Journal of Cardiac and Pulmonary Rehabilitation

Perspective Open Access

# Cardiac Rehab: Expanding Access, Equity, Personalization

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**Received:** 01-May-2025, Manuscript No. jcpr-25-173610; **Editor assigned:** 05-May-2025, PreQC No. jcpr-25-173610(PQ); **Reviewed:** 19-May-2025, QC No. jcpr-25-173610; **Revised:** 22-May-2025, Manuscript No. jcpr-25-173610(R); **Published:** 29-May-2025, **DOI**: 10.4172/jcpr.1000315

**Citation:**Cheng K (2025) Cardiac Rehab: Expanding Access, Equity, Personalization. J Card Pulm Rehabi 09: 315.



## Abstract

Cardiac rehabilitation (CR) is crucial for cardiovascular disease, yet underutilized. Studies show its benefits in reducing mortality and improving quality of life. Key challenges include access barriers, which telerehabilitation and virtual models, particularly after the COVID-19 pandemic, effectively address. Addressing sex and gender disparities and implementing personalized medicine are vital for equitable outcomes. The integration of patient-reported outcomes further refines care, ensuring CR is accessible, tailored, and truly patient-centric for optimal cardiovascular health across diverse populations.

## Keywords

Cardiac rehabilitation; Myocardial infarction; Telerehabilitation; Virtual care; Personalized medicine; Sex and gender; Patient-reported outcome measures; Cardiovascular disease; Health disparities; Telehealth; Cost-effectiveness; Secondary prevention

## Introduction

This study examines recent trends, patient demographics, and clinical outcomes of cardiac rehabilitation (CR) after myocardial infarction in contemporary practice. It highlights the underutilization of CR despite its proven benefits, especially in older patients and those with comorbidities. The findings underscore the critical need for improved CR access and adherence to optimize patient recovery and reduce adverse cardiac events post-MI, advocating for broader implementation and tailored strategies [1].

This comprehensive Cochrane review evaluates the efficacy and safety of exercise-based cardiac rehabilitation for adults with cardiovascular disease. It reaffirms that CR significantly reduces cardiovascular mortality and hospital admissions, improves exercise capacity, and enhances quality of life. The review emphasizes CR's role as a cornerstone in secondary prevention, advocating for its broader implementation and suggesting it remains a highly effective intervention [2].

This review article offers a thorough overview of cardiac rehabilitation, detailing its components, established benefits, persistent barriers to uptake, and future directions, including the integration of digital health. It stresses the multidisciplinary nature of CR and its critical impact on patient outcomes, while acknowledging the need to address access disparities and evolve service delivery models to meet modern healthcare demands [3].

This article synthesizes the current evidence on telerehabilitation in cardiac rehabilitation, highlighting its potential to overcome geographical and logistical barriers to access. It discusses the effectiveness, safety, and patient adherence to remote programs, alongside the technological and regulatory considerations for future implementation, advocating for hybrid models combining in-person and virtual care to maximize reach and impact [4].

This article explores the critical role of sex and gender considerations in cardiac rehabilitation, emphasizing how biological dif-

ferences and gender roles influence participation, outcomes, and access to CR. It calls for tailored CR programs that address the unique needs of women and men to improve equitable access and optimize long-term cardiovascular health benefits across all patients, highlighting the need for a nuanced approach [5].

This cost-effectiveness analysis investigates a virtual model of cardiac rehabilitation in Australia, concluding that it is a highly cost-effective strategy for expanding CR access. The study suggests that virtual CR can significantly improve patient participation and outcomes, offering a viable solution to enhance service delivery, particularly in regions with limited conventional CR programs, ultimately leading to better population health [6].

This review synthesizes insights gained from the COVID-19 pandemic regarding telehealth cardiac rehabilitation. It discusses the rapid expansion and adaptation of virtual CR programs, their effectiveness in maintaining care continuity, and challenges related to digital equity and technology adoption. The article advocates for integrating telehealth into standard CR models, leveraging lessons learned for future resilience, accessibility, and improved patient engagement [7].

This paper discusses the growing importance of personalized medicine approaches in cardiac rehabilitation. It explores how tailoring CR interventions based on individual patient characteristics, genetic predispositions, and lifestyle factors can optimize outcomes, improve adherence, and significantly enhance the overall effectiveness of rehabilitation programs, moving away from a one-size-fits-all model [8].

This systematic review and meta-analysis investigates the use of patient-reported outcome measures (PROMs) in cardiac rehabilitation. It highlights which PROMs are most frequently used and their utility in assessing the impact of CR on patients' quality of life, symptoms, and functional status, advocating for their standardized inclusion in CR programs to better capture patient perspectives and improve care delivery [9].

This systematic review and meta-analysis specifically examines cardiac rehabilitation participation and outcomes among women. It identifies disparities in women's enrollment and adherence to CR compared to men, and analyzes the impact on clinical outcomes. The review emphasizes the need for gender-specific strategies to improve women's access to and engagement in CR programs to achieve equitable health benefits and address existing inequalities [10].

# Description

Cardiac rehabilitation (CR) remains a fundamental pillar in the comprehensive recovery and long-term management strategies for individuals afflicted with cardiovascular disease. Its established role in secondary prevention is unquestionable. However, an examination of contemporary practice reveals significant challenges, particularly regarding the consistent utilization of CR following acute myocardial infarction, with older patients and those presenting with multiple comorbidities often showing lower participation rates [1]. Despite overwhelming evidence demonstrating CR's profound capacity to substantially reduce cardiovascular mortality, decrease hospital readmissions, and markedly improve both physical exercise capacity and the overall quality of life for patients, these programs unfortunately continue to be underutilized in many settings [1, 2]. Comprehensive review articles consistently detail the inherently multidisciplinary nature of CR, outlining its well-established benefits alongside persistent barriers that hinder patient uptake. These analyses underscore a critical need for continuous innovation and evolution in service delivery models to effectively address existing disparities and meet the dynamic demands of modern healthcare [3].

Driving pathways toward overcoming prevalent barriers to CR access lies in the strategic integration of digital health solutions, most notably telerehabilitation. This innovative approach offers a powerful means to circumvent common geographical limitations and logistical complexities that frequently impede patient participation in traditional, in-person rehabilitation programs [4]. The unprecedented global health crisis of the COVID-19 pandemic further served to highlight and accelerate the imperative for rapid adaptation and widespread expansion of virtual CR programs. These virtual models emphatically demonstrated their efficacy in sustaining crucial care continuity during challenging times. While acknowledging certain challenges, such as ensuring digital equity and fostering broader technology adoption, the prevailing consensus strongly advocates for the seamless integration of telehealth into standard CR frameworks. This strategic move promises to leverage valuable lessons learned, fostering enhanced resilience, vastly improved accessibility, and sustained patient engagement in future healthcare paradigms [7].

Further reinforcing the viability of remote care, extensive research provides compelling evidence concerning the effectiveness, safety, and impressive patient adherence observed in telerehabilitation programs [4]. A particularly illustrative example comes from a detailed cost-effectiveness analysis conducted within Australia, which decisively concluded that a virtual model of cardiac rehabilitation presents an exceptionally cost-effective strategy for signif-

icantly broadening CR access across the population. This innovative model has been shown to substantially elevate patient participation levels and lead to superior clinical outcomes, thereby offering a highly practical and scalable solution for enhancing service delivery. This is especially pertinent in regions where conventional, facility-based CR options are inherently limited, ultimately contributing positively to overall public health outcomes [6].

To truly realize equitable access to cardiac rehabilitation, a more nuanced and comprehensive understanding of diverse patient needs is absolutely essential, with particular emphasis on crucial sex and gender considerations. Academic studies consistently highlight how intrinsic biological differences, coupled with pervasive societal gender roles, can profoundly impact an individual's likelihood of participation, their achieved clinical outcomes, and their overall access to vital CR services [5]. Such findings unequivocally emphasize the critical importance of developing and meticulously implementing tailored CR initiatives. These programs must be specifically designed to holistically address the distinct and often unique requirements of both women and men. Moreover, systematic reviews that specifically scrutinize CR participation and outcomes among women have consistently identified notable disparities in both enrollment rates and adherence when contrasted with their male counterparts. These insights forcefully advocate for the urgent development and deployment of gender-specific strategies aimed at significantly enhancing women's engagement in CR programs, thereby ensuring truly equitable health benefits and actively rectifying existing inequalities in healthcare provision [10].

Finally, the trajectory of cardiac rehabilitation is decisively moving towards increasingly individualized and patient-centered methodologies. Personalized medicine is gaining considerable momentum, with ongoing research actively exploring how CR interventions can be precisely customized. This customization is based on a complex interplay of individual patient characteristics, specific genetic predispositions, and unique lifestyle factors. This deliberate shift away from a generic 'one-size-fits-all' model is meticulously designed to optimize clinical outcomes, substantially improve patient adherence, and thereby significantly enhance the overarching effectiveness of rehabilitation programs [8]. Complementing this trend, the systematic and widespread integration of patient-reported outcome measures (PROMs) is proving to be immensely valuable. Comprehensive reviews meticulously identify the PROMs most frequently employed and underscore their critical utility in accurately assessing CR's profound impact on patients' quality of life, their management of symptoms, and their functional status. Advocating for their standardized and routine inclusion in all CR programs promises to yield a much richer and more accurate capture of patient perspectives, ultimately leading to the delivery of more refined, truly patient-centric care [9].

## Conclusion

Cardiac rehabilitation (CR) stands as a vital, evidence-based intervention for individuals with cardiovascular disease, significantly reducing mortality, hospital admissions, and enhancing quality of life. However, its underutilization, particularly among older patients and those with comorbidities after myocardial infarction, remains a persistent challenge, necessitating improved access and adherence strategies. A significant area of focus involves overcoming existing logistical and geographical barriers through innovative approaches.

The integration of digital health solutions, such as telerehabilitation and virtual care models, has emerged as a highly effective and cost-efficient method to expand CR access and improve patient participation. Lessons from the COVID-19 pandemic further validated the rapid expansion and effectiveness of telehealth in maintaining care continuity, advocating for its integration into standard CR models. Furthermore, achieving equitable CR access demands explicit attention to sex and gender considerations, as these factors influence participation and outcomes. Research highlights disparities in women's enrollment and adherence, underscoring the need for gender-specific strategies and tailored programs.

The future of CR is also moving towards personalized medicine, tailoring interventions based on individual patient characteristics to optimize outcomes and improve adherence, moving away from a one-size-fits-all approach. Concurrently, the standardized inclusion of patient-reported outcome measures (PROMs) is critical for comprehensively assessing CR's impact on quality of life and functional status, ensuring that care delivery is truly patient-centric. These collective advancements are pivotal for broadening CR reach, improving long-term adherence, and ultimately enhancing cardiovascular health outcomes across diverse patient populations.

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