5. Phase III—Long-Term Exercise Training

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5.1. General Rules

Phase III, or the maintenance phase, contains a program that typically starts within the cardiac rehabilitation center and is continued at the local fitness center, gym, or the patient's home.

The objective of phase III is to provide guidance and support for a continuous lifestyle change [1]. Phase III involves more independence and self-monitoring, shifting a center-based program into a home-based environment. Therefore, the transition between structured phase II and long-term phase III can be a vulnerable point due to the risk for non-adherence to recommended pharmacological treatment and lifestyle modifications, including physical activity. As expected, adherence to phase III of cardiac rehabilitation is poor, and barely 20–30% of patients continue exercise after a year of discharge from phase II [2]. This relates to individual- and environmental-level barriers that lead to poor adherence to physical activity plans. These barriers include, e.g., lack of time, lack of motivation, work tasks, social obligations, or unfavorable weather [3].

Prescribing an individually tailored physical activity plan that takes into consideration the underlying cardiac condition and cardiorespiratory fitness level is essential. Utilizing digital tools, e.g., wearable physical activity monitors, should help to maintain long-term adherence to physical activity. The authors recommend the ABC model of phase III by Rudnicki, with analogous rules to those for phase II [4]. Patients with an intermediate level of risk and very low functional capacity, as well as high-risk patients with an intermediate, low, or very low functional capacity, should be treated equivalently to model D of phase II cardiac rehabilitation. Tables 40–42 exhibit the A, B, and C models of exercise prescription.

Table 40. Suggested A model of phase III exercise prescription for low-risk patients.

	Duration	Frequency	Exercise Type	Intensity
Stage 1	2–3 months	3 × 45 min/week	Medically supervised training on cycle ergometer or treadmill, interval or continuous Calisthenics at gym	60%–80% of heart rate reserve
Stage 2	3 months	3 × 45 min/week	Exercise training on cycle ergometer or treadmill, interval or continuous Calisthenics at the gym Resistance circuit training, 2–3 sets	60%–80% of heart rate reserve
Stage 3	Unlimited	3 × 45–60 min/week	Walking, cycling, swimming	60%–80% of heart rate reserve

Source: Adapted from [4].

Table 41. Suggested B model of phase III exercise prescription for intermediate-risk patients with good exercise tolerance.

	Duration	Frequency	Exercise Type	Intensity
Stage 1	2–3 months	3 × 30–40 min/week	Medically supervised interval training (initially with ECG monitoring) on cycle ergometer or treadmill Calisthenics at gym	40%–50% of heart rate reserve
Stage 2	3 months	3 × 45 min/week	Medically supervised interval exercise training on cycle ergometer or treadmill Calisthenics at gym Resistance circuit training, 1 set.	50%–60% of heart rate reserve
Stage 3	Unlimited	3 × 45–60 min/week	Walking, cycling	50%–60% of heart rate reserve

Source: Adapted from [4].

Table 42. Suggested C model of phase III exercise prescription for a patient with intermediate risk and low or intermediate functional capacity and for high-risk patients with good exercise tolerance.

	Duration	Frequency	Exercises Type	Intensity
Stage 1	2–3 months	3 × 30 min/week	Individual, medically supervised (with continuous ECG monitoring) interval exercise training on cycle ergometer or treadmill Calisthenics at gym	40%–50% of heart rate reserve
Stage 2	3 months	3 × 45 min/week	Individual, medically supervised interval exercise training on cycle ergometer or treadmill Calisthenics at gym	50%–60% of heart rate reserve
Stage 3	Unlimited	3 × 45 min/week	Walking, cycling, swimming, dancing, gardening	50%–60% of heart rate reserve

Source: Adapted from [4].

5.2. Telerehabilitation

5.2.1. Background

Patients' adherence to the center-based cardiac rehabilitation model remains suboptimal, with rate of participation in phase II being 40% in Europe and 30% in the United States, both an insufficient referral rate by medical professionals and a suboptimal enrollment for referred patients [5]. Multiple cardiac rehabilitation barriers have been identified, including a lack of adequate patient and healthcare provider awareness, a lack of rehabilitation center availability, and a lack of financial remuneration. Patients report that their main barriers to cardiac rehabilitation attendance are related to work and family responsibilities, financial costs, lack of motivation, or the long distance from home to cardiac rehabilitation facilities. Thus, up to one third of participants prematurely drop out of the program—these are mainly patients with coronary artery disease, older age, and lower economic status [6–8]. Alternative strategies have been developed accordingly, to resolve several barriers impeding the utilization of cardiac rehabilitation programs and creating a more active role for the patient in the whole system [9]. Historically, physical activity has been evaluated by pedometers and accelerometers, with a further rapid development of online applications providing activity tracking by smartphones and smartwatches, including heart rate, distance covered, and energy expenditure calculation [10,11]. The recent COVID-19 pandemic has affected the traditional model of center-based cardiac rehabilitation delivery due to restrictions imposed by the authorities to prevent the spread of the infection, along with unit closure and staff redeployment [12–14]. This emergency triggered the rapid development of telemedicine and highlighted the role of cardiac telerehabilitation as an efficacious, safe, and essential part of cardiac rehabilitation [15]. Cardiac telerehabilitation is based on ECG-monitored exercise training at home and is controlled and modified remotely by the cardiac rehabilitation team. It entails telemonitoring, tele-advice, and direct interaction with the patient [16]. Cardiac telerehabilitation may be a continuation of an outpatient or residential program and is suitable for the following groups of patients [17]:

- Those living far from the cardiac rehabilitation facility;
- The elderly;
- Patients with social or financial issues creating barriers to regular attendance.

5.2.2. Technical Aspects

Patients utilize remotely controlled devices for tele-ECG monitoring, with the ECG signal being transmitted from precordial leads to a mobile phone through, e.g., Bluetooth technology. The data are then typically transmitted through a mobile phone network to the monitoring center [18]. Patients communicate with their supervising team via a mobile phone (Figure 18). Prior to commencing telerehabilitation sessions, patients initially attend an outpatient program (typically for 5–10 sessions) with clinical examination, individual training prescription, and the supervision of training progress [19]. Remote telerehabilitation sessions start with questions regarding the patient's current clinical status, followed by the transmission of resting ECG and reporting values of blood pressure and weight. Personalized training programs applied by the supervising cardiac rehabilitation team can be executed in the form of marching on the spot, walking, or training on a stationary bike. Exercise training sessions of 45–60 min duration are typically prescribed, comprising 2 to 5 sessions per week, including a warm-up phase and a cool-down phase [20]. In the case of interval training, the device notifies patients about the transition between phases through sounds, voice commands, or light signals. In addition, an alarm system will be triggered if an abnormal situation occurs, alerting the monitoring team.

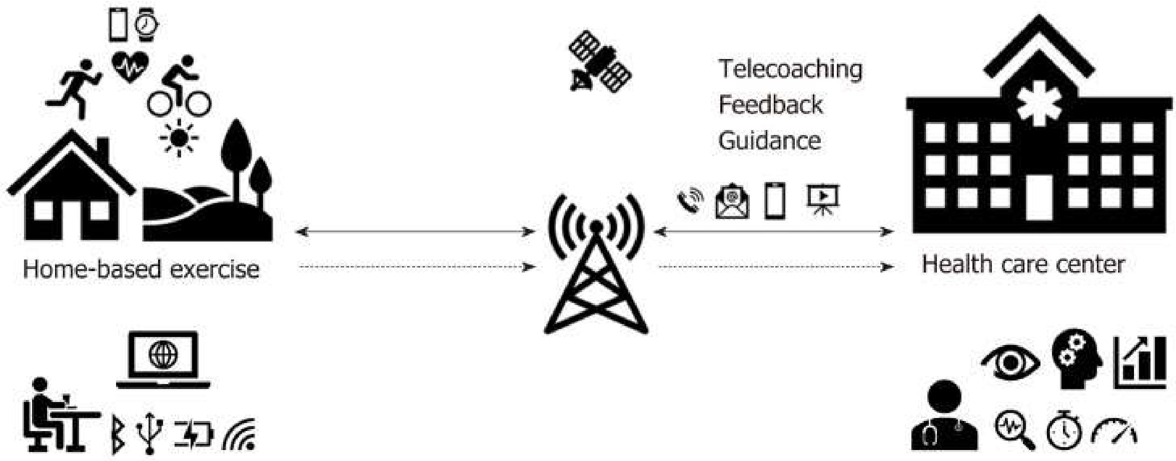

Figure 18. Principles of remotely monitored cardiac telerehabilitation. Source: Reprinted from [19].

5.2.3. Efficacy of Cardiac Telerehabilitation

Meta-analyses have demonstrated that home-based cardiac telerehabilitation is not inferior to outpatient cardiac rehabilitation in terms of mortality, cardiac events, improvement in exercise capacity, modifiable risk factors, or improvement in the quality of life in patients with coronary artery disease or heart failure [21,22]. The main purpose of the study conducted by Batalik was to compare the feasibility and effectiveness of telerehabilitation and conventional outpatient programs [23]. The study group included 56 patients with coronary artery disease who participated in a 12-week phase II program randomized into telerehabilitation and outpatient groups. After 12 weeks, the patients' average intensity adherence, defined as the total average of training intensity, did not differ statistically between the groups (74.8% of heart rate reserve for the telerehabilitation group compared to 75.3% of heart rate reserve for those in the outpatient program). Moreover, the time spent at the prescribed training intensity was similar. A considerable number of studies have been published on the effectiveness and safety of cardiac telerehabilitation [24–26]. In a study by Hwang et al. involving 53 patients with heart failure receiving a 12-week, remotely monitored home-based exercise training program, there was no significant difference in the group's 6-min walk distance gains compared with those of a group participating in an outpatient program. A recent influential account of the effectiveness of telerehabilitation in heart failure patients was provided by the Telerehabilitation in Heart Failure Patients (TELEREH-HF) study, which demonstrated a significant improvement in the New York Heart Association (NYHA) class and quality of life after a 9-week remotely monitored exercise training program [27].

5.3. Long-Term Physical Activity

Physical inactivity remains one of the leading causes of death around the world, according to the World Health Organization [28]. The level of adherence of the general population to recommended levels of physical activity remains unacceptably low [29,30]. On the other hand, aerobic capacity is a strong prognostic marker in healthy individuals, with each 1 MET increase in aerobic fitness reflecting a 13% decrease in all-cause mortality and a 15% decrease in the incidence of cardiovascular events [31]. Moreover, individuals with a functional capacity of less than 5 MET had a relative risk of fatal events that was four times greater compared with that of individuals with an exercise capacity of 10.7 MET or more over a period of six years [32]. Long-term physical activity after completing cardiac rehabilitation program is fundamental. Current international guidelines on physical activity recommend that individuals with increased cardiovascular risk perform at least 150 min of aerobic exercise at a moderate intensity or 75 min of high-intensity exercises three to five days a week and that individuals use a combination of moderate- and vigorous-intensity exercise to reduce all-cause mortality, cardiovascular mortality, and morbidity [2]. Moderate-intensity activities (3–5.9 MET) entail, e.g., brisk walking (4.8–6.5 km/h), slow cycling (15 km/h), and gardening, whereas examples of vigorous activities ($\geq$6 MET) are jogging, running, and bicycling > 15 km/h. Exercise intensity prescription given in absolute measures (i.e., MET) does not take into account individual factors; older individuals exercising at a vigorous intensity of 6 METs may become exhausted, while a younger person working at the same absolute intensity may only be exercising moderately. In addition to the endurance component, moderate-intensity resistance training involving large muscle groups is recommended twice a week [1]. Those who cannot perform 150 min of moderate-intensity physical activity each week should as be active as their health condition allows, as even a low volume of moderate to vigorous exercise has been demonstrated to be sufficiently effective to reduce mortality by 22% in older adults [33]. Furthermore, to maintain an adequate physical activity level, motivational interventions should be applied. These include behavioral strategies, such as goal setting; the re-evaluation of goals; and self-monitoring utilizing new technologies—e.g., wearable activity trackers [34,35].

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