Beyond phase II cardiac rehabilitation: strategies for long-term exercise adherence and cardiovascular health maintenance

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DOI: 10.5281/zenodo.23943165

Abstract:
Cardiac rehabilitation is a comprehensive, evidence-based intervention designed to improve functional capacity, reduce cardiovascular risk, support psychological recovery, and enhance quality of life in individuals with cardiovascular disease. Although Phase II cardiac rehabilitation provides structured, supervised exercise and education following an acute cardiac event or cardiovascular intervention, its benefits may diminish when patients transition to independent exercise and long-term self-management. Maintaining regular physical activity after completion of supervised rehabilitation is therefore a major challenge in secondary cardiovascular prevention. Barriers such as low motivation, fear of exercise, comorbidities, limited access to facilities, socioeconomic constraints, inadequate social support, and difficulty integrating exercise into daily routines can contribute to declining adherence. This review examines strategies that extend beyond Phase II cardiac rehabilitation to promote sustained exercise participation and cardiovascular health maintenance. It discusses the transition from supervised rehabilitation to community-based and home-based exercise, individualized exercise prescription, behavioural counselling, goal setting, self-monitoring, wearable technology, tele-rehabilitation, family involvement, and multidisciplinary follow-up. Particular attention is given to the role of physiotherapists and cardiac rehabilitation professionals in developing long-term exercise habits, monitoring cardiovascular risk factors, and adapting physical activity to changing clinical needs. The review also considers outcome measures, including exercise adherence, cardiorespiratory fitness, functional capacity, blood pressure, lipid profile, glycaemic control, body composition, quality of life, and cardiovascular events. A practical maintenance framework is proposed to connect supervised rehabilitation with lifelong physical activity through individualized planning, progressive exercise, behavioural support, and periodic reassessment. Long-term cardiovascular health should not be viewed as the final stage of a time-limited rehabilitation programme, but as an ongoing process requiring patient engagement, accessible services, and coordinated healthcare support.

Keywords:
Cardiac rehabilitation, Exercise adherence, cardiovascular health, Long-term exercise, Secondary prevention, Physiotherapy, Home-based rehabilitation, Telerehabilitation, Behavioural modification, Physical activity.

1. Introduction:

Cardiovascular diseases remain a major cause of morbidity, mortality, disability, and healthcare expenditure worldwide. Advances in acute cardiac care, coronary revascularization, pharmacological treatment, and emergency management have improved survival following myocardial infarction, acute coronary syndrome, heart failure, and other cardiovascular events. However, survival alone does not ensure long-term cardiovascular health. Many individuals continue to experience reduced exercise capacity, physical deconditioning, fatigue, anxiety, obesity, hypertension, dyslipidaemia, diabetes, and an increased risk of recurrent cardiovascular events. Cardiac rehabilitation (CR) addresses these challenges through a comprehensive programme involving exercise training, cardiovascular risk-factor modification, nutritional

counselling, psychosocial support, medication education, and lifestyle management. Phase II cardiac rehabilitation generally represents the early outpatient stage following hospital discharge, during which patients participate in structured, supervised exercise and receive education regarding safe physical activity and secondary prevention. This phase is essential for restoring confidence, improving functional capacity, and preparing individuals to resume daily activities. Nevertheless, the completion of Phase II does not mean that cardiovascular risk has been eliminated or that the benefits of rehabilitation will automatically continue. A major clinical challenge emerges when patients move from a supervised rehabilitation environment to independent exercise at home, in the community, or in a fitness facility. During this transition, regular exercise may decline because professional supervision becomes less frequent, motivation decreases, symptoms or fear of exertion return, and patients struggle to incorporate exercise into work, family, and social responsibilities. The 2024 European Society of Cardiology (ESC) chronic coronary syndrome guideline emphasizes that continued exercise is important for maintaining functional capacity, quality of life, and physical activity after formal rehabilitation, and recommends personalized exercise prescriptions based on patient preferences and abilities (Vrints et al., 2024). Similarly, the American Heart Association (AHA) and American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) identify physical activity counselling, aerobic training, resistance training, risk-factor management, and programme quality as core components of comprehensive cardiac rehabilitation (Brown et al., 2024). The 2023 AHA/ACC chronic coronary disease guideline recommends regular aerobic and resistance exercise for eligible patients, including at least 150 minutes per week of moderate-intensity aerobic activity or an equivalent amount of higher-intensity activity, alongside resistance exercise on at least two days per week (Virani et al., 2023). However, achieving these recommendations requires more than providing an exercise prescription. It requires behavioural support, individualized progression, monitoring, access to appropriate facilities, family and community involvement, and continuing contact with healthcare professionals. The concept of rehabilitation should therefore extend beyond a time-limited supervised programme towards lifelong cardiovascular health maintenance. This review explores strategies for maintaining exercise adherence after Phase II cardiac rehabilitation, with particular emphasis on the role of physiotherapy, long-term exercise prescription, behavioural interventions, home-based and community programmes, digital health technologies, psychosocial support, and multidisciplinary secondary prevention. It also proposes a structured maintenance framework that connects supervised rehabilitation with independent physical activity and periodic clinical reassessment.

2. Understanding the Transition beyond Phase II Cardiac Rehabilitation:

Cardiac rehabilitation is commonly described through different phases, although terminology and service organization vary between healthcare systems. Phase I generally refers to early inpatient rehabilitation, including mobilization, education, and preparation for discharge. Phase II usually involves structured outpatient rehabilitation, with supervised exercise, risk-factor assessment, and education following an acute cardiac event or intervention. Phase III is often used to describe longer-term supervised or community-based exercise and lifestyle maintenance, while Phase IV may refer to continuing independent physical activity and lifelong cardiovascular risk management. These phase labels are not universally standardized, and the essential objective is continuity of care rather than adherence to a particular numbering system. During Phase II, patients benefit from professional supervision, regular feedback, structured exercise sessions, and opportunities to discuss symptoms and concerns. Exercise intensity can be adjusted according to clinical status, exercise-test findings, perceived exertion, heart-rate response, and functional capacity. Patients also become familiar with warm-up, aerobic exercise, resistance training, cool-down, and symptom-monitoring procedures. The transition beyond Phase II changes the environment in which these behaviours occur. Patients may no longer attend the rehabilitation centre several times per week, and exercise becomes more dependent on personal motivation, self-management skills, environmental opportunities, and social support. The maintenance period is therefore not simply a continuation of the same exercise programme without supervision, it is a distinct stage requiring the development of independent decision-making and sustainable behaviour. Sánchez-Delgado et al. (2020) examined maintenance cardiac rehabilitation and highlighted the importance of longer-term programmes designed to preserve improvements achieved during conventional rehabilitation. Martinello et al. (2019) similarly reviewed interventions intended to maintain exercise and physical activity after cardiac rehabilitation, demonstrating that the post-programme period requires specific strategies rather than assuming that exercise habits will persist automatically. The 2024 ESC guideline also emphasizes the importance of maintaining prescribed exercise, personalized decision-making, and continuation of exercise therapy beyond the initial rehabilitation programme (Vrints et al., 2024). The transition should ideally begin before the final Phase II session. Patients should leave supervised rehabilitation with a written exercise plan, clear intensity guidance, an understanding of warning symptoms, realistic activity goals, and a follow-up pathway. The physiotherapist should assess whether the individual can exercise independently, whether additional

supervision is required, and which delivery model is most practical. Some patients may be suitable for home walking and resistance exercise with periodic telephone follow-up, while others may benefit from community cardiac exercise groups, hybrid programmes, or continued centre-based supervision. Patients with heart failure, complex arrhythmias, significant residual ischaemia, frailty, major comorbidities, or persistent symptoms may require more closely supervised follow-up. Therefore, successful transition depends on matching the maintenance strategy to clinical risk, functional capacity, personal circumstances, and patient preference.

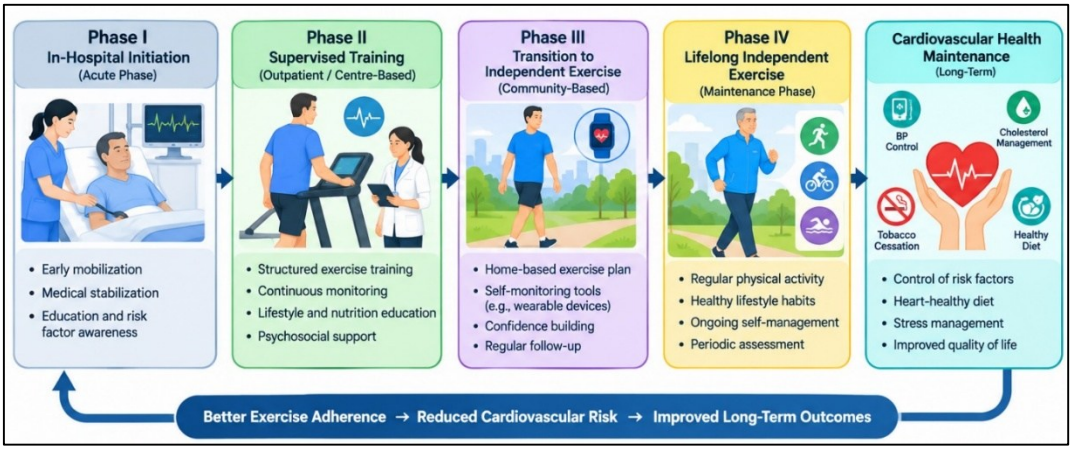


Figure. 1: Continuum of cardiac rehabilitation from supervised Phase II training to lifelong independent exercise and cardiovascular health maintenance

3. Why Long-Term Exercise Adherence Is Difficult:

Exercise adherence after Phase II cardiac rehabilitation is influenced by interacting physical, psychological, behavioural, social, environmental, and healthcare-system factors. A patient may understand the benefits of exercise but still struggle to perform it consistently because of fatigue, joint pain, breathlessness, work commitments, transport difficulties, family responsibilities, or lack of suitable exercise facilities. Fear of provoking another cardiac event is another important barrier. Some individuals interpret an increased heart rate, sweating, or mild breathlessness as signs of cardiac danger, even when these responses occur within an appropriately prescribed exercise intensity. Others may become overconfident after improvement in symptoms and discontinue structured activity because they believe that treatment is complete. Depression, anxiety, low self-efficacy, and reduced social support can further weaken motivation. Ozemek et al. (2021) identified enrolment, adherence, mental health, and population-specific needs as important areas in contemporary cardiac rehabilitation research. The 2025 AHA scientific statement on cardiac rehabilitation in women highlights disparities in referral, participation, and completion, including barriers related to comorbidities, financial constraints, transport, social responsibilities, and inadequate psychosocial support (Coutinho et al., 2025). Older adults may face additional challenges, including frailty, reduced mobility, balance impairment, multimorbidity, and limited access to transport. Younger adults may struggle with employment, childcare, and the perception that conventional rehabilitation schedules are incompatible with their daily routines. Patients living in rural or underserved areas may have difficulty accessing specialist rehabilitation services, while people with limited digital literacy may not benefit fully from technology-based interventions. Remote exercise programmes also have their own barriers, including unreliable internet access, device costs, limited confidence in using technology, and concerns about privacy. A systematic review by Bomtempo et al. (2025) identified technology access, health status, social support, environmental conditions, and logistical factors as important influences on remote exercise engagement among individuals with cardiovascular disease. The barriers are not necessarily fixed. For example, a patient who cannot attend a hospital-based exercise programme because of transport limitations may be able to participate in a home-based programme. An individual who lacks confidence in independent exercise may benefit from a gradual transition with telephone coaching and periodic supervised sessions. Patients who find exercise repetitive may adhere more successfully to walking groups, cycling, swimming, dancing, or other preferred activities. The clinical objective is therefore not to identify a single universal adherence strategy but to understand why each patient may discontinue exercise and select interventions that address the relevant barriers. A structured assessment should explore exercise beliefs, confidence, previous activity patterns, symptoms, comorbidities, daily schedule, financial limitations, family support, access to safe exercise spaces, and preferred modes of communication. These findings should inform a personalized maintenance plan that can be modified over time.

4. Physiological and Clinical Benefits of Sustained Exercise after Cardiac Rehabilitation:

Long-term exercise participation contributes to cardiovascular health through several physiological mechanisms. Regular aerobic exercise improves cardiorespiratory fitness by enhancing peripheral oxygen extraction, skeletal muscle oxidative capacity, endothelial function, and the efficiency of cardiovascular responses to physical activity. Depending on the patient's baseline condition and exercise programme, improvements may occur in peak oxygen uptake, walking distance, exercise tolerance, and the ability to perform daily activities. Exercise can also contribute to improved blood pressure regulation, insulin sensitivity, lipid metabolism, body composition, and vascular function. Resistance training supports muscle strength, functional independence, glucose metabolism, and the ability to perform activities such as stair climbing, carrying objects, and rising from a chair. These benefits are particularly important in older adults and individuals with frailty or sarcopenia. Exercise may also improve sleep, mood, stress management, and perceived quality of life. The 2023 AHA scientific statement on resistance exercise emphasizes that appropriately prescribed resistance training can improve muscle strength, physical function, and cardiometabolic health in people with and without cardiovascular disease (Paluch et al., 2024). Evidence from exercise-based cardiac rehabilitation studies supports benefits beyond short-term improvements in exercise capacity. The 2021 Cochrane review of exercise-based cardiac rehabilitation in coronary heart disease reported reductions in myocardial infarction and hospital admission, alongside improvements in health-related quality of life, although the magnitude of effects varied by outcome and follow-up duration (Dibben et al., 2021). In adults with heart failure, the 2023 Cochrane review found that exercise-based rehabilitation reduced short-term all-cause hospitalizations and improved health-related quality of life (Molloy et al., 2023). A 2024 systematic review and meta-analysis also reported improvements in exercise tolerance and quality of life and reductions in rehospitalization following longer-term exercise-based cardiac rehabilitation in chronic heart failure (Yamamoto et al., 2024). These findings support the importance of continuing exercise after formal rehabilitation, although the specific benefits depend on diagnosis, exercise dose, adherence, and clinical status. Exercise should be understood as one component of comprehensive secondary prevention rather than a substitute for prescribed medication, smoking cessation, dietary management, blood pressure control, lipid management, diabetes care, and routine medical follow-up. Patients should not discontinue medication or modify treatment because they have become more physically active. Long-term maintenance is most effective when exercise is integrated with the broader management of cardiovascular risk.

5. Individualized Long-Term Exercise Prescription Using the FITT Principle:

A sustainable maintenance programme requires an exercise prescription that is safe, achievable, enjoyable, and adaptable. The FITT principle frequency, intensity, time, and type provides a practical framework for developing and progressing exercise after Phase II cardiac rehabilitation. Frequency refers to the number of exercise sessions performed each week, intensity describes how demanding the activity is, time represents the duration of each session, and type refers to the activity selected. Progression is an additional essential component because exercise capacity and tolerance may change over time. For many clinically stable adults with cardiovascular disease, guidelines recommend accumulating at least 150 minutes per week of moderate-intensity aerobic activity or an equivalent amount of higher-intensity activity, together with resistance exercise on at least two days per week, when no contraindication exists (Virani et al., 2023, World Health Organization [WHO], 2020). The 2024 ESC chronic coronary syndrome guideline recommends aerobic exercise on at least three days per week, preferably on most days, with resistance training incorporated into the weekly programme (Vrints et al., 2024). However, these targets should not be applied without considering the patient's clinical status, functional capacity, medication, symptoms, and exercise-test findings. A patient who has completed Phase II rehabilitation with good exercise tolerance may progress towards the recommended activity volume, whereas an individual with severe deconditioning, heart failure, frailty, or multiple comorbidities may require shorter bouts and slower progression. Moderate intensity can be estimated using heart-rate reserve, percentage of peak heart rate, ventilatory thresholds, workload, or rating of perceived exertion. The Borg 6–20 scale is commonly used, with moderate exertion often corresponding to approximately 12–13, although individual interpretation is required. Heart-rate targets may be less reliable in patients taking beta-blockers, those with chronotropic incompetence, or individuals with certain arrhythmias, in such cases, perceived exertion, symptoms, and workload may be more useful. The exercise programme should include warm-up and cool-down periods, particularly for individuals with coronary disease or a history of exercise-related symptoms. Aerobic activities may include brisk walking, stationary cycling, treadmill exercise, swimming where clinically appropriate, or other rhythmic activities involving large muscle groups. Resistance training should address major muscle groups using body weight, resistance bands, light free weights, or machines, with technique and breathing control emphasized. Patients should avoid breath-holding and excessive straining during resistance exercise. Flexibility, balance, and functional training may be added according to age,

mobility, fall risk, and individual goals. Exercise progression should generally modify one component at a time, such as duration before intensity, and should be based on tolerance and clinical response rather than a fixed calendar schedule. The 2024 AHA/AACVPR statement describes individualized aerobic and resistance exercise prescription, assessment, and progression as core elements of high-quality cardiac rehabilitation (Brown et al., 2024). A written maintenance plan should specify the patient's preferred activities, weekly schedule, target exertion, progression method, symptom precautions, and arrangements for review.

Table. 1: Suggested long-term exercise prescription framework following completion of Phase II cardiac rehabilitation

Exercise component	Suggested maintenance target	Practical examples	Important considerations
Aerobic exercise	Progress towards at least 150 minutes/week of moderate activity, if clinically appropriate	Walking, cycling, swimming, low-impact aerobic activity	Individualize intensity using exercise testing, symptoms, and perceived exertion
Exercise frequency	Most days of the week, at least 3 days/week for structured aerobic sessions	30 minutes on 5 days or shorter accumulated bouts	Begin with achievable frequency and progress gradually
Exercise duration	Commonly 20–60 minutes per session according to capacity	Continuous or accumulated 10–15-minute bouts	Include warm-up and cool-down
Resistance training	At least 2 days/week	Bands, light weights, machines, body-weight exercise	Train major muscle groups with controlled breathing
Flexibility	Regular sessions according to mobility needs	Gentle stretching and range-of-motion exercises	Avoid painful or forceful movements
Balance and functional training	Add when indicated, especially in older adults	Sit-to-stand, supported stepping, balance tasks	Consider fall risk and supervision requirements
Sedentary-time reduction	Interrupt prolonged sitting throughout the day	Short walking breaks, standing activities	Encourage movement beyond formal exercise sessions

6. Progressive Exercise Training and Functional Goal Setting:

Progressive exercise training is important for maintaining the physiological adaptations achieved during Phase II rehabilitation. If exercise duration and intensity remain unchanged for a prolonged period, the training stimulus may become insufficient to produce further improvements. However, excessive progression may increase fatigue, musculoskeletal discomfort, and the risk of symptoms, particularly in patients with complex cardiovascular disease. A planned progression strategy should therefore consider the patient's baseline functional capacity, response to the current exercise programme, recovery, and personal goals. Progression can begin by increasing the duration of aerobic exercise before increasing intensity. For example, a patient who initially completes 15 minutes of walking may gradually increase to 20, 25, and then 30 minutes, provided symptoms and recovery remain satisfactory. Resistance training may progress through additional repetitions, sets, or small increases in resistance after the patient demonstrates correct technique and tolerance. Functional goals should be meaningful to the patient rather than limited to laboratory measures. Examples include walking to a local market, climbing stairs without excessive fatigue, returning to gardening, participating in recreational cycling, or resuming occupational activities. Goal setting should be specific, measurable, achievable, relevant, and time-bound. Instead of instructing a patient to “exercise more,” the physiotherapist may collaboratively establish a goal such as walking for 20 minutes on five days each week for the next four weeks, followed by reassessment. Patients should also develop contingency plans for illness, travel, poor weather, and temporary interruptions. If a patient misses several sessions, the maintenance programme should restart at a manageable level rather than immediately returning to the previous workload. This reduces the risk of discouragement and excessive exertion. Goal setting becomes more effective when combined with regular feedback, self-monitoring, and review by a healthcare professional. The patient should understand that physical activity is a long-term behaviour and that temporary interruptions do not represent failure. Progress should be evaluated using both objective measures and personal achievements. A combination of exercise-test performance, six-

minute walk distance, daily activity, resistance capacity, and patient-reported function can provide a broader picture of progress. The physiotherapist should periodically revise goals as functional capacity improves or clinical circumstances change.

7. Behavioural Strategies to Improve Long-Term Exercise Adherence:

Behavioural support is central to maintaining physical activity after supervised cardiac rehabilitation because knowledge of exercise benefits does not automatically produce sustained behaviour change. Patients need practical strategies that help them initiate activity, repeat it regularly, overcome setbacks, and integrate exercise into everyday routines. Behavioural approaches may include motivational interviewing, goal setting, action planning, self-monitoring, problem-solving, positive reinforcement, habit formation, and relapse prevention. Motivational interviewing is a collaborative communication approach that explores the patient's reasons for change, confidence, concerns, and personal priorities. Rather than giving repeated instructions, the clinician encourages the patient to identify personally meaningful reasons for remaining active. For example, an individual may be more motivated by the ability to play with grandchildren or return to work than by abstract information about cardiovascular risk. Self-efficacy the individual's confidence in performing a behaviour despite challenges is particularly important. Confidence can be strengthened through gradual progression, achievable goals, positive feedback, and opportunities to experience successful exercise sessions. Action planning helps convert general intentions into specific behaviours by identifying when, where, and how exercise will occur. Habit formation may be supported by linking exercise to established daily routines, such as walking after breakfast or completing resistance exercises on selected evenings. Self-monitoring through activity diaries, step counts, calendars, or wearable devices can provide feedback and reinforce progress. Problem-solving strategies should address barriers such as time limitations, weather, fatigue, transport, and lack of equipment. Relapse prevention is also important because exercise habits may be disrupted by illness, travel, family responsibilities, or changes in employment. Patients should be encouraged to identify likely barriers in advance and develop alternative plans. For example, if outdoor walking is not possible because of rain, an indoor walking route or stationary cycling may be used when appropriate. If a patient experiences a temporary decline in motivation, a shorter exercise session may help maintain the habit until confidence improves. The 2024 ESC guideline emphasizes that information and education alone are often insufficient to change long-established lifestyle behaviours, and that personalized counselling, self-monitoring, and repeated support are important for improving long-term adherence (Vrints et al., 2024). Martinello et al. (2019) and Sánchez-Delgado et al. (2020) also support the need for structured post-rehabilitation maintenance strategies. Behavioural interventions should be adapted to the patient's health literacy, culture, language, psychological status, and personal preferences. For individuals with significant anxiety or depression, referral for psychological support may be appropriate. The aim is to help patients move from externally supervised exercise towards self-directed activity supported by confidence, routines, and periodic professional guidance.

8. Self-Monitoring, Exercise Diaries, and Physical Activity Tracking:

Self-monitoring allows patients to observe their activity patterns and recognize whether they are meeting their individualized exercise goals. Traditional approaches include paper-based exercise diaries, weekly calendars, pedometers, and written symptom records. Digital approaches include smartphone applications, smartwatches, heart-rate monitors, and activity trackers. These tools can record steps, walking duration, heart rate, sedentary time, exercise frequency, and sometimes sleep patterns. Their value lies not only in data collection but also in helping patients connect daily behaviours with progress towards functional goals. A patient may discover that activity decreases on working days or that walking is more consistent when performed with a family member. Such information can support practical changes to the exercise schedule. However, activity trackers should be used as supportive tools rather than as substitutes for clinical assessment. Step counts do not indicate whether the exercise intensity is appropriate, and heart-rate readings may be inaccurate or difficult to interpret in patients taking rate-limiting medication or with rhythm disturbances. Patients should be taught which measurements are useful and which readings require clinical review. The 2024 ESC guideline recognizes that smartphone applications and wearable activity trackers may support adherence to exercise and physical activity goals, particularly when integrated into a personalized care plan (Vrints et al., 2024). Nevertheless, the evidence for digital maintenance interventions after Phase II is not uniformly strong. A 2024 systematic review and meta-analysis of 20 randomized trials involving 1,801 participants found a small effect on subjectively measured physical activity but no clear effect on objectively measured physical activity, physical fitness, or health-related quality of life, the authors highlighted low certainty and the need for higher-quality studies with longer follow-up (Effectiveness of Digital Health Interventions, 2024). This finding suggests that technology alone is unlikely to solve the adherence problem. Digital tools may be more useful when combined with

personalized feedback, regular communication, behavioural coaching, and clinical oversight. Patients should be allowed to choose between digital and non-digital monitoring according to access, confidence, and preference. A simple paper diary may be more sustainable than a complicated application for some individuals. The purpose of monitoring is to encourage meaningful self-management, not to create anxiety or excessive concern about daily fluctuations in activity.

9. Home-Based and Community-Based Cardiac Rehabilitation:

Home-based and community-based exercise programmes provide alternatives for patients who cannot attend centre-based rehabilitation regularly or who need ongoing support after Phase II. Home-based cardiac rehabilitation may include an individualized exercise prescription, written educational material, scheduled telephone contact, remote monitoring, and periodic reassessment. Community programmes may be delivered through supervised exercise groups, local health centres, primary-care facilities, or partnerships with trained exercise professionals. These approaches can reduce travel requirements and make exercise more compatible with work and family responsibilities. A systematic review and meta-analysis by Ramachandran et al. (2022) found that home-based cardiac telerehabilitation improved functional capacity and physical activity compared with usual care and showed comparable outcomes to centre-based rehabilitation for several measures. Home-based approaches may be especially relevant for patients living in rural areas, people with mobility limitations, and individuals who face transport or scheduling barriers. However, home-based rehabilitation should not simply mean advising patients to exercise alone. It requires appropriate risk assessment, clear instructions, access to professional support, and a process for responding to symptoms or deterioration. The intensity of monitoring should be matched to the patient's clinical risk and ability to self-manage. Community programmes may also improve social connection and motivation by allowing patients to exercise with peers who have similar health experiences. Group walking programmes, supervised circuit training, and community-based resistance exercise may help maintain participation after the completion of formal rehabilitation. For individuals with heart failure, home-based and hybrid exercise approaches have also been investigated. Gao et al. (2023) reported that home-based cardiac telerehabilitation could improve exercise capacity and quality of life in patients with heart failure, while Molloy et al. (2023) found that exercise-based cardiac rehabilitation was beneficial across centre-based, home-based, and hybrid delivery models. However, the selection of a delivery model should be based on clinical suitability, patient preference, available resources, and local service capacity. Patients with unstable symptoms, high-risk arrhythmias, decompensated heart failure, or other unstable conditions should not be transferred to unsupervised exercise without appropriate clinical evaluation. Hybrid models can offer a practical balance by combining periodic centre-based reviews with home exercise and remote communication.

10. Tele-Rehabilitation and Digital Health Support:

Tele-rehabilitation uses communication technologies to deliver or support rehabilitation activities at a distance. It may involve live video consultations, telephone coaching, mobile applications, web-based education, remote exercise monitoring, or wearable devices. These methods can extend professional support beyond the rehabilitation centre and may be particularly useful for long-term maintenance. A physiotherapist may review exercise diaries, discuss symptoms, modify activity goals, and provide feedback through scheduled virtual consultations. Wearable devices may provide additional information about daily activity and heart-rate response, while mobile applications can deliver reminders and educational material. Hybrid programmes may combine in-person reassessment with remote support, allowing patients to retain professional contact without attending a facility for every session. Ramachandran et al. (2022) found that home-based telerehabilitation was comparable with centre-based rehabilitation for several outcomes in coronary heart disease. A network meta-analysis by Yang et al. (2024) reported that combinations of telehealth approaches, including wearable devices, smartphone applications, and instant communication tools, may improve exercise capacity and adherence, although the effectiveness of individual combinations requires further investigation. The 2024 systematic review of digital interventions for physical activity maintenance after Phase II rehabilitation, however, found that improvements in objectively measured activity and fitness were uncertain (Effectiveness of Digital Health Interventions, 2024). This contrast highlights the importance of evaluating digital programmes according to the outcomes they actually improve. A digital platform should not be considered effective simply because patients download an application or transmit activity data. It should demonstrate meaningful improvements in sustained exercise participation, functional capacity, or cardiovascular health. Tele-rehabilitation should also be accessible to people with different levels of digital literacy. Clear instructions, simple interfaces, language options, technical support, and alternative telephone-based communication may improve participation. Privacy and data security should be addressed, and patients should understand how their health information is collected

and used. Importantly, remote monitoring cannot replace emergency medical assessment. Patients should be instructed to seek urgent care for concerning symptoms such as new or severe chest pain, fainting, severe breathlessness, or other signs of acute deterioration rather than relying on an application or wearable alert alone.

11. Role of Physiotherapists in Long-Term Cardiovascular Health Maintenance:

Physiotherapists play a central role in maintaining exercise participation after Phase II cardiac rehabilitation because they translate clinical assessment into safe, practical, and individualized physical activity plans. Their responsibilities include evaluating functional capacity, prescribing and progressing exercise, teaching symptom monitoring, addressing movement-related fear, improving confidence, and supporting independent self-management. Before transition from supervised rehabilitation, the physiotherapist should assess the patient's exercise tolerance, walking capacity, muscle strength, balance, mobility, exercise technique, and ability to follow an independent programme. Cardiovascular risk factors and relevant comorbidities should be considered in collaboration with the wider healthcare team. The physiotherapist should also evaluate whether the patient understands the difference between expected exercise responses and warning symptoms. For example, a moderate increase in breathing rate and heart rate may be expected during appropriately prescribed exercise, whereas new chest pressure, unusual dizziness, faintness, or disproportionate breathlessness requires stopping exercise and following the agreed clinical action plan. Patients taking beta-blockers or other medications that influence heart rate may need exercise intensity monitored through perceived exertion and workload rather than heart-rate targets alone. Physiotherapists should teach correct warm-up and cool-down procedures, controlled breathing during resistance training, and safe progression of exercise duration and intensity. They should also identify musculoskeletal problems that may interfere with adherence, including osteoarthritis, back pain, balance limitations, and peripheral neuropathy. Functional exercise can be adapted to the patient's abilities through chair-based activity, supported walking, resistance bands, or modified movement patterns. Long-term follow-up may include periodic exercise reassessment, goal revision, and communication with cardiologists, nurses, dietitians, psychologists, and primary-care professionals. The 2024 AHA/AACVPR statement identifies physical therapists and other rehabilitation professionals as important members of the multidisciplinary cardiac rehabilitation team (Brown et al., 2024). The physiotherapist's role should therefore extend beyond supervising exercise sessions to developing the patient's ability to sustain physical activity independently and safely.

12. Family, Peer, and Social Support:

Social support can influence exercise adherence by providing encouragement, accountability, practical assistance, and emotional reassurance. Family members may help patients establish regular exercise routines, accompany them during walking, assist with transport, and reinforce healthy lifestyle changes. However, family involvement should be collaborative rather than controlling. Overprotection may unintentionally discourage activity if relatives interpret all exertion as dangerous or prevent patients from participating in appropriate daily activities. Education should therefore include family members when the patient wishes, explaining the purpose of exercise, expected responses, warning symptoms, and the importance of gradual progression. Peer support can also be valuable. Group exercise sessions allow participants to share experiences, compare strategies, and develop a sense of belonging. Patients may feel more confident when they see others with similar cardiovascular conditions performing appropriate exercise. Walking groups and community exercise programmes may also provide social interaction, reducing isolation and improving enjoyment. The 2025 AHA scientific statement on cardiac rehabilitation in women highlights the importance of social integration and psychosocial support, particularly because women may experience additional barriers related to caregiving responsibilities, financial limitations, and lower participation in conventional rehabilitation programmes (Coutinho et al., 2025). Social support should be tailored to individual circumstances. Some patients prefer exercising alone, while others benefit from group activity or family involvement. The healthcare team should ask about the patient's preferred sources of support and incorporate them into the maintenance plan.

12.1. Peer-led and Community Exercise Groups:

Peer-led groups may help sustain activity by providing regular meeting times, shared goals, and a supportive environment. These groups should operate within clearly defined safety arrangements, with exercise intensity appropriate to participants' clinical status and access to professional guidance when required. Community exercise leaders should understand that participants may have different cardiovascular diagnoses, medication regimens, mobility limitations, and exercise capacities. A peer group should not replace clinical rehabilitation

for patients who require specialist supervision, but it may provide an effective continuation option for suitable individuals after formal assessment. Regular attendance, participant feedback, and referral pathways should be monitored to ensure that the programme remains safe and inclusive.

13. Psychological Health, Fear of Exercise, and Motivation:

Psychological health is closely linked with long-term physical activity. Following a myocardial infarction, cardiac surgery, or diagnosis of heart failure, patients may experience anxiety, depression, fear of recurrence, loss of confidence, or altered perceptions of their physical abilities. Some individuals may avoid exercise because they associate an increased heart rate with another cardiac event. Others may experience reduced motivation because improvements in symptoms are gradual or because the benefits of exercise are not immediately visible. Psychological distress can also interfere with sleep, medication adherence, dietary behaviour, and participation in social activities. A comprehensive maintenance programme should therefore include screening for anxiety, depression, stress, and exercise-related fear. Patients with significant psychological symptoms may benefit from counselling, psychological therapy, or referral to appropriate mental health services. Exercise professionals should use reassuring but accurate communication, explaining the expected physiological response to exercise and the importance of remaining within the prescribed intensity. Gradual exposure to physical activity can help restore confidence, particularly when patients have avoided exertion for an extended period. Goal setting should focus on achievable improvements and meaningful activities rather than unrealistic performance targets. The 2024 AHA/AACVPR statement includes psychosocial management as a core component of cardiac rehabilitation, reinforcing that long-term cardiovascular health involves emotional as well as physical recovery (Brown et al., 2024). Ozemek et al. (2021) also identify mental health as an important area in contemporary cardiac rehabilitation. Psychological support should continue beyond Phase II when symptoms or behavioural barriers remain. Patients should be encouraged to communicate concerns rather than independently reducing or stopping exercise without clinical advice.

14. Comprehensive Cardiovascular Risk-Factor Management:

Long-term exercise adherence is most effective when integrated with comprehensive cardiovascular risk-factor management. Physical activity contributes to improved cardiovascular health, but it does not replace other secondary prevention strategies. Blood pressure should be monitored and treated according to the patient's clinical profile. Lipid management should follow guideline-directed pharmacological and lifestyle recommendations. Diabetes management should include appropriate glucose monitoring, medication review, nutritional counselling, and physical activity. Smoking cessation remains a major priority, and patients should be offered behavioural support and evidence-based cessation treatment when appropriate. Weight management should focus on sustainable dietary and activity changes rather than rapid weight loss. Dietary counselling may address fruit and vegetable intake, whole grains, fibre, salt, saturated fat, and overall dietary quality. Medication adherence should be reviewed regularly because patients may incorrectly assume that improved exercise capacity removes the need for prescribed cardiovascular medication. The 2023 AHA/ACC chronic coronary disease guideline emphasizes exercise, nutrition, smoking cessation, and cardiovascular risk-factor management as essential components of long-term care (Virani et al., 2023). The 2024 ESC chronic coronary syndrome guideline also emphasizes lifestyle behaviour and adherence to secondary prevention measures (Vrints et al., 2024). A multidisciplinary approach is particularly important for individuals with diabetes, obesity, hypertension, dyslipidaemia, chronic kidney disease, or heart failure. Exercise plans should be coordinated with medication schedules, dietary recommendations, and other treatments. For example, individuals using glucose-lowering medication that can cause hypoglycaemia may require specific advice regarding exercise timing, food intake, and glucose monitoring. Patients with heart failure may need monitoring of symptoms, weight changes, fluid status, and exercise tolerance. Long-term cardiovascular health maintenance is therefore a coordinated process rather than an isolated exercise programme.

Table. 2: Integrated strategies for long-term exercise adherence and cardiovascular risk management after Phase II cardiac rehabilitation

Strategy	Main intervention	Expected contribution	Responsible team members
Individualized exercise prescription	FITT-based aerobic and resistance programme	Maintains fitness and functional capacity	Physiotherapist, exercise professional, cardiologist

ISSN: 3139-4310; SJCN
Scienxt Journal of Cardiovascular Nursing

Behavioural counselling	Goal setting, motivational interviewing, action planning	Improves confidence and exercise consistency	Physiotherapist, nurse, psychologist
Self-monitoring	Exercise diary, step counter, wearable tracker	Increases awareness of activity patterns	Patient, physiotherapist
Home-based exercise	Walking, cycling, resistance bands, functional exercise	Improves access and flexibility	Physiotherapist, patient
Tele-rehabilitation	Video consultations, telephone coaching, remote review	Extends professional support	Rehabilitation team
Family and peer support	Shared activity, walking groups, encouragement	Improves social engagement and motivation	Family, peer group, community team
Psychological support	Screening and management of anxiety or depression	Addresses emotional barriers	Psychologist, physician, nurse
Risk-factor management	Blood pressure, lipids, diabetes, weight, smoking	Supports comprehensive secondary prevention	Cardiologist, physician, nurse, dietitian
Periodic reassessment	Exercise testing, functional evaluation, goal review	Maintains safety and appropriate progression	Physiotherapist, cardiologist

15. Exercise Safety and Clinical Monitoring During Long-Term Maintenance:

Safety remains essential when patients transition from supervised rehabilitation to independent activity. Before establishing a maintenance programme, clinicians should review cardiovascular stability, symptoms, medication, comorbidities, exercise-test results were available, and any restrictions advised by the treating cardiologist. Exercise should be deferred and clinical evaluation obtained in the presence of unstable angina, decompensated heart failure, uncontrolled serious arrhythmias, acute myocarditis or pericarditis, severe symptomatic valvular disease, or other unstable conditions. Patients should be taught to stop exercise and seek appropriate medical advice if they experience new chest pain or pressure, fainting, severe dizziness, unusual palpitations, disproportionate breathlessness, or other concerning symptoms. A patient-specific action plan should explain what to do when symptoms occur, including when emergency services should be contacted. Warm-up and cool-down periods are important because abrupt changes in exercise intensity can produce unnecessary cardiovascular stress. Hydration, temperature, medication timing, and recovery should also be considered. Patients with diabetes may require additional precautions related to blood glucose, while those with heart failure may need closer monitoring of symptoms and fluid status. Patients taking beta-blockers should not rely solely on predicted maximum heart-rate equations because medication can alter the heart-rate response. Perceived exertion, workload, symptoms, and clinical assessment may provide more appropriate guidance. Patients with implanted cardiac devices or exercise-related arrhythmias may require individualized heart-rate limits and specialist advice. The maintenance programme should include periodic review, particularly after changes in medication, hospital admission, new symptoms, or deterioration in functional capacity. Patients should not independently increase exercise intensity beyond their agreed prescription if new symptoms or clinical concerns arise. The purpose of safety education is not to discourage physical activity but to provide patients with the knowledge and confidence to exercise appropriately.

16. Measuring Long-Term Exercise Adherence and Cardiovascular Outcomes:

Evaluation of long-term maintenance programmes should include both adherence measures and clinical outcomes. Attendance at supervised sessions, completion of prescribed exercise, weekly activity duration, step count, and sedentary time can provide information about participation. However, adherence should not be measured only by attendance because patients may remain physically active outside formal programmes. Objective activity monitoring using accelerometers or wearable devices can complement patient-reported activity diaries, although device limitations and missing data should be considered. Functional outcomes may include peak oxygen uptake, six-minute walk distance, treadmill exercise duration, gait speed, sit-to-stand performance, and muscle strength. Cardiovascular risk-factor outcomes may include resting blood pressure, lipid profile, glycated haemoglobin, body mass index, waist circumference, and smoking status. Patient-reported outcomes should assess quality of life, exercise confidence, anxiety, depression, symptom burden, and satisfaction with the maintenance programme. Clinical outcomes may include hospital admissions,

recurrent myocardial infarction, cardiovascular events, and mortality, although these require larger studies and longer follow-up. The 2024 AHA/AACVPR statement emphasizes assessment of programme quality and outcomes as a core component of contemporary cardiac rehabilitation (Brown et al., 2024). A robust evaluation framework should therefore measure whether patients are continuing to exercise, whether functional improvements are being maintained, and whether broader cardiovascular risk is being controlled. Data should be interpreted in relation to the patient's diagnosis, baseline risk, age, comorbidities, and treatment goals. A patient with advanced heart failure may demonstrate meaningful improvement through better walking tolerance and reduced symptoms even if peak exercise capacity remains limited. Similarly, an older adult may benefit from improved balance, strength, and independence even when changes in conventional cardiovascular risk markers are modest.

Table. 3: Recommended assessment schedule and outcome measures for long-term cardiovascular health maintenance

Assessment domain	Suggested measure	Baseline or transition	Follow-up
Exercise capacity	Cardiopulmonary exercise testing or standardized exercise test	At entry to or completion of Phase II, when indicated	Periodically and after significant clinical change
Functional capacity	Six-minute walk test or functional performance assessment	At transition	At planned review intervals
Physical activity	Weekly activity minutes, step count, exercise diary	At transition	Ongoing or monthly review
Exercise adherence	Completed sessions compared with planned sessions	At transition	Monthly or quarterly
Blood pressure	Standardized resting blood pressure	At transition	According to clinical risk and treatment plan
Lipid profile	LDL cholesterol and other prescribed lipid measures	At transition or recent clinical review	As clinically indicated
Glycaemic control	HbA1c and glucose monitoring where relevant	At transition	According to diabetes care plan
Body composition	Weight, BMI, waist circumference	At transition	Periodically
Psychological health	Validated anxiety and depression screening	At transition	If symptoms persist or emerge
Quality of life	Validated cardiovascular or generic HRQoL questionnaire	At transition	At planned follow-up
Clinical safety	Symptoms, adverse events, hospital admissions	Ongoing	Ongoing

17. A Proposed Long-Term Cardiac Rehabilitation Maintenance Model:

A practical maintenance model should connect the final stage of Phase II rehabilitation with a structured period of supported exercise and eventual independent activity. The first component is transition assessment, during which the physiotherapist reviews functional capacity, clinical stability, exercise confidence, comorbidities, and patient preferences. The second component is individualized exercise planning, with a written prescription describing aerobic and resistance activity, frequency, intensity, duration, progression, and symptom precautions. The third component is behavioural preparation, which includes goal setting, motivational counselling, self-monitoring, and identification of barriers. The fourth component is a supported maintenance period, during which patients may participate in home-based, community-based, hybrid, or supervised exercise according to clinical needs. The fifth component is periodic reassessment, which reviews adherence, functional capacity, risk factors, psychological health, and safety. The sixth component is long-term self-management, in which patients maintain an enjoyable and realistic exercise routine while remaining connected to healthcare services. The model should allow patients to move between different levels of support rather than assuming that every individual will progress in a linear manner. For example, a patient who becomes less active after a

ISSN: 3139-4310; SJCN
Scienxt Journal of Cardiovascular Nursing

period of illness may require temporary return to supervised exercise. Another patient may need a revised programme after developing arthritis or experiencing a change in cardiac medication. A patient who has maintained regular walking for several months may be ready to add resistance training or a new recreational activity. This flexible approach recognizes that adherence is dynamic and influenced by changing circumstances. The 2024 ESC guideline supports individualized exercise prescriptions, patient preferences, and continued exercise after formal rehabilitation (Vrints et al., 2024). Maintenance programmes should therefore be designed as an ongoing service pathway rather than a brief educational session delivered at discharge.

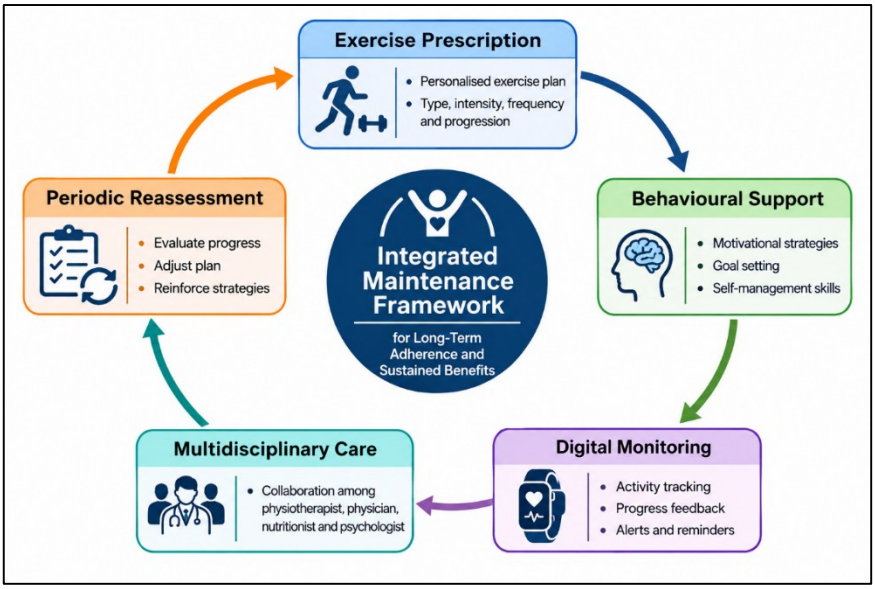


Figure. 2: Proposed integrated maintenance framework combining exercise prescription, behavioural support, digital monitoring, multidisciplinary care, and periodic reassessment

18. Special Considerations in Different Cardiovascular Populations:

Long-term exercise maintenance should be adapted to the underlying cardiovascular diagnosis because patients with coronary artery disease, heart failure, valve disease, arrhythmias, and other cardiovascular conditions may have different exercise limitations and monitoring requirements. Individuals with stable coronary artery disease may often progress towards moderate-intensity aerobic and resistance exercise after appropriate risk assessment, while patients with residual angina or inducible ischaemia may require specific exercise limits and medical review. Patients with heart failure may benefit from ongoing exercise-based rehabilitation, but their programme should account for symptoms, functional class, medication, fluid status, and the possibility of clinical deterioration. The 2023 Cochrane review of exercise-based rehabilitation in adults with heart failure reported improvements in quality of life and reductions in all-cause hospitalizations, supporting the importance of exercise-based care in this population (Molloy et al., 2023). Individuals with implanted pacemakers or defibrillators may require exercise prescription that accounts for device programming, heart-rate response, and underlying arrhythmia risk. Patients after valve surgery or transplantation may need additional attention to surgical recovery, immunosuppressive therapy, musculoskeletal deconditioning, and other condition-specific issues. Older adults may require strength, balance, and functional training alongside aerobic activity to preserve independence and reduce falls. Women may experience different referral patterns, comorbidities, psychosocial needs, and social barriers, and rehabilitation programmes should address these factors rather than assume that a uniform approach is suitable for all. The 2025 AHA scientific statement on cardiac rehabilitation in women emphasizes the need to improve access, engagement, and tailored support (Coutinho et al., 2025). Patients with diabetes, obesity, chronic kidney disease, peripheral arterial disease, or pulmonary disease may require integrated rehabilitation planning. A maintenance model should therefore be flexible enough to accommodate diverse clinical conditions while maintaining a consistent focus on safe physical activity and secondary prevention.

19. Implementation Challenges in Low-Resource and Diverse Healthcare Settings:

The implementation of long-term cardiac rehabilitation maintenance programmes may be particularly challenging in low-resource settings. Limited numbers of trained cardiac rehabilitation professionals, unequal distribution of services, transport barriers, cost, low awareness, and limited availability of exercise facilities

can restrict access to continued care. In some regions, patients may complete an initial rehabilitation programme but have no structured maintenance service available. Rural populations may be required to travel long distances to reach specialist centres, making regular attendance difficult. Digital rehabilitation may offer an alternative, but access to smartphones, internet connectivity, electricity, and digital literacy cannot be assumed. Therefore, maintenance strategies should include low-cost and locally adaptable approaches. Walking programmes, home-based resistance exercise using simple equipment, community health-worker support, telephone follow-up, and group education may be practical options when specialist facilities are limited. Primary-care services can contribute by monitoring blood pressure, diabetes, lipid management, smoking status, medication adherence, and physical activity. Physiotherapists can train community-level personnel to support safe exercise routines within defined clinical boundaries. Written instructions should be available in local languages and use clear descriptions of exercise intensity, symptoms, and safety precautions. Family involvement may be especially valuable where formal rehabilitation resources are limited. However, low-cost programmes must retain appropriate risk assessment and referral pathways. Patients with unstable symptoms or complex clinical conditions should be referred for specialist evaluation rather than placed into unsupervised community exercise. A sustainable model should also consider the affordability of follow-up, access to medication, transport, and the opportunity costs associated with attending exercise sessions. Equity should be treated as a core outcome of programme development, with attention to women, older adults, people with disabilities, low-income populations, and rural communities. The AHA/AACVPR statement identifies low enrolment, adherence, and disparities in access as major quality challenges for cardiac rehabilitation (Brown et al., 2024).

20. Future Directions and Research Priorities:

Future research should investigate which combinations of behavioural, clinical, and digital interventions are most effective in sustaining physical activity after Phase II cardiac rehabilitation. Existing evidence suggests that maintenance programmes may preserve selected benefits, but differences in intervention design, duration, intensity, follow-up, and outcome measurement make comparisons difficult. Studies should clearly define maintenance interventions and report exercise frequency, intensity, duration, type, professional contact, behavioural support, and participant adherence. Longer follow-up is required because short-term improvements may not persist after active intervention support ends. Randomized trials should compare standard discharge advice with structured maintenance programmes incorporating individualized exercise plans, motivational counselling, digital monitoring, and periodic professional review. Outcomes should include objectively measured physical activity, exercise capacity, cardiovascular risk factors, quality of life, healthcare utilization, and cardiovascular events where feasible. Researchers should also examine whether certain patient groups benefit more from home-based, centre-based, community-based, or hybrid approaches. Digital interventions require further evaluation because current evidence indicates that improvements in objectively measured activity and fitness are not yet consistently demonstrated after Phase II rehabilitation (Effectiveness of Digital Health Interventions, 2024). Future studies should examine how digital feedback, human coaching, and personalized goals interact to influence adherence. Additional research is required in women, older adults, people with frailty, patients with heart failure, and populations from low- and middle-income countries. Implementation studies should assess cost-effectiveness, workforce requirements, accessibility, digital literacy, and long-term service sustainability. Patient involvement in programme design is also important because exercise plans that are clinically effective but incompatible with daily life are unlikely to be maintained. The most promising direction is likely to be a flexible, patient-centred maintenance pathway that combines professional guidance with independent activity, social support, and accessible follow-up.

21. Conclusion:

The completion of Phase II cardiac rehabilitation should be regarded as the beginning of long-term cardiovascular self-management rather than the end of rehabilitation. Although supervised programmes improve exercise capacity, confidence, and cardiovascular risk-factor awareness, these benefits require continued physical activity and ongoing secondary prevention. Long-term adherence is influenced by clinical status, exercise confidence, motivation, psychological health, social support, financial resources, access to facilities, and the availability of professional follow-up. Effective maintenance therefore requires individualized FITT-based exercise prescription, progressive aerobic and resistance training, behavioural counselling, self-monitoring, home and community-based options, tele-rehabilitation where appropriate, and regular reassessment. Physiotherapists have a central role in preparing patients for independent activity, adapting exercise to changing functional needs, and coordinating care with the wider cardiovascular team. Family involvement, peer support, psychological care, and comprehensive risk-factor management further

strengthen the maintenance process. Digital tools can extend support and improve monitoring, but they should complement rather than replace professional guidance and must demonstrate meaningful benefits in sustained physical activity. Future cardiac rehabilitation services should establish clear pathways between Phase II and lifelong exercise participation, ensuring that patients receive continued support according to their clinical needs and personal circumstances. Ultimately, cardiovascular health maintenance is a continuous process that depends on safe exercise, sustainable behaviour change, equitable access to rehabilitation, and active partnership between patients and healthcare professionals.

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