

1 Cost-effectiveness of digitally enabled cardiac rehabilitation: progress, promise, and
2 persisting questions

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1 Cardiac rehabilitation (CR) improves clinical outcomes in patients with coronary
2 heart disease, yet uptake remains persistently low despite decades of evidence.(1)
3 Barriers to CR are multifactorial, with frequently reported patient-related barriers including
4 long distances to the CR centre, limited transport options, and scheduling difficulties.(2)
5 Digitally enabled cardiac rehabilitation (DeCR), delivered through telehealth consultations
6 and mobile applications, has been shown to be non-inferior to traditional face-to-face CR
7 and offers a potential solution to the persistent challenges of access and adherence.(3)
8 In this issue of the *European Journal of Preventive Cardiology*, Braver et al.(4) present a
9 cost-effectiveness analysis of a DeCR programme versus usual care (face-to-face CR or
10 no CR) in patients after hospitalisation for coronary heart disease.

11 The study relied on observational claims data rather than data from a randomised
12 controlled trial, analysing national private insurance claims from 337 patients in Australia.
13 Eighty-eight patients participated in DeCR, while propensity score matching was used to
14 select 249 patients receiving usual care, of whom 85 attended face-to-face CR and 164
15 received no CR. The intervention consisted of an eight-week remote programme that
16 combined weekly 30-minute telehealth consultations with a mobile application designed
17 to support risk-factor management, personalised education, reminders, and behavioural
18 change.

19 Over a five-year horizon, patients in the DeCR group accrued 4.677 quality-adjusted life
20 years (QALYs) at a cost of AUD \$121,235, compared with 3.244 QALYs at AUD \$100,733
21 for usual care. This resulted in an incremental cost-effectiveness ratio (ICER) of AUD
22 \$14,302 per QALY, below the commonly used Australian willingness-to-pay threshold of

1 \$50,000. Probabilistic sensitivity analyses suggested that DeCR remained cost-effective
2 under most assumptions examined by the authors.

3 A strength of this study lies in its focus on a critical evidence gap: the cost-effectiveness
4 of DeCR programmes. While the effects of DeCR have been shown to be non-inferior to
5 those of face-to-face CR, evidence on its cost-effectiveness has been primarily limited to
6 \leq 1-year follow-ups. The use of a five-year horizon moves beyond short-term
7 observations, attempting to capture the longer-term consequences of secondary
8 prevention. By including both face-to-face participants and non-attenders in the
9 comparator group, the analysis also reflects real-world practice more closely than trial-
10 based comparisons. Taken together, these features make the study a valuable
11 contribution to the current literature for understanding the economic case for digital
12 rehabilitation, while emphasising the need for more robust data.

13 Nonetheless, the study by Braver et al. has several limitations that should be considered
14 when interpreting its findings. Only 12 months of outcomes were directly observed; the
15 remaining four years were extrapolated using a Markov model, meaning long-term cost-
16 effectiveness estimates rest heavily on assumptions rather than empirical data. Although
17 propensity score matching was applied, residual confounding cannot be excluded, and
18 sociodemographic variables such as education and income, factors known to influence
19 adherence and outcomes, were not included in the propensity score. A well-conducted
20 randomised trial would have balanced these and other unmeasured characteristics
21 across groups. Key parameters, including transition probabilities, readmission costs, and
22 utilities for usual care, were drawn from heterogeneous published sources rather than
23 measured directly, introducing further uncertainty.(5) While the Markov model allowed

1 extrapolation beyond 12 months and included multiple readmissions, it used a small
2 number of health states and could not capture patient subgroups. Such simplification is
3 typical in cohort Markov models but may limit the applicability of the findings to real-world
4 coronary heart disease populations.(6) Cost estimates also warrant caution: the DeCR
5 intervention excluded programme development costs since the mobile application was
6 already available, while comparator costs for face-to-face rehabilitation were drawn from
7 the literature rather than observed directly. Interestingly, with \$2,750 per patient, the
8 estimated costs for the delivery of DeCR were ~80% higher than the applied costs for
9 face-to-face CR (\$1,525 per patient). This is in contrast to previously published cost
10 analyses reporting similar or even lower costs for digital delivery of CR.(7) As discussed
11 by the authors, this difference is likely attributable to the one-on-one consultations in the
12 investigated DeCR model, in contrast to the group-based formats typically used in face-
13 to-face CR. (4) While previous research has highlighted personal contact as an important
14 factor associated with both telemedicine acceptance and efficacy in lifestyle
15 interventions,(8) one-on-one consultations limit the scalability of digital approaches – a
16 feature frequently cited as a key advantage of digital interventions. Although described as
17 “nationally implemented,” the programme was restricted to members of a single private
18 insurer with smartphone and internet access, limiting generalisability and raising equity
19 concerns. Finally, despite coronary heart disease being the primary indication for CR, the
20 omission of other indications and the exclusion of patients with concomitant heart failure
21 further limit generalisability beyond the investigated population.

22 A pragmatic trial with prospective data linkage offers one way forward to more reliable
23 evidence on cost-effectiveness. Such a design would combine the internal validity of

1 randomisation with the breadth of linked outcomes, including primary care, pharmacy
2 claims, hospital admissions and mortality, and where feasible, patient-reported measures.
3 Linkage allows outcomes to be tracked long after the trial ends, providing estimates of
4 recurrent events, incident heart failure, and longer-term health service use. It also enables
5 modelling approaches such as microsimulation or discrete-event simulation, which are
6 better suited than cohort Markov models to capture patient heterogeneity and the
7 cumulative effects of recurrent events.(9) Pre-specified subgroup analyses (by
8 socioeconomic position, rurality, sex, and digital access) together with distributional cost-
9 effectiveness analysis would provide evidence directly relevant to both value for money
10 and equity.

11 Important questions remain. Can value for money be replicated in publicly funded
12 systems? Will results hold in more diverse populations, particularly among those at
13 highest risk of exclusion? And can digital rehabilitation be scaled equitably within existing
14 care pathways, ensuring its benefits extend beyond privately insured patients?

15 DeCR holds considerable promise as it offers an opportunity to extend evidence-based
16 secondary prevention beyond hospital walls, meeting patients where they live and work.
17 From a policy perspective, however, the cost-effectiveness evidence remains preliminary,
18 and more concrete data are needed to establish whether the apparent value can be
19 sustained in broader health systems. Moreover, telemedicine-supported home-based
20 interventions may not represent the optimal solution for every patient.(10) Accordingly,
21 DeCR should be viewed not as a replacement, but as a potential alternative or adjunct to
22 face-to-face CR. If, through shared-decision-making, patients and physicians can
23 determine whether face-to-face CR or DeCR is more appropriate, the accessibility and

1 impact of CR in both formats could be substantially enhanced. Nevertheless, if digital
2 rehabilitation is to have real impact, it must be accessible not only to privately insured
3 patients with digital means, but also to those in publicly funded systems and underserved
4 communities. Finally, as previously evaluated DeCR programmes have been highly
5 heterogenous, future interventions need to be standardized and clearly defined to
6 enhance comparability and strengthen the scientific evidence. Such standards have
7 recently been published in a scientific statement of the *European Society of*
8 *Cardiology*.⁽³⁾

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10 **Conflict of Interest:**

11 Dr Walli-Attai is an Associate Editor of the *European Journal of Preventive Cardiology*
12 and declares no conflicts of interest. Dr Halle reported receiving personal fees from
13 Abbott, Amgen, Boehringer Ingelheim, Bristol Myers Squibb, Daiichi Sankyo, sanofi-
14 aventis, Novartis and Medical Park (consulting fees and honoraria for lectures) outside
15 the submitted work, and being the past-president of the *European Association of*
16 *Preventive Cardiology* (2020–22). Dr Mueller is a Deputy Editor of the *European Journal*
17 *of Preventive Cardiology* and reported personal fees from Bristol-Meyers Squibb
18 (advisory board), WIP — Scientific Institute of Private Health Insurance (lecture), and the
19 German Cardiac Society (lecture) outside the submitted work.

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