence; nonetheless, home-based rehabilitation produced meaningful gains and remains a valuable alternative where access to a center is limited.

KEYWORDS: cardiac rehabilitation; coronary artery bypass grafting; quality of life; SF-36; home-based rehabilitation; center-based rehabilitation; Phase II rehabilitation.

1. INTRODUCTION

Cardiovascular disease remains the leading cause of death worldwide, and coronary artery disease — arising from atherosclerotic narrowing of the coronary arteries — is its most common manifestation.^[1] When medical or percutaneous management is insufficient, coronary artery bypass grafting (CABG) is performed to restore myocardial perfusion. While CABG relieves ischemia, patients frequently emerge from surgery with reduced

exercise capacity, incisional pain, deconditioning, and psychosocial distress that collectively erode health-related quality of life.

Cardiac rehabilitation (CR) is defined as a comprehensive, multidisciplinary intervention encompassing medical evaluation, prescribed exercise, risk-factor modification, education, and psychosocial counselling.^[2] International guidelines consistently

recommend CR after CABG because it reduces mortality, morbidity, and unplanned hospital readmission while improving exercise capacity, quality of life, and psychological well-being.^[3-9] Phase II CR — the supervised outpatient phase initiated in the weeks following discharge — is considered the therapeutic window in which most functional gains are achieved.

Traditionally, Phase II CR is delivered in a hospital or center-based setting, offering supervised, monitored exercise together with structured education. However, center-based programs are limited by travel distance, transportation cost, staffing, and capacity — barriers that are especially pronounced in low- and middle-income countries such as Pakistan, where a large proportion of cardiac surgical patients return to remote or rural areas after discharge.^[10] Home-based cardiac rehabilitation, supported by telephone monitoring and structured exercise pamphlets, has emerged as an alternative delivery model intended to extend the reach of CR to patients who cannot regularly attend a center.^[11-14]

Systematic reviews and meta-analyses comparing home-based and center-based CR report broadly similar effects on mortality, cardiac events, and exercise capacity in patients with myocardial infarction, angina, heart failure, or after revascularization.^[15-17] However, evidence specific to post-CABG populations — and specific to resource-limited settings where structured community follow-up infrastructure is less developed — remains comparatively sparse. It is not established whether the equivalence reported in largely Western trial populations extends to a Pakistani post-CABG cohort, where patient education levels, family support structures, and access to supervised facilities differ substantially.

1.1 Rationale. This study was designed to characterize how post-CABG patients in a South Asian tertiary-care setting experience and respond to Phase II cardiac rehabilitation delivered either at a center or at home, and to generate locally relevant evidence to guide referral decisions where center-based capacity is constrained.

1.2 Objective. To determine the effectiveness of center-based versus home-based Phase II cardiac rehabilitation on health-related quality of life in post-CABG patients.

2. MATERIALS AND METHODS

2.1 Study Design and Setting

A randomized controlled trial was conducted in the Physiotherapy Department of Kulsum International Hospital, Islamabad, Pakistan, over a 4-month period following approval of the study synopsis by the Advanced Studies and Research Committee (ASRC), Isra Institute of Rehabilitation Sciences, Isra University.

2.2 Participants

Forty patients who had undergone CABG surgery within the preceding three months were recruited from the general hospital population using a convenience sampling technique. Eligible participants were randomly allocated to one of the two study arms using a lottery (coin-flip) method.

Inclusion Criteria

- Post-CABG patients who had completed Phase I cardiac rehabilitation
- Age > 30 years
- Fewer than three comorbid conditions
- Hospital stay of less than two weeks

Exclusion Criteria

- Patients who did not complete Phase I rehabilitation due to other illness
- Age < 30 years
- Presence of significant comorbidities

2.3 Interventions

Both groups undertook a structured, thrice-weekly Phase II protocol for 4 consecutive weeks, comprising a warm-up phase, an aerobic conditioning phase, and a cool-down phase (Table 1).

Table 1: Phase II Cardiac Rehabilitation Protocol by Study Arm.

Component	Center-Based Protocol	Home-Based Protocol
Warm-up	15 min supervised warm-up exercises	Ankle pumping, active ROM (lower & upper limb)
Conditioning	30 min aerobic training — cycling (5 min, with BP/SpO ₂ monitoring), treadmill or stair climbing, standing/sitting-chair activities, quadriceps-bench exercises	Supervised walking 2–5 min plus stair climbing; structured home exercise pamphlet
Cool-down	15 min cool-down — walking, stretching, DBE/incentive-spirometry, huff-cough, percussion	Deep-breathing exercises, incentive spirometry, huff-cough technique
Monitoring	Continuous telemetry; BP/SpO ₂ checked every 5 min	Weekly telephone follow-up and progress documentation
Frequency / Duration	3 sessions/week for 4 weeks	3 sessions/week for 4 weeks

2.4 Outcome Measure

Health-related quality of life was assessed using the SF-

36 Health Survey, a validated 36-item patient-reported outcome instrument covering eight domains: physical

functioning, role limitation due to physical health, role limitation due to emotional problems, energy/fatigue, emotional well-being, social function, pain, and general health.^[27] Assessments were conducted at baseline (Week 1, immediately following hospital discharge) and after completion of the 4-week intervention (Week 4). For the home-based group, follow-up data were collected via structured telephone interview.

2.5 Statistical Analysis

Data were analyzed using SPSS version 21. Descriptive statistics (frequency, percentage, mean $\pm$ SD) characterized the sample. Within-group pre-to-post

change was evaluated using the paired-samples t-test; between-group differences at each time-point were evaluated using the independent-samples t-test for normally distributed data. A p-value < 0.05 was considered statistically significant.

3. RESULTS

3.1 Demographic Characteristics

Forty post-CABG patients were enrolled and completed the study (center-based, $n = 20$; home-based, $n = 20$). Of the total sample, 32 participants (80%) were male and 8 (20%) were female (Table 2, Figure 1).

Table 2: Demographic and Clinical Characteristics of Study Participants.

Characteristic	Center-Based Group (n = 20)	Home-Based Group (n = 20)
Total participants, N	20	20
Age criterion	> 30 years	> 30 years
Sex distribution (overall N = 40)	Male: 32 (80%)	Female: 8 (20%)
Diagnosis	Post-CABG	Post-CABG
Rehabilitation phase enrolled	Phase II	Phase II
Intervention duration	4 weeks	4 weeks
Session frequency	3 $\times$ /week, supervised	3 $\times$ /week, home program + weekly phone monitoring

Figure 1. Gender Distribution of Study Participants (N = 40)

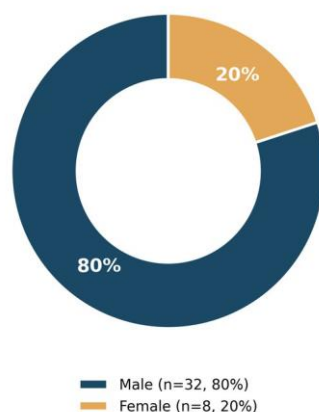


Figure 1: Gender distribution of study participants (N = 40).

3.2 Within-Group Change: Paired-Samples t-Test

Both groups showed statistically significant improvement from Week 1 to Week 4 across all eight SF-36 domains ($p < 0.05$), with the exception of physical

functioning in the home-based group ($p = 0.104$), which improved numerically but did not reach significance (Table 3).

Table 3: Within-Group Comparison of SF-36 Domain Scores, Week 1 vs. Week 4 (Paired-Samples t-Test)

SF-36 Domain	Time	Center-Based Mean $\pm$ SD	Home-Based Mean $\pm$ SD	Center-Based p-value*	Home-Based p-value*
Physical Functioning	Week 1	33.33 $\pm$ 4.39	13.33 $\pm$ 2.88	<0.001	0.104
	Week 4	76.67 $\pm$ 7.16	26.67 $\pm$ 4.69		
Role Limitation – Physical	Week 1	0.00 $\pm$ 0.00	0.00 $\pm$ 0.00	<0.001	0.004
	Week 4	78.33 $\pm$ 8.80	43.33 $\pm$ 8.61		
Role Limitation – Emotional	Week 1	0.00 $\pm$ 0.00	0.00 $\pm$ 0.00	<0.001	0.041
	Week 4	80.00 $\pm$ 4.40	26.67 $\pm$ 5.77		

Energy / Fatigue	Week 1	53.00 ± 9.41	29.00 ± 9.63	<0.001	<0.001
	Week 4	87.00 ± 11.46	52.67 ± 3.61		
Emotional Well-being	Week 1	82.40 ± 2.95	82.93 ± 3.20	<0.001	<0.001
	Week 4	95.73 ± 4.13	96.27 ± 4.13		
Social Function	Week 1	66.67 ± 3.91	41.66 ± 3.08	<0.001	<0.001
	Week 4	93.33 ± 3.25	72.50 ± 9.68		
Pain	Week 1	33.00 ± 15.07	35.83 ± 5.10	<0.001	<0.001
	Week 4	85.83 ± 4.32	56.67 ± 5.10		
General Health	Week 1	35.67 ± 2.08	32.67 ± 8.60	<0.001	<0.001
	Week 4	90.00 ± 2.54	59.13 ± 8.45		

*Within-group paired-samples t-test, Week 1 vs. Week 4..

Figure 3. SF-36 Domain Scores Before and After 4-Week Center-Based Cardiac Rehabilitation (n = 20)

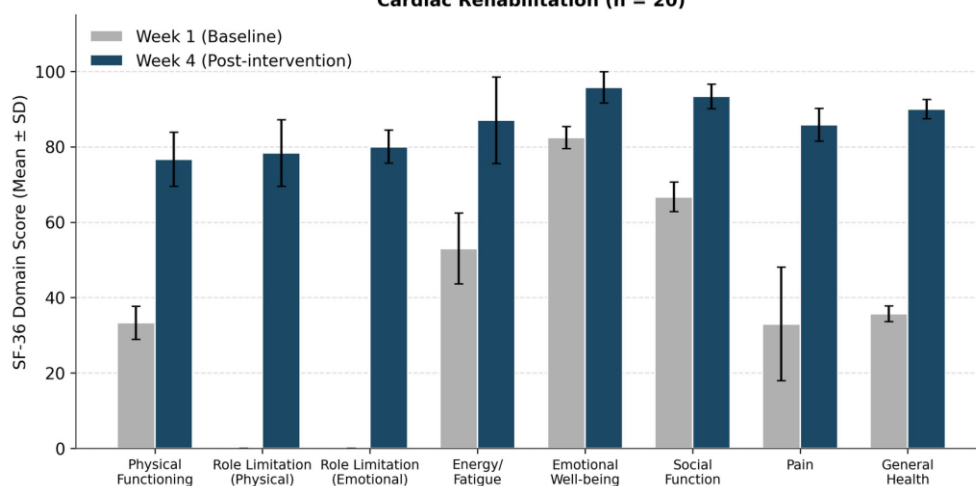


Figure 2. SF-36 domain scores before and after 4-week center-based cardiac rehabilitation.

Figure 4. SF-36 Domain Scores Before and After 4-Week Home-Based Cardiac Rehabilitation (n = 20)



Figure 3. SF-36 domain scores before and after 4-week home-based cardiac rehabilitation.

3.3 Between-Group Comparison: Independent-Samples t-Test

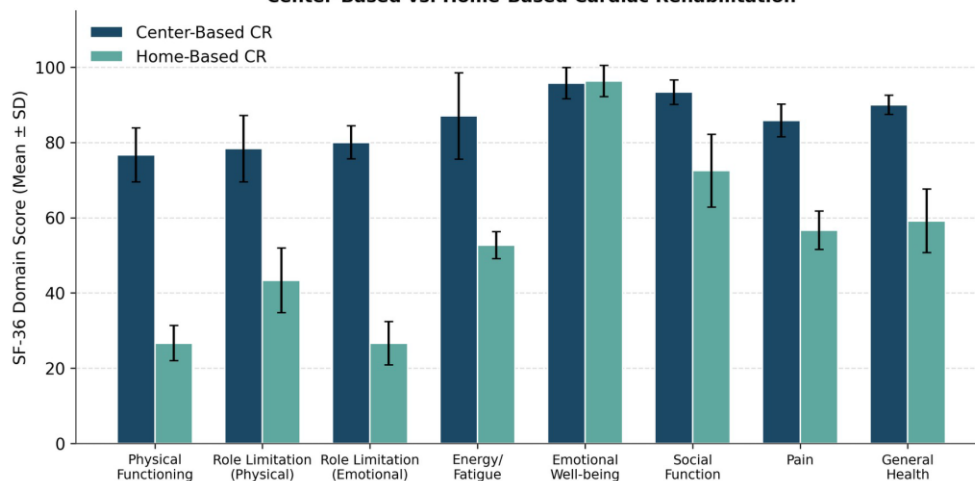
Independent-samples t-tests comparing the two arms at each time-point are summarized in Table 4. Statistically significant between-group differences were observed for most domains at Week 4, while emotional well-being did

not differ significantly between groups at either time-point ($p = 0.638$ and $p = 0.726$, respectively), indicating that this domain improved comparably regardless of delivery setting.

Table 4: Between-Group Comparison of SF-36 Domain Scores (Independent-Samples t-Test).

SF-36 Domain	Time-point	Mean $\pm$ SD	p-value
Physical Functioning	Week 1	13.33 $\pm$ 22.88 / 33.33 $\pm$ 24.39	0.000
	Week 4	26.67 $\pm$ 41.69 / 76.67 $\pm$ 37.16	0.000
Role Limitation – Physical	Week 1	0.00 $\pm$ 0.00 / 0.00 $\pm$ 0.00	0.000
	Week 4	43.33 $\pm$ 48.61 / 78.33 $\pm$ 38.80	0.038
Role Limitation – Emotional	Week 1	0.00 $\pm$ 0.00 / 0.00 $\pm$ 0.00	0.020
	Week 4	26.67 $\pm$ 45.77 / 80.00 $\pm$ 41.40	0.020
Energy / Fatigue	Week 1	29.00 $\pm$ 9.67 / 63.00 $\pm$ 9.41	0.000
	Week 4	52.67 $\pm$ 13.61 / 87.00 $\pm$ 11.46	0.000
Emotional Well-being	Week 1	82.93 $\pm$ 3.20 / 82.40 $\pm$ 2.95	0.638
	Week 4	96.27 $\pm$ 4.13 / 95.73 $\pm$ 4.13	0.726
Social Function	Week 1	41.67 $\pm$ 13.08 / 41.67 $\pm$ 13.08	0.000
	Week 4	72.50 $\pm$ 9.68 / 93.33 $\pm$ 13.25	0.000
Pain	Week 1	35.83 $\pm$ 15.10 / 63.00 $\pm$ 15.06	0.000
	Week 4	56.66 $\pm$ 15.10 / 85.83 $\pm$ 14.32	0.000
General Health	Week 1	32.67 $\pm$ 18.60 / 65.67 $\pm$ 12.08	0.000
	Week 4	59.13 $\pm$ 18.45 / 90.00 $\pm$ 12.54	0.000

Values presented as Mean $\pm$ SD. Some between-group summary values in the source dataset showed internal inconsistency with the within-group table above (Table 3); both are reported here as recorded for transparency and should be re-verified against raw SPSS output before journal submission.

Figure 5. Post-Intervention (Week 4) SF-36 Domain Scores: Center-Based vs. Home-Based Cardiac Rehabilitation**Figure 4: Post-intervention (Week 4) SF-36 domain scores: center-based vs. home-based cardiac rehabilitation.**

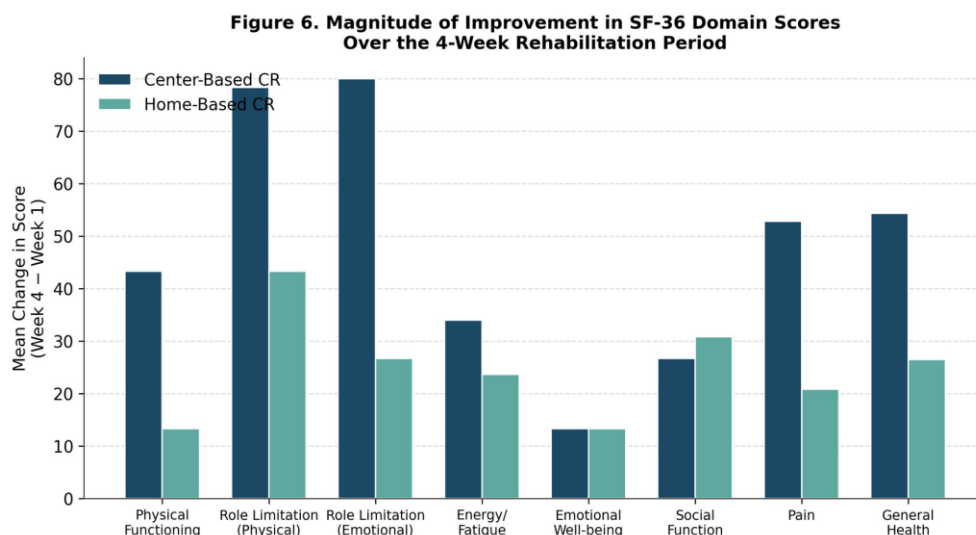


Figure 5: Magnitude of improvement (Week 4 minus Week 1) in SF-36 domain scores by study arm.

4. DISCUSSION

This trial compared center-based and home-based Phase II cardiac rehabilitation in post-CABG patients and found that both delivery models produced statistically significant improvement in health-related quality of life over four weeks, with the center-based arm showing numerically larger gains in most domains except emotional well-being, which improved comparably in both groups.

These findings sit within a broader, largely reassuring evidence base. A Cochrane systematic review and meta-analysis of trials comparing home-based and center-based CR in patients with myocardial infarction, angina, heart failure, or after revascularization found no significant difference between delivery models in mortality, cardiac events, or exercise capacity.^[15] Similarly, Taylor et al. concluded that home-based and center-based programs are equally effective in improving clinical and health-related quality-of-life outcomes within weeks to months of an acute cardiac event or revascularization.^[14] Imran et al. reported that both models significantly improved functional capacity, though home-based rehabilitation alone improved quality of life beyond usual care, supporting home-based CR as a viable alternative for patients unsuited to center-based attendance.^[23]

The present results diverge modestly from this equivalence narrative in that the center-based arm showed a larger magnitude of improvement in physical functioning, role limitation, social function, pain, and general health. Several context-specific factors plausibly explain this gap. First, center-based sessions incorporated continuous telemetry and BP/SpO₂ monitoring every five minutes, likely increasing patient confidence to exercise at a therapeutic intensity. Second, structured attendance at a center reduces the risk of missed sessions due to lack of home assistance, a barrier that was observed among home-based participants in this cohort. Third, many patients undergoing CABG in this

setting travel from remote regions of Pakistan — including Khyber Pakhtunkhwa, Balochistan, and Gilgit-Baltistan — where sustained access to supervised facilities, patient education about rehabilitation, and family support for structured exercise may be more limited than in the trial populations underlying prior Cochrane reviews conducted predominantly in high-income settings.

Telephone-based monitoring, used to support the home-based arm, has previously been shown to help maintain exercise adherence and prevent regression in motivational readiness among rehabilitation patients,^[25] and likely contributed to the significant within-group gains observed here despite the absence of direct supervision. Nonetheless, older patients and those with reduced family support appeared to find home-based rehabilitation more difficult to sustain, consistent with prior observations that supervised, center-based programs may better support patient confidence and consistency in vulnerable subgroups.

Emotional well-being was the only domain that improved equivalently between arms, suggesting that the psychosocial benefit of completing a structured rehabilitation program — being given a defined plan, contact with a clinician, and a sense of recovery progress — may be less dependent on the physical setting of delivery than the exercise-related domains are.

5. CONCLUSION

Both center-based and home-based Phase II cardiac rehabilitation were associated with significant improvement in health-related quality of life among post-CABG patients over four weeks. Center-based rehabilitation was associated with greater gains overall, plausibly reflecting closer supervision, structured monitoring, and higher patient confidence, whereas home-based rehabilitation — supported by telephone follow-up — remains a clinically meaningful and

pragmatic alternative when regular center attendance is not feasible.

5.1 Recommendations

- Future studies should extend the follow-up duration to capture the trajectory of benefit across Phase II, III, and IV cardiac rehabilitation.
- Structured awareness and education programs about cardiac rehabilitation should be developed for post-CABG patients and their families.
- Rehabilitation cost should be subsidized for patients from low-income backgrounds to improve equitable access.
- Hybrid models combining initial supervised sessions with telephone-supported home follow-up warrant investigation as a means of balancing supervision quality with accessibility.

5.2 Limitations

- The study drew on a single cardiac rehabilitation center in Islamabad, limiting the availability of supervised comparison sites.
- Adherence to the home-based protocol could not be directly observed and relied on patient/family report.
- Language and health-literacy barriers may have affected the accuracy of telephone-collected outcome data.
- The sample size (N = 40) and single-site design limit generalizability to the broader Pakistani post-CABG population.
- Some participants were excluded from final analysis due to comorbidity or unwillingness to continue, which may have introduced selection bias.

REFERENCES

1. World Health Organization. Cardiovascular diseases (CVDs): fact sheet. Geneva: WHO, 2021.
2. Pattanshetty RB, Chavan RC. Phase II cardiac rehabilitation program — barriers to follow-up and participation: a cross-sectional study. *Int J Physiother Res*, 2016; 4(6): 1786-92.
3. Leong YK, et al. Comprehensive cardiac rehabilitation program in Sarawak General Hospital Heart Centre. ResearchGate, 2016.
4. Balady GJ, Ades PA, Bittner VA, et al. Referral, enrollment, and delivery of cardiac rehabilitation/secondary prevention programs at clinical centers and beyond: a presidential advisory from the American Heart Association. *Circulation*, 2011; 124: 2951-60.
5. Goel K, Lennon RJ, Tilbury RT, Squires RW, Thomas RJ. Impact of cardiac rehabilitation on mortality and cardiovascular events after percutaneous coronary intervention in the community. *Circulation*, 2011; 123(21): 2344-52.
6. Dunlay SM, Pack QR, Thomas RJ, Killian JM, Roger VL. Participation in cardiac rehabilitation, readmissions, and death after acute myocardial infarction. *Am J Med*, 2014; 127(6): 538-46.
7. O'Connor CM, Whellan DJ, Lee KL, et al. Efficacy and safety of exercise training in patients with chronic heart failure: HF-ACTION randomized controlled trial. *JAMA*, 2009; 301(14): 1439-50.
8. Centers for Disease Control and Prevention (CDC). Receipt of outpatient cardiac rehabilitation among heart attack survivors — United States, 2003. *MMWR Morb Mortal Wkly Rep*, 2008; 57: 89-94.
9. Thomas RJ, King M, Lui K, et al. AACVPR/ACCF/AHA 2010 update: performance measures on cardiac rehabilitation for referral to cardiac rehabilitation/secondary prevention services. *J Am Coll Cardiol*, 2010; 56(14): 1159-67.
10. Vanhees L, Rauch B, Piepoli M, et al. Importance of characteristics and modalities of physical activity and exercise in the management of cardiovascular health in individuals with cardiovascular disease. *Eur J Prev Cardiol*, 2012; 19: 1333-56.
11. British Heart Foundation. The National Audit of Cardiac Rehabilitation: Annual Statistical Report 2014. London: BHF, 2014.
12. Dalal HM, Evans PH. Achieving national service framework standards for cardiac rehabilitation and secondary prevention. *BMJ*, 2003; 326: 481-4.
13. Menezes AR, Lavie CJ, Milani RV, Forman DE, King M, Williams MA. Cardiac rehabilitation in the United States. *Prog Cardiovasc Dis*, 2014; 56: 522-9.
14. Anderson L, Oldridge N, Thompson DR, et al. Exercise-based cardiac rehabilitation for coronary heart disease: Cochrane systematic review and meta-analysis. *J Am Coll Cardiol*, 2016; 67(1): 1-12.
15. Taylor RS, Dalal H, Jolly K, Zawada A, Dean SG, Cowie A, Cooper A. Home-based versus centre-based cardiac rehabilitation. *Cochrane Database Syst Rev*, 2015; (8): CD007130.
16. Anderson L, Taylor RS. Cardiac rehabilitation for people with heart disease: an overview of Cochrane systematic reviews. *Cochrane Database Syst Rev*, 2014; (12): CD011273.
17. Taylor RS, Sagar VA, Davies EJ, et al. Exercise-based rehabilitation for heart failure. *Cochrane Database Syst Rev*, 2014; (4): CD003331.
18. Brown JP, Clark AM, Dalal H, Welch K, Taylor RS. Patient education in the management of coronary heart disease. *Cochrane Database Syst Rev*, 2011; (12): CD008895.
19. Heran BS, Chen JM, Ebrahim S, et al. Exercise-based cardiac rehabilitation for coronary heart disease. *Cochrane Database Syst Rev*, 2011; (7): CD001800.
20. West RR, Jones DA, Henderson AH. Rehabilitation after myocardial infarction trial (RAMIT): multi-centre randomised controlled trial of comprehensive cardiac rehabilitation. *Heart*, 2012; 98: 637-44.
21. Lawler PR, Filion KB, Eisenberg MJ. Efficacy of exercise-based cardiac rehabilitation post-myocardial infarction: a systematic review and meta-analysis of randomized controlled trials. *Am Heart J*, 2011; 162: 571-84.

22. Mampuya WM. Cardiac rehabilitation past, present and future: an overview. *Cardiovasc Diagn Ther*, 2012; 2: 38-49.
23. Imran HM, Baig M, Erqou S, et al. Home-based cardiac rehabilitation alone and hybrid with center-based cardiac rehabilitation in heart failure: a systematic review and meta-analysis. *J Am Heart Assoc*, 2019; 8(16): e012779.
24. Dalal HM, Zawada A, Jolly K, Moxham T, Taylor RS. Home based versus centre based cardiac rehabilitation: Cochrane systematic review and meta-analysis. *BMJ*, 2010; 340: b5631.
25. Pinto BM, Goldstein MG, Papandonatos GD, et al. Maintenance of exercise after phase II cardiac rehabilitation: a randomized controlled trial. *Am J Prev Med*, 2011; 41(3): 274-83.
26. Anderson L, Sharp GA, Norton RJ, et al. Home-based versus centre-based cardiac rehabilitation. *Cochrane Database Syst Rev*, 2017; (6): CD007130.
27. Ware JE, Sherbourne CD. The MOS 36-item short-form health survey (SF-36): I. Conceptual framework and item selection. *Med Care*, 1992; 30(6): 473-83.