JACC: ADVANCES VOL. 2, NO. 5, 2023

VIEWPOINT

Cardiac Rehabilitation

A Global Perspective on Where We Have Come and Where We Must Go

Sherry L. Grace, PhD,[a,b] Rod S. Taylor, PhD,[c] Diann E. Gaalema, PhD,[d] Julie Redfern, PhD,[e,f] Kornelia Kotseva, MD, PhD,[g] Gabriela Ghisi, PT, PhD[a,b]

Cardiovascular diseases (CVDs) continue to be the leading cause of mortality globally, but are also the leading cause of disability in those over 50.[1] CVDs are becoming more preponderant in low- and middle-income countries (LMICs), where the need for care is greatest,[2] yet access is a great challenge. Cardiovascular rehabilitation (CR) is an established and comprehensive model of secondary preventive care, proven through rigorous Cochrane reviews to mitigate this burden through all the advances in interventional cardiology and pharmacotherapy from 2000 to present.[3] CR has a long history since the mid-1940s, with more global diffusion since the 2000s.[4,5]

Given the health benefits and cost-effectiveness of CR, cardiovascular clinical practice guidelines from around the world include recommendations for patient referral.[6] Yet CR is known to be under-available and under-used when compared to other guideline-recommended therapies.[7] The global CR community came together through a World Council of CR to address this, but unfortunately, it folded into a subcommittee of one CR association around 2004.

Given the continued and growing need for CR,[8] major CR societies initiated discussions almost 15 years ago to begin again to tackle the issues together. The International Council of Cardiovascular Prevention and Rehabilitation (ICCPR)[9] was founded, comprised of named board members of preventive cardiology-related clinical societies from around the world. Our network has continued to grow—now comprised of 43 societies, and 16 "friends" in countries where CR services are in development—with reach around the globe.

One of ICCPR's priorities is promoting CR in LMICs.[10]

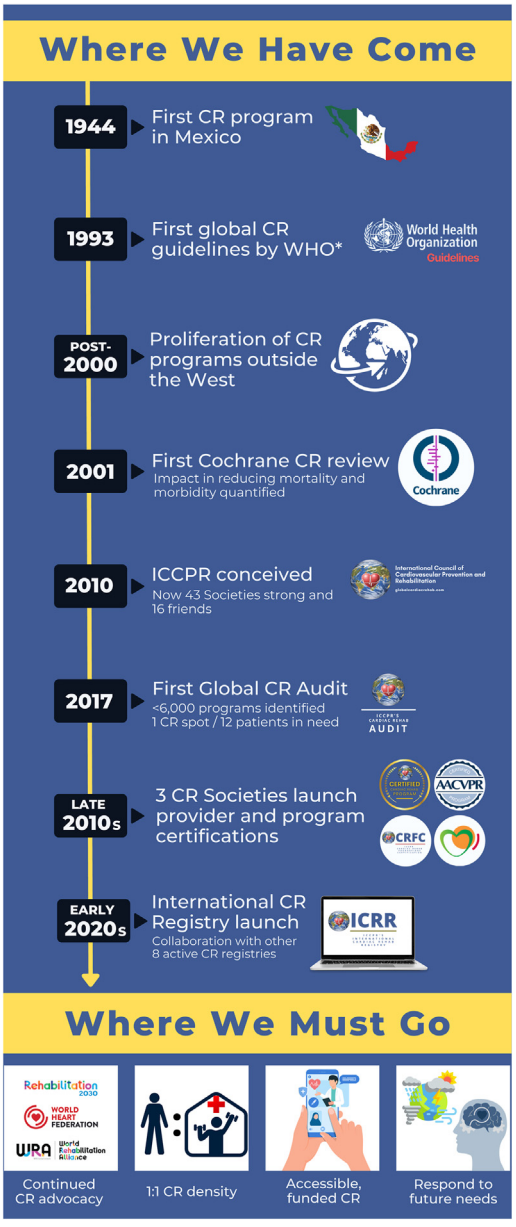
Upon consultation with members, one of our first initiatives was to determine the availability of CR globally in relation to need.[5] Results revealed that as of 2017, only 111/203 countries globally had any CR, with about 6,000 programs operating around the world. We estimate there is only one CR "spot" for every 12 incidentally indicated patients per year. The gross inequity in care access was quantified, with results showing only 1 spot for every 66 patients in need in LMICs.

When we asked programs in the audit about their barriers to broader delivery, one of the major factors was lack of trained personnel.[5] ICCPR thus developed a CR Foundations Certification.[11] Approximately 3,000 learners from ~35 countries have become certified, and we are now looking to leverage artificial intelligence to offer this training in more languages. Given the Audit identified the particularly great need in India and China, we implemented initiatives to engage physicians in these countries specifically. We also currently partner with our colleagues in Australia to offer scholarships to waive the $100USD fee for

From the [a]Faculty of Health, York University, Toronto, Ontario, Canada; [b]KITE Research Institute, University Health Network, University of Toronto, Toronto, Ontario, Canada; [c]Social and Public Health Sciences Unit & Robertson Centre for Biostatistics, School of Health and Well Being, College of Medical, Veterinary and Life Sciences, University of Glasgow, Glasgow, United Kingdom; [d]Vermont Center on Behavior and Health, University of Vermont, Burlington, Vermont, USA; [e]Faculty of Medicine and Health, School of Health Sciences, University of Sydney, Sydney, Australia; [f]Imperial College Healthcare NHS Trust, London, United Kingdom; and the [g]National Institute for Prevention and Cardiovascular Health, National University of Ireland-Galway, Galway, Ireland.
The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the Author Center.

ISSN 2772-963X https://doi.org/10.1016/j.jacadv.2023.100412

FIGURE 1 Cardiac Rehabilitation: Where We Have Come and Where We Must Go



Timeline from CR inception through the present day, with projected direction for future to address gaps. CR has matured to be more comprehensive and to leverage technology to best optimize patient access and outcomes. The ICCPR was conceived in 2010, and as an umbrella organization, it has sought to amplify efforts of member CR societies and other stakeholders. Launches of CR guidelines, registries, and certifications are highlighted. In future, ICCPR's Global Audit shall be repeated to determine postpandemic capacity. The community must continue to work together to get from 1 CR spot for every 12 patients in need to 1:1. CR = cardiac rehabilitation; ICCPR = International Council of Cardiovascular Prevention and Rehabilitation; WHO = World Health Organization. *See here for current available CR guidelines globally: https://globalcardiacrehab.com/CR-Guidelines and Table 2 of https://pure.qub.ac.uk/en/publications/global-perspectives-on-heart-disease-rehabilitation-and-secondary.

LMIC providers and trainees.[12] This training is applicable to low-resource settings and complements the more advanced training available from CR-related societies in the United States[13] and Europe.[14]

Another key barrier identified by programs in the global audit[5] was lack of patient referral and awareness about CR. Evidence for the effect of automatic or electronic CR referral in increasing CR access by 8 times is highly compelling, and there are now data also demonstrating feasibility and impact of this approach in low-resource settings.[15] Moreover, the Cochrane review on interventions to increase CR use established the importance of patient CR encouragement at the bedside; a corresponding clinical guideline was developed by the ICCPR community, with a free online course for inpatient health care providers to support implementation.[16] Our partners in the United States have been leaders globally in application, offering free modules on implementing automatic referral with patient encouragement/care co-ordination.[17] ICCPR also seeks to promote equitable CR access in vulnerable patient populations, such as women.[18]

We also seek to support emerging CR programs to develop high-quality services. ICCPR recently launched an International CR Registry,[19] which already contains data from over 2,000 patients in all regions of the globe. This is now the ninth active CR registry around the world,[20] but uniquely focuses on low-resource settings. Participating sites can be assessed for ICCPR Program Certification, demonstrating they meet internationally-agreed minimum standards.[21] Again, this program certification is applicable to low-resource settings and complements the more advanced certifications available from our partners in the United States[22] and Europe.[23]

ICCPR is also supporting CR programs in delivering alternative, affordable models of CR; this is germane given an update of ICCPR's Global Audit at the beginning of the COVID-19 pandemic showed many programs had shifted to remote delivery.[24] While meta-analysis by our group has established the benefits of CR as delivered in LMICs,[25] further randomized trials of hybrid, technology-based CR are recently being undertaken in LMICs in connection with ICCPR,[26-28] and efforts are underway to adapt the United Kingdom's arguably first evidence-based model of home-based CR for low-resource settings.[29]

WHERE WE MUST GO

Figure 1 summarizes from where we have come to inform future directions.

Undoubtedly, the major challenge impeding capacity increases continues to be reimbursement parity of CR services with acute cardiac care-including remotely-delivered CR, given that it is now more commonly delivered but is less commonly reimbursed than center-based CR.[24] Back at ICCPR inception, advocacy tools to lobby for coverage were developed for members,[30] but while there have been some success stories (eg, Iran, Qatar, United States), admittedly not much progress has been made. ICCPR worked with the World Health Organization on the Package of Rehabilitation Interventions for ischemic heart disease (which is based on ICCPR recommendations for low-resource settings, among other guidelines).[31] With its release in 2023, implementation by member states could certainly greatly increase CR provision globally. ICCPR is also a member of the recently-initiated World Rehabilitation Alliance, also working to move this agenda forward. Finally, it is hoped efforts to augment universal health care as part of the United Nations Sustainable Development Goals will also benefit CR access.

ICCPR will soon repeat their global audit, to ascertain the capacity of CR peri- or post-pandemic, including assessment of delivery modalities and their reimbursement sources as well as service comprehensiveness. We are also eagerly watching progress of the INTERASPIRE study, which includes assessment of secondary prevention including CR in 6,000 patients globally and will be combined with the results of EUROASPIRE to provide the most current and fulsome international snapshot of CVD patient care and outcomes to date.

We realize our efforts must span from the policy and health systems through health care provider and patient levels if we are to successfully improve access to quality CR services and optimize secondary prevention. There are some key factors we currently face at each level. For instance, accelerating climate change and associated causes also mean CR patients may have less access to clean air, temperate conditions, and green space for safe outdoor exercise. Data from the Prospective Urban Rural Epidemiology study demonstrate that patient access to and affordability of secondary preventive medications continues to be a major challenge for patients, particularly in LMICs. We must work together with governments as well as the medical and pharmaceutical communities to improve access to cardiovascular medication and rehabilitation (which promotes adherence to medication as well as all other secondary prevention recommendations) so patient outcomes can be improved. Increases in the burden of mental health issues and broader recognition of their intersection with chronic disease and impact on patient outcomes underscore the need for more focus on psychosocial screening and treatment within CR. Our CR registries could tackle this through our quality initiatives. We are also assessing patients' CR barriers in all regions of the globe; recent results identify the top ones as lack of CR awareness, travel distance, and cost.

In just 2 more decades, we shall celebrate CR's centennial and hopefully ICCPR's 30-year anniversary. During this time, we will continue to work with the many others who are also dedicated to improving access to CR around the world. For example, ICCPR's program email distribution list reaches almost one-third of programs globally,[32] and as such, it serves as an important forum to share CR initiatives and resources. Moreover, we are currently working closely with leaders in Africa to bolster their efforts in CR capacity-building. There remains much work to be done, so please join us.

ACKNOWLEDGMENTS The authors are grateful to other members of the International Council of Cardiovascular Prevention and Rehabilitation's Executive Board since inception, including: Drs John Buckley, Aashish Contractor, Colin Yeung, Robyn Gallagher, and Mr Steve Woodruffe.

FUNDING SUPPORT AND AUTHOR DISCLOSURES

Dr Gaalema is funded by National Heart, Lung, and Blood Institute grant number R33HL143305. Dr Redfern is funded by a National Health and Medical Research Council Investigator Grant (GNT1143538) and is Chief Investigator of the SOLVE-CHD National Health and Medical Research Council Synergy Grant (GNT1182301). Dr Taylor is the lead investigator on the following ongoing externally funded research projects on cardiac rehabilitation: REACH-HFpEF randomized trial funded by the United Kingdom National Institute of Health Research (NIHR130487) and DK:REACH:HF study funded by the Danish Heart Foundation (20-R145-A9654-22157). Dr Taylor declares that he is the Director of Cardiac Rehabilitation at the Cochrane Center. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

ADDRESS FOR CORRESPONDENCE: Dr Sherry L. Grace, Bethune 368 - York University 4700 Keele Street, Toronto, Ontario M3J 1P3, Canada. E-mail: sgrace@yorku.ca. Twitter: @sherrylgrace.

REFERENCES

1. Murray CJL. Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet*. 2020;396:1204–1222.

2. Teo K, Lear S, Islam S, et al. Prevalence of a healthy lifestyle among individuals with cardiovascular disease in high-, middle- and low-income countries: the Prospective Urban Rural Epidemiology (PURE) study. *JAMA*. 2013;309:1613–1621.

3. Taylor RS, Dalal HM, McDonagh STJ. The role of cardiac rehabilitation in improving cardiovascular outcomes. *Nat Rev Cardiol*. 2022;19:180–194.

4. Redfern J, Gallagher R, O'Neil A, et al. Historical context of cardiac rehabilitation: learning from the past to move to the future. *Front Cardiovasc Med*. 2022;9:842567.

5. Turk-Adawi K, Pola MS, Jimenez FL, et al. Cardiac rehabilitation availability and density around the globe. *EClinicalMedicine*. 2019;13:31–45.

6. Taylor R, Fredericks S, Jones I, et al. Global perspectives on heart disease rehabilitation and secondary prevention: a scientific statement from the Association of Cardiovascular Nursing and Allied Professions (ACNAP), European Association of Preventive Cardiology (EAPC), and International Council of Cardiovascular Prevention and Rehabilitation (ICCPR). *Eur Heart J*. 2023. In press.

7. Grace SL, Kotseva K, Whooley MA. Cardiac rehabilitation: under-utilized globally. *Curr Cardiol Rep*. 2021;23:118.

8. Cieza A, Causey K, Kamenov K, Hanson SW, Chatterji S, Vos T. Global estimates of the need for rehabilitation based on the global burden of disease study 2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet*. 2020;396:2006–2017.

9. International Council of Cardiovascular Prevention and Rehabilitation. Accessed May 26, 2023. https://globalcardiacrehab.com/

10. Grace SL, Warburton DR, Stone JA, et al. International Charter on Cardiovascular Prevention and Rehabilitation: a call for action. *J Cardiopulm Rehabil Prev*. 2013;33:128–131.

11. Babu AS, Heald FH, Contractor A, et al. Building capacity in cardiac rehabilitation through the International Council of Cardiovascular Prevention and Rehabilitation's cardiac rehabilitation foundations certification (CRFC) program: evaluation of reach, barriers and impact. *J Cardiopulm Rehabil Prev*. 2022;42:178–182.

12. SOLVE-CHD. Accessed May 26, 2023. https://solvechd.org.au/

13. Certified Cardiac Rehabilitation Professional, American Association of Cardiovascular and Pulmonary Rehabilitation. Accessed May 26, 2023. https://www.aacvpr.org/Certified-Cardiac-Rehabilitation-Professional

14. Certification in Preventive Cardiology, European Association of Preventive Cardiology. Accessed May 26, 2023. https://www.escardio.org/Education/Career-Development/Certification/Preventive-cardiology

15. Miralles-Resurreccion KV, Grace SL, Cuenza LR. Trends in cardiac rehabilitation enrolment post-coronary artery bypass grafting upon implementation of clinical pathway-based automatic referral with bedside discussion in a Southeast-Asian Tertiary Centre. *J Cardiovasc Thorac Res*. 2022;14:84–89.

16. Heald F, Santiago Pio C, Liu X, Rivera Thereul F, Pavy B, Grace SL. Evaluation of an online course in five languages for inpatient cardiac care providers on promoting cardiac rehabilitation: reach, effects and satisfaction. *J Cardiopulm Rehabil Prev*. 2022;42(2):103–108.

17. TAKEheart, Agency for Healthcare Research and Quality. Accessed May 26, 2023. https://www.ahrq.gov/takeheart/index.html

18. Ghisi GLDM, Marzolini S, Price J, et al. Women-focused cardiovascular rehabilitation: an International Council of Cardiovascular Prevention and Rehabilitation Clinical Practice Guideline. *Can J Cardiol*. 2022;38:1786–1798.

19. Turk-Adawi K, Ghisi GLM, Tran C, et al. First report of the International Council of Cardiovascular Prevention and Rehabilitation's Registry (ICRR). *Expert Rev Cardiovasc Ther*. 2023;21(5):357–364.

20. Poffley A, Thomas E, Grace SL, et al. A systematic review of cardiac rehabilitation registries. *Eur J Prev Cardiol*. 2017;24(15):1596–1609.

21. Program Certification, International Council of Cardiovascular Prevention and Rehabilitation. Accessed May 26, 2023. https://globalcardiacrehab.com/Program-Certification

22. Program Certification, American Association of Cardiovascular and Pulmonary Rehabilitation. Accessed May 26, 2023. https://www.aacvpr.org/Program-Certification

23. Program Certification, European Association of Preventive Cardiology. Accessed May 26, 2023. https://www.escardio.org/Education/Career-Development/Accreditation/EAPC-centre-accreditation

24. Ghisi GLM, Xu Z, Liu X, et al. Impacts of the COVID-19 pandemic on cardiac rehabilitation delivery around the world. *Glob Heart*. 2021;16:43.

25. Mamataz T, Uddin J, Ibn Alam S, Taylor RS, Pakosh M, Grace SL. Effects of cardiac rehabilitation in low-and middle-income countries: a systematic review and meta-analysis of randomized controlled trials. *Prog Cardiovasc Dis*. 2022;70:119–174.

26. Menezes HJ, D'Souza SRB, Padmakumar R, et al. Technology-based comprehensive cardiac rehabilitation therapy (TaCT) for women with cardiovascular diseases in a middle-income setting: a randomized controlled trial protocol. *Res Nurs Health*. 2023;46:13–25.

27. Pakrad F, Ahmadi F, Grace SL, Oshvandi K, Kazemnejad A. Traditional vs extended hybrid cardiac rehabilitation based on the continuous care model for patients who have undergone coronary artery bypass surgery in a middle-income country: a randomized controlled trial. *Arch Phys Med Rehabil*. 2021;102:2091–2101.e3.

28. Chaves G, Ghisi GLM, Grace SL, et al. Effects of comprehensive cardiac rehabilitation on functional capacity in a middle-income country: a randomised controlled trial. *Heart*. 2019;105:406–413.

29. Dalal HM, Taylor RS, Jolly K, et al. The effects and costs of home-based rehabilitation for heart failure with reduced ejection fraction: the REACH-HF multicentre randomized controlled trial. *Eur J Prev Cardiol*. 2019;26:262–272.

30. Babu A, Lopez-Jimenez F, Thomas RJ, et al. Advocacy for outpatient cardiac rehabilitation globally. *BMC Health Serv Res*. 2016;16:471.

31. Rauch A, Negrini S, Cieza A. Toward strengthening rehabilitation in health systems: methods used to develop a WHO package of rehabilitation interventions. *Arch Phys Med Rehabil*. 2019;100:2205–2221.

32. Email distribution list, International Council of Cardiovascular Prevention and Rehabilitation. Accessed May 26, 2023. https://globalcardiacrehab.com/ICCPR-News/

KEY WORDS access to health care, capacity building, cardiac rehabilitation, global health, health equity, secondary prevention