

# Barriers to Establishing Outpatient Cardiac Rehabilitation in the Western Region of Saudi Arabia: A Cross-Sectional Study

Alaa Khushhal<sup>1</sup>, Mohammed Alsubaiei<sup>2</sup>

<sup>1</sup>Department of Physical Therapy, Faculty of Applied Medical Sciences, Umm Al-Qura University, Makkah, Kingdom of Saudi Arabia; <sup>2</sup>Department of Physical Therapy, Faculty of Applied Medical Sciences, Imam Abdulrahman Bin Faisal University, Dammam, Kingdom of Saudi Arabia

Correspondence: Alaa Khushhal, Department of Physical Therapy, Faculty of Applied Medical Sciences, Umm Al-Qura University, Makkah, Kingdom of Saudi Arabia, Email [aakhushhal@uqu.edu.sa](mailto:aakhushhal@uqu.edu.sa); Mohammed Alsubaiei, Department of Physical Therapy, Imam Abdulrahman bin Faisal University, Dammam, Kingdom of Saudi Arabia, Email [MSubaiei@iau.edu.sa](mailto:MSubaiei@iau.edu.sa)

**Background:** The core of cardiac rehabilitation (CR) is structured exercise training. CR reduces 28–56% hospital readmission rate, and around 25% increases cardiorespiratory fitness but the number of outpatients CR centers in Saudi Arabia (SA) is very limited and there is a need to establish outpatient CR (Phase III) in SA. Furthermore, the awareness of outpatient CR in SA is unknown.

**Aim:** To determine the main barriers to establishing an outpatient CR program (Phase III) in the western region of SA, as well as assess the awareness of outpatient CR (Phase III) in the western region of SA.

**Methods:** A cross-sectional study survey was conducted between March – July 2021 among physiotherapists, cardiologists and the cardiac surgeon using a questionnaire distributed electronically to determine the awareness level of outpatient CR and barriers to establishing outpatient CR (Phase III) in the western region of SA. Frequencies and percentages were used to report the variables.

**Results:** Of the 141 participants who completed the online survey, our findings showed that 131 (93%) were aware of CR but only 29 (21%) were aware of the four phases of CR. There were three main barriers to establishing CR: lack of appropriate CR 135 (96%); lack of awareness among healthcare professions of CR and its benefits 134 (95%) and the lack of healthcare providers trained in CR 133 (94%). There was a significant relationship between physiotherapists and cardiologists' responses on agreeing to all barriers to establishing CR in SA ( $r=0.69$ ,  $P=0.03$ ).

**Conclusion:** To overcome the barriers to establishing CR outpatient centers in the western region of SA, it is recommended to provide more CR outpatient training programs to healthcare providers and raise the awareness of the CR phases, its benefits, and the risk factors for developing cardiac diseases among healthcare providers.

**Keywords:** cardiac rehabilitation, barriers, awareness

## Introduction

Annually, 17.9 million people die worldwide because of cardiovascular diseases (CVDs).<sup>1</sup> A report released by the Ministry of Health in Saudi Arabia (SA) 2013 stated that 42% of non-communicable diseases in SA are caused by CVDs including heart attacks;<sup>2</sup> with a 42% death rate caused by CVDs alone.<sup>3</sup> It is predicted that by 2030, the number of people who will die from CVDs worldwide will increase to around 23 million if no effective treatment or prevention is implemented. Moreover, cardiovascular morbidity intends to increase unless effective action is taken.<sup>2</sup>

In the Gulf Region, there is a need for effective preventive strategies to reduce the risk of CVDs in the coming years.<sup>3</sup> The prevalence of ischemic heart disease in SA is 23%, with an acute coronary syndrome prevalence of 77% in males and 32% in females.<sup>3</sup> The most common risk factors for developing cardiac disease in SA are being diabetic (56%), hypertensive (48%), a smoker (39%), and having high cholesterol (31%).<sup>3</sup> Physical inactivity, an unhealthy diet, and smoking are the most important risk factors for developing of CVDs;<sup>2</sup> therefore, comprehensive cardiac rehabilitation (CR) is the optimal treatment for patients with CVDs and prevention for those at risk.<sup>4–8</sup>

Comprehensive CR has many facets, including psychological and dietary support and exercise programming, with structured exercise training being the main component.<sup>4</sup> CR is effective in decreasing the total mortality rate by around 13–26% and the cardiac mortality rate by 26–36%, increasing the quality of life, reducing dyspnea<sup>4</sup> and around 28–56% hospital readmission rates<sup>4,7,9</sup> around 25% increasing cardiorespiratory fitness of cardiac patients<sup>4,10,11</sup> and reducing the risk of future cardiac events.<sup>12,13</sup> CR Phase III has showed to reduce the cardiovascular events in patients with stable coronary artery disease and reduce lipid level profile in the long term.<sup>14,15</sup> Exercise in CR phase III after cardiac surgery showed to increase functional capacity.<sup>16</sup>

Changing lifestyle after cardiac events is important for the cardiac patients to improve their health but there are some barriers among patients in SA to get change in the lifestyle. In semi-structure review with 21 patients revealed that the major barriers were family values, religious believe and sociocultural norms while the mediating barriers were physical environment, policy regulations and insufficient health care services.<sup>17</sup>

A narrative review revealed that there is a need to establish CR centers in SA in the cardiac centers in SA to prevent future heart problems and to return cardiac patients to the normal lifestyle. Moreover, a review recommended to improve CR in SA and there is a need to increase number of CR in SA, to establish Arabic cardiac rehabilitation guidelines and to establish a link between the college of Medicine and college of Applied Medical Sciences to provide more CR unit in SA but the obstacles to establish CR in SA are still not clear and need to be investigated.<sup>10</sup>

There are four phases of CR. The first phase is inpatient and begins after cardiac surgery; the second phase starts after the patients are discharged from hospital for three to six weeks; the third phase is the outpatient phase and is more independent with training exercises; and the fourth phase is the maintenance phase and provided in the community.<sup>9,18</sup> To the best of our knowledge, most cardiac centers in SA conduct Phase I, providing cardiac rehabilitation for inpatients after cardiac surgery, but there are very few and limited number of cardiac centers conducting phase III CR for outpatients after cardiac surgery in the western region of SA. In order to implement CR programs in the western region of SA, it requires to investigate the barriers of establishing outpatient CR centers in the western region of SA and to overcome these barriers. It is also important to examine the awareness level for the health career professionals in CR in the western region of SA. Thus, there is a need to establish outpatient CR (Phase III) centers in the western region of SA on the physiotherapists and cardiologists views,<sup>10</sup> so the main aim of this study is to investigate the barriers for setting up CR centers in the western region of SA were identified by physiotherapists and cardiologists and the secondary aim of this study is to determine the level of awareness of CR in the western region of SA among the physiotherapists and cardiologists.

## Hypothesis

This study hypothesized that to identify the obstacles to establishing CR in the western region of SA in the health care professional views such as the physiotherapists and cardiologists and to know their level of awareness with CR and CR four phases.

## Methods

### Study Design and Participants

This cross-sectional study was approved by the Biomedical Research Ethics Committee of Umm Al-Qura University, approval number HAPO-02-K—012-2021-03-591 and conducted between March – July 2021 using an electronic questionnaire in English language, which was distributed in 20 Saudi hospitals and two universities in the western region of SA.

A convenience sample method was used to recruit participants in this survey. The target responders for this questionnaire were cardiologists, cardiac surgeons, and physiotherapists. To reach more participants in SA, the questionnaire was distributed by emails and social media such as WhatsApp.

The high quality of the questionnaire can reflect on the following: each question in the questionnaire was based on a previous report from the expertise review of barriers to CR in SA and some elements were derived from a previous study regarding barriers to establishing pulmonary rehabilitation in SA.<sup>10,13</sup> The validity and reliability of the

questionnaire was tested by physiotherapists (a total of 8) as a pilot survey regarding the clarity of the questionnaire and easy to use before it is used. From the results of the pilot survey, some modifications have been done to the questionnaire to increase the clarity of the questionnaire and to make it easier to use.

Each participant received an invitation message including the aims of the study, state “taking part in the survey is totally voluntary and participant can with at any time” and identify the principal investigator before to start the survey. The survey started with the question that “are you happy to take part in this study?”. Five to ten minutes was the expected time to complete the questionnaire. The first part of the survey included some demographic questions such as age, gender, nationality, and job description such as physiotherapists, cardiologists and cardiac surgeon. The main questionnaire consisted of two parts. The first part was concerned about the awareness of comprehensive CR (outpatient) in SA among cardiologists, cardiac surgeons, and physiotherapists. If the participants were not aware of comprehensive CR and its phases, the definition of CR (outpatient) and some details about CR were provided to increase participant awareness. The first part of the questionnaire included some questions such as the important to establish CR, the preference of the participants for delivering the CR. The second part of the questionnaire was concerned about the barriers to establishing comprehensive CR (outpatient) in SA. There are nine barriers in the second part and the response for each barrier is based on 5 points of the Likert scale, ranging from 1 for “strongly disagree” and 5 for “strongly agree”.

## Sample Size

The sample size for this study was based on the past study.<sup>13</sup>

## Data Analysis

The descriptive data were statistically analyzed and reported as frequency and percentage using SPSS (27 version) to address the objectives of this survey. Mean and SD used in the demographic data such as age. This study used the Pearson correlation test using SPSS (27 version) to test the relationship between physiotherapists and doctors/cardiologists’ groups on agreeing to the barriers to establishing CR. P value was set at 0.05 to test for significance of the relationship.

## Data Availability

All data generated or analyzed during this study are included in the supplement data document.

## Results

The study participants were 67 physiotherapists and 73 cardiologists with 1 cardiac surgeon aged 24 to 66 years old. In total, there were 141 responses from the western region of SA (141 participants; [Table 1](#)). About 83% of the responders were male, and 17% were female. The response rate for this study survey was 57.5% as 250 surveys were distributed and 141 returned.

## Awareness of CR

About 93% of the responders were aware of CR but only 21% were aware of the phases of CR, with 97% of the responders aware of the benefits of CR and 99% considered it important to establish CR in SA ([Table 2](#)). Most responders (90%) prefer to establish hospital-based CR, with very few (10%) preferring home-based CR. Nearly all the responders (99%) believed that CR would be beneficial to the management of their cardiac patients and 94% thought that cardiac patients could not resume their normal daily activities without CR ([Table 2](#)). Additionally, 90% of the physiotherapists were aware of CR, but 33% of the physiotherapists were aware of CR phases. Further, 96% of the cardiologists and cardiac surgeons were aware of CR, but only 9% of the cardiologists and cardiac surgeons were aware of CR phases. The awareness of CR phases among physiotherapists (33%) was better than among cardiologists (9%).

**Table 1** Study Participant Demographics

	Western Region of SA
<b>No. of participants</b>	141
<b>Mean age ± SD</b>	41±12
<b>Gender</b>	
Male	117
Female	24
<b>Job title</b>	
Cardiologist	73
Physiotherapist	67
Cardiac surgeon	1
<b>Nationality</b>	
Saudi	82
Non-Saudi	59

**Abbreviations:** SD, Standard deviation; SA, Saudi Arabia.

**Table 2** The Awareness of Healthcare Professionals of CR

	No. of Total Participants (Out of 141)	% of Total Participants
<b>Do you think it is important to establish comprehensive cardiac rehabilitation (Phase III)?</b>	139	99%
<b>Do you believe that comprehensive cardiac rehabilitation will give some benefits to your management?</b>	139	99%
<b>Do you prefer to establish comprehensive cardiac rehabilitation phase III as?</b>	139	99%
<b>Hospital-based</b>	127 Hospital-based	90% Hospital-based
<b>Home-based</b>	14 Home-based	10% home-based
<b>If your hospital provides comprehensive cardiac rehabilitation, are you willing to refer your patients to it?</b>	137	98%
<b>Are you aware of the benefits of comprehensive cardiac rehabilitation (Phase III)?</b>	136	97%
<b>Are you aware of any comprehensive cardiac rehabilitation?</b>	131	93%
<b>Are you aware of cardiac rehabilitation's four phases?</b>	29	21%
<b>Do you believe that patients who have cardiac diseases can return to normal life without a comprehensive cardiac rehabilitation program?</b>	9	7%

## Barriers to Establishing Comprehensive Outpatient CR in the Western Region of Saudi Arabia

The three main barriers to establishing comprehensive outpatient CR in all participants, were the lack of appropriate comprehensive CR (96%), followed by a lack of awareness of patients and healthcare professionals of CR and its benefits (95%), and the lack of healthcare providers trained in CR (94%) (Table 3). Furthermore, 88% of the participants agreed that there is a lack of specific Arabic guidelines regarding cardiac diseases, which could be why CR does not exist, and 83% of the participants also agreed that there is a lack of funding to support cardiac CR; hence the lack of comprehensive CR in SA (Table 3). These three barriers were the same main barriers to establishing outpatient CR centers among the physiotherapist participants alone and cardiologist participants alone (Table 3).

The lowest-ranked barriers to CR in the western region of SA among all participants were the lack of hospital capacity in the cardiac wards (63%), referrals from cardiologists to CR (66%), and cooperation between applied medicine and the college of medicine (68%). Also, 70% agreed that the lack of cooperation between the physiotherapist and cardiologist could be a barrier to establishing CR in SA (Table 3). The lowest-ranked barriers to CR in the western region

**Table 3** Barriers to Establishing CR in the Western Region of SA in Total and Among Physiotherapists and Cardiologist and Cardiac Surgeon

Barriers to Establishing CR in SA	No. and % of Total Participants (Out of 141)	No. and % of Physiotherapists (Out of 67)	No. and % of Cardiologists And Cardiac Surgeons (Out of 74)
1-Lack of appropriate comprehensive CR	135 (96%)	62 (93%)	73 (99%)
2-Lack of awareness among healthcare professionals of CR and its benefits	134 (95%)	61 (91%)	73 (99%)
3-Lack of trained healthcare providers	133 (94%)	59 (88%)	74 (100%)
4-Lack of specific Arabic guidelines	125 (88%)	55 (82%)	70 (95%)
5-Lack of funding to support establishing CR	117 (83%)	55 (82%)	62 (84%)
6-Lack of cooperation between physiotherapists and cardiologists	99 (70%)	45 (67%)	54 (73%)
7-Lack of cooperation between the colleges of applied medicine and medicine	95 (68%)	41 (61%)	54 (73%)
8-Lack of referrals from cardiologists to CR	93 (66%)	51 (77%)	42 (62%)
9-Lack of hospital capacity in the cardiac wards	88 (63%)	50 (75%)	38 (51%)

**Abbreviations:** No., Number; CR, Cardiac rehabilitation.

of SA among cardiologist participants only were the same as among all participants, but it is slightly different among the physiotherapist participants only, as lack of cooperation between the allied health care providers and physicians was 61%, followed by the cooperation between physiotherapist and cardiologists were at 67%, followed by the lack of hospital capacity in the cardiac wards were at 75% (Table 3).

There was a significant positive relationship between number and percentage of physiotherapists and cardiologists' groups on agreeing to the barriers to establishing CR in the western region of SA ( $r = 0.69$ ;  $P = 0.03$ ).

Regarding the main barrier to not having CR in the western region of SA, almost half of the participants agreed that the lack of awareness among patients and healthcare professionals of CR phase III and its benefits was the most important barrier for not having cardiac rehabilitation in SA, with about a quarter of the respondents agreeing that the lack of trained healthcare providers was the main barrier for not having CR in SA. Furthermore, a few participants agreed that the lack of appropriate CR and communication between therapists and cardiologists could be the main barrier to establishing CR in SA.

## Discussion

This is the first study to examine the barriers to establishing outpatient cardiac rehabilitation in the western region of SA among physiotherapists and cardiologist views and the awareness of CR among cardiologists, physiotherapists, and cardiac surgeons in the western region of SA. The main barriers to not having outpatient CR in the western region of SA were the lack of awareness among healthcare professionals of cardiac rehabilitation phases and its benefits, as well as the lack of healthcare professionals trained in cardiac rehabilitation. There are a few outpatients CR centers in SA, but they do not provide comprehensive cardiac rehabilitation. The novelty of this study is to determine the barriers for establishing outpatient CR to overcome these barriers and establish more outpatient CR centers in SA. Physiotherapists and cardiologists agreed with the same barriers to establishing CR in SA with significant relationships between these two groups ( $r = 0.69$ ;  $P = 0.03$ ).

In comparisons to other high-income countries such as Chanda, the United States, and Australia, lack of awareness of CR among healthcare professionals was also the same main barrier for referring patients to CR.<sup>19</sup> Lack of training in health care and lack of cardiac rehabilitation centers were the most important barriers in India and Brazil; also, the same main barriers existed in Saudi Arabia.<sup>20,21</sup> To overcome these barriers, there is a need to increase awareness of CR among healthcare providers worldwide by adding CR topics in both undergraduate and postgraduate levels.<sup>20</sup> Moreover, there is a need to establish many cardiac rehabilitation services worldwide and to train the health care providers more about the

CR.<sup>20</sup> Besides, lack of funding was the main barriers in middle and low income countries, such as Brazil and India.<sup>20,21</sup> Lack of funds should not be the main point because CR program can be implemented using local services in hospital resources with low-costs.<sup>20</sup>

The present study's findings are in line with another study that states there are no specific Arabian cardiac rehabilitation guidelines, with limited cardiac rehabilitation centers in SA; hence the need to establish cardiac rehabilitation centers in SA.<sup>10,22</sup> Furthermore, the expert opinion suggests that the lack of hospital capacity and healthcare providers for cardiac rehabilitation may be the obstacles for not having cardiac rehabilitation centers in SA, whereas our survey revealed that the lack of hospital capacity was not a major barrier to providing comprehensive cardiac rehabilitation in SA.

A narrative review of barriers that physicians face when referring patients to cardiac rehabilitation revealed that increased physician awareness of cardiac rehabilitation increases their referral rate.<sup>23</sup> The present study's findings are in line with these results, that the awareness of physicians of the cardiac rehabilitation phases was a barrier to establishing cardiac rehabilitation in SA. The UK is also facing a lack of staff training and education in cardiac rehabilitation to achieve the recommended exercise intensity during cardiac rehabilitation, which is an obstacle to cardiac rehabilitation in the UK<sup>24-26</sup> as confirmed in our study.

CR barriers scale (CRBS) was developed to focus on barriers of CR enrolment and adherence. A study completed to determine the key barriers in East Central Europe using CRBS showed that the most barriers to enroll and adhere to CR were distance and travel, while lack of time and work responsibilities were from the main barriers to enroll in CR in east central Europe.<sup>27</sup> Another study showed that transport, travel and distance were the most barriers to attend CR and the patients prefer to attend home-based CR programs to overcome the past barriers,<sup>28</sup> however, our results showed that most (90%) of the physiotherapists and cardiologists preferred hospital-based CR program and the possible reason for this preference from the health care professionals in SA may be because they prefer to establish the hospital-based CR programs first in the western region of SA and then apply the home-based CR programs second. However, a survey study has done in SA to examine the barriers to refer to CR in SA in heart failure disease from nurse's views reported that most of the nurse in SA prefer to deliver CR as home-based CR program<sup>29</sup> and the possible reason is that the different job responsibilities may affect the difference preferences on delivering CR in SA. Another study investigated the barriers to referral system to CR in SA in heart failure disease among physiotherapists views and their preference to deliver the CR was hospital-based CR program which is in line with our results.<sup>17,29,30</sup> Our results support that lack of CR centers in SA was the most barriers to refer to CR in SA. Moreover, the results of the semi-structure interview in agreement with our results as the most important barriers to refer cardiac patients and to establish CR in the western region in SA was lack or insufficient CR centers in western region of SA.<sup>17</sup>

The present study findings also agree with a study that investigated the barriers to establishing pulmonary rehabilitation in SA in the eastern region, which reported that the barriers were a lack of hospital capacities, lack of healthcare professional training, and lack of funding to support pulmonary rehabilitation.<sup>13</sup> Based on our results and the expert opinion,<sup>13</sup> there is a need to establish comprehensive cardiac rehabilitation centers in different regions of SA.

A study conducted in only three cardiac rehabilitation centers in Riyadh included physicians and nurses mainly and semi-structure interviews to see the patients views of the cardiac rehabilitation services. The results of the study revealed that a shortage of staff and lack of staff continuing education is one of the main challenges faced in establishing cardiac rehabilitation in SA, which are in alignment with our results. Our study results and Alasiry study results can add that these findings are in alignment with all health care providers such as physiotherapists, nurses and doctors' views in SA as our study only included the physiotherapist and cardiologists' views of CR in the Western region of SA and Alasiry study in Riyadh, which is a center of SA included nurses and physicians.<sup>31</sup>

To establish outpatient cardiac rehabilitation in SA, it is recommended that healthcare professionals are taught more about the cardiac rehabilitation during their undergraduate and postgraduate training and to open more courses in the Saudi Universities focusing on the cardiac rehabilitation and its update to raise awareness because staff who are working on CR centers asked for more education and training programs.<sup>31</sup> Patients should also be educated about the benefits of cardiac rehabilitation, as well as the risk factors for CVDs. Furthermore, cooperation between physiotherapists and cardiologists, developing cardiac rehabilitation guidelines in Arabic, and securing funding are vital to establishing

cardiac rehabilitation centers in SA. The possible alternative way of delivering CR in SA as home-based CR which could be one of the solution to overcome the barriers of limited number of CR in the western region of SA. Home-based CR may help on removing barriers,<sup>32</sup> because it has easy access for cardiac patients particularly to those who lives in the rural areas, it is suitable to use during the pandemic such as COPVID and patients can use telehealth during home-based CR centers.<sup>15,33,34</sup>

## Strengths and Limitations

The strength of this study is that all results report in this study with no bias as all results in this study were based on the physiotherapists and cardiologists' views without any affect from the authors to influence the results. The importance of this study is to identify the barriers to establish CR in the western region of SA and to recommend the possible solutions to overcome these barriers and to increase the awareness level with CR in the western region of SA. Although this study used a convenience sampling method could cause a possible selection bias, the results were in lines with previous strides.

Moreover, this study has some limitations. First, all respondents were from the western region; however, a previous study was conducted in Riyadh with three cardiac centers and our results are in alignment with their results; therefore, the findings may be generalizable across SA.<sup>23</sup> This study used a questionnaire while a structured interview to gather more detailed information regarding the barriers to cardiac rehabilitation in SA but a semi-structure interview done on a previous study to explore the patient view of CR.<sup>31</sup>

The implications of this study are to overcome these barriers for establishing CR in the western region of SA to increase the number of CR centers in the western region of SA to prevent the future heart problems in SA. The future research could focus on how to improve the cardiac rehabilitation services in SA and how to establish Arabic cardiac rehabilitation guideline.

## Conclusion

Awareness of cardiac rehabilitation among healthcare providers is high, but most were unaware of the phases of cardiac rehabilitation. The barriers to establishing cardiac rehabilitation Phase III-outpatient in practice were the lack of awareness among healthcare professionals of the cardiac rehabilitation phases, as well as the lack of trained healthcare providers; some cardiac rehabilitation is provided in SA, but it is not comprehensive.

## Ethical Approval and Consent to Participants

All methods were carried out under declaration of Helsinki.<sup>35</sup> This study was approved by the Biomedical Research Ethics Committee of Umm Al-Qura University, approval number HAPO-02-K—012-2021-03-591, and written informed consent was obtained from all subjects.

## Acknowledgment

We thank all participants for their time and commitment to completing the survey. We are also grateful to the ethical committee at Umm Al-Qura University for reviewing our study.

## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

## Disclosure

The authors report no conflicts of interest in this work.

## References

- World Health Organization. Cardiovascular disease; 2020. Available from: [https://www.who.int/health-topics/cardiovascular-diseases#tab=tab\\_1](https://www.who.int/health-topics/cardiovascular-diseases#tab=tab_1). Accessed March 6, 2023.
- Ministry of Health in SA. Cardiovascular diseases cause 42% of non-communicable diseases deaths in the Kingdom; 2013. Available from: <https://www.moh.gov.sa/en/Ministry/MediaCenter/News/Pages/News-2013-10-30-002.aspx>. Accessed March 6, 2023.
- Aljefree N, Ahmed F. Prevalence of cardiovascular disease and associated risk factors among the adult population in the Gulf region: a systematic review. *Adv Public Health*. 2015;2015:1–23. doi:10.1155/2015/235101
- Townsend N, Bhatnagar P, Wilkins E, et al. *Cardiovascular Disease Statistics*. BHF; 2015.
- ACPICR. *Standards for Physical Activity and Exercise in the Cardiovascular Population*. Heather P, Helen B, Samantha B, et al. eds. 3rd ed: Association of Chartered Physiotherapists in Cardiac Rehabilitation (ACPICR); 2015.
- Cowie A, Buckley J, Doherty P, Furze G, Hayward J, Hinton S, et al. Standards and core components for cardiovascular disease prevention and rehabilitation; 2019. Available from: <https://heart.bmj.com/content/105/7/510>. Accessed March 6, 2023.
- Dalal HM, Doherty P, Taylor RS. Cardiac rehabilitation. *BMJ*. 2015;351:1.
- Piepoli MF, Corra U, Stamatis A, et al. Secondary prevention in the clinical management of patients with cardiovascular diseases. Core components, standards and outcome measures for referral and delivery. *Eur J Prev Cardiol*. 2014;21:664–681. doi:10.1177/2047487312449597
- Visseren FLJ, Mach F, Smulders YM, et al. 2021 ESC guidelines on cardiovascular disease prevention in clinical practice: developed by the task force for cardiovascular disease prevention in clinical practice with representatives of the European society of cardiology and 12 medical societies with the special contribution of the European Association of Preventive Cardiology (EAPC). *Eur Heart J*. 2021;42:3227–3337. doi:10.1093/eurheartj/ehab484
- Rashed M, Theruvan N, Gad A, et al. Cardiac rehabilitation: future of heart health in Saudi Arabia, a perceptual view. *World J Cardiovasc Dis*. 2020;9:666–677. doi:10.4236/wjcd.2020.109064
- Physiotherapy works. Physiotherapy-led cardiac rehabilitation (CR) is a clinical and cost-effective intervention for those living with cardiovascular disease; 2017. Available from: <https://www.csp.org.uk/publications/physiotherapy-works-cardiac-rehab>. Accessed March 6, 2023.
- British Heart Foundation. The national audit of cardiac rehabilitation - annual statistical report 2017. London: BHF. 2017. Available from: <https://www.bhf.org.uk/informationsupport/publications/statistics/national-audit-of-cardiac-rehabilitation-annual-statistical-report-2017>. Accessed March 6, 2023.
- Alsubaiei ME, Cafarella PA, Frith PA, et al. Barriers for setting up a pulmonary rehabilitation program in the Eastern Province of Saudi Arabia. *Ann Thorac Med*. 2016;2:121. doi:10.4103/1817-1737.180028
- Onishi S, Shimada K, Sato H, et al. Effects of phase III cardiac rehabilitation on mortality and cardiovascular events in elderly patients with stable coronary artery disease. *Circ J*. 2010;74(4):709–714. doi:10.1253/circj.CJ-09-0638
- Batalik L, Pepera G, Su JJ. Cardiac telerehabilitation improves lipid profile in the long term: insights and implications. *Int J Cardiol*. 2022;367:117–118. doi:10.1016/j.ijcard.2022.08.055
- Moghadam BA, Tavakol K, Hadian MR, Bagheri H, Jalaei S. Phase III cardiac rehabilitation after CABG: combined aerobic and strengthening exercise protocols. *Int J Ther Rehabil*. 2009;16(8):420–430. doi:10.12968/ijtr.2009.16.8.43480
- Tunsi A, Chandler C, Holloway A. Perspectives on barriers and facilitators to lifestyle change after cardiac events among patients in Saudi Arabia: a qualitative study. *Eur J Cardiovasc Nurs*. 2022;2022:1.
- Dibben G, Anderson L, Thompson DR, et al. Exercise-based cardiac rehabilitation for coronary heart disease. *Cochrane Database of Syst Rev*. 2021;11:1.
- De Melo G, Lima G, Benetti M, et al. Barriers to cardiac rehabilitation use in Canada versus Brazil. *J Cardiopulm Rehabil Prev*. 2013;33:173–179. doi:10.1097/HCR.0b013e3182930c9f
- Babu AS, Veluswamy SK, Contractor A. Barriers to cardiac rehabilitation in India. *J Prev Cardiol*. 2016;2016:871–876.
- Sérvio TC, Britto RR, de Melo Ghisi GL, et al. Barriers to cardiac rehabilitation delivery in a low-resource setting from the perspective of healthcare administrators, rehabilitation providers, and cardiac patients. *BMC Health Serv Res*. 2019;19:1–10. doi:10.1186/s12913-019-4463-9
- Mutwalli HA, Fallows SJ, Arnous AA, Zamzami MS. Randomized controlled evaluation shows the effectiveness of a home-based cardiac rehabilitation program. *Saudi Med J*. 2012;33(2):152–159.
- Elsakr C, Bulger DA, Roman S, et al. Barriers physicians face when referring patients to cardiac rehabilitation: a narrative review. *Ann Transl Med*. 2019;17:414. doi:10.21037/atm.2019.07.61
- Khushhal A, Nichols S, Carroll S, et al. Characterising the application of the “progressive overload” principle of exercise training within cardiac rehabilitation: a United Kingdom-based community program. *PLoS One*. 2021;8:e0237197.
- Sandercock G, Hurtado V, Cardoso F. Changes in cardiorespiratory fitness in cardiac rehabilitation patients: a meta-analysis. *Int J Cardiol*. 2013;167(3):894–902. doi:10.1016/j.ijcard.2011.11.068
- West RR, Jones DA, Henderson AH. Rehabilitation after myocardial infarction trial (RAMIT): multi-centre randomised controlled trial of comprehensive cardiac rehabilitation in patients following acute myocardial infarction. *Heart*. 2012;98(8):637–644. doi:10.1136/heartjnl-2011-300302
- Winnige P, Filakova K, Hnatiak J, et al. Validity and reliability of the cardiac rehabilitation barriers scale in the Czech Republic (CRBS-CZE): determination of key barriers in east-central Europe. *Int J Environ Res Public Health*. 2021;18(24):13113. doi:10.3390/ijerph182413113
- Bakhshayeh S, Sarbaz M, Kimiafar K, Vakilian F, Eslami S. Barriers to participation in center-based cardiac rehabilitation programs and patients’ attitude toward home-based cardiac rehabilitation programs. *Physiother Theory Pract*. 2019;37:158–168. doi:10.1080/09593985.2019.1620388
- Aldhahir AM. Nurses’ perception of, and barriers to, delivering cardiopulmonary rehabilitation for heart failure patients: a national survey in Saudi Arabia. *Int J Environ Res Public Health*. 2022;19(20):13586. doi:10.3390/ijerph192013586
- Aldhahir AM, Alhoty M, Alqahani JS. Physiotherapists’ attitudes, and barriers of delivering cardiopulmonary rehabilitation for patients with heart failure in Saudi Arabia: a cross-sectional study. *J Multidiscip Healthc*. 2022;Volume 15:2353–2361. doi:10.2147/JMDH.S386519
- Alasiry SH. *Modelling Cardiac Rehabilitation Programs in Saudi Arabia* PhD [dissertation]. Melbourne: Monash University; 2019. Available from: [https://bridges.monash.edu/articles/thesis/Modelling\\_Cardiac\\_Rehabilitation\\_Programs\\_in\\_Saudi\\_Arabia/7956200/1](https://bridges.monash.edu/articles/thesis/Modelling_Cardiac_Rehabilitation_Programs_in_Saudi_Arabia/7956200/1). Accessed March 6, 2023.



32. Nso N, Nassar M, Mbome Y. Comparative assessment of the long-term efficacy of home-based versus center-based cardiac rehabilitation. *Cureus*. 2022;14:3.
33. Stefanakis M, Batalik L, Papathanasiou J, Dipla L, Antoniou V, Pepera G. Exercise-based cardiac rehabilitation programs in the era of COVID-19: a critical review. *Rev Cardiovasc Med*. 2021;22(4):1143–1155. doi:10.31083/j.rcm2204123
34. Antoniou V, Davos CH, Kapreli E, Batalik L, Panagiotakos DB, Pepera G. Effectiveness of home-based cardiac rehabilitation, using wearable sensors, as a multicomponent, cutting-edge intervention: a systematic review and meta-analysis. *J Clin Med*. 2022;11(13):3772. doi:10.3390/jcm11133772
35. World Medical Association Declaration of Helsinki. Ethical principles for medical research involving human subjects. *JAMA*. 2013;310(20):2191–2194. doi:10.1001/jama.2013.281053JMDH\_A\_398687#

Journal of Multidisciplinary Healthcare

Dovepress

### Publish your work in this journal

The Journal of Multidisciplinary Healthcare is an international, peer-reviewed open-access journal that aims to represent and publish research in healthcare areas delivered by practitioners of different disciplines. This includes studies and reviews conducted by multidisciplinary teams as well as research which evaluates the results or conduct of such teams or healthcare processes in general. The journal covers a very wide range of areas and welcomes submissions from practitioners at all levels, from all over the world. The manuscript management system is completely online and includes a very quick and fair peer-review system. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.

Submit your manuscript here: <https://www.dovepress.com/journal-of-inflammation-research-journal>