NICE National Institute for Health and Care Excellence

NICE guidance

Digital platforms to support cardiac rehabilitation: early value assessment

HealthTech guidance

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This guidance replaces HTE35.

1 Recommendations

Can be used with evidence generation

1.1 Seven digital technologies can be used in the NHS during the evidence generation period as options to support cardiac rehabilitation for adults with cardiovascular disease (CVD). The technologies are:

- Activate Your Heart
- D REACH-HF
- Digital Heart Manual
- Gro Health HeartBuddy
- KiActiv
- myHeart
- Pumping Marvellous Cardiac Rehab Platform.

These technologies can only be used:

- after a trained healthcare professional has assessed that the technology is suitable for the person having cardiac rehabilitation
- if the evidence outlined in the evidence generation plan for these technologies is being generated
- as long as they have appropriate regulatory approval including NHS England's Digital Technology Assessment Criteria (DTAC) approval.

1.2 The companies must confirm that agreements are in place to generate the evidence. NICE will contact the companies annually to confirm that evidence is being generated and analysed as planned. NICE may revise or withdraw the

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guidance if these conditions are not met.

1.3 At the end of the evidence generation period (3 years), the companies should submit the evidence to NICE in a format that can be used for decision making. NICE will review the evidence and assess if the technology can be routinely adopted in the NHS.

More research is needed

1.4 More research is needed on 5 digital technologies to support cardiac rehabilitation for adults with CVD before they can be funded by the NHS. The technologies are:

- Beat Better
- Datos Health
- Get Ready
- Luscii vitals
- R Plus Health.

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What this means in practice

Can be used with evidence generation

The 7 technologies in recommendation 1.1 can be used as an option in the NHS during the evidence generation period (3 years) and paid for using core NHS funding. During this time, more evidence will be collected to address any uncertainties. Companies are responsible for organising funding for evidence generation activities.

After this, NICE will review this guidance, and the recommendations may change. Take this into account when negotiating the length of contracts and licence costs.

Potential benefits of use in the NHS with evidence generation

- **Access:** Access to and uptake of cardiac rehabilitation is limited across the NHS. Digital technologies to support cardiac rehabilitation may help improve access, uptake and adherence for people offered cardiac rehabilitation but who may not be able to or may be less inclined to attend in-person sessions. This could include, for example, people:
  - with work or caring responsibilities
  - living in rural communities with long travel times to clinics
  - who think that the current in-person offering is not suited to their needs.
- **System benefit:** Increasing the number of people who use cardiac rehabilitation programmes could reduce secondary cardiovascular events and unplanned hospital admissions.
- **Clinical benefit:** Clinical evidence suggests that these digital technologies may improve the exercise capacity, cardiovascular risk profile, health-related quality of life and psychological wellbeing of people with CVD.
- **Resources:** Increasing the number of people who do cardiac rehabilitation is likely to use fewer resources if those people use digital tools compared with conventional cardiac rehabilitation.

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- **Equality:** Offering digital technologies could increase flexibility so that patient preferences, needs and commitments can be accommodated better.

Managing the risk of use in the NHS with evidence generation

- **Costs:** Early economic modelling suggests that the technologies could be cost effective, but the results are uncertain. This guidance will be reviewed after 3 years and the recommendations may change. Trusts should take into account the costs of the digital technologies in this evaluation when implementing the technologies. When negotiating with companies, trusts should also consider the upfront costs for implementing a technology, delivering staff and patient training, integrating with NHS systems, and providing smart devices.
- **Clinical risk:** Evidence comparing digital technologies with conventional cardiac rehabilitation is limited and the results are uncertain. When deciding whether to do digital or conventional cardiac rehabilitation, healthcare professionals and people with CVD should consider how likely it is that digital technologies will have similar effectiveness to conventional cardiac rehabilitation for that person. People who choose to do digital cardiac rehabilitation should have continued access to support from the cardiac rehabilitation team.
- **Clinical subgroups:** There is no evidence to show whether digital technologies to support cardiac rehabilitation are clinically effective in particular subgroups. CVD risk is higher in older people, people living in more deprived areas and people in certain ethnic groups. The incidence of CVD is increasing in younger people. Uptake of cardiac rehabilitation is low among women, people living in more deprived areas and people in ethnic minority groups. It is uncertain whether the digital technologies are as effective in these subgroups as in the general CVD population.
- **Clinical assessment:** A trained NHS healthcare professional should do a full clinical assessment before offering these technologies to make sure they are suitable for the person with CVD. Referral to these services should be in line with national and local guidelines. Some people may choose not to use a digital service and may prefer another treatment option. People with CVD should always be given the option to do conventional cardiac rehabilitation. Everyone has the right to make informed decisions about their care (see the NICE guideline on

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shared decision making).

- **Resources:** Implementing digital technologies for cardiac rehabilitation could lead to an increase in the number of people doing cardiac rehabilitation and the number of appointments needed for assessments. Also, staff may have to spend time training people how to use digital tools.
- **Equality:** There is a risk that using digital technologies could widen the gap in access to cardiac rehabilitation. There are groups of people who may struggle to use digitally supported cardiac rehabilitation, such as people:
  - less comfortable or skilled in using digital technology
  - with limited access to equipment and the internet
  - experiencing homelessness
  - living in houses in multiple occupation or in residential care.

  Additional support may be needed for people who:

  - have visual, hearing or cognitive impairment
  - have reduced manual dexterity
  - have a learning disability
  - do not have English as a first language
  - do not understand health-related information.

  People's cultural, ethnic or religious backgrounds may affect how cardiac rehabilitation should be delivered. These people should be supported through shared decision making to select the appropriate treatment option for them and may need additional support.

More research is needed

There is not enough evidence to support funding in the NHS for the 5 technologies

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listed in recommendation 1.4.

Access to technologies should be through company, research or non-core NHS funding, and clinical or financial risks should be managed appropriately.

NICE has produced tools and resources to support the implementation of this guidance.

What evidence generation and research is needed

Evidence generation and research is needed on:

- the clinical effectiveness of digital technologies to support cardiac rehabilitation compared with conventional cardiac rehabilitation
- the clinical effectiveness of offering both digital and conventional cardiac rehabilitation compared with conventional cardiac rehabilitation alone
- how changing from paper to digital manuals affects clinical effectiveness
- the comparative costs of delivering digital and conventional cardiac rehabilitation, including implementation and training.

The evidence generation plan gives further information on the prioritised evidence gaps and outcomes, ongoing studies and potential real-world data sources. It includes how the evidence gaps could be resolved through further studies.

Why the committee made these recommendations

Digital technologies to support cardiac rehabilitation are a possible option for people with CVD to self-manage their care at a time and location that is convenient to them. A potential benefit is that these technologies could improve access, uptake and adherence to cardiac rehabilitation programmes. This could reduce unplanned hospital admissions and acute cardiovascular events resulting from the condition progressing.

Activate Your Heart, Gro Health HeartBuddy, KiActiv and myHeart have direct clinical evidence that suggests that they may reduce the risk of secondary cardiovascular events.

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The clinical evidence for D REACH-HF, Digital Heart Manual and Pumping Marvellous Cardiac Rehab Platform is uncertain. There is evidence of clinical benefit for the non-digital cardiac rehabilitation programmes widely used in the NHS that Digital Heart Manual and D REACH-HF are based on. Pumping Marvellous Cardiac Rehab Platform was designed using evidence-based cardiac rehabilitation programmes used in the NHS for people with heart failure. There is no evidence that the digital technologies offer the same benefit. But these uncertainties can be addressed through evidence generation. The clinical risk to patients and the financial risk to the NHS associated with using these technologies while further evidence is generated is low.

Early economic evidence for these 7 technologies suggests that they could be cost effective.

Clinical evidence on Datos Health and R Plus Health is not generalisable to cardiac rehabilitation programmes in the UK. There is no evidence for Beat Better, Datos Health, Get Ready, Luscii vitals or R Plus Health. So, these 5 technologies can only be used in research to generate more clinical and economic data.

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2 Information about the technologies

2.1 Digital technologies to support cardiac rehabilitation are a possible treatment option for people with cardiovascular disease (CVD). They can be used on mobile phones, tablets or computers. They are intended to be offered as an option to support cardiac rehabilitation programmes remotely. This would enable people with CVD to self-manage their care at a time and location that is convenient to them. These digital platforms are not intended to replace the initial assessments in a cardiac rehabilitation programme, which is when prescribing decisions would usually be made (see the British Association for Cardiovascular Prevention and Rehabilitation [BACPR] Standards and Core Components 2023 [PDF only])

2.2 Thirteen technologies were included in the scope and external assessment report. Many of the technologies are in use in the NHS. Some of the technologies are indicated for a specific CVD population.

2.3 The technologies typically include most or all of the standard components of conventional cardiac rehabilitation (see the BACPR Standards and Core Components 2023 [PDF only]). These include:

- health behaviour change and education
- lifestyle risk factor management
- medical risk management
- psychosocial health
- long-term strategies.

2.4 Digital platforms for cardiac rehabilitation vary in terms of:

- the mode of delivery (through websites [web] or applications [apps])
- the components of cardiac rehabilitation that are offered
- target populations
- programme duration

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- the frequency and level of support by healthcare professionals
- other features.

See table 1 and table 2 for comparisons of the features of the technologies included in this evaluation.

Table 1: Core components of cardiac rehabilitation

Technology	Health behaviour change and exercise	Lifestyle risk factor management	Medical risk management	Psychosocial health	Long-term strategies
Activate Your Heart	Yes	Yes	Yes	Yes	Yes
Beat Better	Yes	Yes	Yes	Yes	Yes
Datos Health	Yes	Yes	Yes	No	No
D REACH-HF	Yes	Yes	Yes	Yes	Yes
Digital Heart Manual	Yes	Yes	Yes	Yes	Yes
Get Ready	Yes	Yes	Yes	Yes	Yes
Gro Health HeartBuddy	Yes	Yes	Yes	Yes	Yes
KiActiv	Yes	Yes	Yes	Yes	Yes
Luscii vitals	Yes	Yes	No	No	No
myHeart	Yes	Yes	Yes	Yes	Yes
Pumping Marvellous	Yes	Yes	Yes	Yes	Yes
R Plus Health	Yes	Yes	Yes	Yes	Yes

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Table 2: Other features of the technologies

Technology	CE or UKCA mark	Length of programme (weeks)	Clinician dashboard	Remote monitoring	Connectivity to other devices	Communication with NHS healthcare professional via platform	Access to company-employed rehabilitation support staff
Activate Your Heart	NR	12	Yes	No	No	Yes	No
Beat Better	NR	Average 12	Yes	No	No	Yes	Yes
Datos Health	No	24	Yes	No	Yes	Yes	Yes
D REACH-HF	NR	12	Yes	Yes	No	Yes	No
Digital Heart Manual	NR	6	No	No	No	No	No
Get Ready	Class 1 Seeking class 2a	Flexible	Yes	Yes	Yes	Yes	Yes
Gro Health HeartBuddy	Class 1	12	Yes	Yes	Yes	Yes	Yes
KiActiv	Class 1	Flexible	Yes	Yes	No	No	Yes
Luscii vitals	Class 2a	Flexible	Yes	Yes	Yes	Yes	
myHeart	Class 1 UKCA	12	Yes	Yes	Yes	No	Yes
Pumping Marvellous	NR	8	No	No	No	No	Yes
R Plus Health	Class 1	Flexible	Yes	Yes	Yes	Yes	Yes

Abbreviations: NR, not required; UKCA, UK Conformity Assessed.

Activate Your Heart (University Hospitals of

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Leicester NHS Trust)

2.5 Activate Your Heart is a web-based cardiac rehabilitation platform for a range of cardiac conditions including:

- all coronary heart disease conditions
- rehabilitation after bypass or valve surgery
- spontaneous coronary artery dissection
- heart failure
- arrhythmias.

It is part of the i-IMPACT online platform. The platform personalises features such as exercise programmes and educational resources using input from a healthcare professional and the user.

Beat Better (Avegen Ltd)

2.6 Beat Better is an app- and web-based cardiac rehabilitation platform for people who have had a myocardial infarction or coronary artery bypass graft. Healthcare professionals can use the platform to provide exercise and dietary recommendations, and educational resources on heart health and symptom recognition. Users can track health measurements, exercise symptoms, mood and medication using the app, which can be reviewed by healthcare professionals.

Datos Health (Datos Health Ltd)

2.7 Datos Health is a digital remote monitoring artificial-intelligence-enabled platform for supporting cardiac rehabilitation. The Datos CareApp allows users to track vital statistics such as heart rate, blood pressure and weight; report symptoms; complete assessments; and receive personalised educational content.

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D REACH-HF (Health & Care Innovations Ltd)

2.8 D REACH-HF is a facilitated (healthcare professional-supported) web-based digital version of the paper REACH-HF programme for people with heart failure. It includes exercise programmes, educational content, progress tracking and resources for family and friends. D REACH-HF is facilitated (supported) by a healthcare professional who has access to the user's progress tracker. The healthcare professional reviews progress, adjusts goals and personalises support during in-person or telephone consultations.

Digital Heart Manual (NHS Lothian)

2.9 The Digital Heart Manual is a facilitated (healthcare professional-supported) web-based digital version of the paper Heart Manual Programme (NHS Lothian). There are different versions available for people who have had:

- a myocardial infarction or angioplasty
- revascularisation (angioplasty and coronary bypass) but no myocardial infarction.

  The platform includes an exercise guide, education, diet, medication and psychological support. The healthcare professional can review and adjust goals in collaboration with the user based on their input through standard NHS communication channels.

Get Ready (Medtronic)

2.10 Get Ready is an app- and web-based management, remote monitoring and patient engagement platform. It can be used to support cardiac rehabilitation for people with CVD, including people with heart failure and people who have had coronary revascularisation, or valve repair or replacement. The platform delivers educational content on cardiac conditions and risk factors, and general guidance on daily activities, which can be customised by healthcare professionals for local needs.

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Gro Health HeartBuddy (DDM health)

2.11 Gro Health HeartBuddy is an app-based cardiac rehabilitation platform for people:

- who have had:
  - a myocardial infarction
  - percutaneous coronary intervention
  - a coronary artery bypass graft
  - a new diagnosis of heart failure or atrial fibrillation
- after acute admissions for decompensated heart failure or uncontrolled atrial fibrillation.

  The platform personalises content on education, exercise programmes, health tracking, dietary support, medication adherence support, psychosocial support, lifestyle and behavioural modifications and healthcare professional engagement based on input from the user.

KiActiv (Ki Performance Lifestyle Limited)

2.12 KiActiv is an app- and web-based digital platform for cardiac rehabilitation that includes a proprietary wearable device that collects and processes physical activity data. It can be used by people with cardiac conditions including acute coronary syndromes, heart failure, cardiomyopathy, congenital heart disease and post-cardiac surgery. Data collected through the apps and from the wearable device helps users create personalised cardiac rehabilitation programmes. KiActiv provides interactive tools for users to log and self-monitor medication use, physical activity data, pain, stress, fatigue, overall health, lifestyle behaviours and symptoms. A mentor employed by KiActiv signposts users to educational resources related to nutrition, medical risk management, smoking cessation, and psychosocial health (including peer-support groups) at set times.

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Luscii vitals (Luscii healthtech B.V.)

2.13 Luscii vitals is an app that can be used to support cardiac rehabilitation. It provides personalised exercise plans that are developed with the cardiac rehabilitation team. Users can self-monitor by recording their symptoms or completing questionnaires, and outputs such as educational resources can be personalised based on these inputs.

myHeart (my mhealth Limited)

2.14 myHeart is an app- and web-based cardiac rehabilitation platform for people with heart disease or recovering from cardiac surgery. The platform automatically personalises educational content and guidance using the user's diagnosis and information about their lifestyle including smoking status and weight. This can be done remotely to complement face-to-face sessions. The platform provides lifestyle and risk factor interventions such as symptom trackers, an activity diary, a medication diary, and electrocardiograph and echocardiogram results tracking as well as psychosocial support.

Pumping Marvellous Cardiac Rehab Platform (Pumping Marvellous Foundation)

2.15 The Pumping Marvellous Foundation is a heart failure charity that provides a web-based online cardiac rehabilitation platform for people with heart failure. It provides structured exercise programmes based on the person's ability to exercise (low and medium). The platform also provides educational material and psychosocial support through a peer-to-peer online community.

R Plus Health (RPlusHealth Limited)

2.16 R Plus Health is an app- and web-based platform that provides exercise prescription and heart rate monitoring for people with a chronic heart condition

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including heart failure, stable angina, coronary revascularisation and post-cardiac surgery. The app allows users to follow their exercise prescriptions, access health education materials, record vital statistics such as heart rate, blood pressure, weight and diet, and complete questionnaires personalised by their healthcare professional. Users are prompted to measure vital statistics at intervals during exercise sessions, which can trigger alerts to healthcare professionals if they are abnormal. Healthcare professionals can prescribe long-term exercise prescriptions and set follow-up plans after the initial programme.

Sword Move (Sword Health)

2.17 Sword Move is an app-based cardiac rehabilitation platform for people recovering from acute coronary syndrome or cardiac surgery, and people diagnosed with heart failure. It provides personalised exercise and guidance developed with a company-employed physical health specialist. The platform uses a proprietary artificial intelligence model to analyse and collect the user's history and performance, suggest actions and alert abnormalities to the physical health specialists through the healthcare professional portal. The platform also provides personalised educational content, resources and guided meditation and breathing exercises. Sword Move does not hold Class I UKCA or CE marking for use in cardiac rehabilitation, so the committee could not make recommendations on it.

Carbon Reduction Plans

2.18 For information, Carbon Reduction Plans for UK carbon emissions for 2 technologies are published here:

- DDM Health: DDM's Carbon Reduction Plan (PDF only)
- R Plus Health: R Plus Health's Cardiac Reduction Plan (PDF only).

The following companies did not disclose a Carbon Reduction Plan:

- Avegen Ltd

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- Datos Health
- Health and Care Innovations Ltd
- Ki Performance Lifestyle Ltd
- Luscii vitals
- Medtronic
- My mHealth
- NHS Lothian
- Pumping Marvellous Foundation
- Sword Health
- University Hospitals of Leicester NHS Trust.

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3 Committee discussion

The medical technologies advisory committee considered evidence on digital technologies to support cardiac rehabilitation from several sources. This included evidence submitted by the companies, a review of clinical and cost evidence by the external assessment group (EAG), and responses from stakeholders. Full details are available in the project documents for this guidance.

The condition

3.1 Cardiovascular disease (CVD), also known as heart and circulatory disease, is a long-term condition that affects the heart and blood vessels supplying the organs in the body. The term CVD includes but is not limited to:

- Coronary heart disease: This includes conditions that cause narrowing or complete blockage of the blood vessels supplying the heart. This results in increased pressure on the heart and can lead to acute coronary syndrome and heart failure.
- Acute coronary syndromes: These are medical emergencies that include myocardial infarction (heart attack) and unstable angina (unexpected, severe chest pain).
- Heart failure: This is when there is a structural or functional abnormality of the heart in which the heart cannot pump blood efficiently.
- Valvular heart disease: This includes conditions in which one or more of the valves in the heart does not function properly.
- Congenital heart disease: This is a group of conditions present at birth that affect the structure of the heart and the normal way the heart works.
- Peripheral arterial disease: This is a condition that results from a build-up of fatty deposits in the walls of the arteries, which restricts blood supply to the muscles in the leg.

CVD risk is higher in older people, in people living in more deprived areas and

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in certain ethnic groups. The incidence of CVD is increasing in younger people.

Current practice

Conventional cardiac rehabilitation

3.2 Cardiac rehabilitation is an established option for secondary prevention of CVD. A meta-analysis comparing cardiac rehabilitation programmes with at least 6 months of follow-up data compared with no exercise reported a statistically significant risk reduction in cardiovascular mortality and hospitalisations (Dibben et al. 2023). Conventional cardiac rehabilitation may consist of face-to-face sessions, or a hybrid programme of in-person group-based and home-based programmes (including paper manuals, live online classes, home visits or telehealth).

Core components of cardiac rehabilitation

3.3 The core components of cardiac rehabilitation according to the British Association for Cardiovascular Prevention and Rehabilitation (BACPR) Standards and Core Components 2023 (PDF only) are:

- health behaviour change and education
- lifestyle risk factor management
- psychosocial health
- medical risk management
- long-term strategies.

The BACPR recommends that cardiac rehabilitation is offered before discharge from hospital for people who have or have had an eligible cardiovascular condition.

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Regional variation

3.4 Not all people with CVD are currently offered cardiac rehabilitation, and the provision of rehabilitation services varies by region (see NHS England's commissioning standards for cardiovascular rehabilitation). It is beyond the remit of this evaluation to determine whether cardiac rehabilitation should be offered to a wider population than in current practice. But the committee noted that offering additional modes of delivery for cardiac rehabilitation could reduce regional variation.

Unmet need

3.5 Cardiac rehabilitation in England, Northern Ireland and Wales is prioritised for people with acute coronary syndromes, coronary revascularisation and heart failure, in line with NHS England's commissioning standards for cardiovascular rehabilitation. In England in 2023, only 41% of people with acute coronary syndrome and 13% of people with heart failure who were eligible participated in cardiac rehabilitation programmes (National Audit of Cardiac Rehabilitation, 2024 [PDF only]). Stakeholders stated that a lack of access to cardiac rehabilitation services for people with heart failure. Digital technologies have the potential to improve access, uptake and adherence to cardiac rehabilitation programmes. This could reduce unplanned hospital admissions and acute events resulting from the condition progressing. Improved access could also reduce health inequalities by making cardiac rehabilitation accessible to people who would otherwise be unable to do in-person programmes.

Patient considerations

Features, personalisation and accessibility

3.6 The patient experts explained that cardiovascular conditions are lifelong conditions which affect all aspects of their life. They said that all the core components of cardiac rehabilitation are important (see section 3.3), not just exercise. They also said that digital tools should not exclude the human and

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social aspects of cardiac rehabilitation. One patient expert stated that having access to peer support is valuable to reduce feelings of isolation. They emphasised the importance of personalisation to ensure that digitally supported programmes meet the needs of the person with CVD. One patient expert suggested that digital platforms could be made more engaging by gamification. The committee agreed that the features, potential for personalisation and accessibility of a digital platform were important considerations when choosing a suitable programme.

Meeting the needs of different patient groups

3.7 The patient experts highlighted that current cardiac rehabilitation is typically focused on older people with prioritised conditions such as myocardial infarction. This does not meet the needs of all people with CVD, especially people who are younger, or who were previously fit and exercising frequently. There is limited evidence on the views of people with CVD who think that the current offer of conventional cardiac rehabilitation does not work for them. The patient experts suggested that offering digital options could help avoid feelings of alienation and exclusion, which reduce uptake and completion in these groups. To better understand when different modes might be suitable, the committee concluded that further research was needed on:

- patient experiences of the current offer of cardiac rehabilitation
- reasons for declining offers of cardiac rehabilitation.

Stakeholders commented that the Pumping Marvellous Cardiac Rehab Platform was the only option available for cardiac rehabilitation for people with heart failure in some areas of the country where the service is not commissioned in the NHS.

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Clinical effectiveness

Evidence base

3.8 The EAG prioritised 15 clinical-effectiveness studies for this evaluation, of which 5 were randomised controlled trials (RCTs). Eligible evidence was available for 8 of the 13 technologies:

- 3 studies on Activate Your Heart (2 RCTs)
- 1 study on Datos Health
- 2 studies on D REACH-HF
- 1 study on Digital Heart Manual
- 1 study on Gro Health HeartBuddy
- 2 studies on KiActiv (1 RCT)
- 2 studies on myHeart (1 RCT)
- 3 studies on R Plus Health (1 RCT).

For the other 5 technologies, no relevant evidence on clinical effectiveness was available.

Generalisability of study populations

3.9 The committee thought that the study populations were generally representative of the populations that access cardiac rehabilitation in the NHS. The studies included various populations, including people with stable angina, myocardial infarction, heart failure, coronary artery disease and revascularisation, as well as broad CVD populations. The populations typically included older adults (mean or median ages between 50 and 66 years) with a high proportion of White men. People who were less comfortable or skilled in using digital technology or had reduced access to the internet or smart devices, were commonly excluded across studies. In some studies, people with high depression or anxiety scores, or

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cognitive impairment, were also excluded. The EAG did not identify any other evidence addressing the scoped subgroups to determine whether the interventions had different effects in groups already underserved such as women, younger people and ethnic minority groups. So, further research is needed that includes underserved populations, and that analyses outcomes by subgroup.

Generalisability of non-UK evidence

3.10 The committee concluded that evidence from outside the UK was unlikely to be generalisable to clinical practice in the NHS. Studies providing evidence for Datos Health took place in Israel, and those for R Plus Health were in the US and China. The EAG noted that both population and healthcare system can affect generalisability. It stated that the population and healthcare systems in Israel and China were quite different to that in the UK. It also noted that the study done in the US was likely to have a more similar population, but the healthcare setting was very different. A clinical expert noted that the design of cardiac rehabilitation programmes is also very different between countries. They also noted that outcomes collected in these studies, such as peak oxygen uptake (VO_2 peak), were not typically collected in NHS practice. The committee concluded that technologies should be designed to support cardiac rehabilitation programmes similar to those currently used in the NHS. It also concluded that evidence based in the UK is important to show the feasibility and effectiveness of digital platforms in the NHS.

Generalisability of evidence for paper manuals

3.11 The Digital Heart Manual and D REACH-HF are digital formats of the paper manuals used to support home-based cardiac rehabilitation. The EAG did not think the evidence for paper manuals was relevant for this assessment. This was because it had received clinical advice that paper manuals and digital versions do not perform the same role in cardiac rehabilitation. The committee agreed that evidence for a paper manual is not necessarily generalisable to a digital tool because the change in format may affect how people use it. The company representatives mentioned that the content and healthcare professional

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facilitation for the Digital Heart Manual were identical between the paper and digital versions. But it added that D REACH-HF includes remote monitoring of the user's progress tracker by the facilitating (supporting) healthcare professional.

Home-based cardiac rehabilitation is recommended as an option in NICE's guideline on acute coronary syndromes and NICE's guideline on chronic heart failure in adults, which would typically involve using a paper manual. The clinical experts stated that the risk that the digital versions would result in significantly worse outcomes than the paper manuals was low, but that this was uncertain. The committee concluded that further data would be needed to determine any difference in effectiveness between the paper formats and digital versions of the Digital Heart Manual and D REACH-HF. Representatives for the Pumping Marvellous Cardiac Rehab Platform stated that it is based on evidence-based cardiac rehabilitation programmes used in the NHS. The committee noted that there was no direct evidence for the clinical effectiveness of the Pumping Marvellous Cardiac Rehab Platform. But, based on clinical advice and comments from stakeholders, it judged that the clinical risk to people with heart failure and financial risk to the NHS associated with using this technology compared to the cardiac rehabilitation programmes it is based on was low. So, these technologies could still be used while the evidence is generated.

Uptake, adherence and completion

3.12 Many studies reported uptake, adherence and completion of digital cardiac rehabilitation programmes, but the definitions of the outcomes varied. Uptake ranged from 7.51% to 100%, and completion ranged from 82.0% to 92.4% across the studies. There was limited data comparing uptake and completion between digital and conventional programmes. Because of the lack of subgroup analysis, there was no evidence that digital tools would increase uptake in underserved populations. But 1 study on Activate Your Heart reported that 54% of users would not have attended conventional outpatient cardiac rehabilitation. Users generally reported positive usability experiences across the studies, but the scales used were not validated. A prepublication study submitted reported that 6% of people with heart failure registered for the Pumping Marvellous Cardiac Rehab Platform had previously taken part in cardiac rehabilitation. The committee noted that most people in this study had not been referred by heart failure or cardiac

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rehabilitation teams. The clinical and patient experts stated that it was likely that digital technologies would increase uptake in certain groups who cannot or do not want to access in-person cardiac rehabilitation. This could include people with full-time work or caring commitments, younger people or people who think that the in-person offering is not suited to their needs (see section 3.6 and section 3.9). The committee concluded that further evidence is needed on uptake, adherence and completion in subgroups that are likely to benefit from using digital technologies.

Clinical outcomes

3.13 The committee noted that the evidence supporting the clinical benefit of digital cardiac rehabilitation was limited, but the available evidence suggested that the digital technologies could improve clinical outcomes. Definitions of clinical outcomes varied across the studies. Overall, the limited evidence available showed improvements in exercise capacity, cardiovascular risk profile and health-related quality of life for people using digital technologies. The maximum length of follow up in the included studies was 6 months. So, the effectiveness of the digital tools beyond 6 months is uncertain. The committee noted that long-term data was needed to evaluate the true effectiveness of these technologies. It also highlighted the importance of consistency in the outcome measures in future research and evidence generation.

Adverse events

3.14 The available evidence did not provide substantial information on adverse events or hospitalisation because of adverse events. The patient experts highlighted that it is important that tools are suited for the condition of the person having cardiac rehabilitation because inappropriate exercises could lead to adverse effects. The committee noted that some digital platforms are publicly accessible without referral by a healthcare professional. The clinical experts stated that a full clinical assessment would be needed before using any digital technology, to make sure the technology was suitable. The committee concluded that people should only be given access to digital platforms after an initial assessment, and that more evidence is needed on the rate and type of adverse events.

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Cost effectiveness

Economic model

Model structure

3.15 The EAG developed an early economic model that estimated the cost effectiveness of digitally supported cardiac rehabilitation compared with conventional cardiac rehabilitation. It consisted of a short-term decision tree and a long-term state transition model with a 10-year time horizon. For technologies for which information on uptake, completion and risk of secondary cardiovascular events was not available, these inputs were assumed to be the same as for conventional cardiac rehabilitation. The EAG did not include any subgroup analyses in the economic model because there was not enough evidence to inform inputs. The committee concluded that the model structure was appropriate but that the inputs were highly uncertain.

Base-case results

3.16 In the base case, all the technologies were cost saving compared with conventional cardiac rehabilitation. There were very small increases in quality-adjusted life years produced for technologies for which there was applicable evidence of clinical benefit. These results were driven by a decrease in costs associated with delivering cardiac rehabilitation sessions between the initial and final in-person assessment.

Modelling of decision question

3.17 The NICE scope defined the intervention as the choice between conventional and digital cardiac rehabilitation, compared with conventional cardiac rehabilitation alone. There was no evidence evaluating digital technologies alongside conventional cardiac rehabilitation. So, the EAG's model directly compared digital cardiac rehabilitation with conventional cardiac rehabilitation. In a scenario in which the choice of modes was compared with the offer of conventional cardiac

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rehabilitation only, the EAG noted that the total costs and utilities for the choice arm would be a weighted average of both options depending on uptake rates for each mode. This would be cost effective using the EAG's assumptions.

Assumption of clinical equivalence

3.18 The limited evidence on the impact of digital technologies on secondary cardiovascular events showed that they had similar treatment effects to conventional cardiac rehabilitation. So, clinical equivalence was assumed for most technologies in the base case. Only 2 technologies (R Plus Health and Gro Health Heart Buddy) had evidence of impact on cardiovascular risk that could be used in the model. The EAG tested the assumption of equivalence of digital cardiac rehabilitation and conventional cardiac rehabilitation in a scenario analysis. This showed that digital cardiac rehabilitation remained cost effective as long as the 10-year risk of secondary cardiovascular events was no more than 0.1% to 0.3% higher than with conventional cardiac rehabilitation. The committee accepted that the assumption was plausible but uncertain. It noted that the model did not provide information on how effective digital cardiac rehabilitation would have to be to be cost effective compared with no cardiac rehabilitation for the people who would not otherwise have conventional cardiac rehabilitation. But it agreed that digital cardiac rehabilitation was likely better than no cardiac rehabilitation. The existing evidence base also supported significant clinical benefit with cardiac rehabilitation compared with no cardiac rehabilitation (see section 3.2).

Cost of conventional cardiac rehabilitation

3.19 The committee recalled that cost effectiveness was driven by the cost differences resulting from the reduced number of face-to-face appointments (see section 3.15). For the base case, the cost for each cardiac rehabilitation session was based on NHS reference costs. This resulted in a total cost of £862.17 for 8 sessions including consultant-led initial and final assessments. The model was sensitive to the cost of an in-person session, which was explored in the sensitivity analyses using alternative cost inputs. When lower costs for cardiac rehabilitation sessions were used, digital tools were dominated by (that is, were more expensive and less effective than) conventional cardiac rehabilitation.

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The clinical experts questioned the use of consultant-led reference costs for the initial and final assessments. They stated that these appointments are usually held by a cardiac rehabilitation nurse or physiotherapist. They also stated that it is unlikely that a consultant would lead this task, and that multiple allied healthcare professionals may be involved. The EAG suggested that the cost of a consultant-led session presented in their report could be seen as representing the time of 1 or more cardiac rehabilitation specialists. The EAG also noted that this cost was applied for both digital and conventional cardiac rehabilitation arms, so had little impact on the results. The cost difference between arms was largely because of the avoidance of 6 non-consultant-led sessions when using the digital technologies. The committee concluded that further data is needed to determine the true cost of conventional cardiac rehabilitation.

Suitability of technologies for evidence generation

3.20 The committee recalled that the available clinical evidence suggested that digital technologies for supporting cardiac rehabilitation may be clinically effective (see section 3.8). But it also recalled that it was uncertain whether digital and conventional cardiac rehabilitation could be considered equivalent (see section 3.18). It noted that there was limited evidence on the impact on overall uptake of cardiac rehabilitation of offering digital tools. But it thought it was likely that introducing them would increase uptake. The committee concluded that offering digital technologies was likely to improve health by providing an option for people who currently have nothing at all. But it said that there needs to be an initial assessment to determine suitability of the technology for the person.

There is limited UK evidence on some digital technologies to support cardiac rehabilitation. The committee noted that the health systems and structure of cardiac rehabilitation programmes in China, Israel and the US are not comparable to those in the UK (see section 3.10). So, UK evidence is needed before Datos Health and R Plus Health can be widely used. It recalled that the Digital Heart Manual and D REACH-HF did not have clinical evidence, but that there was a substantial evidence base for the predecessor paper manuals. The committee concluded that it is unlikely that the change in format would add much clinical risk, especially for people who would otherwise not do cardiac rehabilitation (see

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section 3.11). So, it concluded that these technologies can be used while more evidence is generated on the impact of changing the mode of delivery.

The committee recalled that there was no direct evidence of the clinical effectiveness of the Pumping Marvellous Cardiac Rehab Platform. The committee heard that it was designed using evidence-based cardiac rehabilitation programmes used in the NHS for people with heart failure (see section 3.11). It also noted that the Pumping Marvellous platform has no licence fee. Based on clinical advice and comments from stakeholders, it concluded that the clinical risk for people with heart failure and financial risk to the NHS resulting from offering the option of using the platform was low. This was particularly so, considering the already low uptake of conventional cardiac rehabilitation by people with heart failure (see section 3.5). The committee considered that it would be beneficial to include the platform in the evidence generation because it was likely to be used widely because of the low cost. Beat Better, Luscii vitals and Get Ready had no relevant clinical evidence, so the committee concluded that they should be used in research only.

Equality considerations

Age and sex

3.21 The committee noted that younger people with CVD may prefer digital tools because they allow more independence while still providing support from healthcare professionals. They stated that people with work or caring commitments are less likely to do in-person cardiac rehabilitation (see section 3.12) and noted that most unpaid carers are women. So, introducing digital tools could reduce inequalities in uptake of and adherence to cardiac rehabilitation by age and sex.

Groups that may find digital tools challenging to use

3.22 The committee recognised that using digital tools may be challenging for some people such as:

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- older people
- people with dexterity issues
- people who do not have regular access to smart devices or the internet
- people who do not have English as a first language
- people experiencing homelessness or living in houses in multiple occupation or in residential care.

  Additional support and resources may be needed for these groups. The clinical experts also noted that some of these groups are already less likely to do cardiac rehabilitation, so introducing digital tools could widen existing equality gaps. The EAG's economic model assumed that a tablet computer and monthly internet access would be provided to reduce the risk of digital exclusion. The committee also recalled that the evidence base was limited and that there was no analysis on subgroups (see section 3.9). The committee concluded that more data is needed on the usability and acceptability of digital tools in different groups.

  The committee recalled that many studies excluded people with high depression or anxiety scores, or cognitive impairment (see section 3.9). The clinical experts stated that these people would need further clinical support outside of the cardiac rehabilitation programme, and that this should be recognised at the initial assessment. The committee concluded that further research is needed on uptake and effectiveness in these subgroups. But it added that the suitability of the technology should be considered in the initial assessment.

Ethnic, religious and cultural background

3.23 The clinical experts noted that people's ethnic, religious or cultural background may affect how cardiac rehabilitation should be delivered. For example, dietary advice may need to be tailored to the cultural background of the person with CVD. The committee stated that healthcare professionals should discuss the language and cultural content of digital technologies as part of the initial

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assessment.

Evidence gap review

3.24 The EAG identified the following evidence gaps relating to the population, intervention and comparator, outcomes, and costs and resource use.

Population

3.25 The clinical experts highlighted that the study populations did not entirely represent the cardiac rehabilitation population. The studies generally excluded people less comfortable and skilled in using digital technologies, with limited access to the internet or smart devices or with significant comorbidities. These are factors that may affect people who currently benefit less from cardiac rehabilitation. These people could be disadvantaged by using digital technologies. The committee agreed that further research is needed on the benefits and risks of using digital cardiac rehabilitation in populations commonly excluded from cardiac rehabilitation.

Intervention and comparator

3.26 There was no eligible evidence for some of the technologies. Evidence comparing the digital technologies with the scoped comparator of conventional cardiac rehabilitation was limited. The committee agreed that further research is needed on the offer of both digital and conventional cardiac rehabilitation compared with conventional cardiac rehabilitation alone. There is also a need for research on any differences in effectiveness between the paper and digital formats.

Outcomes

3.27 The reported outcomes varied across the studies. Length of follow up was relatively short, with no studies having follow up of longer than 6 months. There

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was no evidence for outcomes in the subgroups defined in the scope, especially for uptake and completion of the programmes. No evidence on adverse events was reported. The committee noted that long-term data is needed to evaluate the true effectiveness of these technologies. Also, more research is needed to determine whether digital technologies improve uptake and completion of cardiac rehabilitation programmes in certain subgroups (see section 3.9). More research is also needed on adverse events.

Costs and resource use

3.28 The cost of conventional cardiac rehabilitation was a key area of uncertainty, which had a substantial effect on the model results. So, more evidence is needed on the cost of delivering conventional cardiac rehabilitation.

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4 Committee members and NICE project team

This topic was considered by NICE's medical technologies advisory committee, which is a standing advisory committee of NICE.

Committee members are asked to declare any interests in the technology to be evaluated. If it is considered there is a conflict of interest, the member is excluded from participating further in that evaluation.

The minutes of each committee meeting, which include the names of the members who attended and their declarations of interests, are posted on the NICE website.

Chair

Teik Goh
Vice chair, medical technologies advisory committee

NICE project team

Each evaluation is assigned to a team consisting of 1 or more health technology analysts (who act as technical leads for the evaluation), a technical adviser, a project manager and an associate director.

Chidera Mark-Uchendu
Technical lead

Jacob Grant
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Catherine Pank
Project manager

Rebecca Albrow
Associate director

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Update information

Minor changes since publication

December 2025: Health technology evaluation 35 has been migrated to HealthTech guidance 764. The recommendations and accompanying content remain unchanged.

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