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IN THE CARDIOVASCULAR REHABILITATION UNIT

Assessment, Individualized Interventions, and Treatment Adherence

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CHAPTER 1. PSYCHOSOCIAL FACTORS, NUTRITION, AND ADHERENCE TO TREATMENT

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INTRODUCTION

Modern cardiovascular rehabilitation goes beyond the strict framework of physical training, integrating psychological factors, dietary behavior, and the patient's ability to adhere to therapeutic recommendations over the long term. Current international guidelines emphasize that the clinical and functional outcomes of a rehabilitation program depend directly on how these three components are addressed:

- psychosocial factors,
- nutrition
- adherence, along with physical exercise.

1. CONCEPTUAL FRAMEWORK: THE BIOPSYCHOSOCIAL MODEL IN CARDIOVASCULAR REHABILITATION

OBJECTIVES:

- to describe the evolution of the care paradigm from the biomedical model to the biopsychosocial model in cardiovascular rehabilitation.
- To list the basic components of a modern cardiovascular rehabilitation program, according to the 2024 AHA/AACVPR update.
- To explain the circular interaction between psychological status, eating behavior, and treatment adherence.
- Identifying the roles of the multidisciplinary team members involved in psychosocial, nutritional, and adherence assessment and intervention

1.1 From the Biomedical Model to the Biopsychosocial Model

For several decades, cardiovascular rehabilitation was primarily conceived as an exercise retraining intervention, focused on hemodynamic parameters and functional capacity as measured by exercise tests. This **classic biomedical model** has brought proven benefits in reducing mortality and readmissions, but it has frequently left essential aspects of the experience of illness unaddressed: the emotional distress felt after an acute cardiac event, the difficulty of changing dietary habits ingrained over a lifetime, and the difficulty of maintaining consistent therapeutic behavior month after month.

The biopsychosocial model, originally proposed in general medicine and gradually adopted by preventive cardiology, is based on the premise that a patient's health status results from the ongoing interaction between:

- biological factors (disease severity, comorbidities, functional capacity)
- psychological factors (emotions, cognitions, personality, coping mechanisms)
- social factors (family, support network, socioeconomic status, access to services).

When applied to cardiovascular rehabilitation, this model requires that the initial assessment and treatment plan include, in addition to exercise testing and the FITT-VP prescription, a structured evaluation of the patient's mental state, eating behavior, and ability to adhere to recommendations over the long term.

1.2 Core Components of a Modern Cardiovascular Rehabilitation Program

The 2024 update to the AHA/AACVPR joint scientific statement on the core components of cardiovascular rehabilitation programs confirms and expands the classic framework in five mandatory areas:

- initial patient assessment,
- management of cardiovascular risk factors,

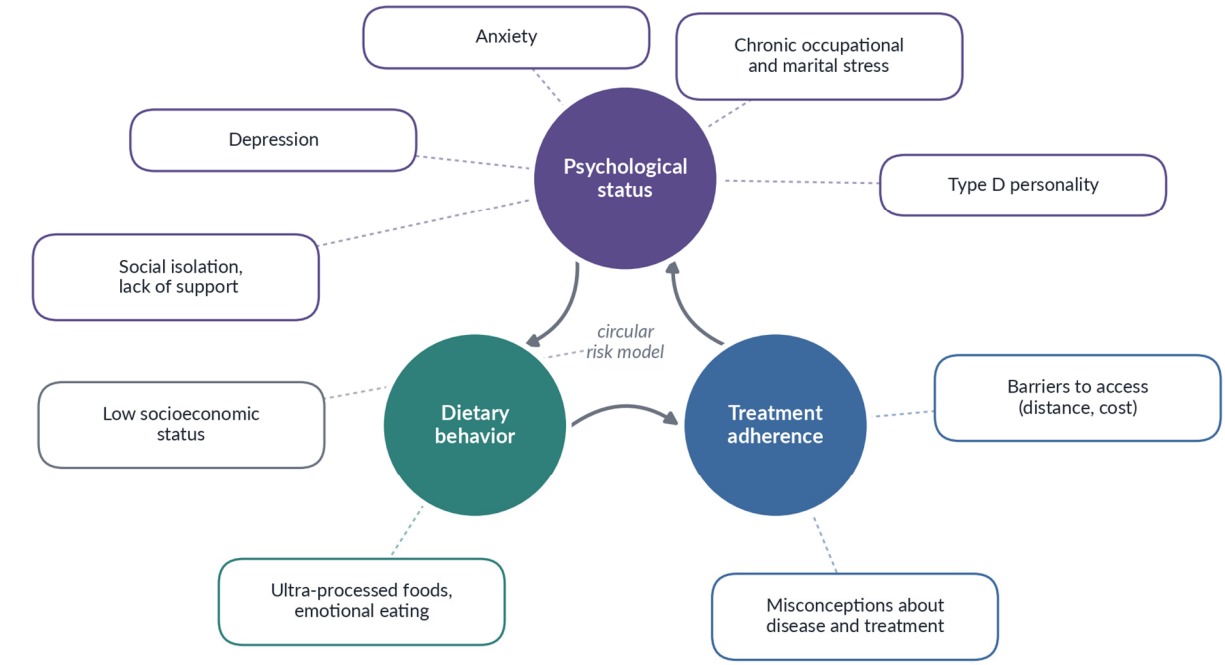
- prescription and monitoring of physical exercise,
- nutritional counseling,
- psychosocial health management, to which is added, across the board, monitoring of adherence to each of these components.

Table 1. Core Components of a Cardiovascular Rehabilitation Program (adapted from AHA/AACVPR 2024)

Component	**Key Elements**	**Primary Responsible Party**
Initial assessment	Medical history, risk stratification, functional tests, psychosocial and nutritional assessment	Medical team
Risk Factor Management	Blood pressure, lipids, blood glucose, smoking, weight	Cardiologist / primary care physician
Physical exercise	FITT-VP prescription, monitoring, progression	Physical Therapist
Nutrition	Nutritional assessment, dietary education, individualized plan	Nutritionist / Dietitian
Psychosocial Health	Depression/anxiety screening, counseling, specialized referral	Psychologist / consulting psychiatrist
Adherence	Longitudinal monitoring, behavioral interventions, digital support	The entire team

1.3 The Interaction Between Psychological Status, Eating Behavior, and Treatment Adherence

These three pillars do not operate independently but influence one another in a **circular risk model**. Psychological distress (depression, anxiety, chronic stress) reduces the motivation and energy needed to maintain healthy eating behaviors and to consistently follow an exercise program or medication regimen. In turn, non-adherence—whether to exercise, diet, or treatment—leads to stagnation or worsening of clinical parameters, which further fuels anxiety about one's health and a sense of helplessness. Maladaptive eating behaviors (emotional eating, erratic restriction, increased consumption of ultra-processed foods) can, in turn, be both a consequence of psychological distress and a factor that exacerbates the metabolic risk profile.



Psychosocial factors act directly on the psychological pillar and, indirectly, on dietary behavior and adherence.

Figure 1 . The network of psychosocial risk factors that interact with cardiovascular recovery.

KEY POINTS

The three pillars—psychosocial, nutritional, and adherence—must be assessed and monitored together, not as separate modules, because they influence one another throughout the recovery program.

1.4 The Role of the Multidisciplinary Team

Integrating these three components into daily practice requires a structured team with clearly defined roles and effective communication. The recommended minimum team composition includes:

- the coordinating cardiologist,
- the physical therapist,
- the medical assistant dedicated to the rehabilitation program,
- the psychologist (or consulting psychiatrist, in more severe cases)
- a nutritionist/dietitian.

Depending on local resources, the team may be supplemented by a clinical pharmacist (to optimize medication adherence) and a social worker (to identify socioeconomic barriers).

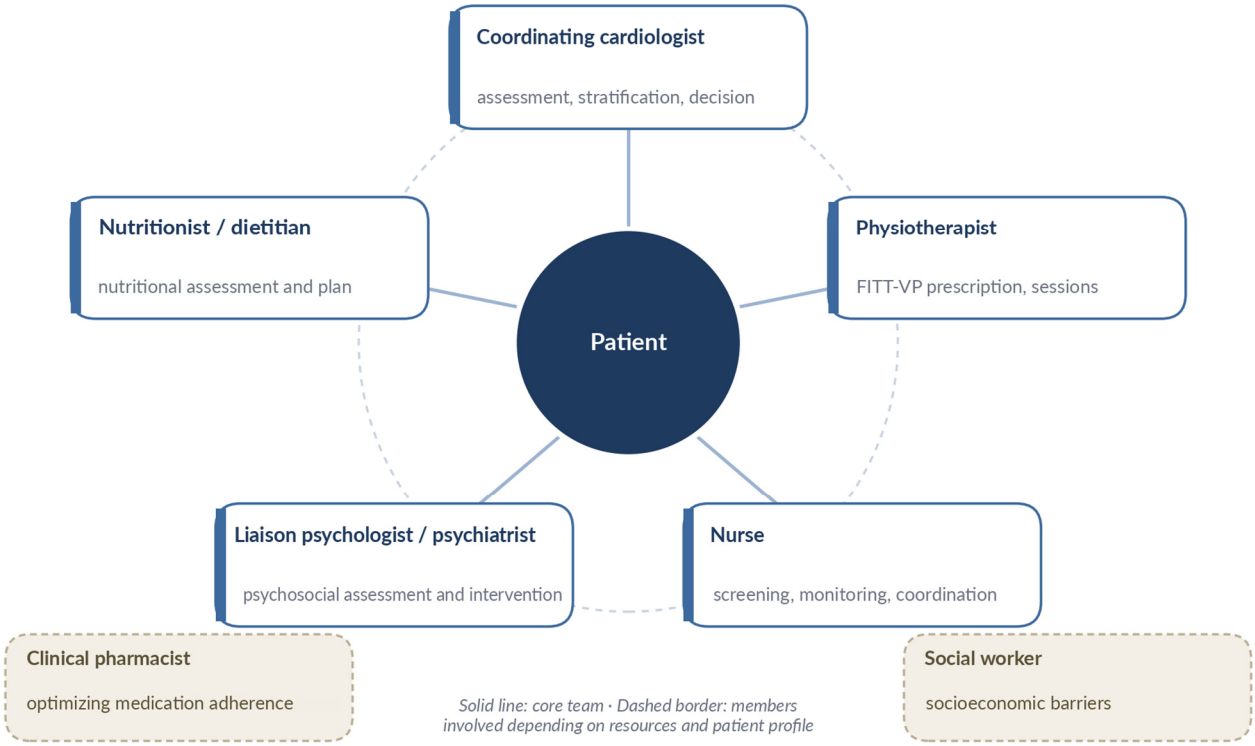


Figure 2 . The multidisciplinary team involved in integrated cardiovascular rehabilitation.

Collaboration workflow during the initial assessment

- The nurse administers standardized screening questionnaires (psychosocial, nutritional, and adherence) upon admission or during the first outpatient visit.
- The results are discussed during a brief multidisciplinary meeting (10–15 minutes) before the individual plan is established.
- Cases with high-risk scores are referred directly to a psychologist or nutritionist, respectively, while the exercise program begins.
- The integrated plan is reviewed at regular intervals (4, 8, 12 weeks), with adjustments made to the goals for each of the three pillars.

PRACTICAL NOTE

Even in the absence of a dedicated psychologist or dietitian on the team, the physical therapist and medical assistant can apply the screening tools presented in this manual and refer the patient to external services when scores exceed the alert thresholds.

2. PSYCHOSOCIAL ASSESSMENT OF THE CARDIAC PATIENT

OBJECTIVES:

- Correct application of standardized screening tools for depression and anxiety (PHQ-9, GAD-7, HADS) in cardiac patients.
- Recognizing psychosocial risk factors beyond depression and anxiety: Type D personality, social isolation, socioeconomic status.
- To identify the psychological characteristics of specific cardiac conditions, such as spontaneous coronary dissection.
- Proposing practical solutions for overcoming organizational barriers to psychosocial screening.

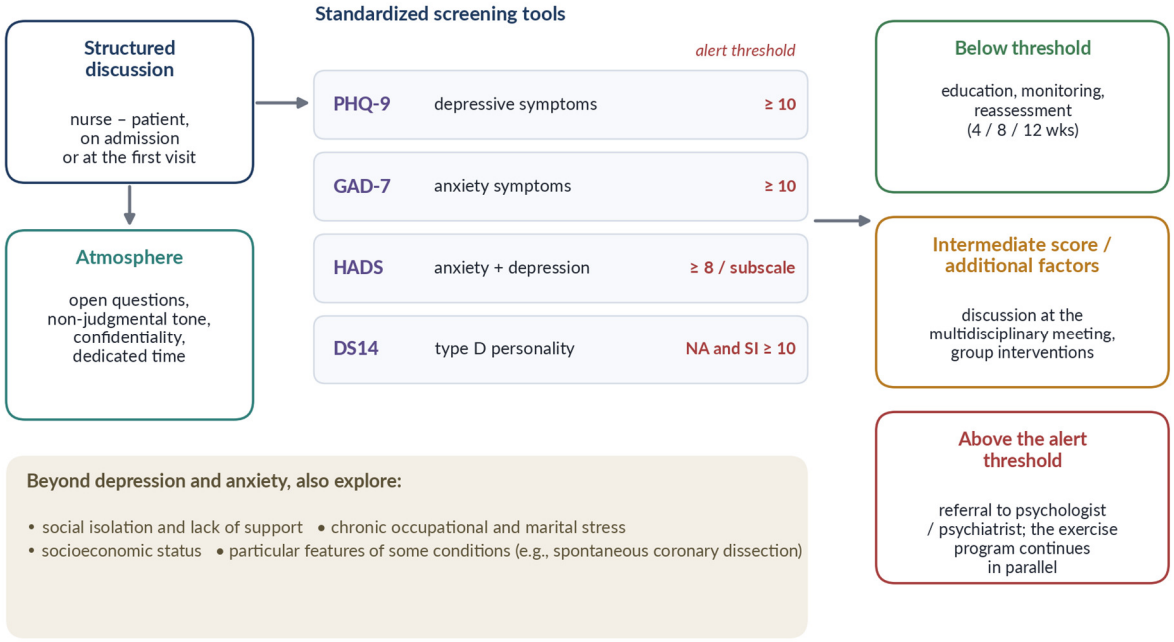


Figure 3 . Initial psychosocial assessment during a structured nurse–patient discussion.

2.1 Screening for Depression and Anxiety

Depression and anxiety are the most common and best-documented psychological comorbidities of cardiovascular disease, with a reported prevalence of between 20% and 40% among patients hospitalized for acute coronary syndrome and with a proven impact on mortality, quality of life, and completion of the rehabilitation program. Systematic screening, using brief, validated instruments, allows for the early identification of patients who require additional intervention [3,4,5].

Table 2 . Psychological screening instruments commonly used in cardiovascular rehabilitation

Instrument	Domain assessed	No. of items	Approximate alert threshold
PHQ-9 (Patient Health Questionnaire-9)	Depressive symptoms	9	≥10 points — moderate depression
GAD-7 (Generalized Anxiety Disorder-7)	Anxiety symptoms	7	≥10 points — moderate anxiety
HADS (Hospital Anxiety and Depression Scale)	Anxiety and depression (separate subscales)	14	≥8 points on the subscale
Type D Scale (DS14)	Distressed personality type	14	Negative affect + social inhibition ≥10 each

PRACTICAL NOTE

Optimal timing for administration: upon admission for an acute cardiac event or at the first outpatient recovery visit, then repeated at the end of the program (typically 8–12 weeks) and, ideally, at a follow-up visit 6–12 months later, to detect any symptomatic relapse after discharge from the program.

2.2 Beyond Depression and Anxiety: Other Psychosocial Risk Factors

An influential review highlights the fact that screening limited to depression and anxiety overlooks a significant portion of the actual psychosocial risk faced by cardiac patients. Additional relevant factors include:

- **Type D Personality** (distressed personality)—a combination of high negative affect and high social inhibition, associated with increased cardiovascular risk independent of clinical depression [6].
- **Social isolation and lack of support** — patients without an active social network have lower rates of completion of the rehabilitation program and higher rates of recurrent events.
- **Chronic occupational and marital stress** — prolonged exposure to interpersonal conflicts or to a job with high demands and low control.
- **Vital exhaustion** — a state of extreme fatigue, irritability, and demoralization, frequently described prior to acute coronary events.
- **Low socioeconomic status**—associated with reduced access to rehabilitation programs, healthy nutrition, and ongoing treatment.

2.3 Psychological Characteristics in Specific Heart Conditions

Certain categories of cardiac patients face a psychological burden that is disproportionately high relative to the objective severity of their heart condition, a situation well documented in the case of spontaneous coronary artery dissection (SCAD)—a condition that frequently occurs in young, otherwise healthy women without classic cardiovascular risk factors. A recent commentary emphasizes that cardiac rehabilitation for these patients must go beyond treadmill exercise and include a dedicated response to the psychological impact—fear of recurrence, loss of confidence in one's own body, and, often, a sense of isolation caused by the rarity of the diagnosis [7].

CASE REPORT

A 34-year-old female patient with no cardiovascular risk factors is diagnosed with spontaneous postpartum coronary dissection. Although a follow-up echocardiogram shows normal left ventricular function, the patient reports an intense fear of physical exertion and avoids any activity that increases her heart rate. The appropriate approach combines education about the typically one-time nature of the event, gradual and supervised exposure to exertion, and, when necessary, referral to psychological counseling specializing in health-related trauma.

2.4 Organizational Barriers to Psychosocial Screening

Although the benefits of psychosocial screening are well documented, many cardiovascular rehabilitation programs lack dedicated mental health resources—a situation directly described in a recent study of post-myocardial infarction patients who underwent rehabilitation without access to structured psychological services within the program. As a result, many patients with clinically significant depression or anxiety remain undiagnosed or, even if identified, are not referred in a timely manner [8,9].

Practical solutions that can be applied even when there is no psychologist on the team:

1. Training nurses and physical therapists in the basic administration and interpretation of the PHQ-9/GAD-7.
2. Establishing a formal partnership with a psychiatry/psychology service within the same institution or in the community, with a rapid referral process.
3. Use of telemedicine for remote psychological consultations, especially for patients in areas with limited access.
4. Incorporate a brief discussion about emotional well-being into every recovery session, not just during the initial assessment.

3. PSYCHOLOGICAL AND STRESS MANAGEMENT INTERVENTIONS

OBJECTIVES:

- To describe the structure of a brief cognitive-behavioral therapy program tailored to cardiac patients.
- Apply basic stress-reduction techniques (diaphragmatic breathing, progressive muscle relaxation, mindfulness).
- Organizing an educational discussion with the patient and family about the emotional impact of heart disease.
- To discuss the benefits of group interventions in psychosocial recovery.

3.1 Cognitive-Behavioral Therapy (CBT) Adapted for Heart Patients

Cognitive-behavioral therapy remains the psychological intervention with the strongest evidence of effectiveness in reducing depressive and anxiety symptoms in cardiac patients. Adapted to the context of recovery, a short program (6–8 sessions) focuses on:

- **Cognitive restructuring** — identifying and correcting catastrophic thoughts related to physical exertion ("if I run, I'll have another heart attack") or prognosis.
- **Behavioral activation** — the gradual resumption of enjoyable and meaningful activities, avoiding social withdrawal and a sedentary lifestyle caused by fear.

Structured problem-solving — applied to practical difficulties related to treatment, diet, or return to work.

PRACTICAL NOTE

A CBT program does not necessarily require a specialized psychologist at every rehabilitation session—the basic elements of cognitive restructuring and behavioral activation can be introduced by a physical therapist or a trained medical assistant, with structured CBT sessions provided by a psychologist for cases with significant risk scores.

3.2 Mindfulness-Based Stress Reduction (MBSR) Techniques

Mindfulness-Based Stress Reduction (MBSR) programs, along with simpler breathing techniques and progressive muscle relaxation, have proven useful as complementary interventions for reducing perceived stress and physiological reactivity to stress in cardiac patients.

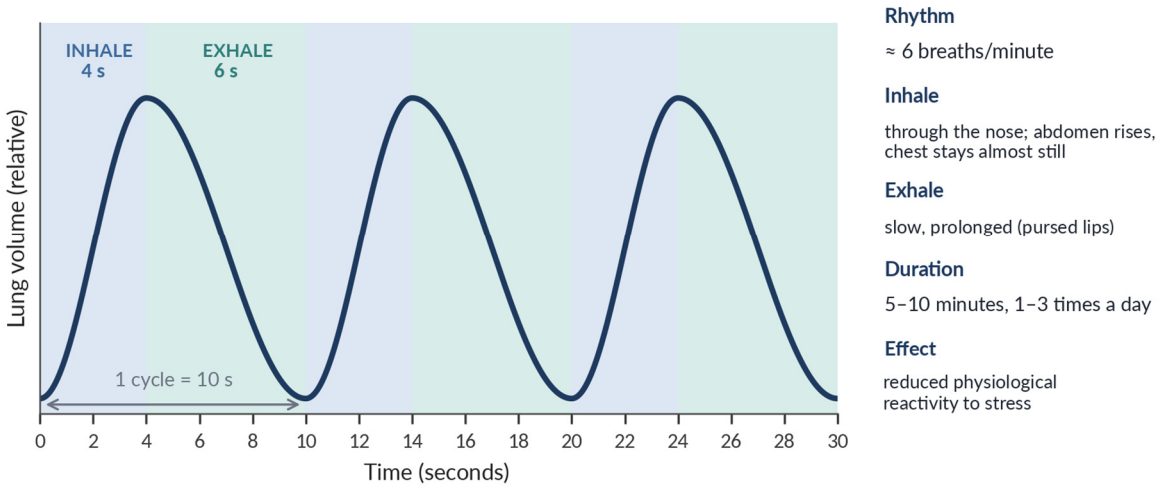


Figure 4 . Diaphragmatic breathing technique: inhale for 4 seconds, exhale for 6 seconds.

Table 3 . Exercise sheet—Guided diaphragmatic breathing (5 minutes)

EXERCISE SHEET — Guided Diaphragmatic Breathing (5 minutes)	
Position	Sit comfortably with your back straight, one hand on your chest and one on your abdomen.
Inhale	Breathe in slowly through your nose for 4 seconds, feeling your abdomen rise (not your chest).
Pause	Hold your breath comfortably for 1–2 seconds.
Exhale	Exhale slowly through your mouth for 6 seconds, feeling your abdomen lower.
Repeat	Repeat the cycle for 5 minutes, 1–2 times a day or before a situation you perceive as stressful.

3.3 Patient and Family Education on the Emotional Impact of Heart Disease

Communicating the diagnosis and recovery plan has a major emotional impact on both the patient and the family. Fear of recurrence (cardiac anxiety)—the specific fear of another cardiac event, often triggered by normal bodily sensations such as mild palpitations or fatigue after exertion—is common and can significantly limit participation in the exercise program if not explicitly addressed.

- Explain the difference between normal sensations associated with exertion (rapid breathing, sweating, muscle fatigue) and actual warning signs.
- Involve the family in educational discussions to avoid both excessive overprotection and downplaying the patient's needs.
- Discuss openly the patient's social and occupational reintegration and any fears related to resuming daily activities (driving, sexual activity, work).

3.4 Support Groups and Group Interventions

Group sessions—whether educational or focused on mutual support among patients at similar stages of recovery—offer benefits beyond the information shared: they reduce social isolation, increase cohesion and motivation, and provide a natural setting for exchanging practical coping strategies.

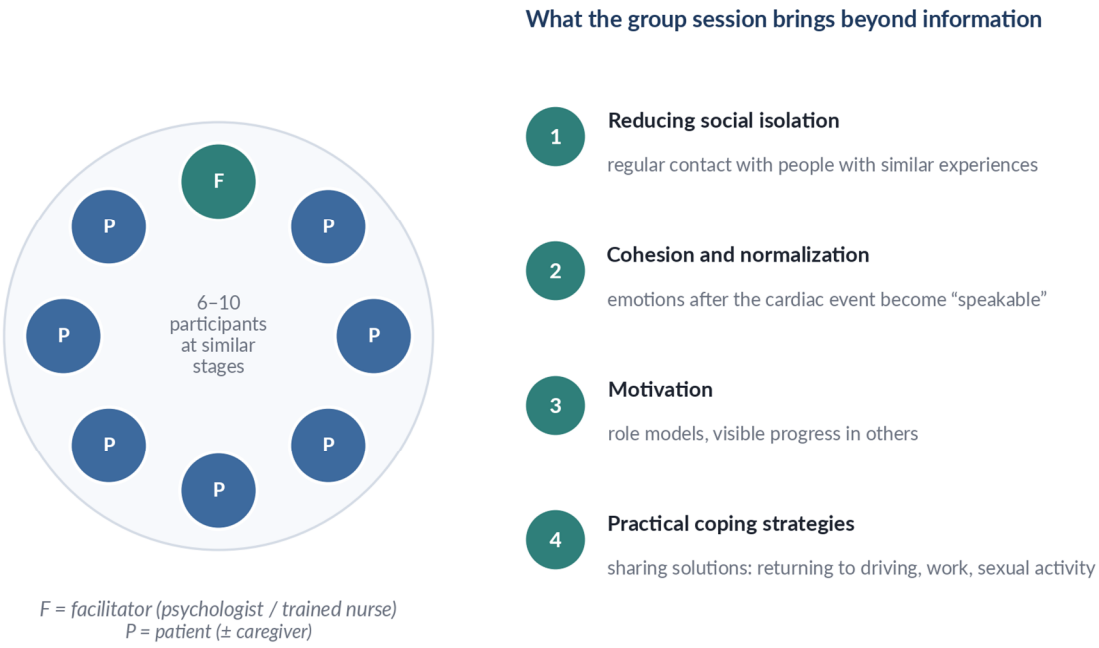


Figure 5 . Psychosocial support group session as part of the recovery program.

REFLECTION Reflect: In your clinical practice program, is there a formal setting (even a single weekly 30- to 45-minute session) where patients in recovery can meet and discuss their shared experiences? If not, what would be needed to introduce such a setting?

3.5 The EAPC Cardiac Rehabilitation Section's Position on Psychosocial Integration

The European Association for Preventive Cardiology (EAPC) Cardiac Rehabilitation Section's position statement on psychosocial aspects of cardiac rehabilitation remains a foundational document for translating theory into practice, recommending a simple triage algorithm: systematic screening of all patients → stratification by severity → basic intervention (education, self-regulation techniques) for mild cases → specialized referral (psychologist/psychiatrist) for moderate-to-severe cases or those at risk of suicide [10].

CAUTION: Any spontaneous mention by the patient of suicidal ideation or hopelessness must be treated as a psychiatric emergency and requires immediate referral, regardless of the score obtained on the screening instruments.

4. ASSESSMENT OF NUTRITIONAL STATUS IN CARDIAC PATIENTS

OBJECTIVES:

- To apply standardized nutritional screening tools (MNA, GNRI) to cardiac patients.
- To identify the risk of malnutrition and sarcopenia associated with cardiovascular recovery.
- Describing the unmet nutritional needs commonly encountered in patients undergoing recovery.

4.1 Nutritional Screening Tools

Structured nutritional assessment is an often underutilized component of cardiovascular rehabilitation programs, even though nutritional status directly influences functional capacity, exercise response, and the risk of complications. Two brief, validated tools that are easy to apply in clinical practice are the Mini Nutritional Assessment (MNA)—originally developed for the elderly population , but also useful for cardiac patients at nutritional risk—and the Geriatric Nutritional Risk Index (GNRI), calculated based on weight, height, and serum albumin [11].

Table 4. Nutritional screening tools useful in cardiovascular rehabilitation

Tool	What it assesses	Time to administration	Guideline for interpretation
MNA (Mini Nutritional Assessment)	Dietary intake, weight loss, mobility, BMI, self-perceived health status	10–15 min	≥24: normal status; 17–23.5: risk of malnutrition; <17: malnutrition
GNRI (Geriatric Nutritional Risk Index)	Current/ideal weight and serum albumin	<5 min (calculation)	>98: no risk; 92–98: low risk; <82: major risk
BMI + waist circumference	Overall body composition	<5 min	Complementary; does not replace MNA/GNRI
Grip strength (dynamometry)	Indirect indicator of muscle mass and function (sarcopenia)	<5 min	Scores below the 20th percentile for age/sex — suspected sarcopenia

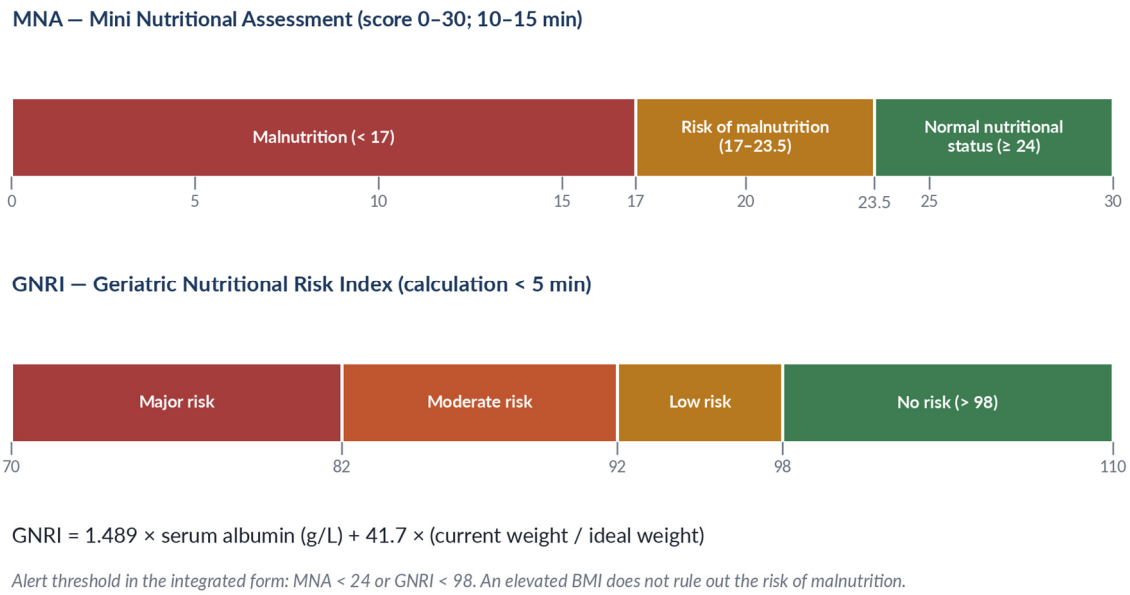


Figure 6 . Assessment of nutritional status using standardized tools (MNA/GNRI).

4.2 Identification of malnutrition and risk of sarcopenia

Contrary to the intuitive perception that cardiovascular diseases are associated exclusively with excess weight, a significant proportion of patients in phase II of cardiovascular recovery are found, upon structured assessment, to be at risk for malnutrition or to have confirmed malnutrition. This situation is particularly common among older patients, those with chronic heart failure (where cardiac cachexia frequently coexists), and those with prolonged or multiple hospitalizations.

Sarcopenia—the loss of muscle mass and strength—often overlaps with frailty in older patients and reduces their ability to fully benefit from an exercise program. e indices such as the modified GNRI have proven useful as highly sensitive markers for identifying the risk of sarcopenia in hospitalized older adults [12].

CAUTION

In patients with chronic heart failure, unintentional weight loss should not automatically be interpreted as a favorable sign—it may reflect cardiac cachexia, a complication associated with a poor prognosis that requires dedicated nutritional assessment and intervention, not additional caloric restriction.

4.3 Unmet Nutritional Needs of Patients in Recovery

Studies investigating patients' experiences in cardiovascular rehabilitation programs show a consistent discrepancy between the theoretical knowledge patients acquire about healthy eating and their actual ability to apply this knowledge in daily life [13,14].

Commonly reported barriers include:

- A lack of personalized recommendations tailored to comorbidities (diabetes, chronic kidney disease, dyslipidemia).
- The perceived higher cost of fresh and whole foods compared to processed foods.
- Practical difficulties in planning meals amid a busy daily schedule or when living alone.
- Confusion caused by contradictory information from non-specialized sources (social media, general-interest media).

KEY POINTS

Nutritional assessment is not limited to calculating BMI—a patient of normal weight or even one who is overweight may simultaneously be at risk for sarcopenia and specific micronutrient deficiencies, which is why structured tools (MNA/GNRI) are superior to simple visual or anthropometric assessments.

5. NUTRITIONAL INTERVENTION IN THE CARDIOVASCULAR REHABILITATION PROGRAM

OBJECTIVES:

- To demonstrate the role of the Mediterranean diet as the foundation of nutritional intervention in cardiovascular rehabilitation.
- To explain the benefits of reducing the consumption of ultra-processed foods on cardiometabolic health.
- Organizing structured dietary education sessions tailored to the patient's level of health literacy
- Adapting nutritional recommendations to special populations (older adults, patients with heart failure, patients with diabetes).

5.1 The Mediterranean Diet as the Foundation of Nutritional Intervention

The Mediterranean diet—rich in vegetables, fruits, whole grains, legumes, fish, and extra-virgin olive oil, with low consumption of red meat and processed foods—remains the dietary model with the strongest evidence for reducing the risk of recurrent cardiovascular events, as confirmed by recent updates to scientific statements on diet and nutrition in the prevention of cardiovascular disease [15].

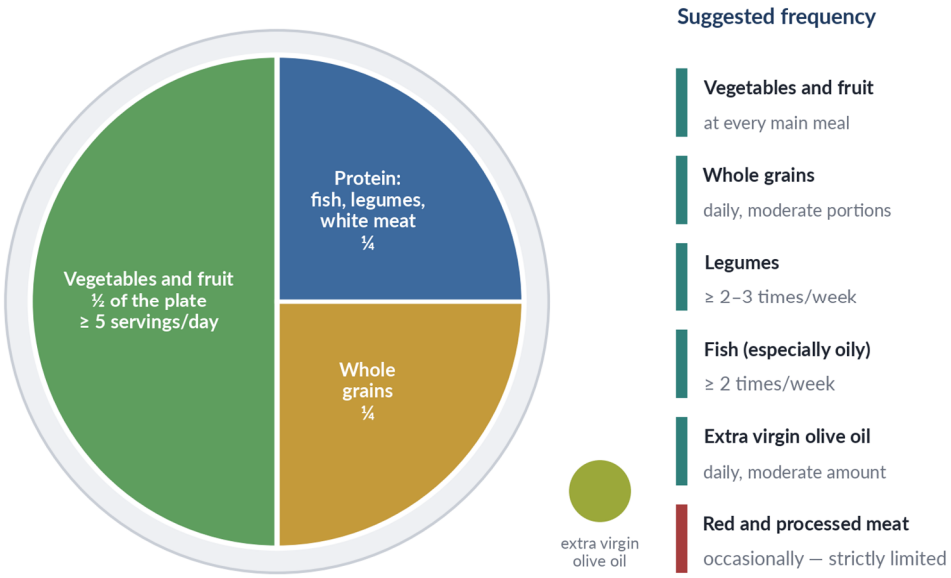


Figure 7 . Visual model of the Mediterranean plate, applicable in patient nutrition education.

Table 4 . Practical principles of the Mediterranean diet adapted for cardiovascular recovery

Food Group	Practical recommendation	Recommended frequency
Vegetables and fruits	At least 5 servings per day, varied in color	At every main meal
Whole grains	Whole-grain bread, oats, brown rice, whole-grain pasta	Daily, in moderate portions
Legumes	Lentils, chickpeas, beans, peas	At least 2–3 times a week
Fish (especially fatty fish)	Salmon, mackerel, sardines	At least 2 times a week
Extra virgin olive oil	Main source of added fat	Daily, in moderate amounts
Red and processed meat	Significantly limited	Occasionally, not as a staple food

5.2 Reducing consumption of ultra-processed foods (UPFs)

Beyond macronutrient composition, the degree of food processing has become a subject of independent study in secondary cardiovascular prevention. The randomized controlled DIABEPIC Reform study evaluated the combined effects of the Mediterranean diet and reduced consumption of ultra-processed foods as part of a cardiovascular rehabilitation program, demonstrating greater cardiometabolic benefits when the two strategies are applied simultaneously, compared to applying each one separately. A complementary analysis by the same research group proposed reducing UPF consumption as an additional approach, complementary to the classic Mediterranean diet, to improve dietary quality and cardiometabolic health [16,17].

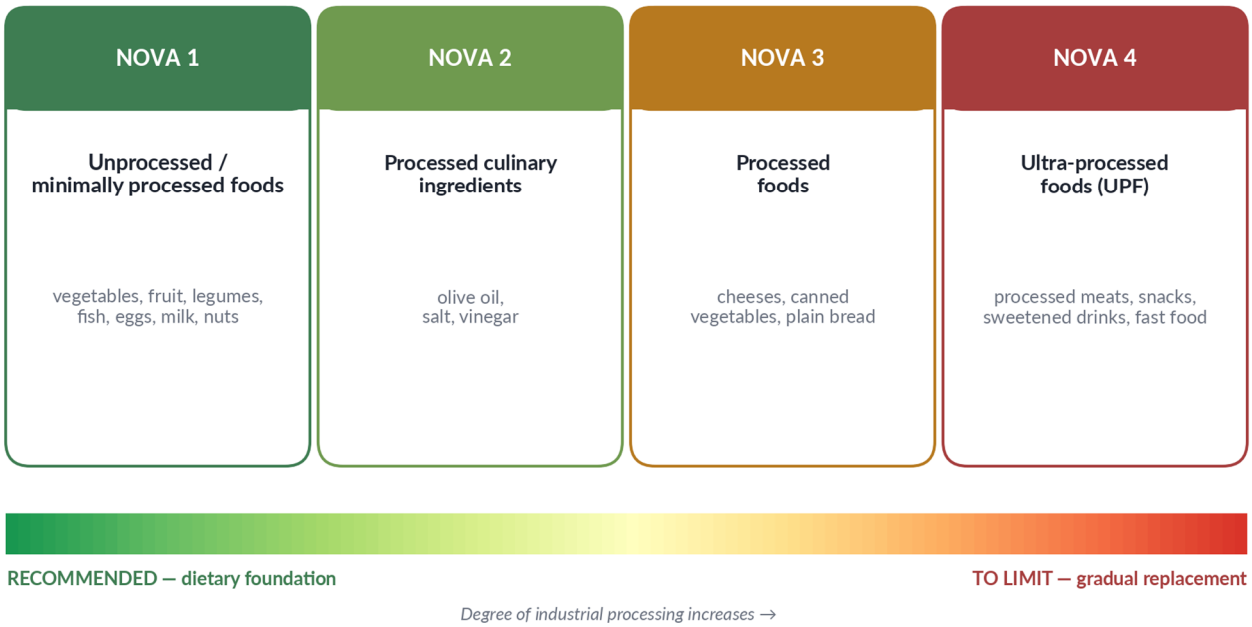


Figure 8 . Practical comparison between recommended whole foods and ultra-processed foods to be limited.

PRACTICAL NOTE

A simple practical guideline for patients: "If the product label contains more than 5 ingredients that you don't recognize or wouldn't use at home when cooking, it's likely an ultra-processed food"—useful as an educational starting point, though it does not replace careful reading of nutrition labels.

5.3 Structured Dietary Education as Part of the Recovery Program

The way nutritional education is delivered significantly influences the degree to which recommendations are put into practice. A recent analysis of the role of dietary education in cardiac rehabilitation highlights the superiority of interactive, personalized, and repeated formats over the simple distribution of generic written materials [18].

- **Individual format** — recommended for patients with multiple comorbidities (diabetes, chronic kidney disease) who require fine-tuning of their meal plans.
- **Group format**—effective for conveying general principles and for sharing recipes and practical strategies among patients.
- **Digital format** (apps, short videos)—useful as a supplement, especially for younger patients or those with limited access to frequent in-person visits.
- Educational materials should be tailored to the patient's level of health literacy—using simple language, concrete examples, and avoiding excessive nutritional jargon.

5.4 Nutritional Considerations for Special Patient Groups

Table 5 . Adapting nutritional recommendations for special groups of cardiac patients

Patient group	Nutritional Consideration	Adapted recommendation
Older adults at risk for sarcopenia	Protein intake is often insufficient	Increase protein intake (1.0–1.2 g/kg/day), distributed across each meal
Chronic heart failure	Fluid retention, risk of hyponatremia	Moderate sodium restriction (<2–3 g/day); fluid restriction only in cases of decompensation, tailored to the individual
Associated diabetes mellitus	Need for glycemic control	Balanced distribution of carbohydrates, prioritizing those with a low glycemic index
Associated chronic kidney disease	Need for adjustment of protein and potassium intake	Direct collaboration with a nephrologist/specialized dietitian

5.5 Long-term monitoring of eating behavior

Initial nutrition education, no matter how well structured, does not guarantee that behavioral changes will be sustained in the long term without self-monitoring tools and periodic reassessments.

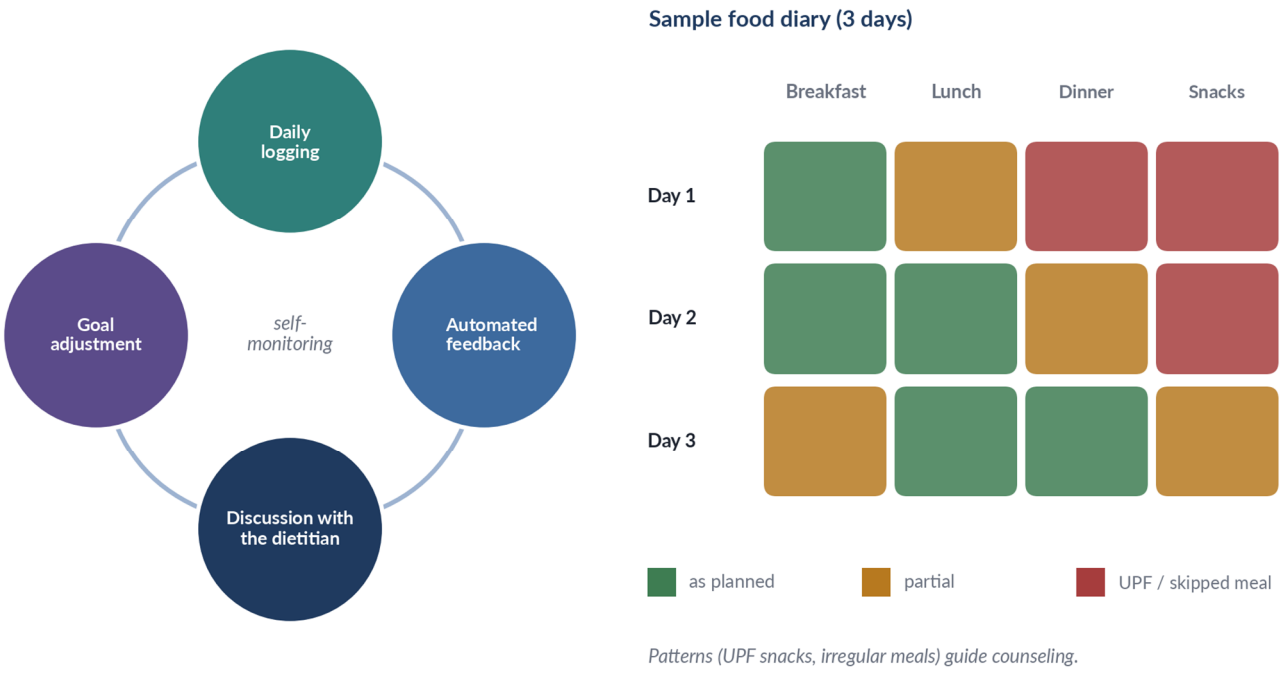


Figure 9 . The digital food diary as a tool for self-monitoring eating behavior.

- The food diary (paper or digital)—particularly useful in the first 4–6 weeks to increase awareness of one's own habits.
- Periodic reassessment of nutritional status (MNA/GNRI, weight, waist circumference) at 4, 8, and 12 weeks, then at every visit during Phase III of recovery.
- Set small, specific, and measurable dietary goals (e.g., "two servings of vegetables at dinner, every day of the week"), rather than general goals such as "eat healthier."

6. THE CONCEPT OF ADHERENCE IN CARDIOVASCULAR RECOVERY

OBJECTIVES:

- Defining and distinguishing the dimensions of adherence (to exercise, to medication, to lifestyle and dietary recommendations).
- Applying validated tools for assessing adherence (CRAS, MMAS-8).
- Interpreting the varied trajectories of adherence over time and identifying at an early stage patients at risk of dropping out.
- Explain the dose-response relationship between the number of completed rehabilitation sessions and clinical outcomes.

6.1 Definitions and Dimensions of Adherence

Adherence is broadly defined as the extent to which a person's behavior—taking medication, following a diet, or making lifestyle changes—aligns with the recommendations agreed upon with the healthcare team. In the context of cardiovascular rehabilitation, adherence is not a single concept but encompasses at least three distinct yet interdependent dimensions:

- **Exercise adherence**—participation in scheduled sessions and, subsequently, continuation of regular physical activity during Phase III (maintenance).
- **Medication adherence** — taking cardiovascular medications (antiplatelet agents, statins, beta-blockers, etc.) correctly, at the prescribed doses and intervals.
- **Adherence to** lifestyle **and dietary recommendations**—incorporating nutritional principles and other lifestyle changes (quitting smoking, weight management) into daily routines.

Although conceptually distinct, these three dimensions tend to be interrelated in the same patient: a patient with low adherence to exercise is, statistically, more likely to also have low adherence to treatment or diet, which justifies an integrated assessment.

6.2 Tools for Assessing Adherence

Objective assessment of adherence, rather than the healthcare team's subjective judgment, allows for the early identification of patients at risk of non-adherence. The Cardiac Rehabilitation Adherence Scale (CRAS) is a specific, psychometrically validated tool developed for patients with coronary artery disease enrolled in cardiac rehabilitation programs, while the Morisky Medication Adherence Scale-8 (MMAS-8) remains one of the most widely used generic tools for medication adherence [19].

Table 6 . Instruments for Assessing Adherence in Cardiovascular Rehabilitation

Instrument	Dimension Assessed	Characteristics
CRAS (Cardiac Rehabilitation Adherence Scale)	Adherence to the rehabilitation program (exercise, attendance)	Psychometrically validated in patients with coronary artery disease; suitable for periodic use
MMAS-8 (Morisky Medication Adherence Scale-8)	Medication adherence	8 items, self-administered, easy to administer at any visit
Structured Dietary Adherence Questionnaire (locally adapted)	Adherence to nutritional recommendations	Can be developed based on individual SMART goals (see Chapter 10)

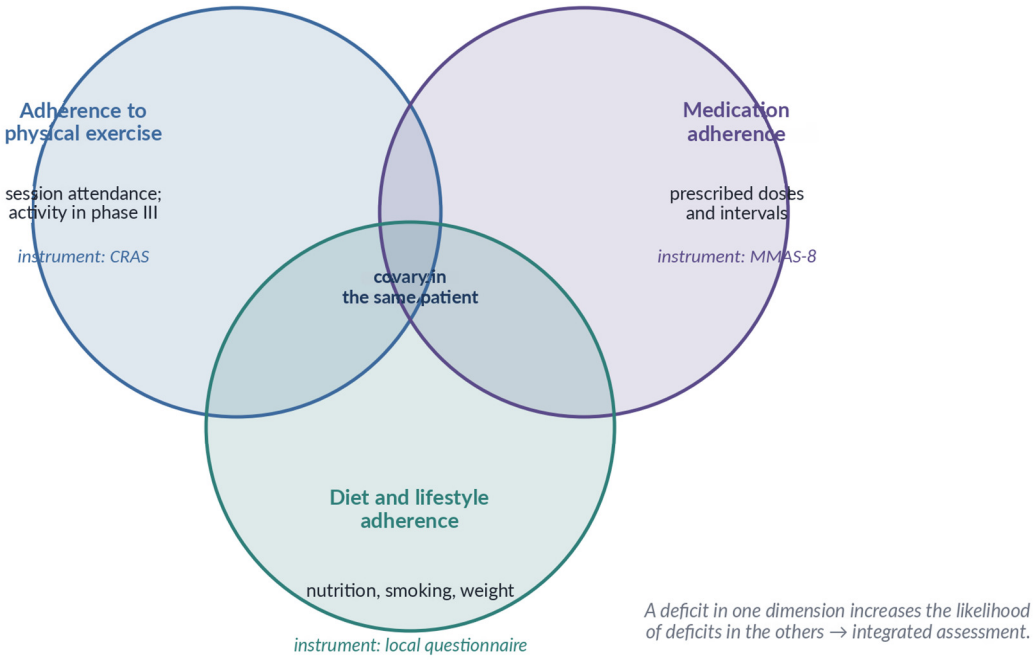


Figure 10 . The three dimensions of adherence: to the exercise program and to the treatment regimen.

6.3 Trajectories of adherence over time

Adherence is not a static patient characteristic but evolves dynamically throughout the rehabilitation program. A cohort study identified heterogeneous adherence trajectories to home-based cardiac rehabilitation exercises—ranging from patients with consistently high adherence to those with progressively declining adherence and those with fluctuating adherence—suggesting that uniform interventions, applied identically to all patients, are less effective than those tailored to individual trajectories. A complementary latent class analysis applied to patients in the early recovery phase following percutaneous coronary intervention confirms the existence of distinct adherence subgroups, which are useful for directing intervention resources toward patients at high risk of dropout [20,21].

PRACTICAL NOTE Early identification of a downward adherence trajectory (e.g., decreased attendance at sessions during the first 2–3 weeks) allows for targeted intervention before complete program dropout becomes likely.

6.4 Cardiovascular Rehabilitation Dose and Dose-Response Relationship

A systematic meta-regression revealed a dose-response relationship between the number of completed cardiovascular rehabilitation sessions and reductions in mortality and morbidity, with benefits increasing progressively with the number of sessions up to a certain threshold. This finding has a direct practical implication: the team's goal should not be merely to enroll the patient in the program, but to ensure the completion of a sufficient number of sessions to reach the minimum effective threshold [22].

KEY POINTS Adherence to cardiovascular rehabilitation should be measured not merely as "participation/non-participation," but as the actual number of sessions completed—a parameter directly correlated with the clinical benefit achieved.

7. BARRIERS AND FACILITATING FACTORS FOR ADHERENCE

OBJECTIVES

- To identify patient-related barriers that limit adherence to cardiovascular rehabilitation.
- Analyzing organizational and healthcare system barriers that affect access to and continuity of the program.
- Identifying psychosocial factors as independent predictors of non-adherence.
- Describing the principles of self-management as applied to cardiac rehabilitation.

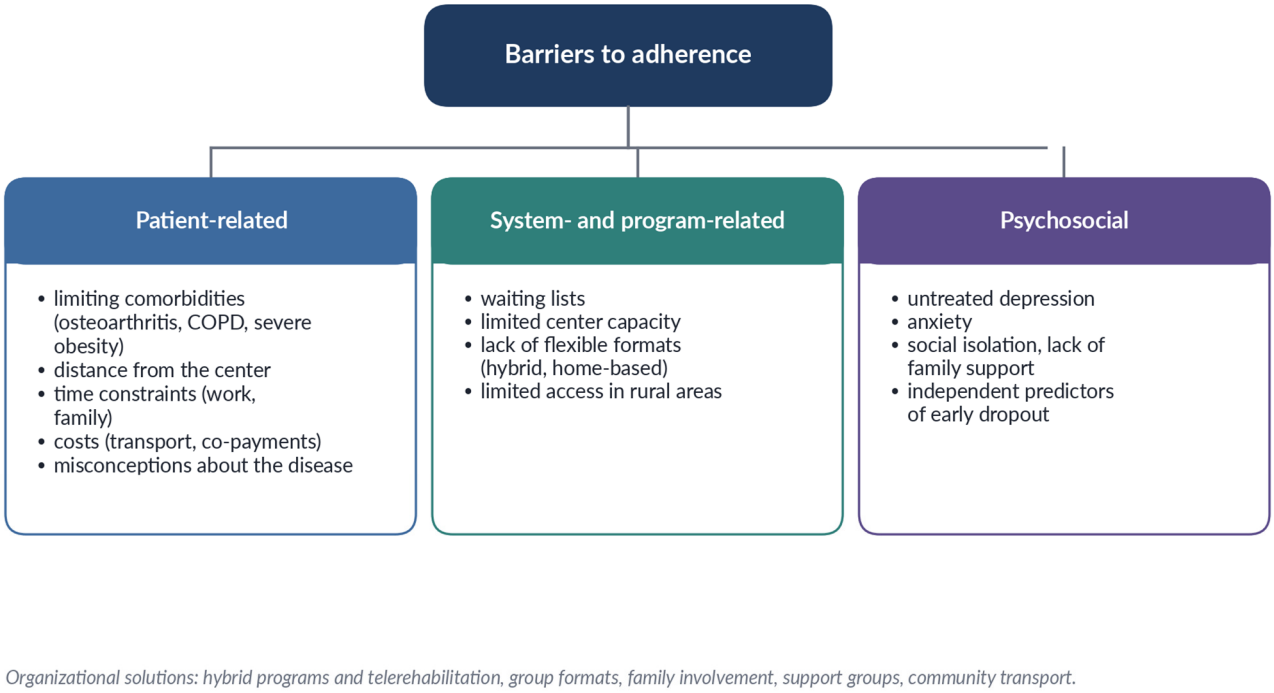


Figure 11 . Classification of barriers to adherence: patient-related, healthcare system-related, and psychosocial.

7.1 Patient-Related Barriers

At the individual level, the main barriers reported by patients include the presence of comorbidities that limit their physical ability to attend sessions (osteoarthritis, chronic lung disease, severe obesity), geographical distance from the rehabilitation center, time constraints related to work or family responsibilities, financial difficulties (cost of transportation, copayments), and misconceptions about the disease and treatment—for example, the belief that once symptoms have improved, treatment or exercise is no longer necessary.

7.2 Barriers Related to the Healthcare System and the Rehabilitation Program

At the system level, waiting lists for enrollment in rehabilitation programs, the limited capacity of existing centers, and the lack of flexible formats—hybrid (center + home) or exclusively at-home—represent major structural barriers, especially for patients in rural areas or with limited mobility.

Table 7 . Summary of barriers and possible organizational solutions

Type of barrier	**Specific example**	**Possible organizational solution**
Patient-related	Significant geographical distance from the center	Hybrid programs or telerehabilitation
-system-related	Long waiting list for enrollment in the system	Prioritizing high-risk patients; expanding capacity through group formats
Psychosocial	Social isolation, lack of family support	Active family involvement; support
Financial	Cost of transportation to each session	Supervised home-based programs; community transportation partnerships

7.3 Psychosocial Factors as Predictors of Non-Adherence

Psychosocial factors—depression, anxiety, social isolation—are not merely comorbidities requiring separate treatment, but **independent predictors of nonadherence** to the cardiovascular rehabilitation program. A patient with untreated depression is significantly more likely to drop out of the program early, regardless of the objective severity of heart disease.

KEY POINTS

The assessment of barriers to adherence must systematically include a psychosocial component—a patient who "doesn't show up for sessions" may, in fact, have untreated depression or exercise-related anxiety, not just logistical constraints.

7.4 Self-Management

Self-management models emphasize developing the patient's ability to monitor their own symptoms, make informed decisions in daily life, and maintain therapeutic behaviors without constant external supervision. A self-management-centered rehabilitation program, implemented for patients with acute coronary syndrome—including during periods of limited physical access to services (such as that described in the context of the COVID-19 pandemic)—has demonstrated feasibility and favorable outcomes in maintaining continuity of care [23].

Basic principles of self-management applicable to cardiovascular rehabilitation:

- **Self-efficacy** — the patient's confidence in their own ability to manage their health, which can be built gradually through small, achievable goals.
- **Self-monitoring** — the use of a journal (paper or digital) to track symptoms, physical activity, and, where applicable, parameters such as blood pressure.
- **Problem-solving** — the ability to identify practical obstacles (for example, a day with low energy) and find tailored solutions without completely abandoning the plan.
- **Active partnership with the healthcare team**—the patient is viewed as a partner, not merely as a passive recipient of recommendations.

8. STRATEGIES AND INTERVENTIONS TO INCREASE ADHERENCE

OBJECTIVES:

- Applying the basic principles of motivational interviewing in setting exercise and diet goals.
- Describe the use of behavioral nudges in home-based cardiovascular rehabilitation.
- Compare the effectiveness of different types of interventions for increasing exercise adherence. Propose specific interventions to optimize medication adherence in heart failure.

8.1 Motivational Interviewing and Behavioral Coaching Techniques

Motivational interviewing is a patient-centered communication method that aims to explore and resolve ambivalence toward behavioral change, rather than imposing recommendations in a directive manner. The basic principles—expressing empathy, avoiding direct confrontation, supporting self-efficacy, and "going with the resistance" (not directly contradicting the patient's reluctance, but exploring it)—are particularly useful in setting exercise and dietary goals.



Figure 12 . Motivational interviewing applied to setting recovery goals.

Table 8 . Worksheet—Structure of a Short Motivational Discussion (10 minutes)

WORKSHEET — Structure of a short motivational discussion (10 minutes)	
Opening	Open-ended question: "How do you feel about the recovery program so far?"
Exploration	Reflective listening: Paraphrase what the patient says without immediately judging or correcting them.
Identifying Ambivalence	Ask: "What would make it easier for you to take this step?"
Supporting self-efficacy	Explicitly acknowledge the small steps the patient has already taken.
Concrete Plan	Conclude with a single small, specific step that the patient can take in the coming week.

8.2 Behavioral Nudges and Choice Architecture

Behavioral nudges are subtle interventions that alter how options are presented, without restricting the patient's freedom of choice, with the aim of facilitating the desired behavior. The ERA (Enhancing Rehabilitation Adherence) study was designed to test the effectiveness of combining

home-based rehabilitation with behavioral nudges (scheduled reminders, visual progress feedback, implicit rather than explicit goals) in increasing adherence to the cardiovascular rehabilitation program [24].

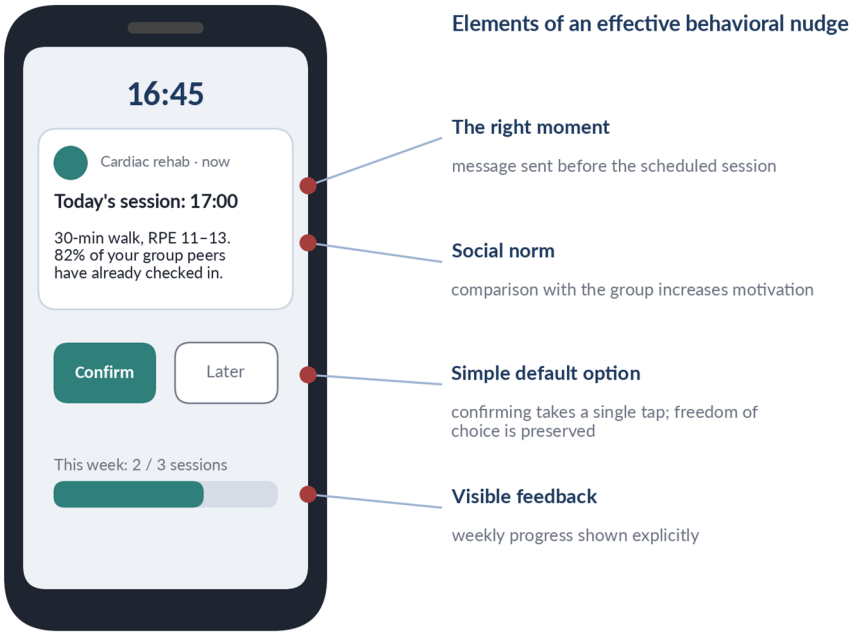


Figure 13 . Behavioral nudge delivered via a mobile app to remind users of their exercise session.

8.3 Comparison of Interventions to Increase Exercise Adherence

A network meta-analysis compared the effectiveness of different types of interventions used to increase adherence to exercise-based cardiovascular rehabilitation in patients following percutaneous coronary intervention [25]. The main conclusions, which are useful for selecting the appropriate intervention based on available resources:

Table 9 . A Comparative Overview of Intervention Types to Improve Exercise Adherence

Type of intervention	Example	Practical considerations
Simple educational	Brochures, one-time informational sessions	Low cost, but limited effect on its own
Structured behavioral	Goal setting, self-monitoring, regular feedback	More effective than simple education; requires continuity
Technology-based (mHealth)	Apps, text messages, wearable devices	Most effective when combined with periodic human support
Combined (multicomponent)	Education + behavioral + technological	Consistently superior results compared to single-component interventions

8.4 Specific Interventions for Medication Adherence in Heart Failure

Poor medication adherence is particularly problematic in patients with heart failure, where the treatment regimen is often complex (multiple classes of medications, progressive dose titr). A narrative review of interventions to improve medication adherence in these patients identifies as effective a combination of structured education, simplification of the treatment regimen (when clinically feasible), and monitoring tools, whether analog (pill organizers) or digital [26].

PRACTICAL NOTE A simple but effective question to ask at every visit: "In the past week, were there any days when you forgot to take any of your medications?"—asked in a non-judgmental manner—increases the likelihood that the patient will honestly report difficulties with adherence.

8.5 Involving the Family and Social Support Network

A spouse or other close family members often play a crucial role in maintaining long-term motivation—from simply reminding the patient of their treatment schedule to actively participating in changing the eating habits of the entire household.



Figure 14 . Family involvement as a facilitator of long-term adherence.

- With the patient's consent, invite a family member to at least one of the program's educational sessions.
- Discuss explicitly how the family can provide support without becoming overly controlling or, conversely, indifferent.
- Determine whether social isolation is a real issue and, if so, consider referring the patient to community support groups.

9. DIGITAL TOOLS (mHEALTH) TO SUPPORT ADHERENCE AND THERAPEUTIC BEHAVIOR

OBJECTIVES:

- To identify clinically validated mobile apps for monitoring medication adherence.
- Interpret the results of studies on the effect of digital therapies on long-term prognosis.
- Selecting a digital solution appropriate for the patient's profile, taking into account digital literacy and privacy considerations
- Explaining the Role of Cardiac Telerehabilitation as a Bridge Between Adherence and Accessibility

9.1 Mobile Apps for Monitoring Medication Adherence

Numerous mobile apps designed to monitor medication adherence have been developed and tested in recent years, with promising results for patients with chronic cardiovascular conditions. The ADHERE-App study used a randomized controlled trial design to evaluate a smartphone app intended to increase self-awareness of adherence to anticoagulant therapy (edoxaban) in patients with atrial fibrillation, demonstrating improved self-reported adherence in the intervention arm. Similarly, the Cardio-Meds app was tested in a randomized controlled pilot study in patients with heart failure, yielding favorable results regarding both disease knowledge and medication adherence [27,28].



Figure 15 . Digital components of adherence monitoring: follow-up calendar and treatment regimen.

9.2 Digital therapeutics and their effect on long-term prognosis

Beyond simple reminder apps, the concept of "digital therapeutics" describes structured, evidence-based digital interventions designed to produce a measurable therapeutic effect. The 8-year results of the BAMA study suggest a potential "legacy effect" of a digital therapeutic on mortality in patients with coronary artery disease treated with percutaneous coronary intervention, with benefits observed long after the active period of intervention use, opening up an interesting line of research into the long-term role of digital interventions in secondary prevention [29].

PRACTICAL NOTE

The findings regarding the "legacy effect" of digital therapies are still preliminary and come from a single large-scale study—useful for understanding the direction of current research, but they should not be presented to patients as an established clinical certainty.

9.3 Practical Considerations for Implementing Digital Solutions

The selection and recommendation of a digital solution must take into account several practical factors, not just published evidence of efficacy:

- **Patient digital literacy**—especially among older patients, a hands-on demonstration of how to use the app is necessary, not just a verbal recommendation.

- **Interface complexity** — apps with a simple interface, requiring few steps to record a dose or an exercise session, have higher sustained usage rates.
- **Data privacy**—patients must be clearly informed about how their health data is stored and used, in accordance with applicable regulations.
- **Cost** — some apps require a subscription; the availability of free alternatives, even if simpler, may be relevant for patients with limited resources.

9.4 Cardiac telerehabilitation as a bridge between adherence and accessibility

Hybrid models of cardiovascular rehabilitation—which combine supervised sessions at a center with periods of monitored exercise at home, supported by phone, video conferencing, or wearable devices—have demonstrated the ability to maintain continuity of care for patients facing significant geographic or logistical barriers, without compromising the safety or effectiveness of the program [30].

KEY POINTS

Tele-rehabilitation is not intended to completely replace the in-person supervised component of cardiovascular rehabilitation, but rather to expand access for patients who would otherwise drop out or be unable to start the program at all.

10. PRACTICAL INTEGRATION OF THE THREE PILLARS INTO THE REHABILITATION PLAN

OBJECTIVES:

Implement an integrated initial assessment that combines psychosocial, nutritional, and adherence screening into a single, practical workflow.

Developing SMART goals for each of the three pillars of recovery.

Develop a timeline for longitudinal monitoring and clear criteria for adjusting the plan.

Describing the role of the medical assistant or physical therapist as the patient's "navigator" within the team.

10.1 Integrated Initial Assessment: Single Psychosocial-Nutritional-Adherence Questionnaire

Although the previous chapters presented the screening tools for each pillar separately, their isolated application—at different times and by different team members—increases the risk that information will remain fragmented. It is recommended to develop a single initial assessment form, to be used upon entry into the program, that integrates the three components into a single reference document for the entire team.

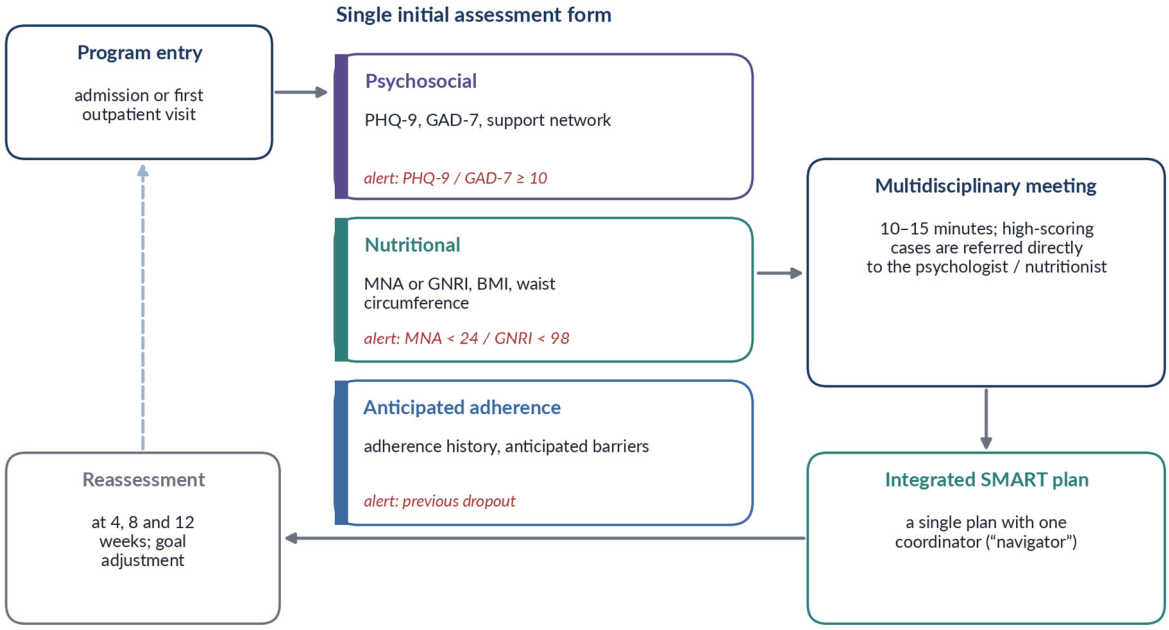


Figure 16 . The integrated initial assessment workflow: psychosocial, nutritional, adherence, integrated plan.

Table 10 . Sample template for an integrated initial assessment form

Section	Tool/Key Question	Alert threshold
Psychosocial	PHQ-9, GAD-7, question about social support network	PHQ-9/GAD-7 ≥10
Nutritional	MNA or GNRI, BMI, waist circumference	MNA <24 or GNRI <98
Anticipated adherence	History of adherence to previous treatments, anticipated barriers	History of previous treatment discontinuation

10.2 Setting SMART Goals Across the Three Pillars

SMART goals—Specific, Measurable, Achievable (realistic), Relevant, and Time-bound—provide a simple and effective framework for translating the initial assessment into a concrete action plan that can be applied to the psychosocial, nutritional, and adherence components alike.

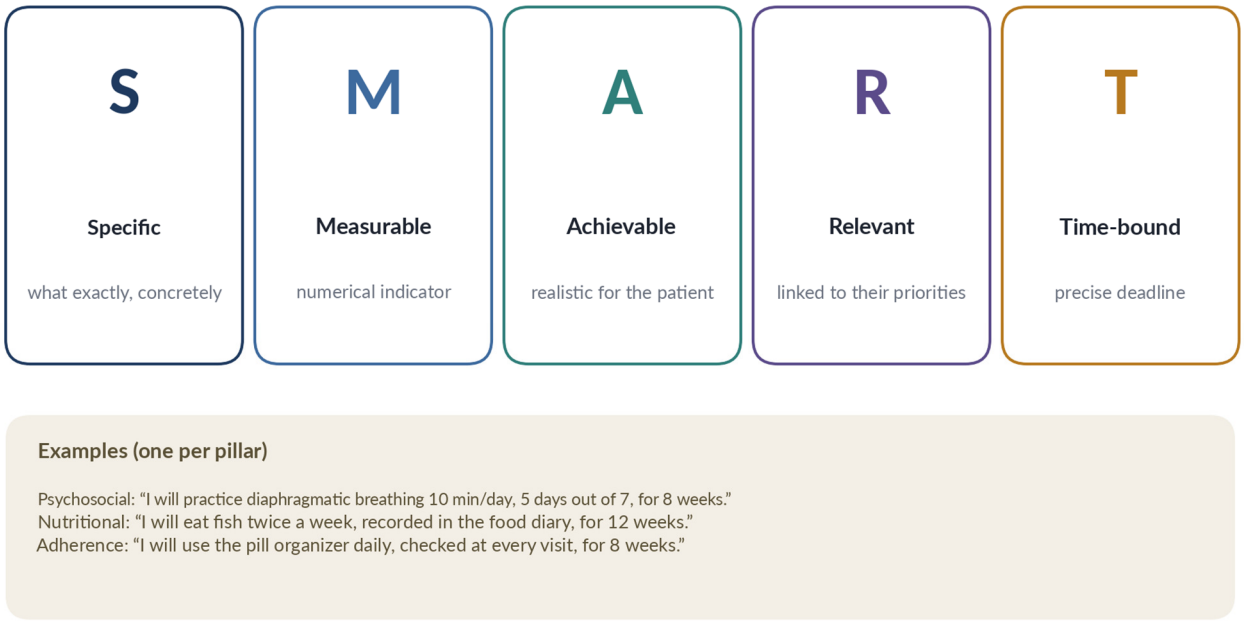


Figure 17 . The SMART goal framework applied to the integrated recovery plan.

Table 11 . Examples of SMART objectives for each pillar

Pillar	Generic Objective (to be avoided)	SMART Objective (recommended)
Psychosocial	"To be less anxious"	"Will practice diaphragmatic breathing for 5 minutes, twice a day, for 4 weeks, with a GAD-7 reassessment"
Nutritional	"To eat healthier"	"Will include 2 servings of vegetables at dinner every day, tracked in a food diary for 4 weeks"
Adherence	"Be more adherent to treatment."	"Will use a weekly pill organizer, checked at each visit for 8 weeks"

10.3 Longitudinal Monitoring and Plan Adjustment

The integrated plan is not static—it requires regular reassessment at 4, 8, and 12 weeks after initiation, with explicit criteria for success (measurable progress toward the established goal) and failure (lack of progress or worsening), which trigger a reconsideration of the strategy, not just a simple repetition of the same recommendation.

PRACTICAL NOTE

A goal not met at reassessment is not a failure on the patient's part, but a signal that the goal, method, or support provided needs to be adjusted—for example, an exercise goal may need to be reduced in intensity, or a nutritional goal may require additional family involvement.

10.4 The Role of the Nurse or Physical Therapist as the Patient's "Navigator"

In daily practice, it is often the nurse or physical therapist—the professionals with the most frequent contact with the patient—who plays the role of "navigator": coordinating information among the cardiologist, psychologist, and dietitian, monitoring progress across all three areas, and alerting the team to any relevant changes in the patient's condition. This role does not require additional specialized skills, but rather a systematic approach to interprofessional communication, supported by the integrated assessment form presented in this chapter.

KEY POINTS

An effective recovery plan is not the sum of three separate plans (psychosocial, nutritional, and adherence), but a single integrated plan with a clear "owner" on the team responsible for coordinating information.

11. CLINICAL CASE STUDIES

Clinical Case—Patient with Post-Myocardial Infarction Depression and Poor Treatment Adherence

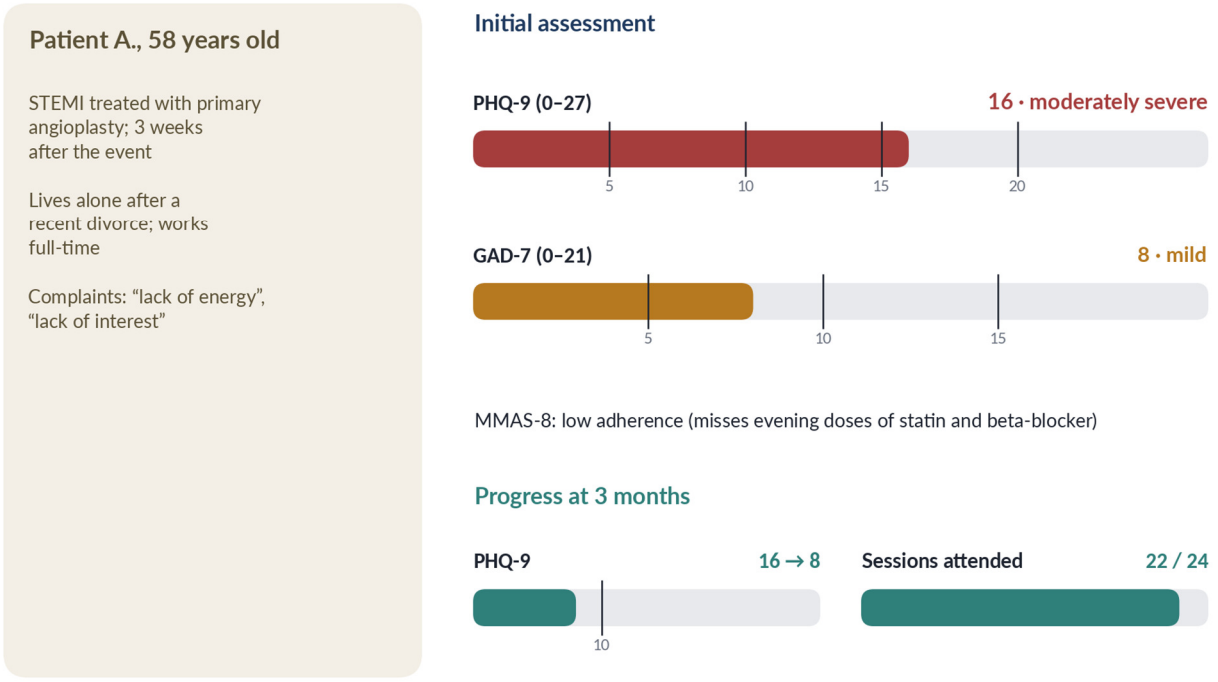


Figure 18 . Initial assessment of Patient A upon entry into the recovery program.

CASE STUDY

Presentation. Patient A., 58 years old, is referred to the cardiovascular rehabilitation program 3 weeks after a myocardial infarction with ST-segment elevation, treated with primary angioplasty. She is employed full-time, has been living alone since her recent divorce, and reports "lack of energy" and "lack of interest in almost everything."

Assessment. The PHQ-9 score is 16 (moderate-to-severe depression); the GAD-7 score is 8 (mild anxiety). The MMAS-8 questionnaire indicates poor adherence, with the patient acknowledging that he "frequently forgets" his evening doses of statins and beta-blockers. He has no history of prior psychiatric treatment.

Integrated intervention plan.

(1) Psychosocial: referral to a psychologist for a comprehensive evaluation and, possibly, initiation of CBT; discussion of the risk of social isolation given the recent divorce and living alone.

(2) Adherence: introduction of a weekly pill organizer and a phone alarm for the evening dose; SMART goal: "will use the pill organizer daily, checked at each visit, for 8 weeks."

(3) Exercise: gradual start, with careful monitoring of energy and mood, given the risk that depressive symptoms may initially limit participation.

Progress at 3 months. The PHQ-9 score drops to 8, reported medication adherence improves significantly after the introduction of the pill organizer, and the patient completes 22 out of 24 scheduled sessions.

11.2 Clinical Case—Female Patient with Obesity, Disorganized Eating Habits, and Associated Diabetes Mellitus

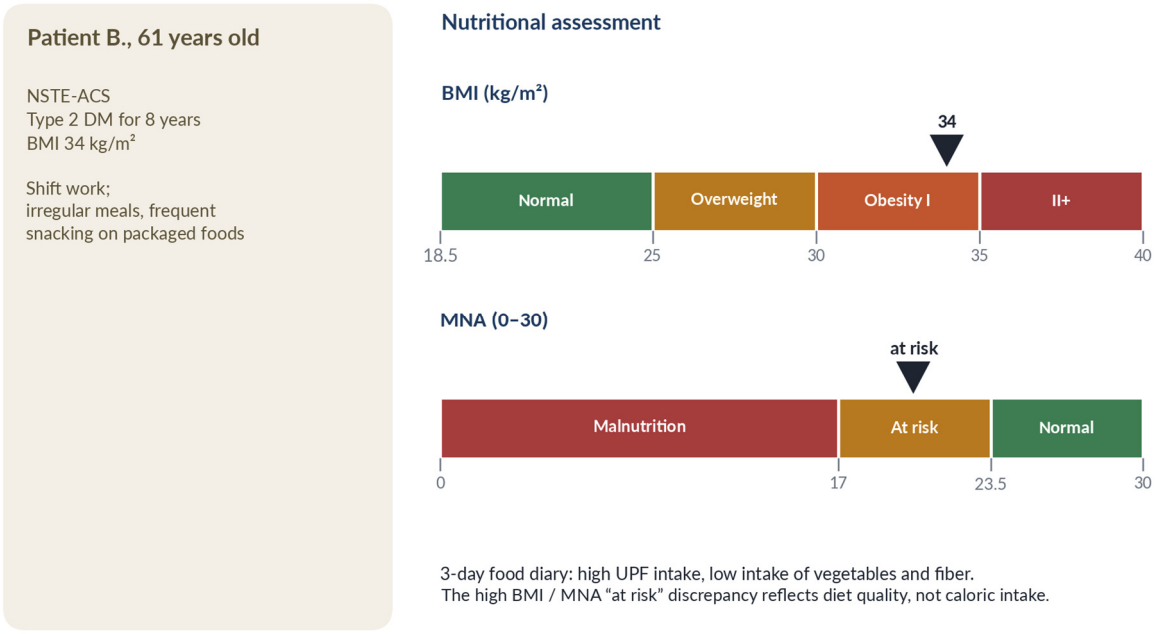


Figure 19 . Nutritional assessment of Patient B upon entry into the recovery program.

CASE STUDY

Presentation. Patient B., 61 years old, with type 2 diabetes diagnosed 8 years ago and a BMI of 34 kg/m², is admitted for acute coronary syndrome without ST-segment elevation. She reports a disorganized eating pattern, with irregular meals and frequent snacks consisting of packaged foods, due to her shift work schedule.

Assessment. The MNA indicates a "at-risk" nutritional status, despite the elevated BMI—a common discrepancy explained by poor dietary quality rather than caloric intake. The 3-day food diary highlights a high consumption of ultra-processed foods and a low intake of vegetables and fiber.

Integrated intervention plan. Nutritional: individual consultation with a dietitian, focusing on meal planning tailored to the shift work schedule rather than on a specific diet

11.3 Clinical Case—Elderly Female Patient with Social Isolation and Non-Adherence to Home Recovery

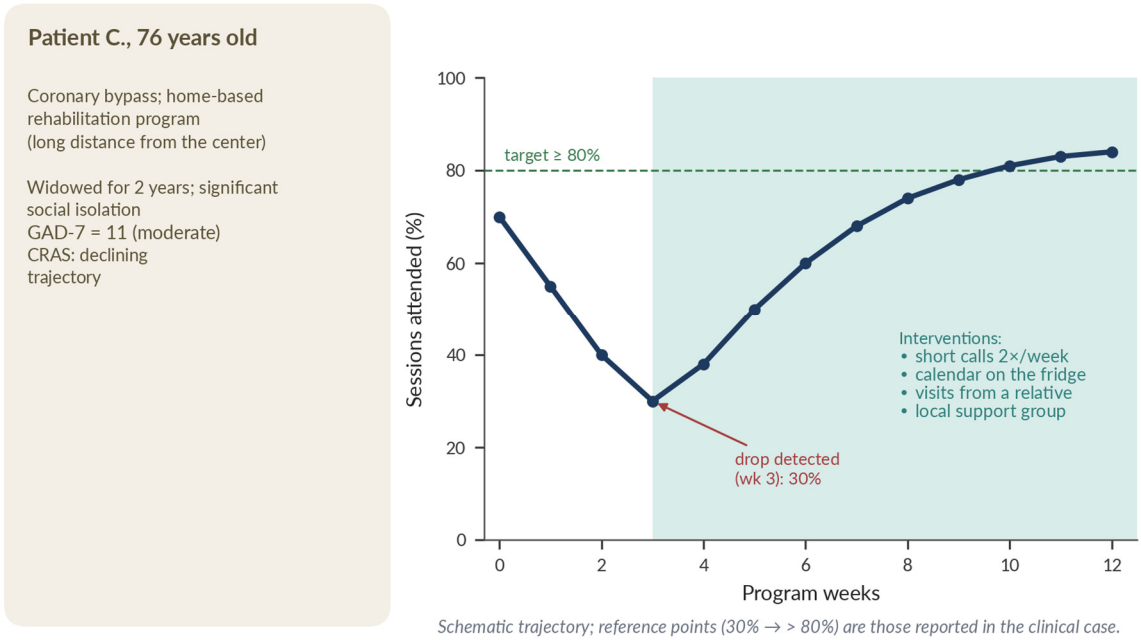


Figure 20 . Patient C.'s self-management of home recovery, supported by behavioral nudges.

CASE STUDY

Introduction. Patient C., 76 years old and a widow for 2 years, is enrolled in a home-based cardiovascular rehabilitation program following coronary artery bypass surgery, due to the significant distance from the rehabilitation center. At 3 weeks, the team observes a marked decrease in the number of reported exercise sessions.

Assessment. The CRAS questionnaire confirms a downward trend in adherence. A telephone conversation reveals significant social isolation ("I don't really have anyone to talk to since my wife died") and a GAD-7 score of 11 (moderate anxiety), which had not previously been formally assessed.

Integrated intervention plan.

(1) Psychosocial: referral for psychological evaluation; identification of a local support group for older adults.

(2) Adherence: introduction of behavioral nudges—short, scheduled phone calls twice a week, and a visual calendar on the refrigerator to check off completed exercise sessions.

(3) Family involvement: contacting, with the patient's consent, a close relative to arrange for more frequent visits during the active phase of the program.

Progress at 3 months. Participation in at-home exercise sessions increased from 30% to over 80% of scheduled sessions, and the patient reported a subjective improvement in mood, attributed in part to social reconnection through the local support group.

12. FUTURE DIRECTIONS AND CONCLUSIONS

OBJECTIVES

- To describe emerging research directions regarding the personalization of psychosocial and nutritional interventions.
- To explain, at an introductory level, the potential role of artificial intelligence in predicting the risk of non-adherence.
- To synthesize the key principles of integrating the three pillars into a checklist applicable in daily practice.

12.1 Emerging Research on the Personalization of Psychosocial and Nutritional Interventions

An increasingly explored direction in recent literature is the shift from standardized interventions, uniformly applied to all patients, toward a "behavioral precision medicine" approach — phenotyping patients based on psychosocial criteria (e.g., the presence or absence of Type D personality), behavioral criteria (adherence trajectory observed in the first few weeks), and nutritional criteria (baseline MNA/GNRI status), in order to more effectively direct the team's limited resources toward patients most likely to benefit from an intensive intervention.

Similarly, research on reducing the consumption of ultra-processed foods during cardiovascular recovery suggests that future nutritional interventions will likely combine classic recommendations based on food groups with more specific targets related to the degree of processing—a relatively new direction compared to the classic approach based exclusively on the Mediterranean diet.

12.2 Artificial Intelligence and Predictive Analysis of Non-Adherence Risk

The use of predictive models based on longitudinal data (attendance at sessions, questionnaire responses, data from mobile apps) for the early identification of patients at high risk of dropout represents an active area of research, complementary to adherence trajectories. Although these tools are not yet part of routine clinical practice in most centers, master's students in clinical training should be familiar with the basic principle: the earlier the intervention is targeted at patients at real risk of dropping out, the greater the chances of success for the recovery program.

PRACTICAL NOTE

Regardless of the level of technological sophistication available at your center, the basic principles remain the same: systematic assessment, longitudinal monitoring, and early intervention tailored to the patient's individual profile.

12.3 Conclusions and Practical Recommendations for the Cardiovascular Rehabilitation Team

This chapter has proposed an integrated framework for incorporating psychosocial factors, nutritional components, and adherence monitoring into the cardiovascular rehabilitation program, based on the premise that these three pillars cannot be treated in isolation without compromising the program's overall clinical outcomes.

Table 12 . Practical wrap-up checklist—key principles of the manual

Area	Practical principle to remember
Assessment	Incorporate psychosocial, nutritional, and adherence screening as a standard part of the initial assessment, not as an optional add-on.
Psychosocial	Look beyond depression and anxiety—Type D personality and social isolation are independent risk factors.
Nutritional	A normal or elevated BMI does not rule out the risk of malnutrition or sarcopenia—use structured tools (MNA/GNRI).
Adherence	Measure adherence as "number of sessions completed," not as a binary variable "participates/does not s participates."
Integration	Develop a single, integrated plan with SMART goals for each pillar, reviewed at regular intervals.
Team	Clearly designate a patient "navigator" responsible for coordinating information among team members.

KEY POINTS

Quality cardiovascular recovery is not measured solely by improved exercise capacity, but by the extent to which the patient is able to maintain, in the long term, a balanced psychological state, healthy eating habits, and consistent adherence to treatment—the three pillars of this manual.

APPENDICES

A. Appendix A — Initial Psychosocial Assessment Form (PHQ-9 / GAD-7 / Type D — template)

Sample structured form for recording psychological screening scores upon admission to the recovery program.

Table 13 . Worksheet — Initial Psychosocial Assessment

WORKSHEET — Initial Psychosocial Assessment	
Patient ID	Patient ID: _____ Date: _____
PHQ-9 (total score)	____ / 27 points → interpretation: _____
GAD-7 (total score)	____ / 21 points → interpretation: _____
Type D Scale (DS14)	Negative affect: ____ Social inhibition: ____
Social Support Network	Lives alone: Yes / No Contact person: _____
Referral Decision	No referral / Basic counseling / Referral to a psychologist or psychiatrist

B. Appendix B — Nutritional Status Assessment Questionnaire (MNA / GNRI — template)

Template for calculating nutritional indices and classifying the patient into risk categories.

Table 14 . Worksheet — Initial Nutritional Assessment

WORKSHEET — Initial Nutritional Assessment	
Weight / Height	Weight: ____ kg Height: ____ cm BMI: ____ kg/m²
Waist Circumference	____ cm
MNA Score	____ / 30 points → ≥24 normal / 17–23.5 at risk / <17 malnutrition
GNRI (if available)	____ → >98 no risk / 92–98 low risk / <82 major risk
Grip strength	____ kg (dominant hand)
Initial nutritional plan	Basic education / Consultation with a dietitian / Special monitoring

C. Appendix C — Adherence Monitoring Form (CRAS / MMAS-8 — template)

Sample questionnaire to be administered periodically to track adherence to exercise and treatment.

Table 15 . Exercise Worksheet — Adherence Monitoring (to be administered at 4/8/12 weeks)

WORKSHEET — Adherence Monitoring (to be used at 4/8/12 weeks)	
Scheduled / Completed Sessions	____ / ____ sessions (current week)
CRAS Score	____ points
MMAS-8 Score	____ / 8 points → ≥6: high adherence / <6: low adherence
Reported barriers	Time / Transportation / Financial / Psychological / Other: _____
Observed trend	Consistently high / Increasing / Decreasing / Fluctuating
Proposed action	_____

D. Appendix D — Motivational Interviewing Guide for the Recovery Team

Step-by-step structure of a brief motivational discussion, applicable during a recovery session.

Table 16 . Worksheet — Quick Guide to Motivational Interviewing (10 minutes)

WORKSHEET — Quick Guide to Motivational Interviewing (10 minutes)	
1. Opening	Open-ended question about the patient's perception of the program.
2. Reflective Listening	Rephrase what you've heard without immediately correcting or judging.
3. Exploring Ambivalence	Ask what would make taking the next step easier.
4. Supporting self-efficacy	Explicitly acknowledge any progress that has already been made, no matter how small.
5. Concrete Plan	Set a single, small, specific step for the coming week.

E. Appendix E — Integrated SMART Goals Plan (completed template)

Annotated example of an individual plan, with goals across the three pillars: psychosocial, nutritional, and adherence.

Table 17 . Sample Integrated SMART Goal Plan — Completed for a Hypothetical Patient

Pillar	**SMART Goal**	**Term**	**Monitoring Method**
Psychosocial	Diaphragmatic breathing for 5 minutes, 2 times a day	4-weeks	GAD-7 reassessment
Nutritional	2 servings of vegetables at dinner, daily	4 weeks	Food diary
Adherence	Use of the weekly compartmentalized container	8 weeks	Check at each visit + MMAS-8

F. Appendix F — Final Chapter Self-Assessment (Review Questions)

1. What are the five basic components of a modern cardiovascular rehabilitation program, according to the 2024 AHA/AACVPR update?

2. Name three psychological screening tools applicable to cardiac patients and their indicative alert thresholds.

3. What is Type D personality, and why is it relevant beyond classic depression and anxiety?

4. Explain the difference between the MNA and the GNRI as nutritional assessment tools.

5. Why does the Mediterranean diet combined with a reduction in ultra-processed foods, according to the DIABEPIC Reform study, offer greater benefits than the separate application of each strategy?

6. Define the three dimensions of adherence in cardiovascular rehabilitation.

7. What is a behavioral nudge, and give an example of its application to home-based recovery.

8. Describe the structure of a SMART goal, providing an example for each of the three pillars of the manual.

9. What is the role of the patient's "navigator" in the multidisciplinary cardiovascular rehabilitation team?

10. List three common organizational barriers that limit access to psychosocial screening in rehabilitation programs.

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CHAPTER 2. CARDIOVASCULAR RECOVERY IN THE ELDERLY

Ana-Maria Pah

Today, the elderly patient with cardiovascular disease is the most common profile encountered in cardiovascular rehabilitation services. These patients typically have multiple comorbidities, take multiple medications, have reduced functional reserve, and define therapeutic success less by "numbers" and more by autonomy: climbing stairs on their own, going to the market, caring for their grandchildren, and avoiding falls. Cardiovascular rehabilitation (CR) is the intervention with the strongest evidence base for achieving these goals, yet it remains underutilized precisely among the elderly, women, and frail individuals.

Objectives:

- to conduct a structured initial assessment of elderly cardiac patients, including geriatric components (frailty, cognition, mood, nutrition, and fall risk);
- to administer and interpret simple functional tests (6MWT, SPPB, TUG, grip strength) and integrate the results into a risk stratification;
- formulating, together with the patient, SMART goals and an individualized recovery plan;
- prescribing and designing a multicomponent exercise program (aerobic, strength, balance, flexibility, respiratory) using the FITT-VP principles;
- monitoring safety during the session and recognizing signs that exercise should be stopped;
- properly managing emergency situations (hypotension, hypoglycemia, arrhythmia, cardiac arrest);
- providing therapeutic education and integrating nutritional, psychosocial, and adherence interventions;

1. FUNDAMENTALS OF CARDIOVASCULAR REHABILITATION IN THE ELDERLY PATIENT

Objectives:

• to describe the physiological changes in the cardiovascular system that occur with age and their implications for exercise;

• defining frailty, sarcopenia, and multimorbidity and their importance in the approach to rehabilitation;

• list the components of a comprehensive CR program and its documented benefits;

1.1. Aging of the Cardiovascular System and Functional Implications

Aging is not a disease, but it profoundly alters how the heart and blood vessels respond to exercise. Large arteries become stiffer, which increases systolic blood pressure and left ventricular afterload. The myocardium becomes thicker and less compliant, so that diastolic filling depends more on atrial contraction and sufficient filling time. The response to beta-adrenergic stimulation decreases, so the maximum heart rate and exercise ejection fraction increase less than in young adults. Peripherally, muscle mass and strength, capillary density, and mitochondrial capacity decrease, and baroreceptor reflexes become slower, with a tendency toward orthostatic and postprandial hypotension.

The practical consequence is a progressive decline in maximal aerobic capacity (VO_2 max) and functional reserve. In the elderly, the threshold between independence and dependence can be crossed even by a trivial acute illness or a period of immobilization. Therefore, the goal of cardiac rehabilitation is not only to treat heart disease but also **to restore functional reserve**.

Table 18 . Age-related cardiovascular changes and practical implications

Change	Functional consequence	Implication for the program
Arterial stiffness, elevated systolic blood pressure	High postpartum blood pressure, wide blood pressure fluctuations	Measure blood pressure before, during, and after exercise; avoid prolonged isometric exercise
Diastolic dysfunction, left ventricular hypertrophy	Low tolerance for tachycardia and dehydration	Long warm-up, slow progression, adequate hydration
Diminished beta-adrenergic response	Lower maximum heart rate, less reliable exercise heart rate	Use RPE (Borg scale) in conjunction with HR
Sarcopenia, decreased strength	Early fatigue, risk of falls	Strength training is mandatory, not optional
Diminished baroreflex	Orthostatic hypotension	Slow transitions; blood pressure upon standing during evaluation
Decreased maximal VO2	Functional threshold close to daily activities	Functional goals (stairs, shopping, grandchildren), not just numbers

1.2. Epidemiology of Cardiovascular Diseases in Older Adults

Cardiovascular diseases remain the leading cause of death in Europe, and the prevalence of most of them increases with age: ischemic heart disease, heart failure, atrial fibrillation, degenerative aortic stenosis, hypertension, and peripheral artery disease. Romania's population is aging rapidly, which means that an increasing proportion of patients in cardiology and rehabilitation services are over 70 years old. Many of them have two or more cardiovascular conditions simultaneously.
Although they stand to benefit greatly, older adults are referred to cardiac rehabilitation (CR) less frequently and are more likely to drop out of the program. Common reasons include a lack of active referral by the physician, transportation difficulties, costs, fear of exertion, comorbidities, and the lack of a tailored program.

The 2026 ESC Guidelines confirm this underutilization: in international surveys, between 9% and 50% of eligible patients participate in cardiac rehabilitation, and in Europe, on average, there is one rehabilitation spot for every seven patients who need it. Older adults remain underrepresented, partly due to clinicians' assumptions—unsupported by available evidence—that they would benefit less than younger patients.

1.3. Frailty, Sarcopenia, and Multimorbidity

Frailty is a syndrome characterized by increased vulnerability to stressors, with an increased risk of falls, hospitalization, dependency, and death. It can be identified using the Fried phenotype (unintentional weight loss, exhaustion, grip weakness, slow gait, reduced physical activity; ≥3 criteria = frail) or the Clinical Frailty Scale (CFS), a 9-point scale based on clinical judgment.

Sarcopenia refers to a decrease in muscle strength and mass and is easily assessed through grip strength and walking speed. **Multimorbidity** (≥2 chronic diseases) and **polypharmacy** (typically ≥5 medications) complicate assessment and prescribing. The important point is that frailty and sarcopenia are, to a large extent, **modifiable** through multicomponent physical exercise and adequate nutrition. Thus, the frail patient is not excluded from RC but is the one who needs it most, with lower doses, slower progression, and an emphasis on strength and balance.

The 2026 ESC Guidelines take the same approach: RE in frail patients must be individualized and progressive, prioritizing **safety and function over intensity**, and accompanied by nutritional, cognitive, and emotional interventions. There is evidence that RC may be most beneficial precisely

in physically frail patients, but these patients are less likely to attend the program; the guidelines conclude that RC is feasible, safe, and effective in frailty and multimorbidity. Recent reviews show that frailty and sarcopenia share common mechanisms (low-grade chronic inflammation, hormonal decline, mitochondrial dysfunction, oxidative stress) and that both can be influenced by exercise.

Table 19 . Adapting the approach based on the level of frailty (guideline)

Profile	**Examples**	**Program Focus**
Robust / fit (CFS 1–3)	Independent, active, plays sports	Standard program; can progress to moderate-to-high intensity
Vulnerable / mild frailty (CFS 4–5)	Slowed down, needs assistance with complex tasks	Strength and balance are just as important as aerobic exercise; short sessions, breaks
Moderate frailty (CFS 6)	Assistance with dressing and bathing	Seated or supported exercises; short intervals; independence goals
Severe frailty (CFS ≥7)	Dependence on personal care	Mobility training, prevention of deconditioning; individualized decision-making with the team and family

1.4. Definition, Components, and Benefits of Cardiovascular Rehabilitation

Cardiovascular rehabilitation is a **complex, multidisciplinary**, **and personalized** intervention that begins following an acute event or in the context of chronic disease and aims to optimize physical, psychological, and social well-being, stabilize or slow the progression of the disease, and reduce the risk of future events. The EAPC position paper lists the following as key elements: patient assessment, exercise prescription and monitoring, risk factor management, nutritional counseling, psychosocial intervention, education, and support for adherence and self-care [1].

Meta-analyses show that exercise-based rehabilitation improves functional capacity and quality of life and reduces hospitalizations in patients with coronary artery disease, with evidence of reduced cardiovascular mortality, particularly in longer-term follow-ups. In heart failure, RE improves exercise tolerance and quality of life [2,3,4].

The 2026 ESC Guidelines add two important points. First: physical training in a rehabilitation center reduces mortality, hospitalizations, or major cardiovascular events in coronary syndromes and heart failure, and this effect cannot be achieved through medication alone. Second: there is a **dose–response relationship**, meaning that the more sessions a patient attends, the greater the benefit, with no clear plateau observed in the range encountered in clinical practice; therefore, completing the program and attending the prescribed sessions are considered key indicators of quality.

Key Points

• RC is a package of interventions, not just “exercise.”

• Physical exercise is the component with the strongest evidence, but it works best in combination with education, nutrition, risk factor management, and psychological support.

• For older adults, the primary goal is functional autonomy and the prevention of falls and readmissions.

1.5. Current Evidence and Recommendations from International Guidelines (2021–2026)

The table below summarizes recent guidelines directly relevant to the rehabilitation program for older adults. They are a required resource for master's students and should be consulted in their entirety.

Table20 . Recent guidelines and documents relevant to rehabilitation in older adults

Document	Practical Tips
ESC 2026 – Cardiac Rehabilitation	The first ESC guideline dedicated to cardiac rehabilitation: frailty is an indication for cardiac rehabilitation (Class I) and not a contraindication (Class III); individualized multimodal program; quality indicators
ESC 2026 – Heart Failure	Personalized physical training as part of cardiac rehabilitation is recommended for stable patients (Class I); assessment of frailty; cardiac rehabilitation in decompensated heart failure after stabilization
ESC/EACTS 2025 – Valvular Diseases	The age threshold for TAVI in aortic stenosis with a tricuspid valve has been lowered from 75 to 70 years, so an increasing number of elderly patients are referred to rehabilitation after TAVI
EAPC 2025 – Sarcopenia in cardiovascular diseases	Dedicated strength training, along with endurance training, plus adequate nutritional and protein intake; evidence from cardiovascular diseases is still limited
ESC 2021 – Prevention of Cardiovascular Diseases	Regular physical activity at any age; a Mediterranean-style diet; smoking cessation; an individualized approach for older adults
ESC 2020 (published 2021) – sports cardiology and exercise in cardiovascular disease	Exercise prescription by disease; pre-program assessment; precautions and contraindications
EAPC 2021 – Secondary Prevention Through Cardiovascular Rehabilitation	RC components, stratification, multidisciplinary programs, equitable access
EAPC 2021 – Telerehabilitation	Remote and hybrid models as alternatives or complements
ESC 2021/2023 – heart failure (replaced by the 2026 guidelines); AHA/ACC 2022; JACC 2021	Physical exercise recommended for stable patients; tailored and supervised programs
ESC 2023 – ACS; ESC 2024 – CCS; AHA/ACC 2023 – CCD	Exercise-based rehabilitation following a coronary event and revascularization
ESC/EACTS 2021 – valvular heart disease	Decision-making framework for intervention; HR after valvular procedures
ESC 2024 – atrial fibrillation; hypertension; peripheral arterial disease	Physical activity as part of management; supervised walking therapy for claudication
ICFSR 2021 – Exercise in Older Adults	Multicomponent program: aerobic + strength + balance + flexibility; adaptation to frailty
Global Guidelines – Fall Prevention 2022	Balance and strength training reduces the risk of falls; multifactorial assessment
ESPEN 2022 – geriatric nutrition	Adequate protein and energy intake, hydration, screening for malnutrition

1.6. The 2026 ESC Guidelines on Cardiac Rehabilitation: Messages for Older Patients

The 2026 ESC Guidelines on Cardiac Rehabilitation (Bäck, Wilhelm et al., published on August 28, 2026) are the first guidelines from the European Society of Cardiology dedicated entirely to cardiac rehabilitation (CR). They are not written specifically for older adults, but they recognize that many patients are older and frail and provide explicit recommendations for them. The table below summarizes the key messages; the evidence class and level are those from the guidelines, where indicated. Where the guidelines use the phrasing "should be considered" (Class IIa), we have retained it as is.

Table 21 . Key messages from the 2026 ESC guidelines relevant to older patients

Guideline Message	Class / Level	What this means in practice
CR is recommended for frail patients with an indication for CR, to improve frailty	I / B2	Frailty is a treatment target, not an exclusion criterion
CR should not be denied to a patient with an indication due to frailty or comorbidities	III / C	We do not "screen out" older adults; we adapt the program
CR for frail patients or those with comorbidities is tailored individually and managed by a multidisciplinary team to ensure safety, efficacy, and adherence	I / C	Joint plan with a geriatrician, clinical pharmacologist, or other specialists as appropriate
Management of frailty as part of CR should be considered	IIa / B2	Strength, balance, and nutritional, cognitive, and emotional support within the same program
Early initiation of CR	I / C	After SCA, ideally within the first 14 days and no later than 30; after CABG, within 28 days, not exceeding 42
Patient-centered delivery, using multiple modalities (face-to-face, virtual, remote)	IIa / C	Offer the patient a choice: center, home, or hybrid
Activity monitors (pedometers, wristbands) as part of CR	I / B1	Increase the number of steps and the level of daily activity
Reduce time spent being sedentary	IIa / B2	Take movement breaks every hour spent sitting
Nutritional interventions (high-protein diet and/or supplements) for older adults at risk or with low muscle mass; screening for malnutrition and sarcopenia	should be considered (IIa)	MNA-SF, weight, and grip strength at baseline
Phase II programs are conducted according to EAPC standards for structure, process, and outcome	I / C	Attendance at sessions and program completion are tracked as indicators

Practical Note

Key takeaway from the guideline: for frail older adults, the program prioritizes **safety and function over intensity**. Specifically: individualized sessions, slow progression, strength and balance as important as aerobic exercise, plus nutrition and psychological support.

1.7. Recent clinical studies (2021–2026) in older adults with cardiovascular disease

Beyond the guidelines, what matters is what studies conducted on real older adults show: those who are frail, have multiple comorbidities, and are often recovering from decompensation or a medical procedure. The table below summarizes relevant recent studies. Their level of evidence varies widely, ranging from multicenter randomized trials to feasibility studies and conference abstracts, and this should be considered alongside the results [5,6,7,8,9].

Table 22 . Recent clinical studies in elderly patients (selection)

Study	Patients	Intervention and primary outcome	Limitations
REHAB-HF (2021)	349 patients hospitalized with decompensated heart failure; mean age 73 years; 97% frail or pre-frail	Individual rehabilitation (strength, balance, mobility, endurance), initiated in the hospital or immediately after discharge, consisting of 36 outpatient sessions. Significantly greater improvement in physical function (SPPB at 3 months) compared to usual care	Hospitalizations and deaths remained common in both groups
REHAB-HF, secondary analysis (2025)	Elderly patients hospitalized with acute heart failure and functional sarcopenia	The 2026 ESC Guidelines state that early intervention prevents sarcopenia and frailty	Secondary analysis of a trial; generates hypotheses
Tele-ADHF (2026)	87 patients enrolled, 64 randomized, frail older adults following decompensation	18 weeks of multidisciplinary telerehabilitation (in-hospital sessions, weekly video coaching, video consultations with a dietitian and psychologist) plus remote monitoring. At 26 weeks, the proportion with "good" SPPB scores increased from 70% to 83%, compared to 48% → 46% in the control group; adherence 90%; no significant difference in quality of life	Conference abstract; small sample size
Vivifrail Program following cardiac y (2026)	38 patients ≥75 years old with SPPB <9; 29 evaluated at 6 weeks	Multicomponent home-based program (strength, balance, mobility). Feasible; clinically relevant improvements in physical performance at 6 weeks; average completion rate of 54%	Feasibility study, uncontrolled, single-center
RC after TAVR in chronic HF (2025)	60 patients with chronic heart failure after TAVR	12 weeks of personalized exercise based on cardiopulmonary testing, compared to conventional CR. Better anaerobic thresholds, peak VO2, 6MWT distance, and MLHFQ score in the exercise group	Small sample size, single-center, open-label

Recent reviews point in the same direction: the 2026 review on exercise rehabilitation in frailty and sarcopenia and the 2025 EAPC statement recommend dedicated strength training, alongside endurance training, and adequate nutritional intake (especially protein); however, both emphasize that high-quality studies in cardiac patients with confirmed sarcopenia are still scarce [10,11,12].

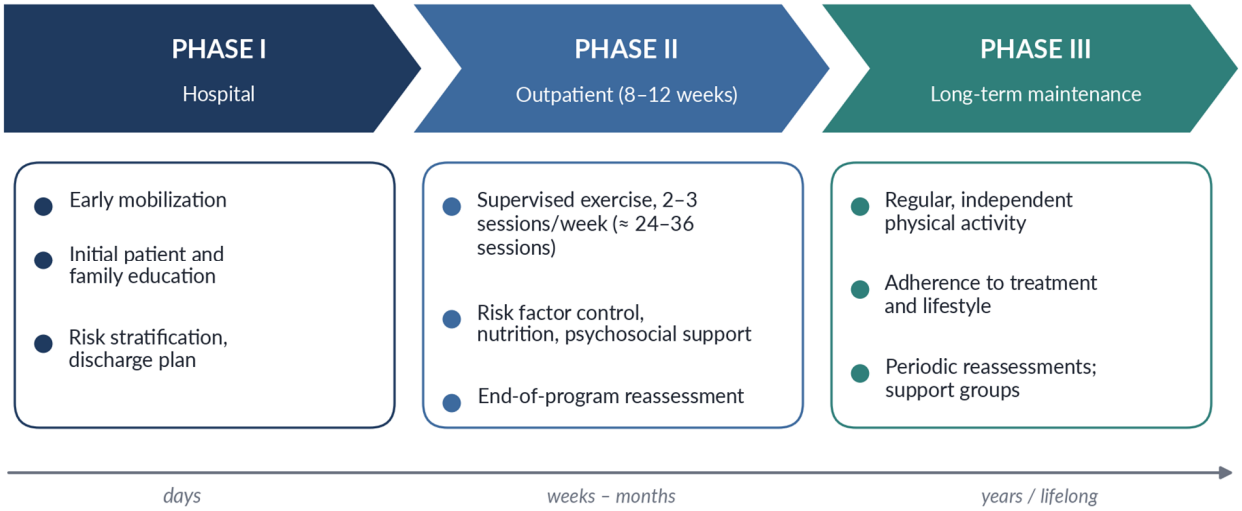


Figure 21 . Stages of cardiovascular recovery: from the hospital to long-term maintenance.

Food for thought

Think of an older patient you have known (in your family or in your practice). What would "recovered" mean to him? How would his goal differ from that of a 50-year-old patient?

2. THE ORGANIZATIONAL, ETHICAL, AND LEGAL FRAMEWORK OF THE CLINICAL ROTATION

Objectives:

- to describe the roles within the multidisciplinary team and the limits of the master's student's responsibility;
- to distinguish the phases of rehabilitation and the indications for inclusion;
- to list temporary, relative, and absolute contraindications to exercise;
- explain the principles of informed consent and personal data protection;
- to verify the equipment and safety conditions of the recovery room.

2.1. The Multidisciplinary Team and the Role of the Master's Student

Rehabilitation is a "team sport." Each member contributes a piece of the puzzle, and the patient is at the center as an active partner. The 2026 ESC Guidelines list the geriatrician, occupational therapist, and clinical pharmacologist among the possible members of the team and consider the presence of the geriatrician particularly important for elderly patients.

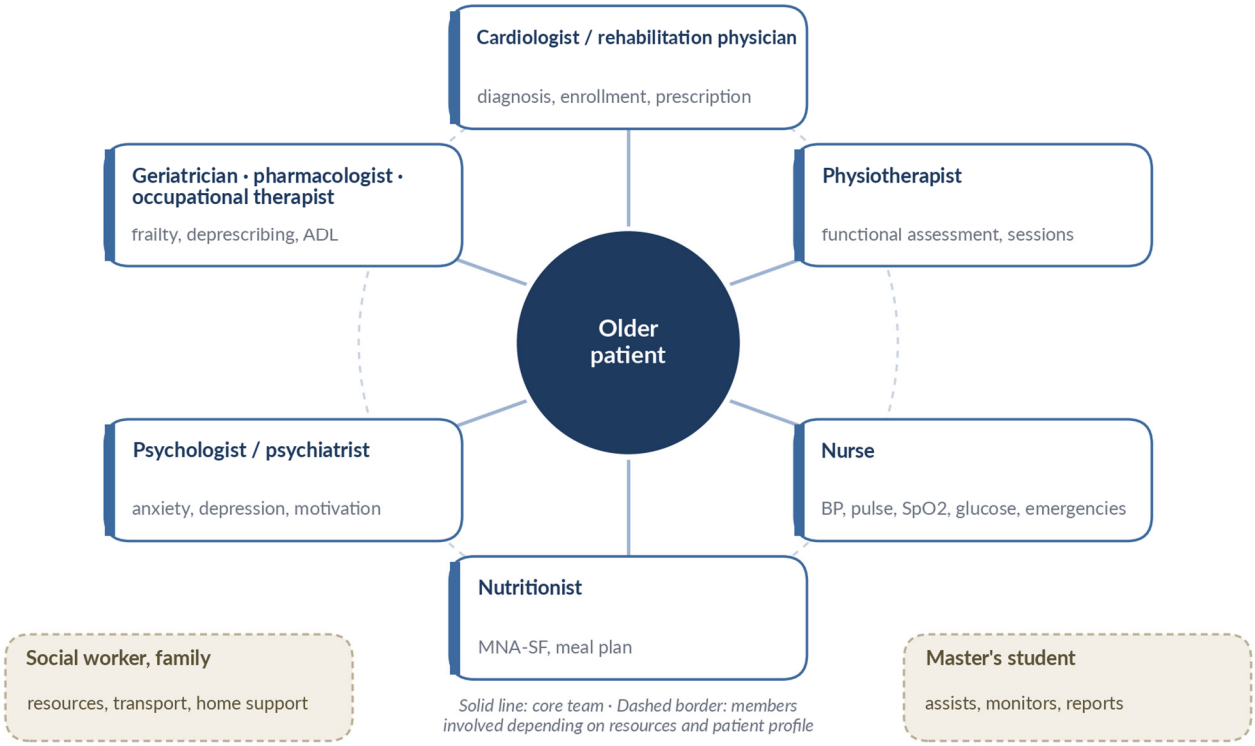


Figure 22 . The multidisciplinary cardiovascular rehabilitation team, centered around the patient.

Table 23 . Team roles and interaction with the master's student

Member	Primary Role	What the master's student does
Cardiologist / Rehabilitation Physician	Diagnosis, treatment, decision to enroll, stratification, medical prescription	Presents the case, receives instructions, reports any clinical changes
Physical Therapist	Functional assessment, exercise prescription, and leading exercise sessions	Assists, performs demonstrated exercises, monitors the patient
Nurse	Measurements, monitoring, medication, emergencies	Assists with measuring blood pressure, pulse, SpO2, and blood glucose

Member	**Primary Role**	**What the master's student does**
Nutritionist / Dietitian	Nutritional assessment and meal plan	Conducts screening (MNA-SF) and reports findings
Psychologist / Psychiatrist	Assessment of anxiety and depression; provides psychological support	Identifies emotional symptoms, supports motivation
Geriatrician, clinical pharmacologist, occupational therapist	Geriatric assessment, medication review (deprescribing), adaptation of daily activities	Identifies frailty, polypharmacy, cognitive impairment, or difficulties with ADL
Social worker, family, caregivers	Social resources, transportation, home- e support	Identify the patient's barriers and resources

2.2. Phases of Cardiovascular Recovery

The classic model describes three phases, although the names and durations vary by country and healthcare setting.

Phase I takes place in the hospital, following the acute event or procedure, and consists of early mobilization, assessment, education, and preparation for discharge.

Phase II is a supervised outpatient program, typically lasting 8–12 weeks with 2–3 sessions per week, during which most of the assessment, supervised exercise, and education take place.

Phase III (maintenance) is the long-term continuation of an active lifestyle, in the community or at home, with periodic contact with the team.

The timing of initiation is important. The 2026 ESC Guidelines recommend early initiation: after an ACS, ideally within the first 14 days and no later than 30 days; after CABG, within 28 days and no later than 42 days; in decompensated heart failure, after decongestion and hemodynamic stabilization, when discharge is considered possible and medication has been initiated. The median duration of exercise programs reported in studies is 3–4 months. The common principle is continuity: the patient should not "fall between phases." An important part of the training program consists of preparing for the transition between phases.

2.3. Indications, Contraindications, and Inclusion Criteria for the Program

Candidates for CR include patients who have experienced acute coronary syndrome, undergone revascularization (PCI, CABG), have stable heart failure, have undergone valvular procedures (surgery, TAVI), have atrial fibrillation, peripheral arterial disease, hypertension, chronic coronary artery disease, and, in general, patients at high cardiovascular risk. Advanced age **is not** a contraindication, and the 2026 ESC guidelines explicitly state that frailty and comorbidities should not be reasons to deny CR to a patient with an indication (Class III).

Contraindications are, for the most part, **temporary**: once the underlying cause is corrected, the patient can subsequently be included in the program. The list below is for guidance only; the decision rests with the physician.

Table 24 . Situations in which exercise testing is postponed or contraindicated (based on Table 4 of the 2026 ESC guidelines)

Category	Examples
Contraindications for exercise testing and training	Early phase after ACS (first 2 days); untreated life-threatening cardiac arrhythmias; decompensated heart failure during the period of hemodynamic instability; recent embolism; thrombophlebitis; acute myocarditis or pericarditis; symptomatic aortic stenosis; acute systemic disease; intracardiac thrombus
Contraindications for exercise	Progressive worsening of exercise tolerance or dyspnea at rest over the past 3–5 days; significant ischemia at very low exertion (<2 METs, <50 W); uncontrolled diabetes; uncontrolled hypertension
High-risk situations during exercise (require close monitoring, often ECG- , and lower intensity)	Weight gain >1.8 kg in 1–3 days; decrease in systolic blood pressure during exercise; NYHA Class IV; complex ventricular arrhythmia; resting heart rate in the supine position >100/min; advanced atrioventricular block; de novo atrial fibrillation/flutter ( ); critical coronary stenosis; hypertrophic cardiomyopathy with severe obstruction; preexisting comorbidities that limit exercise
Age-Specific Considerations (Case-by-Case Decision)	Frailty and comorbidities are **not** contraindications; they require lower doses and closer monitoring. Very high resting blood pressure values (e.g., ≥200/110 mmHg) and other numerical thresholds are determined according to the department's protocol

Practical Note

Before each session, quickly check: **How is the patient feeling today?** (new symptoms, sleep, infection, medications taken, diet, blood glucose in diabetics) and resting vital signs (blood pressure, pulse, SpO2). These 2 minutes prevent most incidents

2.4. Informed Consent, Confidentiality, and Personal Data Protection

Participation in the program is based on **informed consent**: the patient receives clear explanations about the purpose, procedure, risks (rare but real), benefits, alternatives, and the right to withdraw at any time, and their decision is documented in writing, in accordance with patient rights legislation (Law No. 46/2003 in Romania). For patients with cognitive impairment, decision-making capacity is assessed, and, where appropriate, the legal representative or caregiver is involved, while still maintaining the patient's involvement to the extent possible.

Health data constitutes personal data subject to special rules. Its processing complies with Regulation (EU) 2016/679 (GDPR): only necessary data is collected, it is kept confidential, accessed only by authorized personnel, and used in master's theses only in anonymized form. The case studies in the practicum paper do not include names, personal identification numbers, addresses, exact dates of birth, or other identifiable information.

Practical Note

Anonymization rule: Replace names with "Patient A.B." or a code; replace age with a decade ("person aged 70–79") or a rounded age; remove the city, place of employment, and any detail that could lead to identification. Obtain consent from the department and the patient for the use of the data.

2.5. Safety Standards, Room Setup, and Monitoring Equipment

The recovery room must allow for direct supervision of all patients and rapid intervention. The recommended temperature is comfortable (approx. 20–23 °C), with good ventilation, non-slip flooring, adequate space between machines, and easy access to chairs for rest. Patients should wear closed-toe, stable footwear. Telemetry during exercise may be considered for high-risk patients to detect arrhythmias, ischemia, or abnormal hemodynamic responses.

Table 25 . ***Recovery Room Checklist***

Item	**To be checked before the session**
Resuscitation	Functional AED, emergency kit, oxygen, mask and ventilation bag, access to a phone (112 / internal number)
Monitoring	Validated blood pressure cuff, pulse oximeter, stopwatch, Borg scale displayed, telemetry or heart rate monitors, blood glucose meter
Exercise equipment	Exercise bikes, treadmill, stable chairs without wheels, resistance band, light dumbbells (0.5–3 kg), handrail, mats
Hygiene	Disinfecting equipment between patients, drinking water source
Documents	Patient chart, consent form, exercise plan, and emergency protocol must be readily available

Key points

- The team is led by a physician;
- Age is not a contraindication, and frailty does not justify refusing cardiac rehabilitation (ESC 2026 guidelines, Class III); contraindications are generally temporary and are reevaluated.
- Informed consent and data confidentiality are mandatory.

Daily checks asking “How are you feeling today?” and monitoring resting vital signs help prevent incidents

3. INITIAL ASSESSMENT OF THE ELDERLY PATIENT

Objectives:

- conducting a cardiovascular-focused medical history and clinical examination;
- applying the main geriatric assessment tools (ADL/IADL, frailty, cognition, mood, nutrition, balance);
- conducting and interpreting functional tests (6MWT, SPPB, TUG, grip strength) and understanding the role of CPET;
- to stratify risk and select the appropriate level of monitoring;
- identifying the patient's preferences and barriers.

The assessment serves as the program's "compass": the more comprehensive and accurately interpreted it is, the safer and more effective the treatment plan will be. For older adults, it must address **both cardiac and geriatric aspects simultaneously**. It is conducted over 1–2 visits, without rushing, in a quiet environment, with a caregiver present if the patient wishes.

3.1. Medical History and Cardiovascular-Focused Clinical Examination

The medical history focuses on: the cardiovascular diagnosis and the date of the event, current symptoms (angina, dyspnea, palpitations, syncope, edema, claudication), functional status in daily life (how many flights of stairs they climb, how far they walk, which activities they have stopped doing), comorbidities (diabetes, kidney disease, COPD, osteoarthritis, neurological disease), complete medication history (including over-the-counter medications), allergies, smoking and alcohol use, previous physical activity, falls in the past year, social support, and the patient's expectations.

The clinical examination includes: blood pressure in both arms (at the first visit), in the supine and standing positions (at 1 and 3 minutes), heart rate and rhythm, oxygen saturation, weight, height, body mass index, calf circumference, signs of congestion (edema, jugular vein distension, rales), cardiac auscultation, peripheral pulses, wound status (sternotomy, femoral puncture), and a brief musculoskeletal examination. Orthostatic hypotension is defined as a decrease in systolic blood pressure (SBP) of ≥20 mmHg or diastolic blood pressure (DBP) of ≥10 mmHg within the first 3 minutes of standing.

The 2026 ESC Guidelines emphasize that the medical history should also include lifestyle habits, cultural context, education, and social determinants of health; non-traditional risk factors (including sleep); risk factors specific to women (e.g., early menopause), and—with tact—screening for sexual function, which is recommended for cardiac patients of both sexes. For older patients, this information completes the functional and psychosocial picture.

3.2. Comprehensive Geriatric Assessment

A comprehensive geriatric assessment complements the cardiological picture. It does not require complicated tools: a few short, well-chosen scales provide crucial information for the treatment plan.

3.2.1. Functional Status and Activities of Daily Living (ADL/IADL)

ADL scales (e.g., Katz, Barthel) assess independence in dressing, bathing, toileting, eating, transferring, and continence. The IADL scale (Lawton) assesses complex activities: using the phone, shopping, cooking, taking medication, managing finances, and transportation. The results establish **the functional goal**: a patient who has difficulty shopping should prioritize walking long distances and carrying light loads.

3.2.2. Frailty (Fried Phenotype, Clinical Frailty Scale)

The Fried phenotype is based on five criteria; 1–2 criteria = pre-frail, ≥3 = frail. The CFS is completed following an interview and observation. Levels 1–3 indicate a robust person; level 4 indicates a vulnerable person; 5–6 indicate mild to moderate frailty; and 7–9 indicate severe frailty up to the terminal stage. Both instruments can be completed in 5–10 minutes and guide the intensity and type of program. The ESC 2026 Guidelines note that there is no standardized instrument for assessing frailty in the community and, following the EAPC position paper, recommend **the Edmonton Frail Scale** and **the 7-point Clinical Frailty Scale** as appropriate instruments; the HFA frailty score in the hospital setting is currently undergoing validation. Note that the CFS exists in

several versions (7- or 9-item); use the same version for both the initial assessment and re-evaluation. The SPPB battery remains a valuable tool for identifying physical limitations in older adults [13,14].

3.2.3. Cognitive Function and Affective State (MoCA, GDS)

The MoCA (maximum score of 30; a score below 26 suggests cognitive impairment) assesses attention, memory, language, and executive functions and determines how to explain the tasks (short instructions, demonstration, repetition). The Geriatric Depression Scale (GDS-15; a score >5 suggests depression) identifies patients who would benefit from psychological support; depression reduces adherence and increases cardiovascular risk and must be treated.

3.2.4. Nutritional Status (MNA-SF)

MNA-SF (0–14 points): 12–14 = normal nutritional status, 8–11 = risk of malnutrition, 0–7 = malnutrition. Unintentional weight loss, poor appetite, poor dental health, and social isolation are warning signs. In older adults, weight loss is more concerning than moderate overweight. The 2026 ESC Guidelines recommend screening for malnutrition, sarcopenia, and sarcopenic obesity using standard protocols, assessing body composition in patients with chronic kidney disease (CKD), and monitoring unintentional weight loss (especially >5%) in patients with heart failure to detect cachexia. The SARC-F questionnaire (strength, assistance with walking, rising from a chair, climbing stairs, falls) is a rapid screening tool for sarcopenia.

3.2.5. Risk of Falls and Balance Assessment

Patients are asked about falls in the past year and fear of falling, and the TUG test is administered; if necessary, the 4-position balance test (feet together, semi-tandem, tandem, one leg) is also performed. Reversible causes are investigated: orthostatic hypotension, excessive use of sedatives or antihypertensive medications, visual impairment, inappropriate footwear, and hazards in the home.

3.3. Paraclinical investigations (ECG, echocardiography, laboratory tests)

Useful findings for the evaluation: rhythm and rate (FiA, atrioventricular block, pacemaker), signs of ischemia, LVEF, and type of dysfunction (systolic/diastolic), severity of valvular disease, pulmonary artery pressure; Laboratory tests: hemoglobin, renal function (eGFR), potassium and sodium, blood glucose and HbA1c , lipid profile, NT-proBNP (in heart failure), INR (in patients on vitamin K antagonists). The 2026 ESC Guidelines add lipoprotein (a), if not previously tested, uric acid, and urinalysis.

3.4. Functional testing (6MWT, SPPB, TUG, grip strength, CPET)

Functional tests quantify the baseline and allow for monitoring progress. The cardiopulmonary exercise test (CPET) remains the standard for assessing exercise capacity, prescribing exercise intensity, and evaluating prognosis, but it is less accessible and is not always appropriate for frail older adults; In practice, field tests are frequently used. The 2026 ESC Guidelines confirm CPET as the gold standard, accept the 6MWT or another validated test when an exercise test is not available, and recommend including a maximum strength test in the functional assessment for prescribing strength training. For cardiac patients, the 10-repetition maximum (10-RM) test is preferred, from which 1-RM is estimated using formulas, to avoid the Valsalva maneuver. To assess change over time, use the clinically meaningful minimum differences (MCIDs): approximately 30 m on the 6MWT, 1 ml/kg/min for peak VO_2, and 5 points on the MLHFQ and KCCQ.

Table 26 . Functional Tests Useful in the Recovery of Older Adults

Test	What it measures	How it is performed (briefly)	Preliminary interpretation
6MWT	Submaximal functional capacity	Walk as far as possible in 6 minutes along a 30-meter corridor, with breaks allowed; record distance, RPE, heart rate, and SpO2	An increase of approximately 30 m is considered the minimum clinically significant difference (MCID); the distance depends on age and sex
SPPB (0–12)	Balance, walking speed, rising from a chair	3 subtests: balance in 3 positions, 4-meter walk, 5 chair stands	≤9 = impaired performance, risk of disability; ≤8 suggests sarcopenia/frailty
TUG	Mobility, dynamic balance	Stands up from a chair, walks 3 m, turns around, and sits back down; time is recorded	≥12 seconds suggests an increased risk of falling
Grip strength	Overall muscle strength	Hand dynamometer, best result from 3 attempts	Low values: <27 kg for men, <16 kg for women
Walking speed (4 m)	Functional reserve, prognosis	4-meter time trial, usual pace	≤0.8 m/s suggests sarcopenia/frailty

Practical note

Safe 6MWT: measure blood pressure and pulse before and after; offer standard encouragement ("You're doing great") without "pushing" the patient; stop the test if the patient experiences chest pain, severe shortness of breath, dizziness, pallor, cold sweats, or severe cramps in the lower limbs. Inform the patient in advance that they may slow down or stop, but should resume if possible.

3.5. Cardiovascular and Exercise Risk Stratification

Stratification combines clinical, functional, and laboratory data to determine **how closely** the patient should be supervised (number of supervised sessions, ECG monitoring, who leads the session) and **how quickly** they can progress. It is dynamic and is reassessed periodically.

Table 27 . ***Risk stratification—guideline model***

Level	Criteria (examples)	Supervision
Low	LVEF >50%, no significant ischemia or arrhythmias, good functional capacity (>7 METs), no symptoms on exertion, uncomplicated course	Initial monitoring, followed by a partial home care program
Moderate	LVEF 40–50%, symptoms on intense exertion, functional capacity 5–7 METs, comorbidities, mild frailty	Regular clinical supervision, blood pressure/pulse monitoring, occasionally ECG
High	LVEF <40%, symptomatic heart failure, complex ventricular arrhythmias, ischemia with minimal exertion, recent resuscitation, implantable devices, functional capacity <5 METs, moderate-to-severe frailty	Close supervision with ECG monitoring, very short sessions at the beginning

Advanced age, frailty, and comorbidities often place the patient in a higher risk category even if ventricular function is preserved. The clinical rule remains valid: **when in doubt, start with lower doses and increase gradually.**

3.6. Quality of Life, Patient Preferences, and Barriers to Participation

Quality of life can be assessed using brief instruments (EQ-5D, SF-12) or disease-specific questionnaires. Beyond the scores, the essential question is: **"What would you like to be able to do again?"** The answer becomes the focus of the treatment goals. Barriers are also explored: transportation, costs, family schedules, loneliness, fear of exertion (kinesophobia), pain, sensory deficits, lack of confidence in technology, and the need to care for a sick spouse. Each identified barrier has a possible solution (flexible schedule, home exercises, group sessions, transportation provided by family or the city).

Key Points

- The assessment of older adults with heart disease is **both** cardiological **and** geriatric.
- Five simple tests (6MWT, SPPB, TUG, grip strength, walking speed) provide a solid functional picture; frailty is assessed using the Edmonton Frail Scale or CFS, and nutritional screening includes the MNA-SF and SARC-F.
- Risk stratification determines the level of monitoring and the rate of progression.
- The patient's preferences and barriers matter just as much as the scores.

Clinical Case

Exercise: For a 76-year-old patient with recent ACS, hypertension, and a history of one fall in the past year, select 5 assessment tools and justify the order in which you would administer them during the first two visits.

4. SETTING GOALS AND PLANNING AN INDIVIDUALIZED PROGRAM

Objectives:

- implementing shared decision-making between the patient and the team;
- formulating SMART goals by domain (functional, clinical, psychosocial);
- designing an 8–12-week program with progressive training;
- adapting the plan to the patient's resources and social context;
- documenting the plan in a clear format that is accessible to the patient

4.1. Shared Decision-Making Between Patient and Team

The program works if the patient **understands** it**, wants it, and can carry it out**. Shared decision-making involves three steps:
(1) presenting the options and their benefits and risks in plain language,
(2) exploring the patient's values and preferences,
(3) choosing the plan together.

The "teach-back" method is used: the patient repeats in their own words what they have understood to verify their comprehension.

Practical Note

Useful questions: "What is most important to you over the next few months?", "What worries you most when you think about exercise?", "What can help you come regularly?" Write down the answers verbatim; they become goals and motivational strategies

4.2. Formulating SMART Goals (functional, clinical, psychosocial)

A SMART goal is Specific, Measurable, Achievable (realistic), Relevant, and Time-bound. For older adults, functional and autonomy-related goals take priority and are more motivating than those expressed in clinical terms.

Table 28 . Examples of SMART goals for older adults

Domain	Example of a Goal	Target indicator
Functional	"In 12 weeks, I want to climb 2 flights of stairs without stopping to visit my daughter"	Stairs climbed without stopping; 6MWT +40 m
Strength / Balance	"In 8 weeks, I want to be able to stand up from a chair 10 times in 30 seconds"	Number of stands; SPPB +1 point
Daily activity	"Walk for 30 minutes daily on 5 out of 7 days"	Walking log; pedometer
Clinical	"Resting blood pressure below 140/90 on 3 consecutive measurements"	Home blood pressure log
Nutrition	"Eat a source of protein at every meal"	Food diary; stable weight
Psychosocial	"Participate in the neighborhood walking group once a week"	Group participation; GDS score
Safety	"No falls in the next 3 months"	Fall diary; TUG <12 s

4.3. Program structure: duration, frequency, and phases

The standard Phase II program lasts 8–12 weeks, with 2–3 supervised sessions per week (approximately 24–36 sessions), supplemented by home-based activity on the other days, to achieve a total of 3–5 days per week of physical activity. For very frail patients, the duration may be longer, with shorter and more frequent sessions. The 2026 ESC Guidelines note that the benefit increases with the number of sessions attended (dose–response relationship), so regular attendance is a goal in itself; during the first few weeks, the number of exercises, sets, and repetitions can be gradually increased to help the patient become accustomed to the routine, and as the program progresses, the training shifts toward functional exercises related to the needs of daily life.

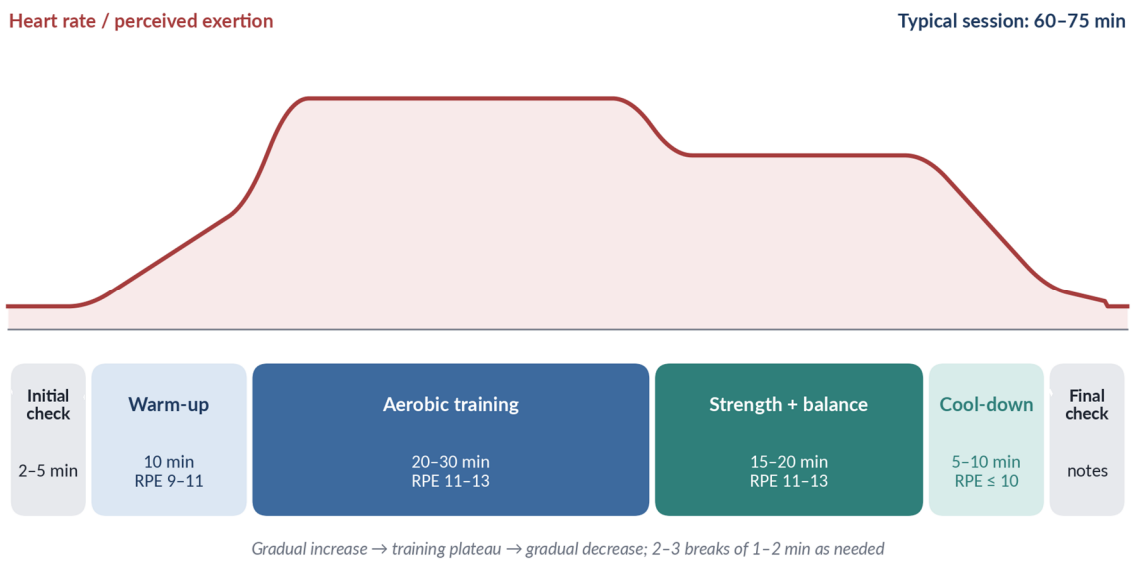


Figure 23 . Structure of a session: warm-up, aerobic training, strength and balance, cool-down.

Table 29 . 12-week progression model (guideline; customized for each individual)

Weeks	Objective	Aerobic (RPE 11–13)	Strength / Balance
1–2 (adaptation)	Technique training, endurance	10–15 min, possibly intermittent (2 min effort / 1 min rest)	1 set × 8 reps, very light load; balance with support
3–6 (development)	Increasing duration	20–30 min continuously or with short breaks	1–2 sets × 8–12 reps; balance with minimal support
7–10 (progression)	Increasing intensity/complexity	30–40 min, at the upper limit of the moderate zone	2 sets × 10–12 reps; balance without support, double loads
11–12 (consolidation)	Transition to maintenance	30–45 min, home workout	Strength program 2×/week, self-directed

4.4. Adapting the Program to the Patient's Social Context and Resources

The best program is the one that can actually be followed. Adjustments include: session times (avoiding peak hours, coordinating with medication schedules), transportation (group sessions with neighbors, programs near home), costs (exercises using household items: water bottles, a chair, stairs), support (a family member as an "exercise partner"), education, and language (materials with large print, pictures, and simple language). People who live alone may benefit from group sessions or regular phone contact.

4.5. Documenting the Rehabilitation Plan

The plan is documented on a **single form**, with a copy for the patient, which includes: diagnosis and risk, SMART goals, exercise prescription (FITT), restrictions and precautions, signs to stop the exercise, who to contact if problems arise, and dates for reevaluations. The template is provided in Appendix B. Clear documentation ensures continuity and protects both the patient and the team.

Key Points

- Decisions are made together with the patient; functional goals are the most motivating.
- SMART goals are measurable and time-bound.
- Standard program: 8–12 weeks, 2–3 supervised sessions + home exercises.
  A written plan, with a copy for the patient, is mandatory.

5. PRESCRIBING PHYSICAL EXERCISE FOR THE ELDERLY

Objectives:

- applying the FITT-VP principles to each type of exercise;
- planning warm-ups, aerobic training, strength training, balance exercises, flexibility exercises, and breathing exercises;
- adjusting intensity using the Borg scale, the talk test, and heart rate;
- safely progressing the program;
- monitoring the session and stopping the exercise when necessary

5.1. The FITT-VP Principles and Session Structure

International recommendations for older adults propose a **multicomponent program**: aerobic, strength, balance, and flexibility exercises, adapted to the patient's capacity and gradually progressed [15,16]. The prescription is described by FITT-VP: Frequency, Intensity, Time (duration), Type, Volume, and Progression [17].

Table 30 . Exercise prescription: the 2026 ESC guidelines and the starting point for frail older adults

Component	ESC 2026 guideline reference (SCA/CCS; chronic heart failure)	Frail/deconditioned older adults: starting point	Progression
Aerobic – frequency	≥3 to 5 days/week (IC: from 2–3 to 3–5)	2–3 supervised sessions + short daily walks	Duration first, then frequency
Aerobic – duration	30–60 min/session (CI: 15–30 to 45–60)	10–15 min, possibly intermittent (2–3 min of exercise / 1–2 min of rest)	+2–5 min every 1–2 weeks
Aerobic – intensity	Moderate and moderate-to-high; "moderate" = Borg 12–17 or 40–85% of heart rate reserve; in IC, moderate (sometimes low); at low capacity, start at ~40% of peak VO_2, then toward ventilatory threshold 1 (VT1)	RPE 11–13 (lower end of the range), talk test; below VT1	Toward VT1; HIIT only in selected patients
Strength	≥2 days/week; ≥2 sets/major muscle group, 12–15 reps (IC: 8–15); 30–70% 1-RM for upper limbs, 40–80% for lower limbs (IC: 40–60%)	2 days/week, 1 set × 8–12 reps, 30–40% 1-RM or RPE 11–13, functional exercises	Repetitions → sets → load
Balance	For frail individuals, incorporate training to prevent falls	≥3 days/week, 5–10 min, with support	Less support, dual tasks
Flexibility / Mobility	Part of a multi-component program	2–3 days/week, 10–30 s/position	Range of motion
Inspiratory muscles (IC)	3–5 times per week, 20–30 min, at 30% to 60% of maximum inspiratory pressure, if tolerated	Only as directed by a physician or physical therapist	Gradual increase in load

Two points from the 2026 ESC guidelines are worth noting. First: in programs for heart disease, approximately two-thirds of the session's duration is devoted to endurance, and strength

exercises are added to make up the remaining third. Second: for setting aerobic intensity, **ventilatory thresholds** (VT1, VT2) are preferred over a percentage of maximum effort (%peak HR, %HR reserve, %peak VO_2), because the same percentage produces very different physiological responses from one patient to another; classification based on metabolic equivalents (METs) is discouraged, and 4–6 METs represent a supramaximal effort for many cardiac patients. If respiratory gas analysis is not available, heart rate at VT1 and VT2 can be estimated from resting HR and peak HR.

Practical Note

Typical session (60–75 min): initial assessment (2–5 min) → 10-min warm-up → 20–30 min of aerobic exercise → 15–20 min of strength and balance training → 5–10 min cool-down → final assessment and scoring. 2–3 breaks of 1–2 minutes are recommended, if the patient needs them.

Warm-up and Cool-down

The warm-up prepares the cardiovascular and musculoskeletal systems and **is longer for older adults** (10 minutes). It includes light movement, joint rotations, and a gradual increase in exertion. The cool-down prevents a sudden drop in blood pressure after exercise and allows the heart rate to return to normal; it includes slow walking and stretching.

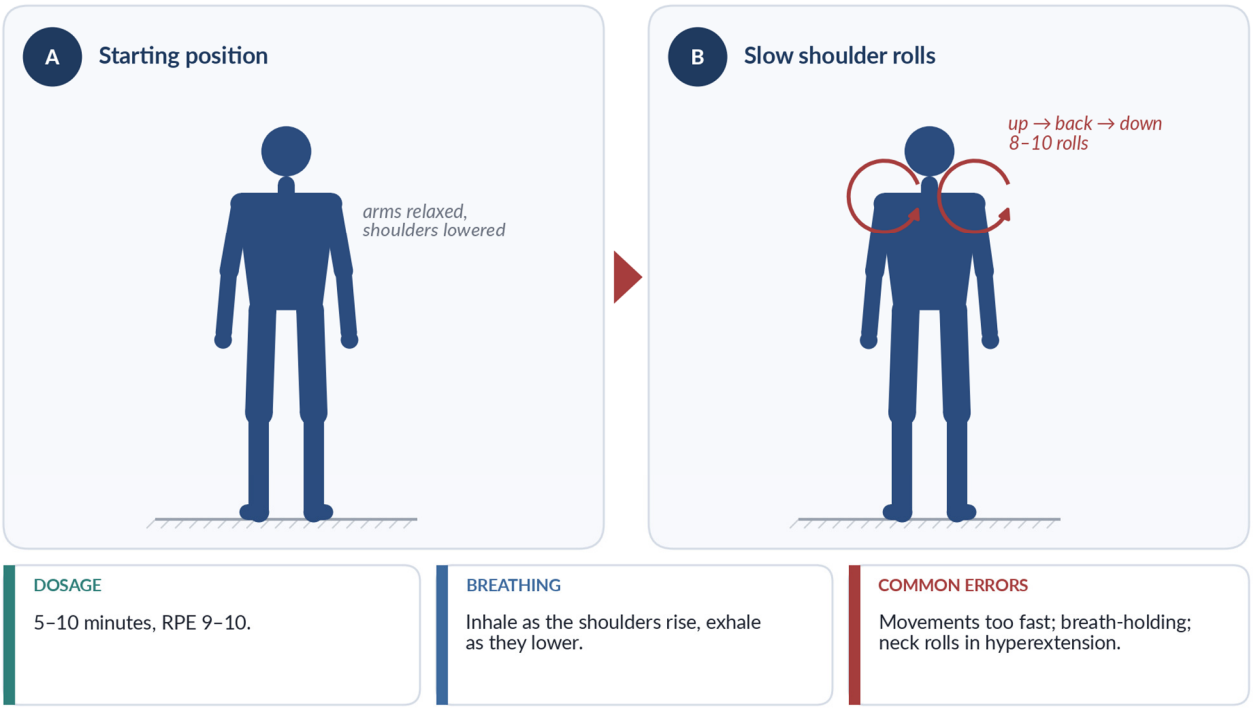


Figure 24 . Warm-up: shoulder rotations with calm breathing.

Table 31 . Exercise sheet—shoulder rotations and joint mobilization

Starting position	**Standing (or sitting), arms relaxed, looking straight ahead, shoulders down.**
Execution	Raise your shoulders toward your ears, bring them back, lower them; 8–10 slow rotations. Continue with ankle, hip, and neck rotations (small, pain-free).
Duration	5–10 minutes, RPE 9–10.
Breathing	Inhale as your shoulders rise, exhale as they lower.
Common Mistakes	Movements that are too fast; holding your breath; neck rotations in hyperextension.
Adaptation	Easier: sitting. Harder: rotations with arms bent and extended forward.

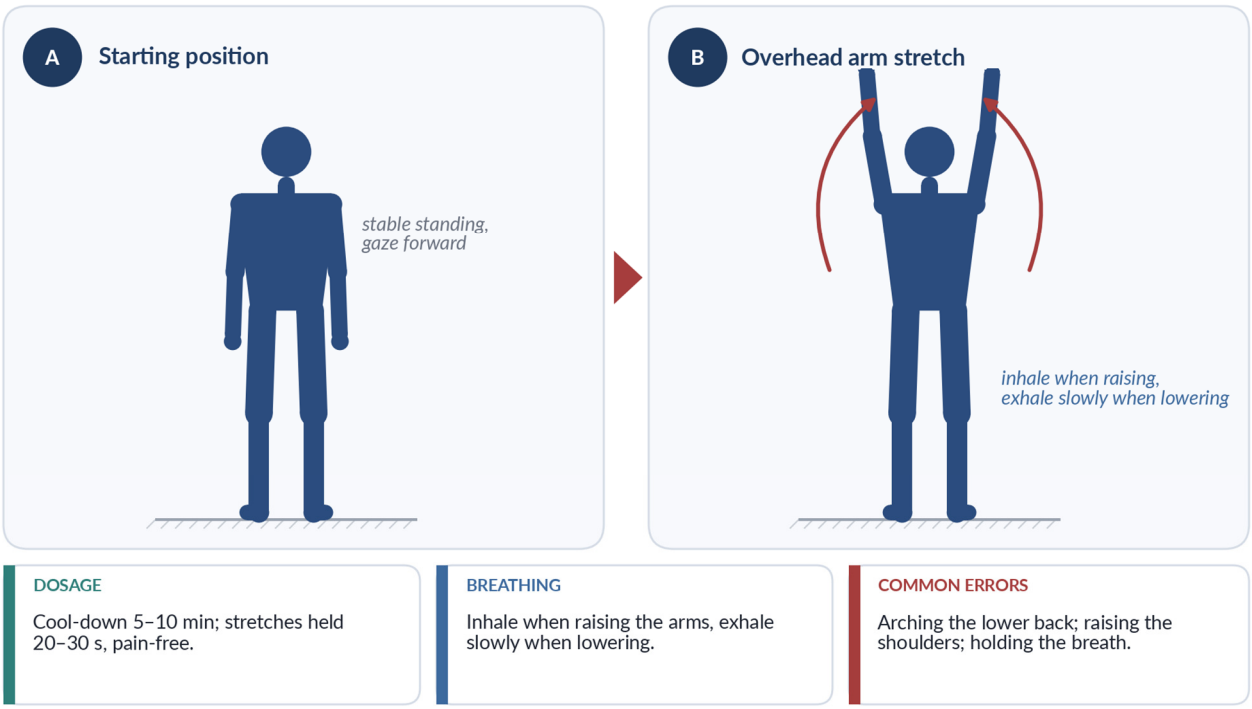


Figure 25 . Recovery: Stretch your arms overhead while breathing slowly.

5.2. Aerobic Training (Continuous and Interval)

Aerobic training improves exercise capacity, blood pressure, glycemic control, and mood. Start with a low volume and first increase **the duration**, then the frequency, and only finally the intensity. In patients who are severely deconditioned or have heart failure, intermittent exercise (2–3 minutes of exercise followed by 1–2 minutes of rest) is better tolerated than continuous exercise. High-intensity interval training (HIIT) should be considered only in selected, stable, low-risk patients under experienced supervision. The 2026 ESC Guidelines concur: the estimated rate of serious adverse events is 1 per 11,333 patient-hours in center-based HIIT, compared with no reported events in center-based moderate-intensity continuous training, and the lack of safety data for unsupervised programs limits the use of HIIT to supervised settings for medically evaluated patients. For frail older adults, continuous or short-interval moderate-intensity exercise remains the standard of care.

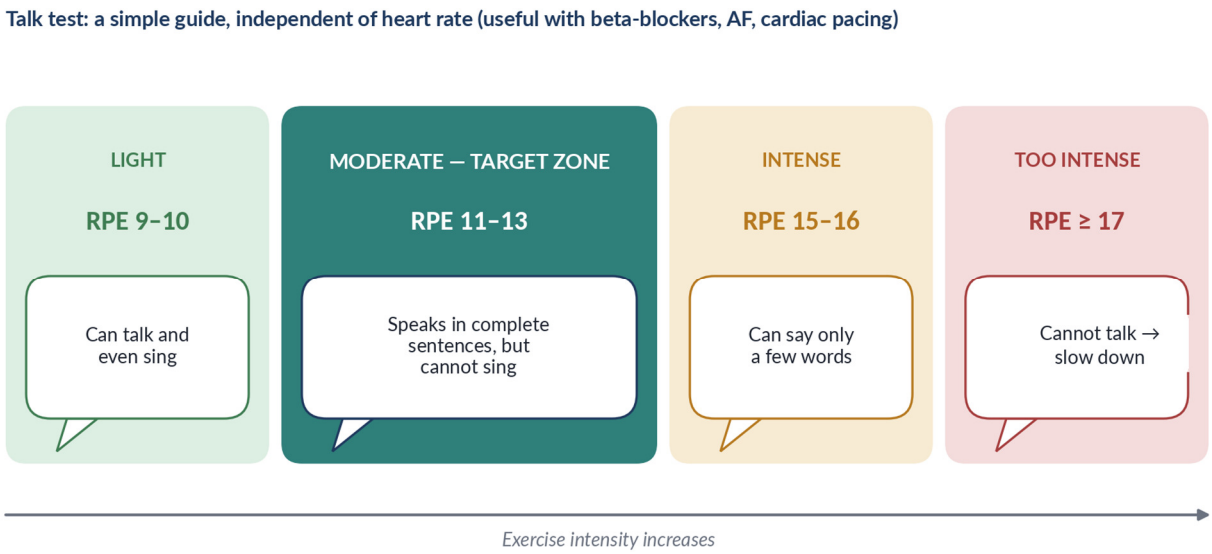


Figure 26 . The talk test: moderate intensity allows for conversation in complete sentences.

Table 32 . Exercise sheet—walking at a moderate pace (treadmill or hallway)

Starting position	**Stand upright, look straight ahead, arms relaxed, wear stable shoes.**
Execution	Walk with regular steps; arms swing freely; if necessary, hold onto the treadmill handrail. The pace should be chosen so that the patient can speak in complete sentences.
Duration	Initially 10–15 min; target 30–45 min; RPE 11–13; 3–5 days/week.
Breathing	Natural, rhythmic; avoid holding your breath.
Common errors	Strides too long, pace too fast at the start, reliance on the bar, looking down.
Adaptation	Easier: short intervals with breaks, walking with support. Harder: longer duration, slight incline on the treadmill.

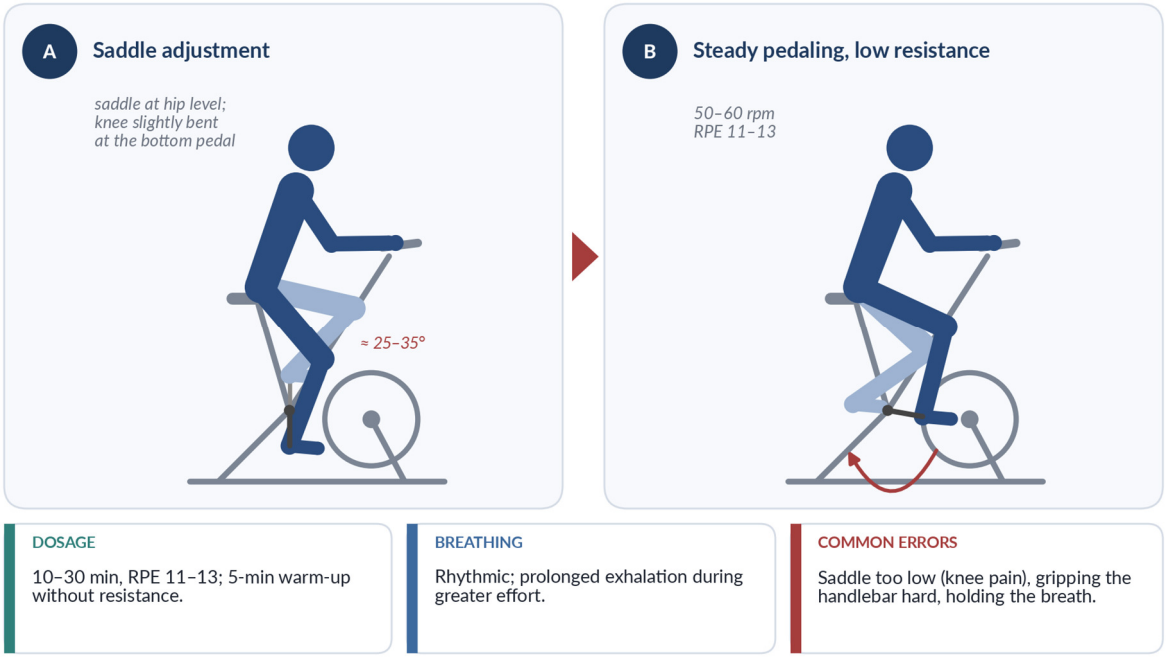


Figure 27 . Exercise bike: adjust the seat and start with low resistance.

Table 33 . Exercise Worksheet – Exercise Bike

Starting position	**Saddle at hip level; at the lowest point of the pedal stroke, knees slightly bent. Hands on the handlebars, back straight, looking forward.**
Execution	Pedal at a steady pace, 50–60 revolutions per minute, with low resistance at the start; gradually increase resistance.
Duration	10–30 min, RPE 11–13; 5-minute warm-up without resistance.
Breathing	Rhythmic; prolonged exhalation during higher-intensity effort.
Common mistakes	Saddle too low (knee pain), gripping the handlebars too tightly, holding one's breath.
Adaptation	Easier: intervals with breaks; recumbent bike. Harder: gradually increasing resistance.

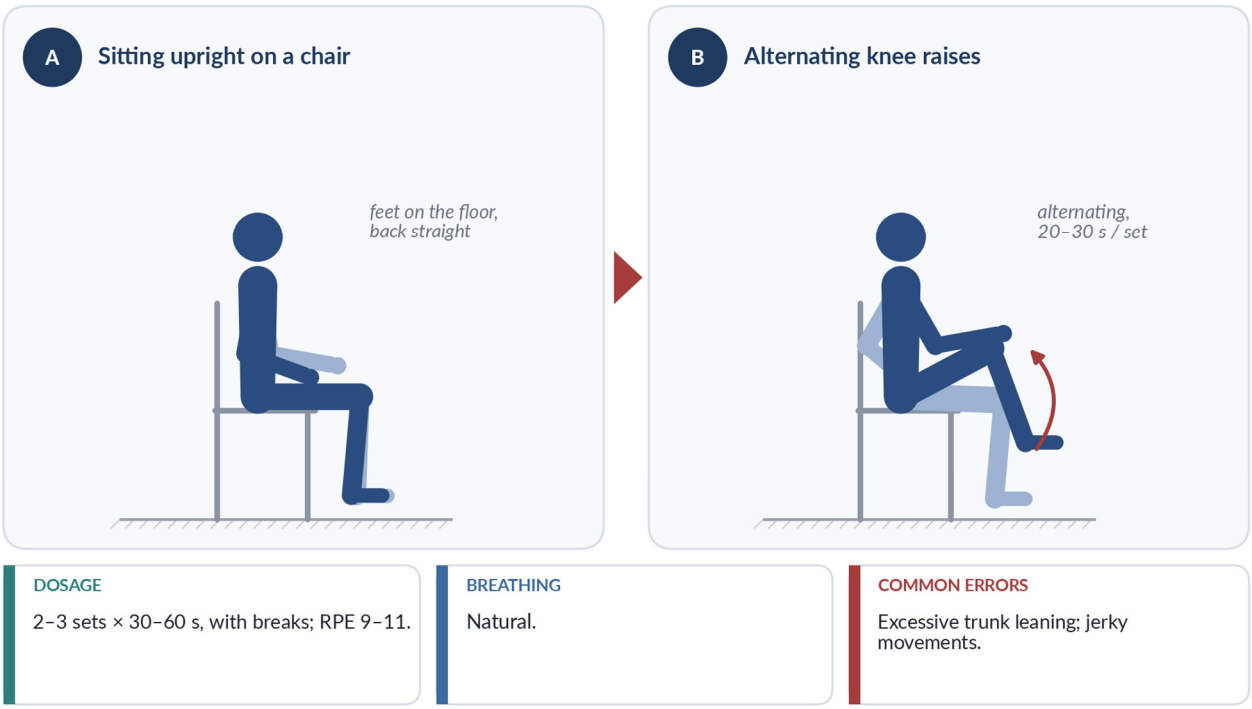


Figure 28 . Seated walking: suitable for frail patients or those just starting the program.

Table 34 . Exercise sheet—marching in place while seated in a chair

Starting Position	**Sit upright on the edge of the chair, feet on the floor, hands on your thighs or arms slightly bent.**
Execution	Alternately lift your knees (marching), 20–30 seconds per set; your arms move naturally, opposite your legs.
Intensity	2–3 sets × 30–60 s, with rest periods; RPE 9–11 (for very frail patients).
Breathing	Natural.
Common errors	Excessive trunk flexion; jerky movements.
Adaptation	Easier: small lifts. Harder: higher lifts with arms raised, walking while standing.

5.3. Strength and Muscle Power Training

Muscle strength is closely linked to independence, balance, and survival in older adults. Strength training is recommended 2–3 times per week, on non-consecutive days, with light-to-moderate loads, performed in a controlled manner and with rhythmic breathing (exhaling during exertion) to avoid the Valsalva maneuver. For frail patients, functional exercises (standing up from a chair, stepping up a stair) are preferred. The load is ideally expressed as a percentage of 1-RM, but in cardiac patients, the 10-repetition maximum (10-RM) test is preferred, from which 1-RM is estimated using formulas, to avoid the Valsalva maneuver; the OMNI-RES scale is used as a subjective benchmark. The 2026 ESC Guidelines also discuss high intensities: in healthy older adults, training at 70–79% of 1-RM increases strength more than light training, and in studies involving frail older adults, high-intensity resistance training did not result in more adverse events; however, there are no safety analyses in patients with uncontrolled hypertension; Therefore, in older adults with chronic conditions, high-intensity training is reserved for selected cases under close supervision. In frail patients ( ), resistance training of large muscle groups at at least moderate intensity must be combined

with endurance training, and balance exercises help prevent falls. In very frail patients, electrical muscle stimulation may be considered initially, with precautions for those with implantable devices.

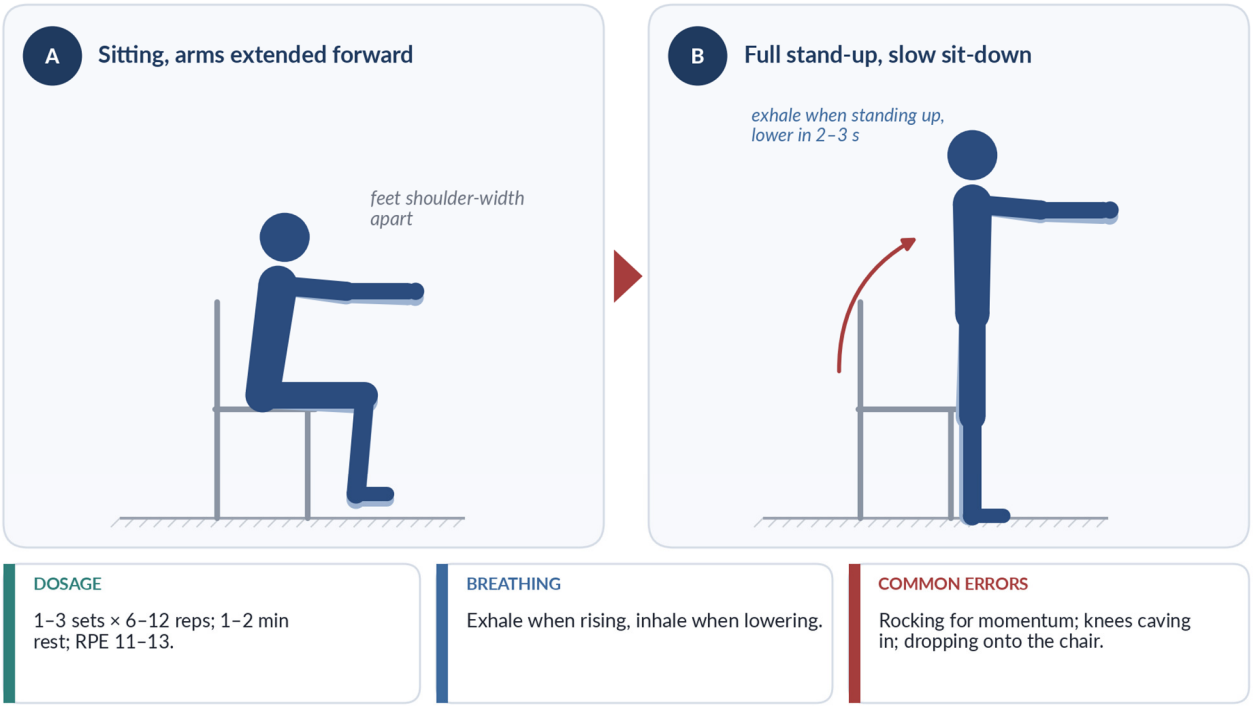


Figure 29 . Chair stands: a basic functional exercise for lower-body strength.

Table 35 . Exercise sheet—standing up from a chair (sit-to-stand)

Starting Position	**Sitting on a stable chair (without wheels), feet flat on the floor, shoulder-width apart; arms extended forward or crossed.**
Execution	Lean your torso slightly forward, push through your legs, and stand up completely; lower yourself slowly (2–3 seconds), in a controlled manner, until you touch the chair.
Setup	1–3 sets × 6–12 repetitions; 1–2-minute rest periods; RPE 11–13.
Breathing	Exhale as you rise, inhale as you lower.
Common Mistakes	Swinging to gain momentum; knees caving in; collapsing onto the seat.
Adaptations	Easier: higher chair, use hands for support. Harder: lower chair, slower pace, hold weight in hands.

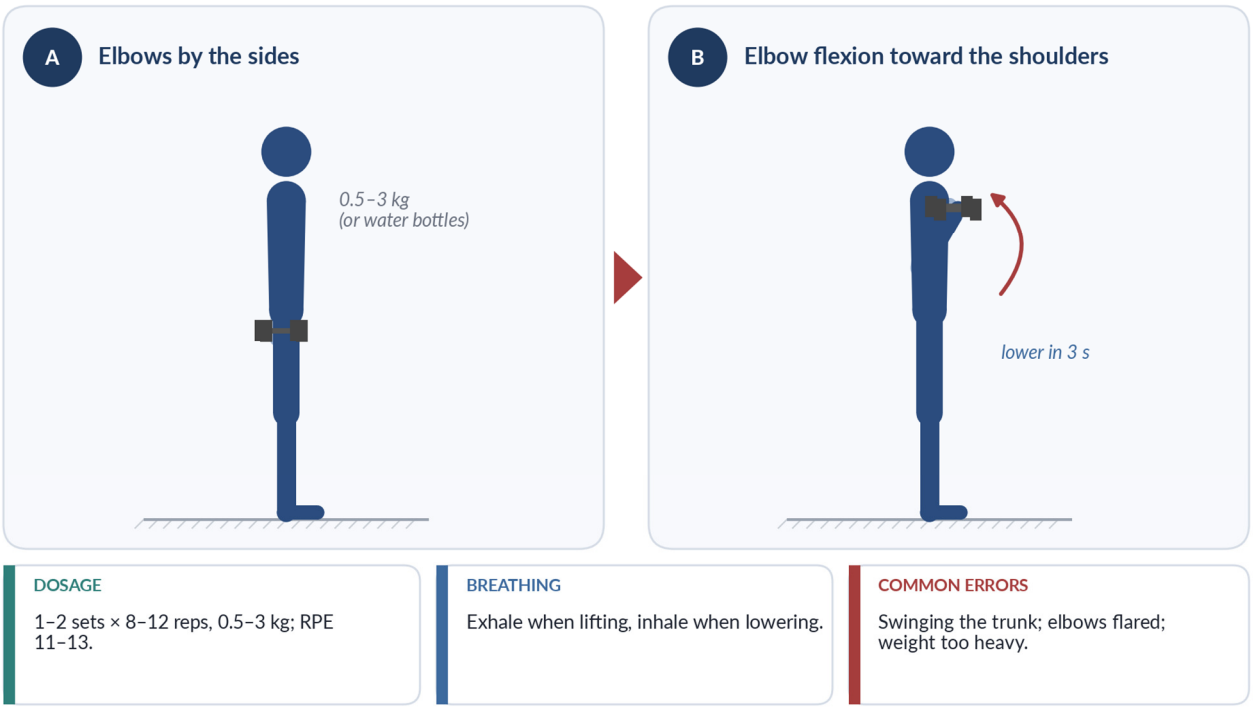


Figure 30 . Push-ups with light dumbbells (or water bottles).

Table 36 . Exercise sheet—push-ups with light dumbbells

Starting position	**Standing or sitting, elbows close to the body, dumbbells held in your hands with palms facing forward.**
Execution	Bend your elbows, bringing the dumbbells toward your shoulders, then lower them slowly (3 seconds).
Setup	1–2 sets × 8–12 repetitions, weight 0.5–3 kg; RPE 11–13.
Breathing	Exhale as you lift, inhale as you lower.
Common Mistakes	Tilting the torso; elbows splayed; weight too heavy.
Adaptation	Easier: no weight or with light bottles. Harder: heavier weight, alternating arms, slow pace.

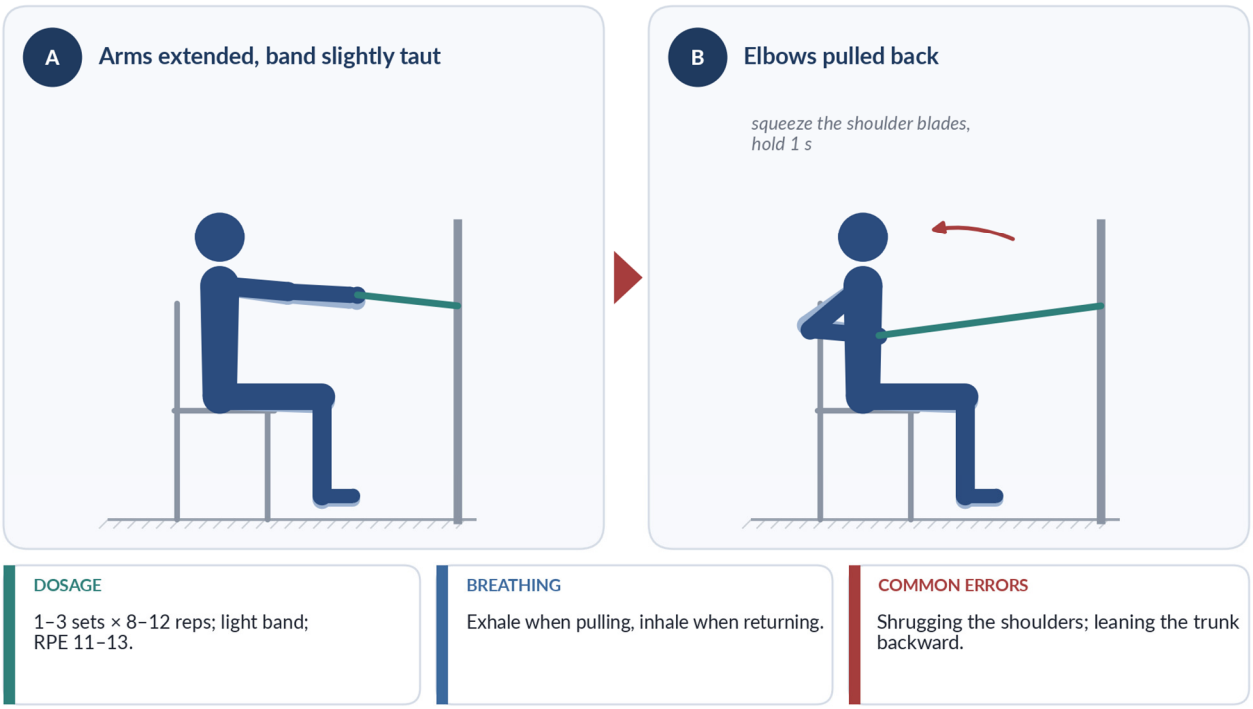


Figure 31 . Seated resistance band pull: strengthens the back and shoulders.

Table 37 . Exercise Worksheet – Resistance Band Pull-Up

Starting position	**Sit upright, with the band secured in front at chest level, arms extended forward, and the band slightly taut.**
Execution	Pull your elbows back, bring your shoulder blades together, hold for 1 second, then return slowly.
Setup	1–3 sets × 8–12 repetitions; light resistance band; RPE 11–13.
Breathing	Exhale as you pull back, inhale as you return to the starting position.
Common Mistakes	Shrugging the shoulders; leaning the torso backward.
Adjustment	Easier: use a weaker band. Harder: use a stronger band or do more repetitions.

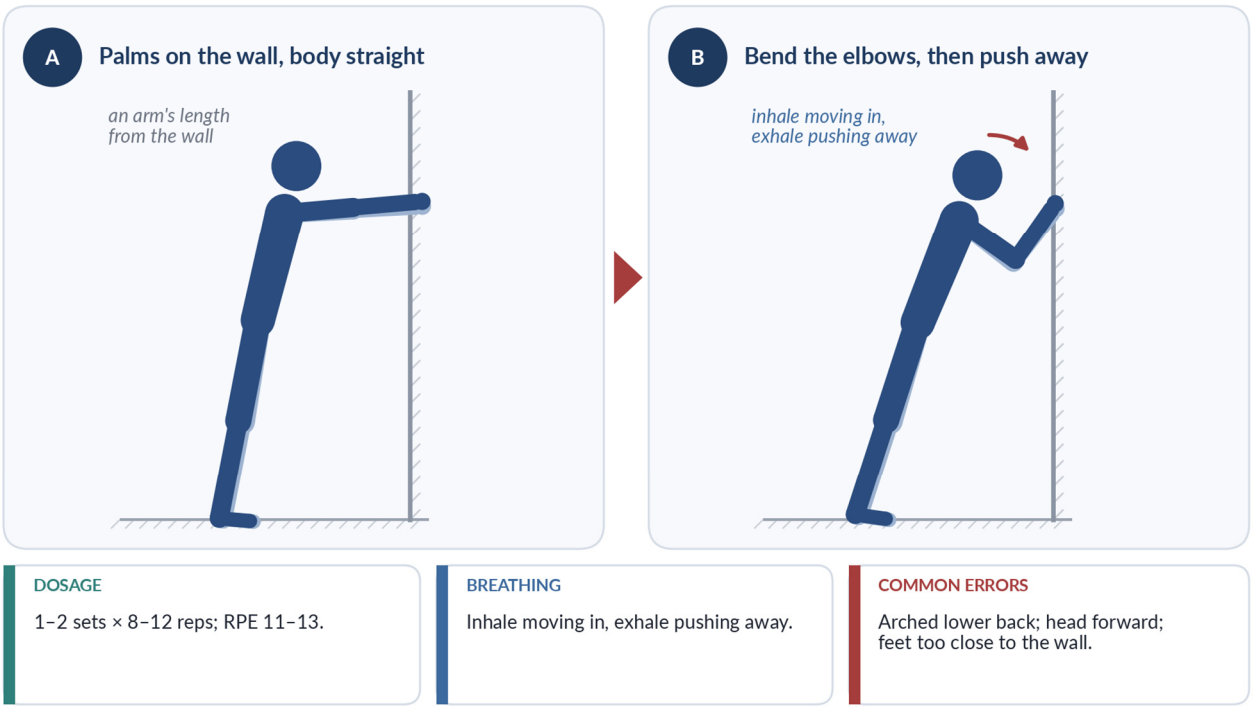


Figure 32 . Wall push-ups: a safe way to build arm and chest strength.

Table 38 . Exercise Guide—Wall Push-Ups

Starting Position	**Stand at arm's length from the wall, palms on the wall at shoulder level, body straight.**
Execution	Bend your elbows and bring your chest toward the wall, then push back until your arms are fully extended.
Setup	1–2 sets × 8–12 repetitions; RPE 11–13.
Breathing	Inhale as you bring your elbows in, exhale as you push back.
Common Mistakes	Arched lower back; head leaning forward; feet too close to the wall.
Modification	Easier: feet closer to the wall. Harder: feet farther away or push-ups on a high bench.

5.4. Balance, Mobility, and Flexibility

Balance exercises reduce the risk of falls and fractures, which are among the leading causes of loss of independence in older adults. They should be practiced at least 3 times a week, first with support, then without. Mobility and flexibility (ankle, hip, shoulder) make walking, climbing stairs, and daily activities easier.

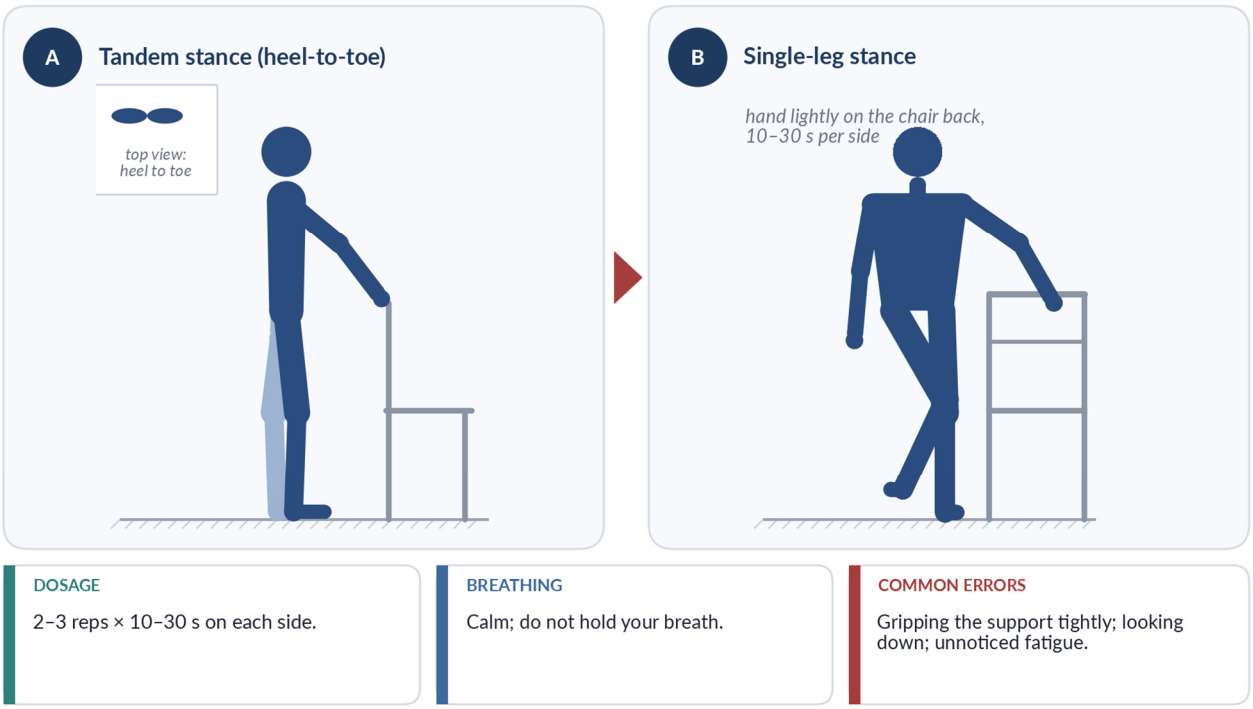


Figure 33 . Balance: tandem stance and standing on one leg, with a hand on the backrest.

Table 39 . Exercise Worksheet—Tandem and One-Legged Stance

Starting position	**In front of a chair or next to a wall, with your hand lightly resting on the back of the chair (just the tip of your finger, not gripping tightly).**
Execution	Tandem: one foot in front of the other, heel touching the toe. Then gently lift one leg (10–30 s).
Intensity	2–3 repetitions × 10–30 s on each side; progression: without support, with eyes closed only under supervision.
Breathing	Calm; do not hold your breath.
Common errors	Gripping the support too tightly; looking down; unnoticed fatigue.
Adaptation	Easier: feet close together, both hands on the support. Harder: no hands, on a soft surface, double load (counted).

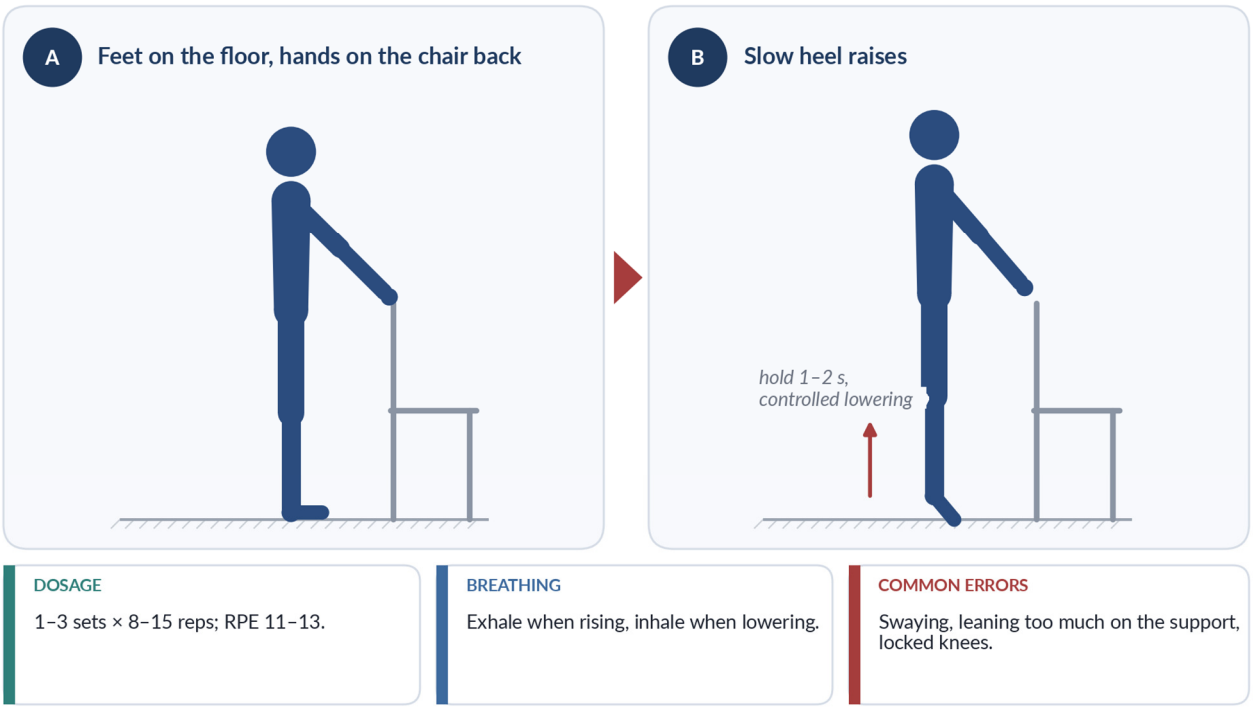


Figure 34 . Supported toe raises: strengthens the calves and improves gait.

Table 40 . Exercise Worksheet – Toe Raises

Starting position	**Standing, feet hip-width apart, hands on the back of a chair.**
Execution	Slowly rise onto your toes, hold for 1–2 seconds, and lower yourself in a controlled manner.
Setup	1–3 sets × 8–15 repetitions; RPE 11–13.
Breathing	Exhale as you rise, inhale as you lower.
Common Mistakes	Swaying, excessive support, locked knees.
Variations	Easier: both hands on the support, small range of motion. Harder: support with one finger, one foot.

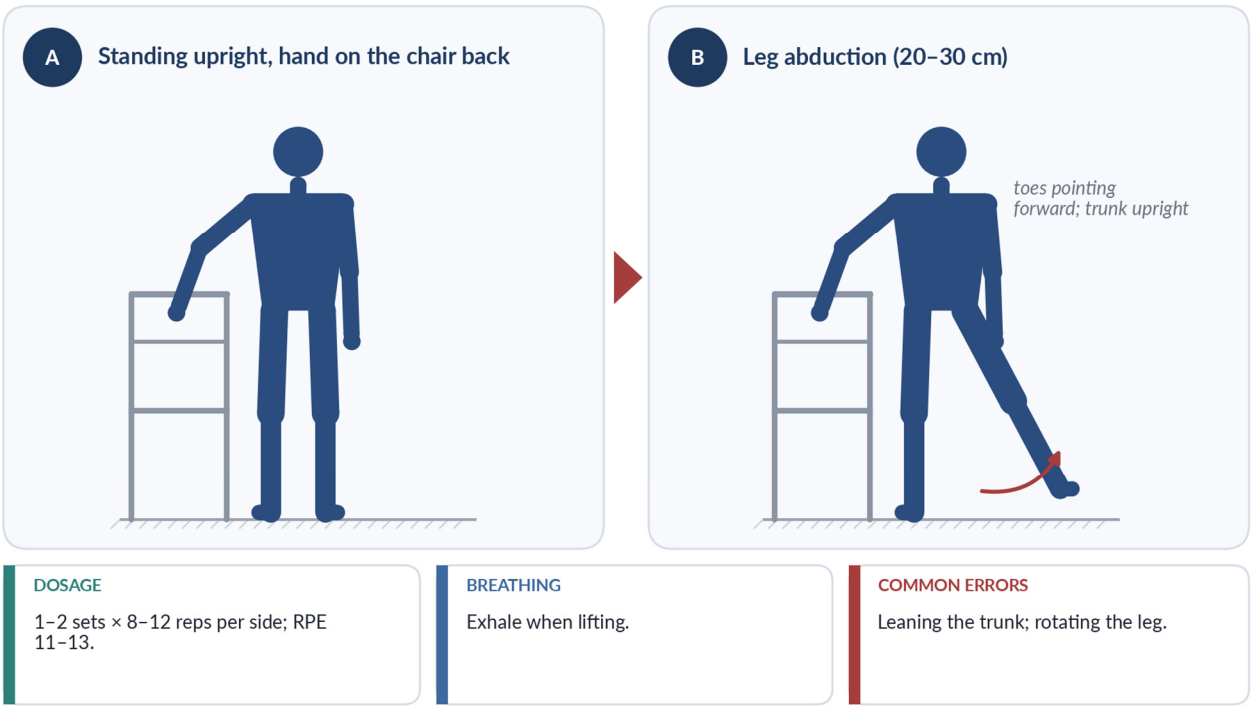


Figure 35 . Side leg lift: strengthens the hip muscles, which are important for balance.

Table 41 . Exercise sheet—side leg lift

Starting position	**Stand upright with one hand on the back of a chair.**
Execution	Slowly lift your leg to the side (20–30 cm), toes pointing forward; hold for 1 second; lower in a controlled manner.
Setup	1–2 sets × 8–12 repetitions per side; RPE 11–13.
Breathing	Exhale as you lift.
Common mistakes	Leaning the torso forward; rotating the foot.
Adaptation	Easier: smaller range of motion. Harder: hold the position at the top for 2–3 seconds, add ankle weights (with the physical therapist's approval).

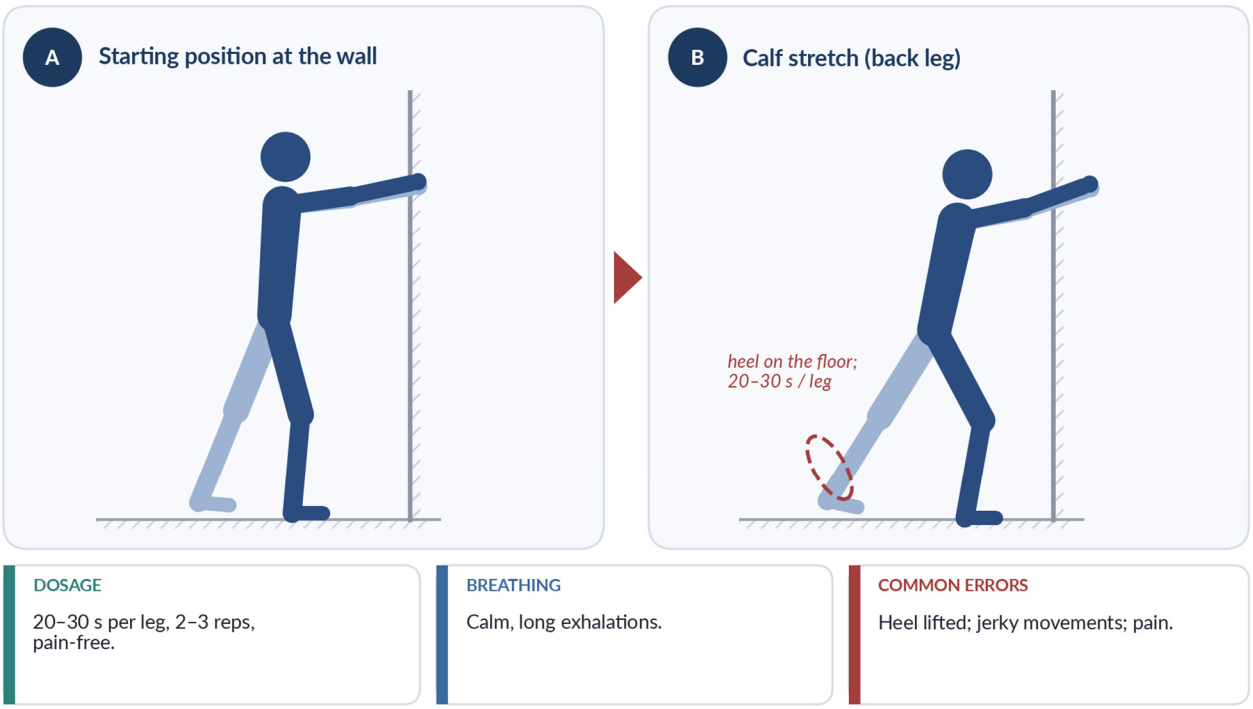


Figure 36 . Calf muscle stretch against a wall.

Table 42 . Exercise sheet—calf stretch

Starting position	**Face the wall, palms against the wall, one foot forward, the other extended backward, heel on the floor.**
Execution	Gently bend your front knee and tilt your pelvis toward the wall until you feel a stretch in your back calf.
Duration	20–30 seconds per leg, 2–3 repetitions, without pain.
Breathing	Calm, with long exhalations.
Common Mistakes	Heel raised; jerky movements; pain.
Adjustment	Easier: shorter distance from the wall. Harder: longer stride.

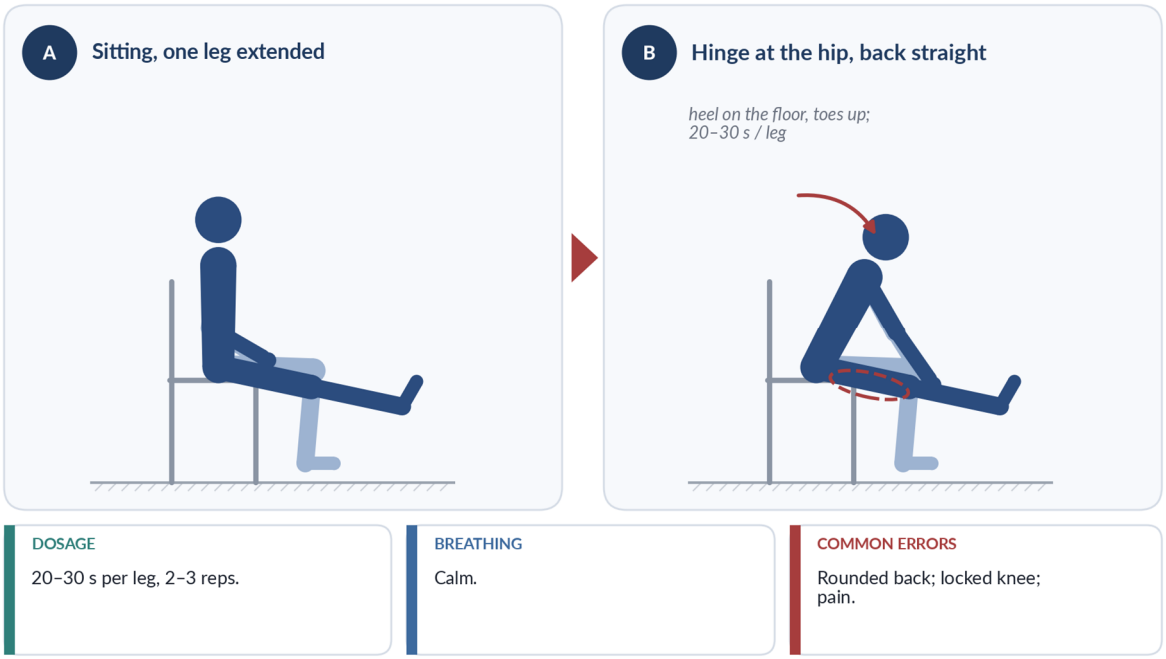


Figure 37 . Seated hamstring stretch.

Table 43 . Exercise sheet—seated hamstring stretch

Starting position	**Sitting on the edge of a chair, one leg extended forward, heel on the floor, toes pointing up.**
Execution	With your back straight, lean forward from the hips toward your foot until you feel a stretch in the back of your thigh.
Duration	20–30 seconds per leg, 2–3 repetitions.
Breathing	Steady.
Common Mistakes	Rounded back; locking the knee; pain.
Adaptation	Easier: knees slightly bent. Harder: greater range of motion.

5.5. Training the Respiratory Muscles

Diaphragmatic breathing and pursed-lip exhalation improve respiratory efficiency, reduce dyspnea, and promote relaxation; they are particularly useful after cardiac surgery and in heart failure. Specific training of the inspiratory muscles using a device may be recommended for selected patients, as indicated by a physician or physical therapist. The 2026 ESC Guidelines recommend, in chronic heart failure, combining inspiratory muscle training (3–5 times per week, 20–30 minutes, at 30% to 60% of maximum inspiratory pressure) with endurance and strength training, if tolerated: on its own, it improves peak VO_2, and when added to the other forms of exercise, it improves quality of life, cardiovascular fitness, and dyspnea.

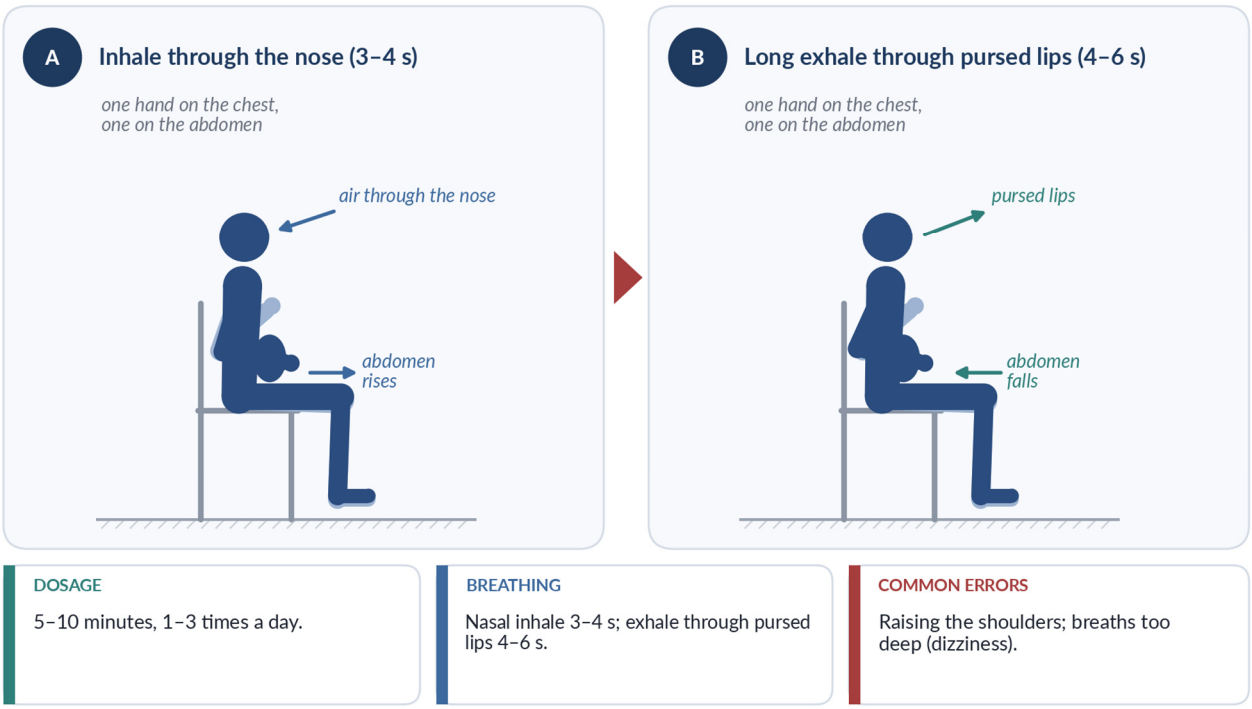


Figure 38 . Diaphragmatic breathing: inhale through the nose (the abdomen expands), exhale slowly through pursed lips.

Table 44 . Exercise sheet—diaphragmatic breathing

Starting position	**Sit comfortably or lie down, with one hand on your chest and one on your abdomen, shoulders relaxed.**
Execution	Inhale slowly through the nose for 3–4 seconds, allowing the abdomen to rise; exhale slowly through pursed lips for 4–6 seconds.
Frequency	5–10 minutes, 1–3 times a day.
Breathing	This is the exercise itself.
Common Mistakes	Raising the shoulders; breathing too deeply (dizziness).
Adaptation	Easier: lying down. Harder: while walking, climbing stairs.

5.6. Monitoring exercise intensity (Borg scale, talk test, heart rate)

In older adults, heart rate is a less reliable indicator (beta-blockers, atrial fibrillation, pacemakers, high variability). Therefore, intensity is assessed by combining three tools: the Borg scale (RPE), the talk test, and, where possible, heart rate. The 2026 ESC Guidelines recommend the Borg scale (6–20) or the talk test for endurance and the OMNI-RES scale for strength, especially at the start of the program or after a change in intensity, and then periodically (e.g., once a week).

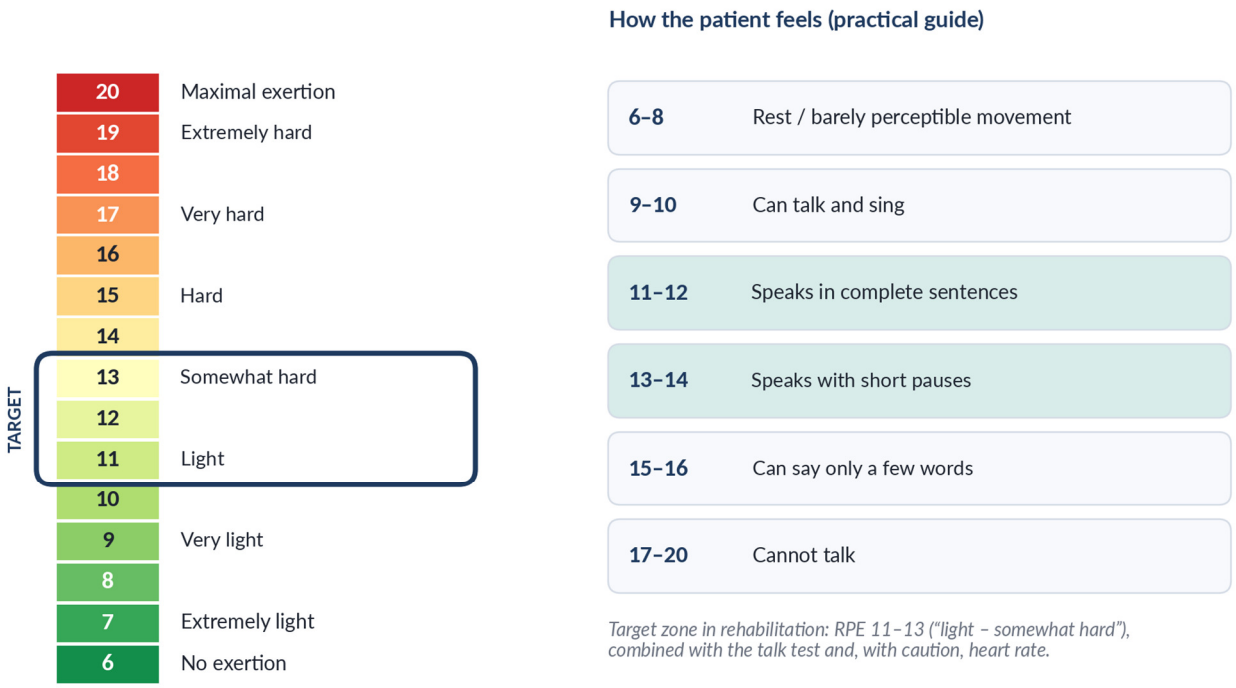


Figure 39 . Borg Scale (RPE 6–20): the target during recovery is zone 11–13 ("light–moderate," with light exertion).

Table 45 . Borg Scale (RPE)—Practical Guidelines

RPE	Description	How the patient feels
6–8	Very, very mild	Rest / almost imperceptible movement
9–10	Very mild	He can speak and sing
11–12	Easily	Can speak in complete sentences
13–14	Somewhat difficult	Speaks with short pauses
15–16	Difficult	Can say only a few words
17–20	Very difficult – maximum	Cannot speak

Calculation of target heart rate. The classic reserve method (target HR = resting HR + percentage × (maximum HR − resting HR), with 40–60% for moderate intensity) is still used in practice, but the 2026 ESC guidelines consider it less reliable than ventilatory thresholds. When a cardiopulmonary test is not available, the heart rate at the first and second ventilatory thresholds can be estimated from values obtained during a maximal exercise test: **HR at VT1 = 4.866 + 0.405 × peak HR + 0.542 × resting HR; HR at VT2 = −2.606 + 0.773 × peak HR + 0.254 × resting HR.**

Example:

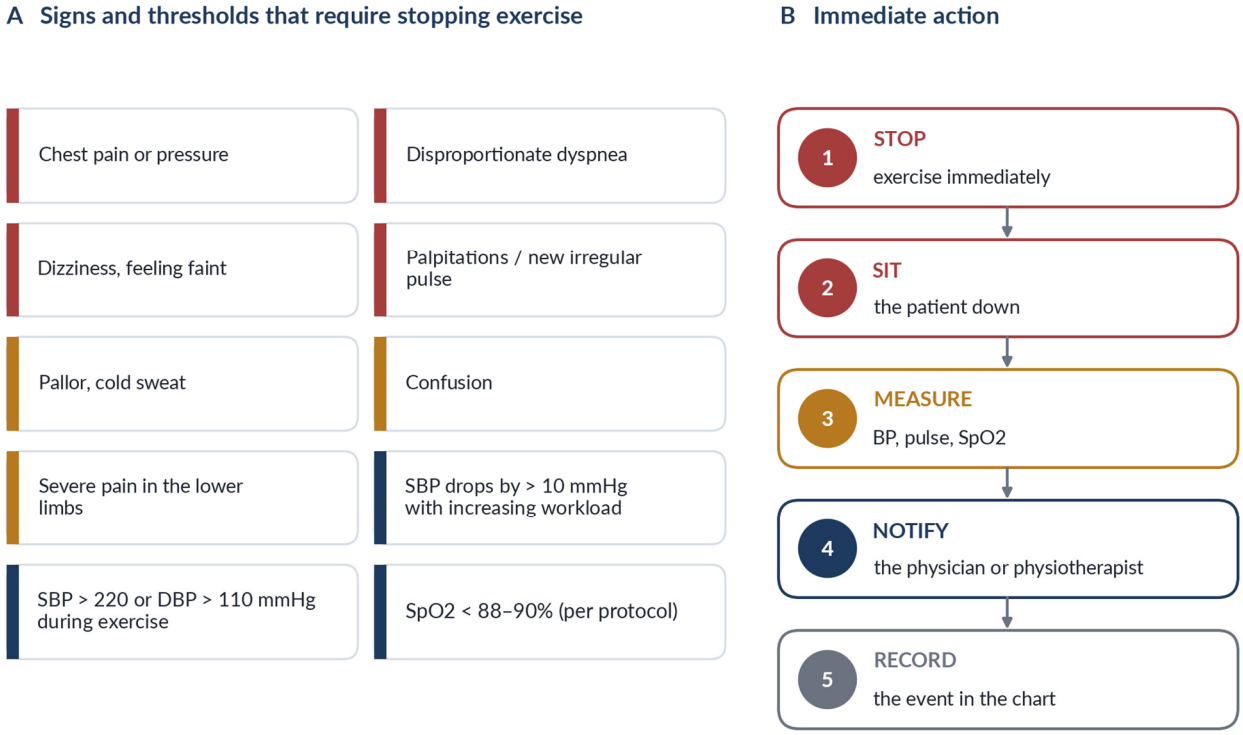
A patient with a resting HR of 70 bpm and a peak HR of 130 bpm during an exercise test (while on current treatment). HR at VT1 = 4.866 + 0.405 × 130 + 0.542 × 70 ≈ **95 bpm**; HR at VT2 = −2.606 + 0.773 × 130 + 0.254 × 70 ≈ **116 bpm**. For a frail patient, aerobic training begins below VT1 (e.g., 85–95 bpm) and approaches VT1 as tolerated. The reserve method would have yielded 94–106 bpm (40–60% of the 60 bpm reserve). If the patient is taking beta-blockers, these values are valid only if the test was performed while on the same medication; otherwise, an RPE of 11–13 remains the primary guideline.

5.7. Progression and Individualization of Workload

The general rule is **"start slowly, progress slowly**." Every 1–2 weeks, change **only one parameter** (duration, then frequency, then intensity; for strength training—number of repetitions, then sets, then load). Progression should occur only if previous sessions were well tolerated: RPE within limits, no symptoms, rapid recovery of heart rate and blood pressure, and no excessive fatigue the following day. A temporary plateau or decrease in exercise dose is also acceptable following an illness, a bad day, or a change in medication. The 2026 ESC Guidelines recommend regular reassessment of intensity, as ventilatory thresholds and strength change with training; in chronotropic insufficiency (more common in heart failure), the heart rate–workload relationship should be periodically reassessed.

5.8. Monitoring During the Session and Criteria for Stopping Exercise

Monitoring includes: the patient's appearance (complexion, sweating, breathing), RPE, pulse, blood pressure (before, during, and after; in at-risk patients, also during exercise), SpO_2 in patients with lung disease or heart failure, and blood glucose in diabetics (before, as needed during exercise, and after). Each session is recorded in the patient's chart.



High-risk situations (ESC 2026): weight gain > 1.8 kg in 1–3 days, resting pulse > 100/min, new-onset AF/atrial flutter.

Figure 40 . Signs to stop the exercise: stop, help the patient sit down, and notify the physician or physical therapist.

Warning

Stop the exercise and immediately notify the physician/physical therapist if any of the following occur: chest pain or pressure, disproportionate shortness of breath, dizziness or a feeling of fainting, palpitations or a new irregular pulse, pallor and cold sweat, confusion, severe pain in the lower limbs, a drop in systolic blood pressure (SBP) of >10 mmHg during an increase in workload, systolic blood pressure (SBP) >220 mmHg or diastolic blood pressure (DBP) >110 mmHg during exercise, or SpO_2 below 88–90% (as per protocol). The patient should sit down, vital signs should be measured, and a decision should be made regarding whether to continue. The 2026 ESC Guidelines include the following among high-risk situations during exercise: weight gain of >1.8 kg in 1–3 days, a drop in systolic blood pressure during exercise, a resting heart rate >100/min in the supine position, and de novo atrial fibrillation or flutter.

Key Points

- The program is multifaceted: aerobic, strength, balance, flexibility, and respiratory training.
- Intensity is determined using an RPE of 11–13 + the talk test + heart rate (with caution).
- Progress on only one parameter at a time.
- The signs indicating when to stop are well known

Reflection Assignment

- Choose an exercise from this chapter and demonstrate it to a classmate: explain the execution, intensity, and adaptations in 60 seconds, then ask for feedback on clarity and safety.

6. SPECIFIC ASPECTS OF RECOVERY IN MAJOR CLINICAL CONDITIONS

Objectives:

- adapting the prescription for ischemic heart disease, heart failure, valvular heart disease, atrial fibrillation, hypertension, and peripheral arterial disease;
- to recognize specific precautions following cardiac surgery, TAVI, and device implantation;
- to identify additional parameters that require monitoring in each situation.

6.1. Ischemic heart disease (acute and chronic coronary syndromes, PCI, CABG)

Rehabilitation is recommended following acute coronary syndrome and after revascularization and is part of the standard of care for chronic coronary artery disease. The assessment focuses on the presence of angina, the ischemic threshold (if tested), LVEF, complete revascularization, arrhythmias, and medication (antiplatelet agents, beta-blockers, statins, nitrates). Patients frequently have diabetes, hypertension, and dyslipidemia, which are treated concurrently. The 2026 ESC Guidelines recommend physical training in the recovery phase following ACS or in chronic coronary syndrome (CCS) to reduce cardiovascular mortality, myocardial infarction, and hospitalizations, and recommend combining strength training with endurance training for greater gains in peak VO_2; HIIT may be considered as a more effective or time-efficient alternative only in selected patients and under close supervision [18,19,20].

- **Intensity:** RPE 11–13; exercise heart rate generally remains below the ischemic threshold (by approximately 10 bpm) or below the angina threshold.
- **Sublingual nitroglycerin** (or other prescribed treatment) must be readily available; the patient knows when and how to use it.
- **Diabetes:** Check blood glucose before and after exercise; the patient should have a source of fast-acting carbohydrates on hand; hypoglycemia can occur even several hours later.
- **Warning signs:** angina with minimal exertion, new-onset shortness of breath, palpitations, syncope—stop and seek medical evaluation.

6.2. Heart Failure

Physical exercise is part of the treatment for stable heart failure and improves exercise tolerance, quality of life, and reduces hospitalizations. The following are required: optimized treatment, absence of decompensation, and a patient educated on self-care (daily weight monitoring, signs of worsening, salt restriction, and medication adherence).

The 2026 ESC Guidelines on Heart Failure recommend personalized exercise training, within a multidisciplinary cardiac rehabilitation (CR) setting, for all stable patients, in the absence of contraindications, to improve exercise tolerance and quality of life and to reduce hospitalizations from any cause (Class I), as well as its long-term continuation, including outside the CR program; Rehabilitation should be considered in decompensated heart failure as soon as possible, provided it is safe (Class IIa), and the assessment of anxiety, depression, and frailty should be considered to develop a personalized plan (Class IIa). The same guideline redefines heart failure with reduced ejection fraction as an ejection fraction (EF) <50% and eliminates the " " category with mildly reduced ejection fraction; it also notes that symptoms in older adults may be atypical, including confusion. The REHAB-HF trial showed that early, individualized rehabilitation in frail older adults hospitalized for decompensation improves physical function [21,22,23,24,25].

- **Program:** Begin with short intervals (2–3 min of exercise, 1–2 min of rest), with an RPE of 11–12; gradually increase the duration; strength training should be combined with light loads and a slow pace.
- **Monitoring:** daily weight measurement (in patient education for HF, a weight gain of >2 kg in 3 days is a warning sign; in the rehabilitation center, the 2026 ESC guidelines consider a weight gain of >1.8 kg in 1–3 days to indicate increased risk [26]), edema, dyspnea at rest, SpO_2, blood pressure (risk of hypotension with diuretics and vasodilators).
- **Avoid:** Valsalva maneuver, intense isometric exertion, exertion on days when symptoms worsen, excessive or insufficient hydration.
- **Devices (ICD, CRT):** The target heart rate is maintained 10–20 bpm below the device's therapy threshold; the programming is known. Exercise training is recommended for ICD

recipients to improve exercise capacity and reduce shocks, and for CRT recipients to improve maximal workload, peak VO_2, and quality of life.

6.3. Valvular Diseases and Valvular Interventions (TAVI, Surgery)

Degenerative valvular diseases are common in the elderly. **Severe, symptomatic, untreated aortic stenosis** is a contraindication to intense exercise; after intervention (TAVI or surgery), patients benefit substantially from recovery. After TAVI, recovery can begin early and progresses more rapidly than after open-heart surgery; the access site, conduction disturbances, blood pressure, and heart rhythm are monitored; frailty is common and requires a focus on strength and balance. After valve surgery, standard sternal precautions apply. Patients with valve prostheses on anticoagulation have an increased risk of bleeding from falls; dental hygiene and infection control are important in preventing endocarditis. The 2026 ESC Guidelines recommend that rehabilitation training be considered after any valvular procedure, whether surgical or percutaneous, to improve exercise capacity (6MWT, peak VO2). The 2025 ESC/EACTS Guidelines lowered the age threshold for TAVI in aortic stenosis with a tricuspid valve from 75 to 70 years, which increases the number of older adults who reach cardiac rehabilitation after TAVI; A 2025 randomized trial in patients with heart failure following TAVR showed that personalized exercise based on cardiopulmonary testing improved exercise capacity and quality of life [27,28].

6.4. Atrial Fibrillation and Implantable Devices

In atrial fibrillation, exercise is part of lifestyle management and risk factor control. Heart rate control, anticoagulation, and symptoms (palpitations, fatigue, dyspnea) are assessed. Because the pulse is irregular, **RPE** is used as the primary guide, and the ventricular rate must remain within acceptable limits (at rest and during exercise), as directed by the physician. Patients on anticoagulants are at risk of bleeding from trauma: fall prevention is a priority. For those with a pacemaker or ICD, the upper limit of the programmed rate is known, and in the immediate post-implantation period, forceful arm movements on the side of the device should be avoided, as directed by the implanting physician. The 2026 ESC Guidelines recommend cardiac rehabilitation (CR) for patients with AF to reduce symptoms and recurrences and to improve quality of life and exercise capacity (Class IIb) [29].

6.5. Hypertension

Regular aerobic exercise (approximately 150 minutes per week of moderate intensity) and dynamic strength training 2–3 times per week help lower blood pressure. Intense isometric exertion and the Valsalva maneuver should be avoided. Very high resting blood pressure readings (e.g., ≥200/110 mmHg) constitute a relative contraindication to exercise and should be discussed with a physician; for systolic readings between 180 and 199 mmHg, a decision is made on a case-by-case basis. Check for postural hypotension, especially in patients taking multi . The 2026 ESC Guidelines state that, in hypertension, aerobic training is the first choice, possibly supplemented with isometric exercises (e.g., “wall-sits”), although the evidence for the latter is still weak; to lower blood pressure, sessions lasting more than 30 minutes (which can be broken up) of at least moderate intensity are recommended, along with at least 8 sets of resistance exercises per session [30].

6.6. Peripheral Arterial Disease

In patients with intermittent claudication, **supervised walking therapy** is one of the most effective interventions and is recommended as a first-line treatment alongside pharmacological therapy and risk factor control. Typical protocol: walk until moderate-to-severe discomfort in the calf, stop and rest until the pain subsides, repeat, 30–60 minutes per session, at least 3 times a week, for a minimum of 12 weeks. The feet should be examined daily (for wounds or lesions), and footwear must be appropriate [31].

6.7. Recovery After Cardiac Surgery

Following median sternotomy, **sternal precautions** are observed for approximately 6–8 weeks (according to the department’s protocol): the patient should avoid lifting heavy weights (generally over 2–5 kg), pulling or pushing forcefully with the arms, placing a pillow on the sternum when coughing or rising from a chair, and sleeping on the abdomen. The wound, pain, fever, bleeding, postoperative arrhythmias (FiA), anemia, and hypotension are monitored. Deep breathing and

assisted coughing prevent pulmonary complications. Walking is initiated early, and upper limb strength is gradually restored. The patient is informed about resuming activities, including driving and sexual activity, according to the surgeon's instructions. The 2026 ESC Guidelines recommend starting exercise or active mobilization as early as possible after cardiothoracic surgery—ideally within the first 4 weeks—to improve or maintain exercise capacity; Phase II rehabilitation should begin within 28 days and should not be delayed beyond 42 days. In frail elderly patients who have undergone surgery, a multicomponent home-based program such as Vivifrail has been shown to be feasible during the first 6 weeks postoperatively, with an average completion rate of 54%.

Key Points

- The program is tailored to the specific condition: what to monitor, what to avoid, and what limits to observe.
- In FiA and for those on beta-blockers, the primary guide for intensity is RPE.
- In heart failure: short intervals, daily weight monitoring, watch for hypotension.
- After surgery: precautions regarding the sternum, wound, and breathing.
  Claudication: supervised walking until moderate pain occurs, with breaks.

7. COMPLEMENTARY INTERVENTIONS TO PHYSICAL EXERCISE

Objectives:

- to provide effective therapeutic education (teach-back method);
- to integrate nutritional recommendations for older adults;
- identifying adherence issues and polypharmacy;
- supporting smoking cessation and limiting alcohol consumption;
- recognizing psychosocial needs, sleep needs, and the need to resume activities

7.1. THERAPEUTIC EDUCATION AND SELF-CARE

Education transforms the patient from a "recipient" into a "partner." It should be brief, repeated, tailored to the patient's level of understanding, and supported by materials with large print and images. Topics: the disease and its treatment, warning signs and what to do in an emergency, weight and blood pressure monitoring at home, diet, daily physical activity, medication, smoking, sleep, and stress. e understanding is verified through **teach-back**: "To make sure I've explained this clearly, could you tell me how you'll do…?" For older adults with cognitive impairment, materials are adapted (short messages, images, repetition), which improves understanding and retention. The 2026 ESC Guidelines also recommend counseling on physical activity and sedentary behavior, in line with WHO recommendations, the use of activity monitors (Class I), and reducing sedentary time; practical examples include walking instead of driving for short distances, using the stairs, doing household chores, gardening, and dancing.

7.2. Nutritional Intervention

For older adults, the nutritional goal is almost never "weight loss at any cost," but rather **maintaining muscle mass** and preventing malnutrition, along with managing risk factors. The ESPEN guidelines recommend a protein intake of approximately 1.0 g/kg body weight/day (higher in cases of acute illness or sarcopenia, with adjustments based on renal function), sufficient energy intake, adequate hydration, and regular screening for malnutrition. From a cardiovascular perspective, a Mediterranean-style diet is recommended—rich in vegetables, fruits, whole grains, fish, olive oil, and nuts—with limited salt (less than 5 g/day), saturated fats, and added sugar. In patients with heart failure, salt and fluid restriction is tailored to the individual as directed by the physician.

The 2026 ESC Guidelines confirm and elaborate on these guidelines: energy intake of approximately 30 kcal/kg body weight/day for the elderly; protein intake of at least 1 g/kg/day for healthy elderly individuals and 1.2–1.5 g/kg/day for maintaining and restoring muscle mass, especially in acute or chronic conditions, with an increase up to 2 g/kg/day in severe illness, trauma, or significant malnutrition, always adjusted for renal function and clinical status. If dietary intake cannot meet these requirements, oral nutritional supplements may be used; these have been shown to improve the 6-minute walk test (6MWT), quality of life, and muscle mass in patients with heart failure and low muscle mass. Nutritional interventions (a high-protein diet and/or supplements) should be considered for older adults in the CR at risk or with reduced muscle mass, and screening for malnutrition and sarcopenia should be considered for all patients in the CR. Low muscle mass is modifiable and can return to normal with early intervention; in sarcopenic obesity, the goal is to reduce fat while preserving muscle mass and strength through moderate caloric restriction, adequate protein intake, and strength training—not through drastic diets.

The 2025 EAPC Statement recommends combining strength training with endurance training and adequate nutritional intake in sarcopenia [32].

- A source of protein at every meal (eggs, dairy, fish, lean meat, legumes).
- Stay hydrated regularly, even if the patient does not feel thirsty (unless medically contraindicated).
- For people with diabetes: eat regular meals; be mindful of exercise-induced hypoglycemia.
- Difficulty chewing or swallowing, poor dentition: seek practical solutions and notify the physician.

7.3. Treatment Adherence and Polypharmacy

Non-adherence to medication is common among older adults due to the large number of pills, perceived side effects, cognitive impairments, costs, and lack of understanding. Practical solutions: a

simplified written medication schedule, a pill organizer, an alarm, caregiver involvement, and a medication review by the physician (deprescribing where appropriate). The master's student does not change the medication but **reports** any observed issues. The 2026 ESC Guidelines indicate that, for older adults in community care—who frequently experience polypharmacy and frailty—medication management includes medication reconciliation and deprescribing, which are essential for safety, adherence, and outcomes.

Table 46 . Common Medications and Significant Effects on Exercise

Group	**Effect/Risk in the Context of Physical Exertion**	**What We Are Looking For**
Beta-blockers	Lower exercise heart rate, fatigue	RPE instead of HR; symptomatic bradycardia
Diuretics	Dehydration, hypotension, hypokalemia, cramps	Orthostatic blood pressure, weight gain, cramps, dizziness
ACE inhibitors, sartans, sacubitril/valsartan, calcium channel blockers	Postural hypotension	Slow transitions, post-exercise blood pressure
Nitrates	Headache, hypotension	Blood pressure, dizziness, risk of falls
Insulin, sulfonylureas	Hypoglycemia during and after exercise	Blood glucose before/after; source of sugar on hand
Anticoagulants / antiplatelet agents	Bleeding from injuries	Risk of falls, bruises, bleeding
Statins	Muscle pain (myalgia)	New muscle pain, weakness

7.4. Smoking Cessation and Alcohol Consumption

Quitting smoking provides cardiovascular benefits at any age, and the 2026 ESC guidelines emphasize these benefits in older adults as well and call for support for smoking cessation to be a priority in primary care programs. Recommended approach: ask, advise, assess readiness, offer support (counseling, substitution therapy, medication as prescribed by a physician), and plan follow-up. Alcohol consumption should be limited according to a physician's recommendations; for those with heart failure, atrial fibrillation, or on anticoagulant therapy, maximum moderation or abstinence is generally recommended. The 2021 ESC Guidelines recommend a maximum of 100 g of pure alcohol per week (approximately one standard drink per day), and the 2026 ESC Guidelines indicate that there is no safe threshold for blood pressure and that the recommendation should be individualized.

7.5. Psychological and Social Support

Depression, anxiety, loneliness, and fear of physical exertion are common after a cardiac event and are associated with poor adherence and a worse prognosis. Signs include persistent sadness, loss of interest, insomnia, irritability, and avoidance of physical activity. The GDS-15 and empathetic discussion are used, and suspected cases are referred to a psychologist or physician. Group programs provide social support and motivation. Caregivers receive information and support, as they are often affected as well. Depression, anxiety, and cognitive decline are common among older adults; cognitive-behavioral interventions reduce distress, and group sessions increase engagement and motivation.

7.6. Sleep and Resuming Daily Activities

Insufficient or fragmented sleep reduces exercise tolerance and lowers mood. Sleep hygiene tips: maintain a regular schedule, avoid caffeine in the evening, get physical activity during the day, expose yourself to natural light, and keep the bedroom quiet; loud snoring with breathing pauses requires evaluation for sleep apnea. al activities should be resumed gradually, according to medical advice (driving, working, cooking, caring for grandchildren, sexual activity). A rule of thumb: if the patient can climb two flights of stairs without symptoms, normal sexual activity is generally well tolerated, barring other medical restrictions.

Key points:

• Effective training is brief, repeated, and verified through teach-back.
• Nutrition for older adults focuses on adequate protein intake and the prevention of malnutrition.
• Report any medication issues; do not change the treatment.
• Actively screen for and treat depression and isolation

8. PATIENT SAFETY AND EMERGENCY MANAGEMENT

Objectives:

- to recognize and classify potential adverse events during the program;
- applying initial measures for orthostatic hypotension, hypoglycemia, and arrhythmia;
- describing the steps of basic life support and the use of an AED;
- implementing measures to prevent falls

8.1. Adverse Events During Rehabilitation

Supervised rehabilitation programs are, on the whole, safe; serious events are rare but do occur and can be prevented through patient selection, proper assessment, progressive dosing, and close monitoring. The most common problems are minor: excessive fatigue, musculoskeletal pain, dizziness, cramps, mild hypotension, and brief palpitations. Rare but significant: angina, arrhythmias, syncope, hypoglycemia, cardiac decompensation, falls, and cardiac arrest. The 2026 ESC Guidelines estimate the rate of serious exercise-related adverse events at approximately 1 per 53,770 patient-hours in remotely supervised sessions, 1 per 11,333 patient-hours in center-based HIIT, and no reported events in center-based continuous moderate-intensity training; however, certain clinical conditions increase the risk and favor center-based continuous monitoring, ECG monitoring, and lower intensities.

Practical Note

Record **any incident** (even minor ones) in the chart: what happened, when, what parameters, what measures were taken, and who was notified. Analyzing incidents as a team helps prevent their recurrence.

8.2. Orthostatic Hypotension, Hypoglycemia, and Exercise-Induced Arrhythmias

Table 47 . Common situations and initial measures (according to local protocol)

Situation	Signs	Initial response
Orthostatic hypotension / presyncope	Dizziness upon standing, blurred vision, pallor	Sit or lie the patient down with their legs elevated; measure blood pressure and pulse; provide fluids if there are no contraindications; notify the doctor
Hypoglycemia (blood glucose <70 mg/dl)	Tremors, sweating, hunger, confusion, irritability	If the patient is conscious: 15 g of fast-acting carbohydrates (juice, glucose); repeat blood glucose test in 15 minutes; if symptoms persist, repeat; notify the doctor. If the patient is unconscious: call emergency services
Angina	Chest pain/pressure, shortness of breath	Stop physical activity, sit the patient down, measure blood pressure and pulse, administer nitroglycerin according to protocol, call the doctor; if symptoms do not subside within a few minutes—call emergency services
Arrhythmia (palpitations, new irregular pulse)	Palpitations, dizziness, shortness of breath	Stop physical activity, have the patient sit down, check pulse and blood pressure, perform an ECG if necessary, notify the doctor
Severe shortness of breath / worsening heart failure	Dyspnea at rest, cough, low SpO_2, weight gain >1.8 kg in 1–3 days	Semi-sitting position, oxygen per protocol, notify the doctor, urgent evaluation
Fall	Trauma, pain, inability to get up	Do not move the patient; evaluation by a physician; if a fracture or head injury is suspected, treat as an emergency

8.3. Emergency Protocol and Basic Life Support

All team members, including the master's student, must be familiar with the basic resuscitation algorithm and the location of equipment. The steps, according to European guidelines, are:

1. Check the safety of the area and **the patient's response** (gentle shaking, asking a question aloud).
2. If the patient is unresponsive and **not breathing normally**: call for help, **dial emergency services (112 / internal number),** and request an AED.
3. Begin **chest compressions**: center of the chest, depth 5–6 cm, rate 100–120 per minute, with full chest recoil.
4. **Apply the AED** as soon as it is available, and follow the voice prompts.
5. Continue until medical personnel arrive or until the patient shows signs of life.

Caution

When in doubt, **call emergency services sooner rather than later**. The emergency protocol and emergency numbers should be prominently displayed in the room [33].

8.4. Fall Prevention

Falls are a common cause of injury, hospitalization, and loss of independence among older adults. Global guidelines recommend risk assessment for individuals over 60 years of age who have a history of falls or risk factors, as well as interventions that include balance and strength exercises, medication review, correction of sensory deficits, and assessment of the home environment. The 2026 ESC Guidelines include balance exercises in the program for frail patients specifically to prevent falls [34].

- **In the exercise room:** dry, unobstructed floor; appropriate footwear; assistance with getting on and off equipment; stable chairs; good lighting.
- **For the patient:** TUG, orthostatic hypotension, medication that causes dizziness, visual acuity, leg pain.
- **At home:** remove loose rugs, use a nightlight, install grab bars in the bathroom, and avoid running in slippers.

Key Points

- Supervised programs are safe when patients are properly selected and monitored.
- Know by heart the first steps to take in cases of hypotension, hypoglycemia, angina, and arrhythmia.
- CPR: response – call – compressions – AED.

Falls can be prevented through balance, strength, medication, and a safe environment.

9. MODELS FOR PROVIDING CARDIOVASCULAR RESUSCITATION

Objectives:

- to compare delivery models (in-center, at home, remote, hybrid);
- selecting patients for an appropriate model;
- planning a safe home exercise program;
- preparing for the transition to maintenance

There is no one-size-fits-all model. Recent guidelines emphasize the need for **flexible options** to increase participation, particularly among older adults, women, and those in remote areas. The 2026 ESC Guidelines recommend center-based CR (Class I) and propose that services be patient-centered, with multiple delivery modes (Class IIa), to increase participation and equity; home-based rehabilitation without digital support may be considered for low-risk patients, while telerehabilitation or hybrid models may be considered following valve procedures or for patients with implantable devices (Class IIb). The rehabilitation team is responsible for the program regardless of the delivery model.

9.1. In-Center Outpatient Program

This is the gold standard model: direct supervision, equipment, monitoring, group setting, and the ability to intervene quickly. It is particularly suitable for patients at moderate and high risk, as well as for frail patients or those new to the program. Disadvantages: transportation, fixed schedule, costs, and limited availability. In heart failure, a network meta-analysis cited by the 2026 ESC guidelines compared center-based CR, full telerehabilitation, hybrid telerehabilitation, and technology-assisted CR: all modalities exceeded the minimum significant difference for peak VO_2, and only in-center rehabilitation significantly reduced HF-related hospitalizations and mortality, with high heterogeneity across studies. For the sickest and most frail patients, inpatient rehabilitation may be appropriate; the REHAB-HF trial demonstrated benefits of early and transitional rehabilitation in hospitalized older adults with decompensated HF.

9.2. Home-Based Recovery

Home-based recovery can be effective for low-risk, motivated patients in a safe environment, provided it is **structured** (written plan, diary, regular contact with the care team). It does not mean "sending the patient home with a pamphlet." The 2026 ESC Guidelines note comparable safety between supervised home-based cardiac rehabilitation and center-based cardiac rehabilitation, provided there is appropriate patient selection, education, and remote monitoring; however, the studies lack sufficient power to rule out differences in rare complications.

Table 48 . Sample weekly home care plan (for guidance only)

Day	Activity	Duration	Effort (RPE)
Monday	Moderate-paced walking + balance exercises in the kitchen	30 min + 10 min	11–12
Tuesday	Strength exercises with bottles/resistance band (chair lifts, push-ups)	20–30 min	11–13
Wednesday	Light walking + stretching	30 min	10–12
Thursday	Strength training + breathing exercises	20–30 min	11–13
Friday	Moderate-paced walking	30 min	11–13
Saturday	Enjoyable activity (gardening, dancing, walking with the grandchildren)	30–45 min	10–12
Sunday	Active rest, breathing exercises, and stretching	10–15 min	≤10

Practical Note

Conditions for the at-home program: low-risk or stable patient, aware of warning signs, has a phone within reach, safe space, minimal equipment, scheduled contact with the team (visit, phone call, video conference) every 1–2 weeks.

9.3. Telerehabilitation and Digital Technologies

Telerrehabilitation uses videoconferencing platforms, apps, wearable devices (pedometers, smartwatches, heart rate monitors), and telephone consultations for remote monitoring. The EAPC document recommends integrating it into rehabilitation services, either as an alternative or a complement, with careful attention to patient selection, safety, confidentiality, and equitable access. For older adults, barriers include a lack of digital skills, visual or hearing impairments, and a lack of equipment. Support from a family member, initial training at the center, and simple interfaces increase the chances of success. The 2026 ESC guidelines note that digital illiteracy and unequal access to technology are significant barriers, even for using a smartphone in teleconsultation. At the same time, a small randomized trial (conference abstract, 2026) involving frail older adults following decompensation reported an improvement in physical function with 18 weeks of multidisciplinary telerehabilitation and a 90% adherence rate.

9.4. Hybrid Models

The hybrid model combines in-center sessions (assessment, technique training, and exercises with equipment) with sessions at home or remotely. It is a realistic solution for many older adults: in-center sessions provide safety and social interaction, while at-home sessions increase total physical activity and independence. The 2026 ESC Guidelines describe a shift toward a patient-centered hybrid model; in the network meta-analysis of heart failure, the hybrid model was most likely to rank first for 6MWT distance [35,36].

Table 49 . ***Comparison of delivery models***

Model	Advantages	Limitations	Suitable for
In the city center	Surveillance, devices, group	Transportation, fixed schedule	Moderate/high risk, vulnerable, beginner
At home	Flexibility, low costs	No direct supervision	Low risk, motivated, safe environment
Telerehabilitation	Remote access, monitoring	Digital skills, equipment	Stable, internet access, remote areas
Hybrid	Balance between security and access	Requires coordination	Mostly, especially after the first few weeks

9.5. Maintenance Phase and Continuity of Care

The program's benefits are lost if physical activity stops upon discharge. Maintenance involves regular physical activity (daily walking, strength training 2 days a week, balance exercises), social support (walking group, senior club, community activities), medical checkups, and periodic contact with the team. Community programs, "refresher" sessions every 3–6 months, and a written plan with realistic goals can be utilized. The 2026 ESC Guidelines emphasize that it is never too late to adopt an active lifestyle, even with established coronary artery disease, and recommend community or peer groups to help maintain motivation.

Key Points

- The model should be chosen based on risk, preferences, resources, and context.
- A home exercise program should be structured and monitored, not improvised.
- Technology helps, but it should not exclude older adults who face digital barriers.
- Maintenance is the most important stage for sustaining the benefits.

10. MONITORING, RE-EVALUATION, AND DISCHARGE OF THE PATIENT

Objectives:

- planning reassessments and selecting outcome measures;
- interpreting the response and adjusting the program;
- establishing discharge criteria and a maintenance plan;
- preparing documentation and the final report.

10.1. Periodic Reassessments

Reassessments are conducted at **4–6 weeks** (interim follow-up) and at **the end of the program**, repeating the same tests as at the beginning (6MWT, SPPB, TUG, grip strength, questionnaires) to allow for comparison. At each session, baseline parameters, symptoms, and tolerance are monitored. The reassessment also includes a clinical component: blood pressure, weight, symptoms, medication, and risk factors. The 2026 ESC Guidelines recommend that results be described in terms of functioning (body functions, activities, participation) and through patient-reported outcome measures (PROMs), not just through clinical parameters.

10.2. Clinical, Functional, and Quality-of-Life Outcome Measures

Table 50 . Outcome indicators—dashboard model

Domain	Indicator	Indicative significance
Functional	6MWT	Increase ≥30 m = minimum clinically important difference (MCID) [26]
Exercise capacity	Peak VO_2 (if CPET is available)	MCID ≈ 1 ml/kg/min [26]
Functional	SPPB	Increase of ≥1 point = clinically significant change
Mobility	TUG	Decrease in time; target <12 s
Strength	Grip strength, chair stands in 30 s	Increase in value
Clinical	BP, resting pulse, weight, symptoms	Control, absence of symptoms
Risk factors	Smoking, lipids, blood glucose, diet	Individualized goals, according to guidelines
Quality of life	EQ-5D / SF-12; GDS	Improvement, reduction in depression
Adherence and completion	Sessions attended (% of those prescribed), program completion, diary, pedometer	Key quality indicators in the ESC 2026 guidelines; ≥80% attendance is a common target [26]
Quality of life in HF	KCCQ, MLHFQ	A 5-point difference = clinically significant [26]
Safety	Falls, incidents, readmissions	Number and causes

10.3. Adjusting the program based on response

Table 51 . Guideline decisions based on response

Observed response	Interpretation	Action
Lower RPE at the same workload, rapid recovery	Good adaptation	Progress one parameter (duration → frequency → intensity)
Excessive fatigue the next day	Too high a dose	Reduce volume by 20–30%, maintain intensity
New symptoms (pain, shortness of breath, palpitations)	Possible clinical problem	Stop, inform your doctor, reevaluate
Plateau after 3–4 weeks	Plateau, adherence, external factors	Check adherence, sleep, diet, technique; modify the stimulus
Weight loss, reduced appetite	Nutritional risk	Nutritional assessment, protein intake
Repeated absences	Barrier	Open discussion; flexible schedule, transportation options, phone

10.4. Discharge Criteria and Maintenance Plan

Discharge from the supervised program occurs when: the main goals have been achieved or a plateau is clearly established, the patient understands and independently follows the program, recognizes warning signs, takes medication, and adheres to the meal plan, and the transition to maintenance is prepared. The maintenance plan is written and includes: recommended activities (type, frequency, duration, intensity), where they take place, who supports them, the follow-up date, and the contact person. A copy is provided to the patient, and a report is sent to the attending physician.

10.5. Medical Documentation and Final Report

The documentation must be **complete, accurate, legible, dated, and signed**, and must respect confidentiality. A useful format is SOAP (S – Subjective, O – Objective, A – Assessment, P – Plan). The final report includes: identifying information (in accordance with confidentiality rules), diagnosis and risk, initial and final assessments, the program carried out, compliance, incidents, results, maintenance recommendations, and follow-up visits.

Practical Note

Example of a SOAP note for a session: S: “I felt fine, no pain, slept poorly.” O: BP 138/82, pulse 72, SpO2 96%, 25 min on exercise bike (RPE 12), maximum pulse 104, final BP 132/80, no symptoms. A: Good tolerance, restless sleep. P: Maintain duration, increase strength by 1 set; recommend sleep hygiene; reassess next week.

Key Points

- The reevaluation uses the same tests as the initial assessment, at 4–6 weeks and at the end.
- Progression occurs only if the sessions are well tolerated.
- Discharge requires a written maintenance plan.
- Clear documentation protects both the patient and the team.

11. CASE STUDIES

11.1. A 78-year-old patient following acute coronary syndrome, with type 2 diabetes

Clinical Case

Patient A., male, 78 years old, retired, lives with his wife. Non-ST-elevation myocardial infarction treated with PCI and a stent in the left anterior descending artery 3 weeks ago. Comorbidities: hypertension, type 2 diabetes mellitus managed with basal insulin and metformin, dyslipidemia. Medication: dual antiplatelet therapy, beta-blocker, ACE inhibitor, statin. LVEF 50%. No angina since discharge. Personal goal: "to be able to go to the market again and carry the shopping bags."

Table 52 . Initial assessment—Patient A.

Parameter	Value
Resting BP / 3-minute orthostatic BP	142/84 → 128/78 mmHg (decrease of 14/6, asymptomatic)
Resting HR / SpO2	68 bpm / 96%
6MWT	310 m (final RPE 13)
SPPB	9/12
TUG	11.5 s
Grip strength	28 kg
CFS	4 (vulnerable)
MoCA / GDS-15 / MNA-SF	27 / 3 / 12
Other	One episode of hypoglycemia in the past 3 months; no falls

Stratification: moderate risk (age, diabetes, insulin, recent history, below-average functional capacity), no residual ischemia or arrhythmias. **SMART Goals:** (1) walk continuously for 30 minutes within 12 weeks; (2) 6MWT ≥350 m; (3) ≥12 chair stands in 30 s; (4) no episodes of exercise-induced hypoglycemia.

Table 53 . Proposed program—Patient A. (for guidance)

Element	Prescription
Frequency	3 supervised sessions/week in weeks 1–6, then 2 + 2 at home
Aerobic	Stationary bike/treadmill 15 → 30 min, RPE 11–13; HR at estimated VT1 ≈ 92 bpm (peak HR 125, resting HR 68), training around and below VT1 and below the symptom threshold; daily walking 20–30 min
Strength	Chair stands, push-ups, resistance band pulls; 1→2 sets × 10–12; 2×/week
Balance	Tandem stance, one-legged stance with support, 3×/week.
Precautions , diabetes	Blood glucose levels before and after; do not exercise if <100 mg/dl without a snack; keep carbohydrates on hand at ; adjust insulin dose in consultation with your doctor
Education	Warning signs, nitroglycerin, home blood pressure monitoring, Mediterranean diet

Progress at 12 weeks: 6MWT 385 m, SPPB 11, chair stands 14/30 s, TUG 9.8 s; resting blood pressure 132/78 mmHg; one episode of mild hypoglycemia in week 5, resolved after adjusting the snack and dose. Transition to a hybrid maintenance program (neighborhood walking group, 2 days of strength training at home).

Reflection Question

Why was the symptom threshold used rather than just the calculation formula for target heart rate? What would you do if the pre-exercise blood glucose level were 85 mg/dL? What would be the appropriate course of action if angina were to occur in week 4? Estimate the heart rate at VT1 for a peak heart rate of 125 and a resting heart rate of 68 bpm (formula from the 2026 ESC guidelines, section 5.6).

11.2. An 82-year-old female patient with heart failure with reduced ejection fraction and frailty

Clinical Case

Patient B., female, 82 years old, widowed, lives alone on the 2nd floor of a building without an elevator; her daughter visits her daily. Heart failure with an ejection fraction of 30% (ischemic etiology), NYHA Class III, implanted ICD, one hospitalization for decompensation 6 weeks ago. Medications: beta-blocker, sacubitril/valsartan, mineralocorticoid receptor antagonist, SGLT2 inhibitor, loop diuretic. She feels “weak”; she has fallen once in the past year.

Table 54 . Initial evaluation – Patient B.

Parameter	Value
Resting/orthostatic BP	108/66 → 94/60 mmHg (mild dizziness)
Resting heart rate / SpO2	62 bpm / 95%
Weight	62 kg (lean body mass 61 kg)
6MWT	180 m (with 2 breaks, RPE 14)
SPPB	5/12
TUG	17 s
Grip strength	12 kg
CFS	6 (moderate frailty)
MoCA / GDS-15 / MNA-SF	25 / 7 / 9

Stratification: high risk (FEVS 30%, ICD, NYHA Class III, frailty, orthostatic hypotension). **SMART Goals:** (1) climb one flight of stairs with only one rest stop within 12 weeks; (2) SPPB ≥8; (3) walk for 10 minutes daily indoors or in the hallway; (4) weigh herself daily and record her weight; (5) avoid falls.

Table 55 . Proposed Program – Patient B. (indicative)

Element	Prescription
Frequency	2–3 supervised sessions/week with monitoring of BP, HR, and SpO2; simple daily program at home
Aerobic	Intervals: 2 min of light exercise / 1–2 min rest × 5–6 (total 15 min), RPE 11–12; sessions performed while seated on a recumbent bike; gradually increase duration, not intensity
Strength	Assisted stands from a high chair, 0.5 kg push-ups, light resistance band pulls; 1 set × 6–8 reps; no Valsalva maneuver
Balance	With both hands on a support, feet close together → semi-tandem
ICD	Maintain HR below the therapy threshold by 10–20 bpm (as determined during programming)
Inspiratory training	If indicated and tolerated: 3–5 times/week, 20–30 min, starting at approximately 30% of maximum inspiratory pressure [26]
Precautions	Gradual transitions; hydration as indicated; daily weight monitoring; discontinue and notify the physician if weight increases by >1.8 kg in 1–3 days (ESC 2026 criterion) or >2 kg in 3 days, or in the event of new-onset dyspnea
Other interventions	Nutritional support (protein), psychological assessment for a GDS score of 7, home assessment for fall risk, support from the daughter

Progress at 12 weeks: 6MWT 235 m, SPPB 8, TUG 13.5 s, grip strength 14 kg, GDS 4; climbs one flight of stairs with one rest stop; no decompensation, no falls. Continuation in a hybrid format is recommended.

Reflection Question

What would you do if the patient arrived at her session having gained 2.5 kg in 3 days? Why is it safer to increase duration before intensity? What would a 40-minute session look like for her?

11.3. 75-Year-Old Patient Following Transcatheter Aortic Valve Implantation (TAVI)

Clinical Case

Patient C., male, 75 years old, former farmer, lives with his son. Severe aortic stenosis; TAVI performed 6 weeks ago without major complications. Permanent atrial fibrillation managed with rate control (beta-blocker) and oral anticoagulant. Balance difficulties; 2 falls in the past year. No angina, dyspnea on moderate exertion. (At age 75, TAVI is consistent with the 70-year threshold in the 2025 ESC/EACTS guidelines.)

Table 56 . Initial evaluation – Patient C.

Parameter	Value
Resting/orthostatic blood pressure	126/74 → 118/70 mmHg
Resting heart rate / rhythm	78 bpm, irregular (FiA)
6MWT	290 m
SPPB	8/12
TUG	13 s
Grip strength	24 kg
CFS	5
MoCA / GDS-15 / MNA-SF	26 / 4 / 11

Stratification: moderate risk (stable post-TAVI, controlled FiA, mild frailty, risk of falls, and anticoagulant therapy). **SMART goals:** (1) SPPB ≥10 within 12 weeks; (2) TUG <11 s; (3) walking 30–40 minutes on flat ground; (4) no falls.

Table 57 . Proposed program – Patient C. (indicative)

Element	Prescription
Frequency	3 sessions/week for the first 6–8 weeks, followed by a hybrid program
Aerobic	Treadmill/outdoor walking, 20 → 40 min, RPE 11–13 (HR is not a guide due to FiA)
Strength	Chair stands, step-ups onto a low step, resistance band pulls; 2 sets × 10; 2–3 times per week
Balance	Daily exercises: tandem walking, single-leg standing, walking along a line, under supervision
Precautions	Anticoagulant: risk of bleeding in case of a fall; check the access site; orthostatic blood pressure; monitor heart rate and symptoms (syncope)
Education	Warning signs, oral hygiene, adherence to anticoagulant therapy, fall prevention at home

Progress at 12 weeks: 6MWT 365 m, SPPB 10, TUG 10.5 s, grip strength 27 kg, no falls. Walks 30–40 minutes daily with her son and participates in the community walking group.

11.4. Comparative Discussion and Key Points

Table 58 . Comparison of the three cases

Aspect	Patient A.	Patient B.	Patient C.
Primary diagnosis	ACS + PCI, DZ	Heart Failure with an EFR of 30%, ICD	Post-TAVI, FiA
Frailty (CFS)	4	6	5
Risk	Moderate	High	Moderate
Intensity Guide	RPE + symptom threshold	RPE (short intervals)	RPE (irregular heart rate)
Critical factor	Hypoglycemia	Orthostasis, daily weight, ICD	Anticoagulant, balance
Follow-up model	Hybrid / group	Hybrid, family support	Community-based group

Key Points

- The same core program is tailored based on **risk, vulnerability, medication, and context**.
- Intensity is guided by RPE, especially in FiA, HF, and among those on beta-blockers.
- Fall prevention is a priority for those on anticoagulants.
- The patient's functional goals are the starting point for the program

12. GUIDELINES FOR THE CLINICAL ROTATION FOR MASTER'S STUDENTS

Objectives:

• understanding the targeted competencies and how they are assessed;
• to organize the portfolio and clinical practice notebook;
• to conduct self-assessment and reflect on one's own work.

12.1. Targeted Professional and Transversal Competencies

Table 59 . Competencies targeted during the practicum

Type	Competency	Evidence (indicator)
Professional	Performs a structured initial assessment of elderly cardiac patients	Complete evaluation forms (at least 3)
Professional	Administers and interprets functional tests (6MWT, SPPB, TUG, grip strength)	Correct protocols, recorded values
Professional	Sets SMART goals and an individualized plan	Written plan for each patient
Professional	Prescribes, performs, and adjusts exercises under supervision	Session log, direct observation
Professional	Recognizes warning signs and applies first aid	Simulation, questionnaire, observation
Professional	Applies current guidelines (ESC 2026) and critically evaluates a recent clinical study in older adults	Written commentary on a guideline and a study from Section 1.7
Cross-Curricular	Communicates empathetically, uses teach-back	Assessment by the supervisor
Cross-Curricular	Work in a multidisciplinary team	Feedback from the team
Cross-Curricular	Adheres to ethics, confidentiality, and GDPR	Anonymization of documents
Cross-Curricular	Search for and apply information from recent and reliable sources	Bibliography, critical discussion

12.2. Portfolio and practice journal

The portfolio demonstrates the master's student's progress and includes:

- **Practice journal:** daily activities, techniques observed/practiced, questions, incidents;
- **Three complete** (anonymized) **patient records**: assessment, risk, goals, plan, re-evaluation;
- **An** in-depth **case study** (maximum 6–8 pages), with a critical discussion and bibliographic references in Vancouver style;
- **List** of **tests performed** and exercises demonstrated/conducted;
- **A written reflection** (1–2 pages) on a challenging issue (communication, decision-making, ethics);
- Final **self-assessment** and personal development plan.

12.3. Criteria and Evaluation Form for Master's Students

Table 60 . Sample evaluation form (indicative weightings)

Criterion	Weight	Level (1–5)	Comments
Patient assessment (completeness, accuracy)	20%		
Prescription and program adaptation	20%		
Safety and monitoring	20%		
Patient Communication and Education	15%		
Documentation, Ethics, and Confidentiality	10%		
Teamwork and Professional Attitude	10%		
Portfolio and Reflection	5%		

12.4. Self-Assessment and Reflection Topics

Reflection Topic

- In what situations did I find it most difficult to adapt an exercise for a frail patient? What did I do? What would I do differently?
- When did I feel that a patient didn't understand what I had explained? How did I verify this?
- What ethical or confidentiality issues did I encounter in practice?

What skill do I want to develop over the next 6 months, and how?

Key Points

- Practice is the best form of learning, provided it is observed, discussed, and reflected upon.
- A portfolio demonstrates not only what you've done, but also what you've understood.

Honest self-assessment is a sign of professionalism

APPENDICES

Appendix A. Initial Assessment Form for Elderly Patients

Sample form to be completed at the first visit (anonymized data).

Table 61 . Appendix A — Initial Assessment Form for Elderly Patients

Section	Fields to be filled out
General Information	Patient ID: __ *Age: Sex: Date of assessment: Referring physician:*
Diagnosis and Event	Primary Diagnosis: __ *Date of Event/Procedure: Type (ACS / PCI / CABG / MI / valvular heart disease / FiA / hypertension / PAD / other):*
Comorbidities	Diabetes / COPD / kidney disease / osteoarthritis / neurological disease / depression / others: ____
Medication	Complete list (doses, times): __ *Allergies: Self-reported adherence:*
Current symptoms	Angina / dyspnea (NYHA) / palpitations / syncope / edema / claudication: ____
Parameters	Resting BP (Systolic/Diastolic): __ *Orthostatic BP at 1' / 3': HR: SpO2: Weight / Height / BMI: Calf circumference:*

Section	Fields to be filled out
Functional	ADL: __ *IADL: Frailty (Friedman / CFS): 6MWT: m (RPE) SPPB: /12 TUG: s Grip strength: kg Walking speed: m*
Cognitive / Affective / Nutritional	MoCA: __*/30 GDS-15: MNA-SF: /*
Risk of falling	Falls in the past year: __ *TUG: Fear of falling: yes / no Risk factors:*
Tests	ECG: __ *Echocardiogram / LVEF: Lab tests (Hb, creatinine/eGFR, K, blood glucose/HbA1c, lipids, NT-proBNP):*
Risk stratification	Low / Moderate / High Level of monitoring: ____
Patient's Goals	"I would like to be able to…": ____
Barriers	Transportation / costs / family support / fear of exertion / pain / technology / other: ____
Contraindications / Precautions	
Evaluator	Master's student: __ *Advisor: Signature:*

Appendix B. Sample Individualized Rehabilitation Program

Table 62 . Appendix B — Sample Individualized Rehabilitation Program

Element	Content
Patient (code) / Date	
Diagnosis and Risk	
SMART Objectives	1. __ *2. 3.*
Frequency and duration of the program	_ *sessions/week* × _ weeks; home activity ___ days/week
Aerobic	Type: __ *Duration: Intensity (RPE / HR):*
Strength	Exercises: __ *Sets* × *repetitions: Load:*
Balance / flexibility	
Respiratory	
Precautions and restrictions	
Signs to Stop Exercising	Chest pain, disproportionate shortness of breath, dizziness, palpitations, pallor, cold sweat, severe leg pain
Contact in case of problems	Name / Phone: ____
Follow-up visits	At 4–6 weeks: __ *At the end:*

Appendix C. Scales and questionnaires used (Borg, MoCA, GDS, MNA-SF, CFS)

Table 63 . Clinical Frailty Scale (CFS) – summary (9-point version; the 2026 ESC guidelines mention the 7-point version)

Level	Description
1	Very fit—active, energetic, motivated, exercises regularly
2	In good shape—no active illnesses, but less fit than Level 1
3	Managing well – illnesses are well controlled; occasional physical activity
4	Vulnerable—independent, but symptoms slow them down; tires easily
5	Mild frailty—needs help with complex activities (finances, transportation, cooking)
6	Moderate frailty – needs help with activities outside the home and in the bathroom; has difficulty with stairs
7	Severe frailty – dependent on care for personal activities
8	Very severe frailty – completely dependent, nearing the end of life
9	Terminally ill – life expectancy <6 months

Table 64 . Indicative Thresholds – Screening Tools

Tool	Range / Threshold	Interpretation
MoCA	0–30; <26	Suggests cognitive impairment
GDS-15	0–15; >5	Suggests depression
MNA-SF	0–14	12–14 normal; 8–11 at risk; 0–7 malnutrition
SPPB	0–12	≤9 reduced performance
TUG	seconds	≥12 s increased risk of falling
Grip strength	kg	<27 kg (M), <16 kg (F) = weakness
Fried phenotype	0–5 criteria	1–2 pre-frail; ≥3 frail
Edmonton Frail Scale	tool recommended by the EAPC and the 2026 ESC guidelines for CR	Used in conjunction with the CFS (7-point version)
SARC-F	0–10; ≥4	Suggests a risk of sarcopenia

For the Borg scale (RPE 6–20), see Chapter 5, Section 5.6. The full questionnaires (MoCA, GDS, MNA-SF) should be used in their validated versions, following the official administration and scoring instructions.

Appendix D. Sample Informed Consent Form

This is a sample template that should be adapted to the institution's forms and procedures.

I, the undersigned, ____, *have been informed, in a manner I can understand, about the cardiovascular rehabilitation program: its purpose (improving exercise capacity, quality of life, and reducing the*

risk of events), how it is conducted (assessments, supervised exercises, education), the possible benefits, the risks (rare but possible: fatigue, muscle pain, dizziness, arrhythmias, chest pain, falls), the alternatives, and the fact that I may ask any questions and may withdraw at any time without any consequences for my care

I understand that my health data will be processed confidentially, in accordance with applicable law (including Regulation (EU) 2016/679), and that it may be used for scientific or educational purposes only in anonymized form, with my consent.

I agree to participate in the program: YES □ NO □

I consent to the use of anonymized data for educational/scientific purposes: YES □ NO □

Date: __ *Signature of the patient / legal representative:* __ *Signature of the physician / therapist:* __

Appendix E. Self-Assessment Questions

Select the correct answer (one option only). The answer key is at the end.

1. What is the usual target for aerobic intensity in a recovery program for older adults? **(a)** RPE 6–8; **(b)** RPE 11–13; **(c)** RPE 17–19; **(d)** maximum heart rate.
2. What is the definition of orthostatic hypotension? **(a)** a decrease in systolic blood pressure (SBP) of ≥20 or diastolic blood pressure (DBP) of ≥10 mmHg within 3 minutes; **(b)** blood pressure <100/60 while at rest; **(c)** heart rate <50; **(d)** a decrease in SBP of >5 mmHg.
3. In a TUG test, what time indicates an increased risk of falling? **(a)** <8 s; **(b)** 9–10 s; **(c)** ≥12 s; **(d)** not applicable to older adults.
4. Which indicator is the most reliable for assessing exercise intensity in a patient with heart failure and a beta-blocker? **(a)** heart rate; **(b)** RPE; **(c)** weight; **(d)** blood glucose.
5. For a female patient with heart failure and an FEVS of 30%, which statement is correct? **(a)** Avoid all exercise; **(b)** Start with short intervals, RPE 11–12, while monitoring weight and blood pressure; **(c)** Perform HIIT from the start; **(d)** A forced Valsalva maneuver is recommended.
6. What do you do if a patient's blood glucose is <70 mg/dl and the patient is conscious? **(a)** Continue the exercise; **(b)** Administer 15 g of fast-acting carbohydrates and check again in 15 minutes; **(c)** Send the patient home without taking any action; **(d)** Give the patient only water.
7. What is the recommended depth of chest compressions in adults? **(a)** 1–2 cm; **(b)** 2–3 cm; **(c)** 5–6 cm; **(d)** 8–9 cm.
8. Which of the following is NOT a contraindication for exercise? **(a)** unstable angina; **(b)** cardiac decompensation; **(c)** age 80; **(d)** severe, symptomatic, untreated aortic stenosis.
9. How many days a week is strength training recommended, on non-consecutive days? **(a)** daily; **(b)** 2–3; **(c)** 6–7; **(d)** once a month.
10. What is the main purpose of the "teach-back" method? **(a)** to verify the patient's understanding; **(b)** to shorten the consultation; **(c)** to assess memory; **(d)** to change medication.
11. Which group of exercises reduces the risk of falling? **(a)** aerobic exercise alone; **(b)** balance and strength exercises; **(c)** flexibility exercises alone; **(d)** bed rest.
12. In intermittent claudication, supervised walking therapy involves: **(a)** walking until moderate pain in the calf, resting, then repeating; **(b)** walking only when pain-free; **(c)** complete rest; **(d)** arm exercises only.
13. After sternotomy, sternal precautions include: **(a)** lifting heavy weights; **(b)** placing a pillow on the sternum when coughing; **(c)** doing push-ups immediately; **(d)** sleeping on the abdomen.
14. The daily protein intake recommended by ESPEN for older adults, as a guideline, is approximately: **(a)** 0.2 g/kg; **(b)** 0.5 g/kg; **(c)** 1.0 g/kg; **(d)** 3.0 g/kg.
15. Which measure is essential before starting any session? **(a)** checking symptoms and resting parameters; **(b)** increasing resistance to the maximum; **(c)** moving directly to HIIT; **(d)** ignoring medication.

16. According to the 2026 ESC guidelines, frailty in a patient indicated for CR: **(a)** is a contraindication; **(b)** should not be a reason to refuse CR (Class III) and can be improved through CR; **(c)** requires rest only; **(d)** is relevant only in patients under 60 years of age.
17. For setting the intensity of aerobic training, the 2026 ESC guidelines prefer: **(a)** the formula 220 − age; **(b)** ventilatory thresholds (VT1/VT2), estimated from resting heart rate and peak heart rate if a cardiopulmonary test is not available; **(c)** MET classification; **(d)** the patient's subjective perception alone, without measurements.
18. The recommended protein intake for maintaining muscle mass in older adults with acute or chronic disease is approximately: **(a)** 0.4 g/kg/day; **(b)** 0.8 g/kg/day; **(c)** 1.2–1.5 g/kg/day; **(d)** 4 g/kg/day.
19. Following CABG, the 2026 ESC guidelines recommend that Phase II cardiac rehabilitation begin: **(a)** within 28 days, not exceeding 42 days; **(b)** after 6 months; **(c)** after 1 year; **(d)** only if the patient requests it.
20. Which of the following is a high-risk situation during exercise (ESC 2026 guidelines)? **(a)** weight gain >1.8 kg in 1–3 days; **(b)** age 78; **(c)** use of a cane; **(d)** slow walking.

Key Points

Answer Key: 1-b; 2-a; 3-c; 4-b; 5-b; 6-b; 7-c; 8-c; 9-b; 10-a; 11-b; 12-a; 13-b; 14-c; 15-a; 16-b; 17-b; 18-c; 19-a; 20-a.

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CHAPTER 3. CARDIOVASCULAR RECOVERY IN PATIENTS WITH DIABETES MELLITUS

Ana-Maria Pah

1. INTRODUCTION

Approximately one-quarter of participants in cardiovascular rehabilitation programs in Europe, North America, and Australia have diabetes, and over 90% of them have type 2 diabetes. Diabetes and cardiovascular disease frequently co-occur, share common risk factors (obesity, physical inactivity), and influence one another. At the same time, patients with diabetes are less likely to enroll in rehabilitation programs, have lower adherence, and are less likely to complete them than those without diabetes, largely due to fear of hypoglycemia.

Objectives:

- To conduct a structured initial assessment of patients with diabetes, including the type and duration of the disease, treatment, episodes of hypoglycemia, and chronic complications;
- To stratify the risk of dysglycemia and cardiovascular risk and determine the appropriate level of monitoring;
- To formulate, together with the patient, SMART goals (glycemic, cardiovascular, functional) and a plan coordinated with the endocrinologist;
- Prescribe and progress a multicomponent exercise program (FITT-VP) tailored to the type of diabetes and complications;
- Apply the protocol for glycemic management before, during, and after exercise, and recognize and treat hypoglycemia;
- Recognizing hyperglycemia with ketosis, ketoacidosis (including euglycemic ketoacidosis associated with SGLT2 inhibitors), and taking appropriate action;
- Provide therapeutic education, nutritional and psychological support, and contribute to foot care; document the case;
- Reassess outcomes and prepare for discharge

FUNDAMENTALS OF CARDIOVASCULAR RECOVERY IN PATIENTS WITH DIABETES MELLITUS

Objectives:

- To explain the mechanism by which diabetes contributes to cardiovascular disease and its implications for exercise;
- Describe the prevalence of diabetes in cardiac rehabilitation and the differences between Type 1 diabetes (T1D), Type 2 diabetes (T2D), and prediabetes;
- Defining cardiac rehabilitation and outlining its benefits for patients with diabetes;
- To explain why participation and adherence are lower and how they can be increased;
- List the main relevant recent guidelines

1.1. The pathophysiology of cardiovascular disease in diabetes (insulin resistance, hyperglycemia, inflammation, endothelial dysfunction)

Diabetes accelerates atherosclerosis and directly affects the myocardium and small blood vessels. The main mechanisms are insulin resistance and hyperinsulinemia, chronic hyperglycemia with oxidative stress and advanced glycation end products, low-grade chronic inflammation, endothelial dysfunction, dyslipidemia (elevated triglycerides, low HDL, small and dense LDL), and a prothrombotic tendency. Added to these are, microangiopathy (retina, kidneys, nerves, myocardium), and autonomic neuropathy, which can mask ischemia and alter the cardiac response to exercise.

Physical exercise acts on these same mechanisms: it increases insulin-independent muscle glucose uptake during exercise, improves insulin sensitivity for hours or days after exercise, reduces visceral fat, blood pressure, and inflammation, and improves endothelial function and aerobic capacity. It is precisely this acute effect on blood glucose that makes it essential to carefully plan exercise in patients treated with insulin or medications that cause hypoglycemia.

Table 65 . The Link Between Diabetes and the Heart and Implications for Recovery

Mechanism	Consequence	Practical Implication
Accelerated atherosclerosis, multivascular disease	Extensive coronary artery disease, frequent revascularization	Tailored treatment plan, attention to ischemia
Cardiac autonomic neuropathy	Silent ischemia, elevated resting heart rate, reduced chronotropic response, orthostatic hypotension	RPE as a guide; ECG; orthostatic blood pressure
Diabetic cardiomyopathy, diastolic dysfunction	Risk of heart failure, especially HFpEF	Monitoring of weight and symptoms
Microangiopathy (kidneys, retina, nerves)	Chronic kidney disease, retinopathy, neuropathy	Exercise-specific adaptations
Acute hypoglycemia / hyperglycemia	Arrhythmias, ischemia, dehydration, ketoacidosis	Glucose management protocol around exercise

1.2. Epidemiology of diabetes and associated cardiovascular disease

European data show that over 25% of people with established coronary artery disease have diabetes, and over 90% of them have T2D; approximately one-quarter of participants in the RC have diabetes, a figure that is rising, and up to one-third will require additional considerations for exercise. Compared to T2D, T1D carries a higher overall cardiovascular risk, and diabetes is also associated with heart failure, stroke, and peripheral artery disease.

Diabetes, hypertension, obesity, and smoking together account for approximately 50% of heart failure events in the general population.

For the master's student, the implication is clear: nearly every rehabilitation center will see patients with diabetes on a daily basis, and knowledge of blood glucose management around exercise must be a core competency, just like blood pressure measurement.

1.3. Classification of Diabetes and Implications for Rehabilitation

Classification matters in rehabilitation because **the risk of exercise-induced dysglycemia** varies greatly between types and depending on treatment.

1.3.1. Type 1 Diabetes (T1D)

Type 1 diabetes is an autoimmune disease characterized by an absolute insulin deficiency; insulin therapy is mandatory (multiple daily injections or an insulin pump). Patients with type 1 diabetes have the highest risk of exercise-related hypoglycemia, hyperglycemia, and ketoacidosis and require the highest degree of individualized care. In the long term, unlike in T2D, exercise generally does not substantially improve glycemic control in T1D, but it reduces the risk of complications and improves cardiovascular health and fitness.

1.3.2. Type 2 Diabetes (T2D)

T2D is the most common form and is characterized by insulin resistance and decreased insulin secretion. Treatment includes lifestyle modifications, metformin, SGLT2 inhibitors, GLP-1 agonists, DPP-4 inhibitors, sulfonylureas, and insulin. Regular aerobic exercise lowers HbA1c by approximately 0.5–0.7% in T2D, and exercise reduces the time spent in hyperglycemia. Acute risk depends on treatment: it is lowest in those treated only with lifestyle modifications or with antidiabetic medications that do not cause hypoglycemia, and higher in those taking sulfonylureas, glinides, or insulin.

1.3.3. Prediabetes and Metabolic Syndrome

Prediabetes (impaired fasting glucose, impaired glucose tolerance) and metabolic syndrome (abdominal obesity, hypertension, dyslipidemia, hyperglycemia) are common in cardiac patients. They represent a "window of opportunity": exercise, diet, and weight loss can prevent or delay

progression to type 2 diabetes (T2D). The cardiac rehabilitation (CR) program is the ideal setting to screen for these conditions using HbA1c and fasting blood glucose levels during the initial evaluation.

Table 66 . Types of Diabetes and Implications for Cardiac Rehabilitation

Type	**Acute exercise-related risk**	**Long-term effect of exercise**
Type 1 Diabetes	Highest (hypoglycemia/hyperglycemia, ketoacidosis)	Cardiovascular benefits and reduced complications; glycemic effect usually limited [1]
Type 2 diabetes with insulin or sulfonylureas/glinides	Moderate, similar to DZ1 in those on insulin	Improved glycemic control; risk of hypoglycemia to be managed
Type 2 diabetes with other antidiabetic medications or lifestyle changes alone	Low, similar to patients without diabetes	Decrease in HbA1c by 0.5–0.7% [3]
Prediabetes / metabolic syndrome	Very low	Prevention of progression; weight and blood pressure control

1.4. Definition, Components, and Benefits of Cardiovascular Rehabilitation in Diabetes

Cardiovascular rehabilitation is a complex, multidisciplinary, and personalized intervention that includes assessment, supervised exercise, risk factor management, nutritional counseling, psychosocial intervention, education, and adherence support. Meta-analyses show that exercise-based CR improves functional capacity and quality of life and reduces hospitalizations in patients with coronary artery disease. For patients with diabetes, the joint statement from rehabilitation associations emphasizes that regular physical activity is even more valuable than for those without diabetes, because it addresses two major, interdependent conditions [4,5,6,7,8].

The 2026 ESC Guidelines outline how to tailor exercise based on glycemic goals. In Type 2 diabetes (T2D), a higher frequency (≥5 days/week) and a higher volume of resistance training (≥21 sets per week) are associated with greater reductions in HbA1c. In Type 1 diabetes (T1D), combined training (endurance plus resistance) is most effective; the decrease in HbA1c begins at approximately 52 MET-min/week, reaches the minimum clinically significant difference (≥0.5%) at 160 MET-min/week, and peaks at around 1,500 MET-min/week. For obesity, a high volume (250–420 minutes/week) is recommended, along with strength training to preserve muscle mass during a low-calorie diet.

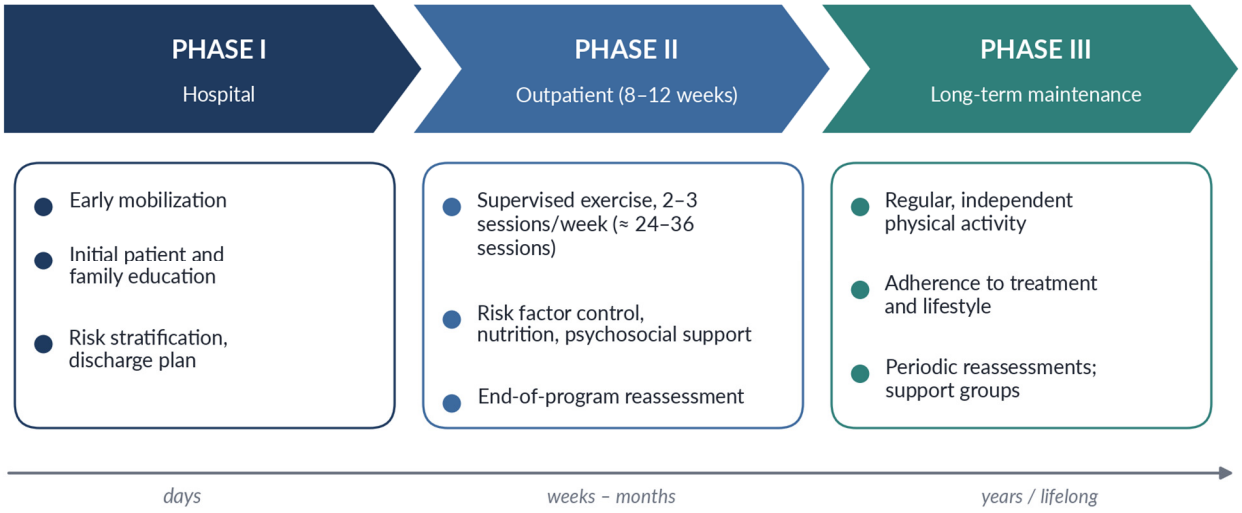


Figure 41 . Stages of cardiovascular recovery: from the hospital to long-term maintenance.

Key points

- Diabetes is common in CR (≈25%) and increases both cardiovascular risk and acute exercise risk.
- The type of diabetes and treatment determine the level of monitoring.
- Exercise has cardiovascular and glycemic benefits; the glycemic effect is greater in type 2 diabetes than in type 1 diabetes.

Blood glucose management around exercise is part of the treatment plan, not a "minor detail."

1.5. Participation and Adherence of Patients with Diabetes in Cardiovascular Rehabilitation

Patients with diabetes have lower participation, adherence, and completion rates in cardiovascular rehabilitation than those without diabetes. Those treated with insulin are more fearful of glycemic events, both during exercise and in the hours afterward; fear of hypoglycemia is one of the main barriers to physical activity, and hyperglycemia induced by intense exercise may be perceived as an additional barrier. The 2026 ESC Guidelines include diabetes among the comorbidities that must be addressed in a structured manner in cardiac rehabilitation, with a tailored program and a multidisciplinary team.

Note

Common mistake: The patient arrives with blood glucose slightly outside the target range and is sent home. They leave with the impression that "exercise is dangerous." Before dismissing the patient, every effort is made to correct their condition (fast-acting carbohydrates, light activity, hydration), and the session is shortened, not canceled.

Strategies to increase participation: education on the effect of exercise on blood glucose, clear and simple rules (carbohydrates, blood glucose, session time), monitoring available in the gym, communication with the endocrinologist, sessions scheduled around treatment times, and reducing sedentary behavior through small steps (movement breaks).

1.6. Recent guidelines and statements (2021–2026) on diabetes and physical activity

Table 67 . Recent documents relevant to clinical practice in diabetes

Document	**Useful message for practice**
ESC 2026 – Cardiac Rehabilitation	Individualized multimodal program; Exercise adaptation for hyperglycemia (T1D/T2D), obesity, hypertension, dyslipidemia; uncontrolled diabetes—a contraindication to training
ESC 2023 – Cardiovascular Disease in Diabetes	Integrated management of cardiovascular disease in patients with diabetes, including cardioprotective therapy
ADA 2026 – Standards of Care	Integrated approach (weight, cardio-renal protection, technology); CGM recommended for patients on insulin or medications that cause hypoglycemia; education and support for self-care
BACPR/CACPR/ICCPR Statement 2021	Nine recommendations for glycemic management before, during, and after exercise in chronic kidney disease; contraindications; drug interactions
ACSM 2022 – DZ2	Aerobic exercise lowers HbA1c by 0.5–0.7%; high-intensity resistance training is more effective for glycemic control; breaks from sedentary behavior; RPE 10–12 if maximum heart rate has not been measured
ADA/EASD 2022 – Hyperglycemia in T2D	Individualized treatment, with cardio-renal protection and weight control
ESC 2026 – heart failure	SGLT2 inhibitors and finerenone in T2D with risk of HF or CKD; GLP-1 RA; avoid antidiabetic drugs with safety concerns in HF
ESC 2021 – Prevention	Mediterranean diet, physical activity, alcohol ≤100 g/week
2025 Study	RCT in patients with coronary artery disease and type 2 diabetes, with individualized exercise based on CPET (design: 8 weeks)

Discussion Topic

You have a patient with type 2 diabetes treated with metformin and another with type 1 diabetes on an insulin pump, both of whom have recently had a heart attack. What differences in monitoring, equipment, and education would you plan for the two patients?

2. ORGANIZATIONAL, ETHICAL, AND LEGAL FRAMEWORK OF THE CLINICAL ROTATION

Objectives:

- describe the roles within the multidisciplinary team and the limits of the master's student's responsibility regarding patients with diabetes;
- distinguish the phases of cardiac rehabilitation and the indications for inclusion;
- list diabetes-specific and general exercise contraindications;
- explain the principles of informed consent and data protection (including CGM data);
- check that the room is equipped for monitoring blood glucose and ketones.

2.1. The Multidisciplinary Team and the Role of the Master's Student

The rehabilitation of a patient with diabetes is based on a three-pronged approach: the patient, the diabetes specialist (physician and/or nurse), and the exercise specialist. The RC team includes the cardiologist, rehabilitation physician, physical therapist, medical assistant, dietitian, psychologist, and social worker; for diabetes, the team also includes the diabetologist, diabetes educator, podiatrist, ophthalmologist, and, if necessary, the nephrologist.

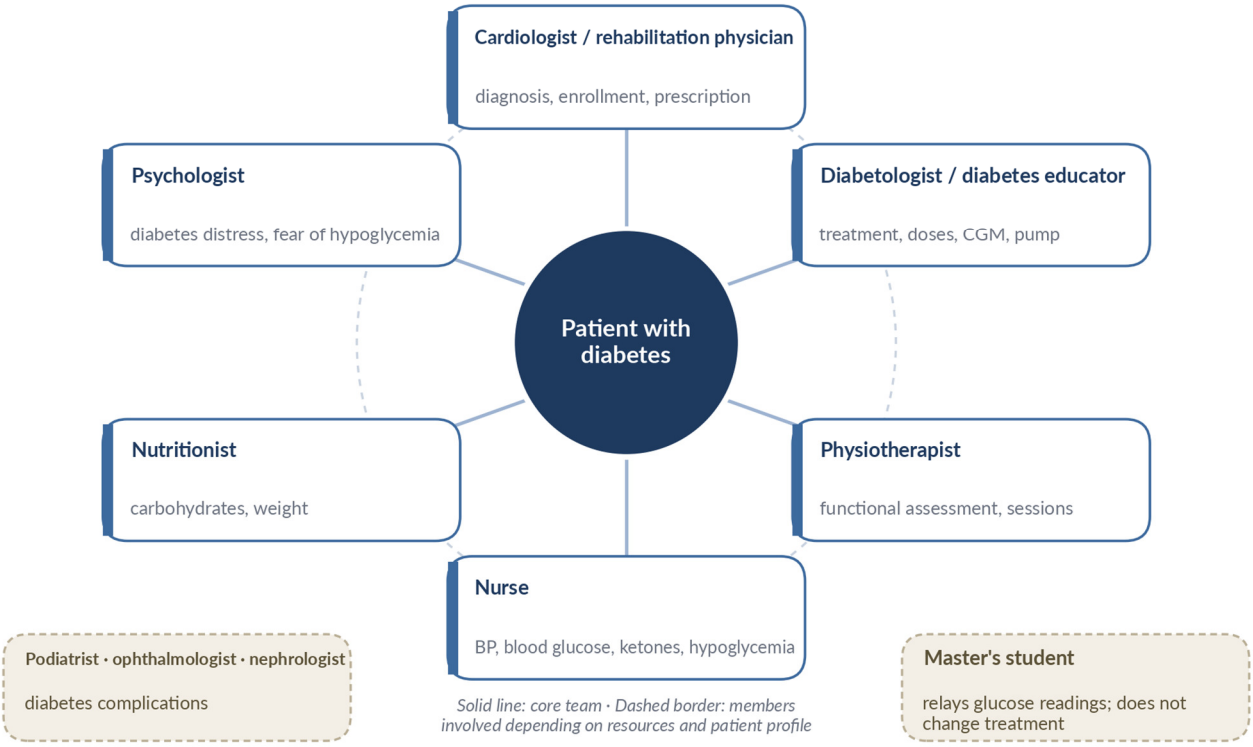


Figure 42 . The multidisciplinary cardiovascular rehabilitation team, centered around the patient.

Table 68 . Team roles and interaction with the master's student

Member	Primary Role	What the master's student does
Cardiologist / Rehabilitation Physician	Diagnosis, treatment, decision to enroll, stratification, prescription	Presents the case, receives instructions, reports any clinical changes
Diabetologist / Diabetes Educator	Diabetes treatment, dose adjustments, education, technology (CGM, insulin pump)	Reports blood glucose levels and events related to exercise; does not modify treatment
Exercise therapist / physical therapist	Functional assessment, prescribing exercises, and leading sessions	Assists, performs demonstrated exercises, monitors the patient
Medical assistant	Measurements (blood pressure, pulse, blood glucose, ketones), medication, emergencies	Assists with measurements and the treatment of hypoglycemia
Dietitian	Meal plan, carbohydrates, weight	Conducts screenings, reports observations regarding meals and snacks
Psychologist	Diabetes-related distress, depression, anxiety	Identifies fear of hypoglycemia, treatment non-adherence
Podiatrist, ophthalmologist, nephrologist	Diabetes complications	Reports foot injuries, blurred vision, swelling, fatigue

Caution: Insulin adjustments should only be made by a doctor or according to the endocrinologist's written protocol.

2.2. Phases of cardiovascular recovery

Phase I takes place in the hospital (early mobilization, education, preparation for discharge).

Phase II is a supervised outpatient program, typically lasting 8–12 weeks, with 2–3 sessions per week.

Phase III is long-term maintenance. The 2026 ESC Guidelines recommend early initiation: after ACS, ideally within the first 14 days and no later than 30 days; after CABG, within 28 days and no later than 42 days; in decompensated heart failure, after decongestion and stabilization. In patients with diabetes, glycemic control during Phase I (especially perioperatively) influences the course of the disease and sets the stage for Phase II.

2.3. Indications, Contraindications, and Inclusion Criteria for the Program

Patients with diabetes and a cardiac indication—such as acute or chronic coronary syndrome, revascularization, stable heart failure, valvular procedures, atrial fibrillation, peripheral arterial disease, hypertension, and increased cardiovascular risk—are candidates for CR. Diabetes, including cases with complications, is not a contraindication in itself.

The joint statement by the CR associations specifies that exercise is contraindicated in patients with diabetes only when one of the following conditions persists:

- a recent history of unstable ("brittle") glycemic control: 4 or more episodes of severe hypoglycemia and hyperglycemia with ketoacidosis, without an obvious cause, that required emergency care or hospitalization in the past 12 months (typically in type 1 diabetes);
- low blood glucose (<5 mmol/l, i.e., <90 mg/dl) that does not resolve with carbohydrate intake within a short period of time (<30 minutes);
- in T1D, hyperglycemia >15 mmol/l (>270 mg/dl) accompanied by ketones >1.5 mmol/l;
- in type 2 diabetes, ketones >1.5 mmol/l.

Practical Note

- **Principle:** Before excluding a patient, every effort should be made to reverse the contraindicated condition; even if this means shortening the session while waiting for blood glucose and ketone levels to normalize.

Table 69 . Situations in which exercise is postponed or contraindicated (based on Table 4 of the 2026 ESC guidelines)

Category	Examples
Contraindications for exercise testing and training	Early phase after ACS (first 2 days); untreated life-threatening arrhythmias; decompensated heart failure during the unstable phase; recent embolism; thrombophlebitis; acute myocarditis or pericarditis; symptomatic aortic stenosis; acute systemic disease; intracardiac thrombus
Contraindications for exercise	Progressive worsening of exercise tolerance or dyspnea at rest over the past 3–5 days; significant ischemia with very minimal exertion; **uncontrolled diabetes**; uncontrolled hypertension
Increased risk during exercise	Weight gain >1.8 kg in 1–3 days; decrease in systolic blood pressure during exercise; NYHA Class IV; complex ventricular arrhythmia; resting heart rate >100/min; advanced AV block; de novo atrial fibrillation/flutter; critical coronary stenosis; comorbidities that limit exercise

2.4. Informed consent, confidentiality, and personal data protection

Participation is based on informed consent: the patient receives clear explanations regarding the purpose, procedure, risks (including hypoglycemia), benefits, alternatives, and the right to withdraw, and the decision is documented in writing, in accordance with Law No. 46/2003 on patient rights and Regulation (EU) 2016/679 (GDPR). Blood glucose levels, data from CGM or the insulin pump, and the blood glucose log are health data: only the necessary data are collected, stored securely, shared with the endocrinologist with the patient's consent, and used in research only in anonymized form. Consent includes agreement to communicate with the endocrinologist and to administer carbohydrates or take other measures in the event of hypoglycemia.

2.5. Safety Standards, Room Setup, and Equipment for Blood Glucose Monitoring

The joint statement by CR associations recommends that RC services have devices for measuring blood glucose and ketones, with a level of availability comparable to that of blood pressure monitors, ECGs, and life support equipment, as well as staff trained to use them. This recommendation is based on the fact that monitoring before and during the session allows for adjustments to the type and intensity of exercise and reduces acute glycemic events.

Table 70 . Gym checklist for patients with diabetes

Item	To be checked before the session
Blood glucose monitoring	Glucose meter with valid test strips, lancets, ketone testing device (blood or urine), CGM reader/app, blood glucose log
Hypoglycemia treatment	Glucose tablets, juice, gel; glucagon according to the department's protocol; protocol posted in a visible location
Resuscitation and emergencies	AED, first-aid kit, oxygen, phone (112/internal number), protocol for severe hypoglycemia and ketoacidosis
Cardiac monitoring	Blood pressure cuff, pulse oximeter, heart rate monitor, or telemetry (for high-risk patients)
Safety	Non-slip flooring, clear space, stable chairs, appropriate footwear, drinking water; container for needles
Documents	Form with a section dedicated to diabetes, informed consent form, written insulin adjustment plan (if applicable)

Key Points

- The approach involves three parties: patient – diabetes specialist – exercise specialist.
- Diabetes is not a contraindication; exercise is contraindicated only in well-defined and persistent conditions.
- The exercise room must be equipped with a blood glucose meter and a ketone tester, as well as a blood pressure monitor.

3. INITIAL EVALUATION OF PATIENTS WITH DIABETES MELLITUS

Objectives:

- to take a diabetes-specific medical history (type, duration, treatment, hypoglycemia, ketoacidosis, technology);
- ordering and interpreting relevant tests (HbA1c, lipids, renal function, UACR, ECG);
- assessing chronic complications (neuropathy, retinopathy, kidney disease, foot complications);
- interpreting blood glucose monitoring data (glucose meter, CGM);
- conducting functional tests, nutritional and psychosocial assessments, and risk stratification.

The assessment serves as the "compass" of the program. For patients with diabetes, it must address both cardiac and metabolic aspects simultaneously. It is conducted over 1–2 visits, with the participation of a diabetologist whenever possible. The 2026 ESC Guidelines call for a personalized initial assessment, which includes medical history, laboratory tests, cardiac imaging, and an evaluation of physical capacity, nutritional status, and mental health.

3.1. Medical History: type and duration of diabetes, treatment, hypoglycemia, ketoacidosis, technology

Table 71 . Diabetes-specific questions and their purpose

Question	Why it matters
The type of diabetes, age at onset, duration	Type 1 diabetes and long duration increase the risk of complications and severe hypoglycemia
Treatment: insulin (type, doses, times), insulin pump, sulfonylureas/glinides, metformin, SGLT2 inhibitors, GLP-1 receptor agonists, DPP-4 inhibitors	Determines the risk of hypoglycemia and the need for carbohydrates and adjustments
Hypoglycemic episodes in the past 3 months: frequency, severity, symptoms, times of day, "I don't feel them"	Risk of exercise-induced hypoglycemia; unrecognized hypoglycemia
Ketoacidosis or hospitalizations for high blood glucose in the past 12 months	Criteria for instability; contraindications in persistent conditions
Use of CGM, insulin pump, or blood glucose meter; typical morning and evening blood glucose levels	Planning monitoring and the timing of the session
Meals, snacks, insulin administration times, previous physical activity	Adjustment of carbohydrates and appointment time
Known complications: neuropathy, retinopathy, kidney disease, foot ulcers, amputations	Exercise modifications
Cardiac symptoms, including atypical or absent symptoms	Ischemia may be asymptomatic in autonomic neuropathy
Alcohol, smoking, planned pregnancy, corticosteroid therapy	Affect blood glucose levels and safety

3.2. Clinical examination and laboratory tests (HbA1c, blood glucose, lipids, renal function, ECG, echocardiography)

The clinical examination includes blood pressure measurements in both arms, in the supine and standing positions (orthostatic hypotension may indicate autonomic neuropathy), heart rate and rhythm, SpO_2, weight, height, BMI, waist circumference, auscultation, peripheral pulses, wounds (sternotomy, puncture), and examination of the legs (skin, nails, deformities, calluses, ulcers, pulses, sensitivity). The master's student reviews the medical record; interpretation is left to the physician.

Useful tests: resting ECG, echocardiogram, HbA1c and fasting blood glucose, lipid profile (including lipoprotein (a), if not previously tested), creatinine and eGFR, urinary albumin-to-creatinine ratio (UACR), electrolytes, complete blood count, uric acid, and urinalysis. HbA1c provides a snapshot of the past 2–3 months; target values are determined individually by the endocrinologist [9]. In patients with kidney disease or anemia, the interpretation of HbA1c may be limited, and CGM provides additional information.

3.3. Assessment of Chronic Complications of Diabetes

Chronic complications can exacerbate problems related to hypoglycemia and hyperglycemia and limit the ability to exercise; they require specialist advice, but patients with advanced disease can still exercise, with precautions, qualified supervision, and a modified program.

3.3.1. Peripheral and Autonomic Neuropathy

Peripheral neuropathy causes loss of sensation in the soles of the feet (risk of unnoticed blisters and ulcers), weakness, and balance disorders, leading to a risk of falls and foot injuries; it is assessed using monofilament testing, vibration sensation testing, and balance testing. Autonomic neuropathy can mask angina and hypoglycemia, reduces the increase in heart rate during exercise, causes orthostatic hypotension, and decreases heat tolerance. Indicators: elevated resting heart rate, lack of heart rate variation with breathing, and decreased orthostatic systolic blood pressure.

3.3.2. Retinopathy

In diabetic retinopathy, there are concerns regarding activities that increase intraocular pressure: the Valsalva maneuver, intense isometric exertion, lifting heavy weights, and head-down positions. The date of the last ophthalmologic examination and the ophthalmologist's opinion are required in cases of proliferative retinopathy, following laser treatment or intravitreal injections, or in cases of blurred vision.

3.3.3. Chronic Diabetic Kidney Disease

eGFR and UACR are assessed. Kidney disease is associated with fatigue, anemia, fluid and electrolyte imbalances, and a risk of dehydration during exercise; patients with chronic kidney disease may require additional monitoring during sessions, including vital signs, symptoms, and hydration status. Medications (SGLT2 inhibitors, finerenone, diuretics) affect hydration and potassium levels.

3.3.4. Diabetic Foot and Peripheral Arterial Disease

Examine for ulcers, infections, deformities (Charcot foot), calluses, and signs of ischemia, and ask about claudication. The ankle-brachial index may be falsely elevated in calcified vessels associated with diabetes; therefore, the toe-brachial index or evaluation by a specialist is preferred when necessary. Active ulcers are treated by a podiatrist or vascular surgeon, and exercise is adjusted.

3.4. Blood Glucose Monitoring: Glucose Meter, Continuous Glucose Monitoring (CGM), Variability, and Unnoticed Hypoglycemia

The 2026 ADA guidelines recommend continuous glucose monitoring for people treated with insulin and those treated with medications that can cause hypoglycemia, as well as whenever CGM aids in management. CGM data include time in range (TIR, typically blood glucose levels of 70–180 mg/dl), time below range (TBR) and above range (TAR), variability, and trend (trend arrow); targets are set by the endocrinologist. Hypoglycemia is classified as level 1 (<70 mg/dl), level 2 (<54 mg/dl), and severe (requiring assistance from another person).

For patients without CGM, a capillary glucose meter is used before, during (if the session is long or the risk is high), and after the session; the joint statement recommends, for safety, that the room be equipped with a glucose meter and a ketone test kit. Unrecognized hypoglycemia (the patient no longer feels the warning signs) requires more frequent monitoring and close supervision; it is assessed through questioning and, if necessary, through validated questionnaires (Appendix C).

Patients are taught to recognize sensations during exercise within the safe glycemic range (RPE, sweating, HR) in order to distinguish them from those associated with hypoglycemia.

3.5. Functional Testing (CPET, 6MWT, Strength) and Considerations in Diabetes

CPET is the gold standard for exercise capacity and ventilatory thresholds; the 6MWT or another validated test is used when CPET is not available. In patients with diabetes, the test is performed after checking blood glucose levels (safe range, no hypoglycemia) and with an ECG, as ischemia may be silent. Diabetes reduces the heart rate response to exercise and decreases it even further with beta-blockers; therefore, exercise intensity is guided by RPE and thresholds, not by percentages of estimated maximum heart rate. For strength, the 2026 ESC guidelines prefer the 10-repetition maximum test (avoiding the Valsalva maneuver). MCID: approximately 30 m on the 6MWT and 1 ml/kg/min for peak VO_2.

3.6. Nutritional, Weight, and Body Composition Assessment

Weight, BMI, waist circumference, and, if possible, body composition are measured; the 2026 ESC guidelines recommend assessing body composition in all patients with CR and screening for malnutrition, sarcopenia, and sarcopenic obesity. Eating habits, mealtimes, carbohydrate counting, alcohol and sugar intake, weight-loss diets, and obesity treatments (GLP-1 agonists or dual-action agents) are explored. Unintentional weight loss (especially >5%, in CKD) is monitored.

3.7. Psychosocial Assessment: Diabetes-Related Distress, Depression, Anxiety, and Fear of Hypoglycemia

ADA guidelines specify when and how to screen for psychosocial factors in diabetes and who should conduct the screening. In the CR, the following are used: **the PHQ-9** (a score of ≥10 suggests moderate depression), **the GAD-7** (a score of ≥10 suggests significant anxiety), a diabetes-related distress scale, and questions about fear of hypoglycemia, treatment non-adherence, loneliness, shift work, and family support. Fear of hypoglycemia is a major barrier to physical activity. Positive scores are reported to the physician and referred to a psychologist.

Caution

Any mention of thoughts of self-harm or deliberate skipping of insulin is immediately reported to the physician; the patient is not left alone until an evaluation is conducted.

3.8. Stratification of Cardiovascular and Exercise Risk

Two factors are combined: cardiac risk (LVEF, ischemia, arrhythmias, functional capacity) and exercise-related dysglycemia risk. The joint statement proposes three levels of monitoring:

Table 72 . Levels of observation for the risk of dysglycemia

Level	Patient	Monitoring
High	T1D (maximum risk of hypo-/hyperglycemia and ketoacidosis)	Maximum individualization; CGM for unstable patients; ketones; contact with the endocrinologist
Moderate, similar to T1D	Type 2 diabetes treated with sulfonylureas or glinides; Type 2 diabetes on insulin (follow the guidelines for Type 1 diabetes)	Blood glucose before, during, and after exercise; carbohydrates on hand
Low	T2D treated with other antidiabetic medications or with a lifestyle	Same as for patients without diabetes, plus occasional blood glucose

3.9. Patient preferences, barriers to participation, and quality of life

Quality of life is assessed using the EQ-5D or SF-12, and in IC, using the KCCQ or MLHFQ. Preferences ("What would you like to be able to do again?") and barriers are explored: fear of hypoglycemia, the cost of test strips and sensors, work schedule and mealtimes, transportation, difficulty administering insulin during work hours, embarrassment about measuring blood glucose in public, and cultural dietary habits. Every barrier has a solution (sessions at convenient times, support, simple materials).

Key Points

- The evaluation is cardiac and metabolic; hypoglycemia and complications must be ruled out.
- Autonomic neuropathy masks ischemia and hypoglycemia and reduces the heart rate response to exercise.
- The risk of dysglycemia has three levels: T1D, T2D on sulfonylureas/insulin, and T2D without hypoglycemic agents.
- CGM and a blood glucose meter (plus ketone test strips) must be available for those at risk.

Clinical Case

- **Exercise:** A 60-year-old patient with T2D treated with metformin, glimepiride, and basal insulin, who has a recent myocardial infarction and peripheral neuropathy, comes in for his first visit. Select the investigations, functional tests, and level of monitoring, and justify your choices.

4. SETTING GOALS AND PLANNING AN INDIVIDUALIZED PROGRAM

Goals:

- implementing the shared decision-making process between the patient and the healthcare team;
- formulate SMART goals for glycemic control, cardiovascular health, functional status, and psychosocial well-being;
- structure an 8–12-week program and schedule sessions based on the treatment plan;
- coordinate the plan with the endocrinologist;
- document the plan in a clear format.

4.1. Shared Decision-Making Between Patient and Team

The program works if the patient understands it, wants it, and can follow through with it. Options are presented in plain language, values and constraints (work, meals, treatment) are explored, and the plan is chosen together. The "teach-back" method is used. Education on how physical activity affects blood glucose levels is effective and builds confidence; it aims to help the patient learn, understand, and independently apply decisions regarding blood glucose and physical activity, so they can be active safely and independently.

Practical Note

Helpful questions: "What worries you most when you think about exercise and blood glucose?", "At what time of day do you feel your best?", "What did you do last time you had low blood glucose?". Write down the answers; they become personal goals and guidelines.

4.2. Formulating SMART Goals (glycemic, cardiovascular, functional, psychosocial)

Table 73 . Examples of SMART Goals in Diabetes

Area	Example	Indicator
Glycemic	"HbA1c decreases by 0.5% in 12 weeks (in consultation with the endocrinologist)"; "TIR above 70%"	HbA1c; CGM
Glycemic Safety	"No exercise-related hypoglycemic episodes in 12 weeks"	Diary; CGM
Cardiovascular	"BP below 130/80 mmHg; LDL within target range; no exertional angina"	BP log; lab tests
Functional	"6MWT +30 m; 30 minutes of continuous walking in 12 weeks"	6MWT; diary
Weight	"5% weight loss while maintaining strength"	Weight; waist circumference; grip strength
Self-management	"Knowing what to do on my own when my blood glucose is <90 or >270 mg/dl before exercise"	Practical Test (Appendix E)
Feet	"Daily foot inspection on 5 out of 7 days"	Diary
Psychosocial	"PHQ-9 score below 10; participation in the monthly support group"	PHQ-9; participation

4.3. Program Structure: Duration, Frequency, and Phases

The standard Phase II program lasts 8–12 weeks, with 2–3 supervised sessions per week, supplemented by homework assignments. The 2026 ESC Guidelines emphasize that the benefit increases with the number of sessions attended and that, in the first few weeks, the number of exercises and sets can be gradually increased, followed by a transition to functional exercises. For patients with T2D aiming for glycemic control, the target is a frequency of ≥5 days per week of physical activity (supervised + at home), and taking breaks to move during prolonged sitting independently helps lower blood glucose levels.

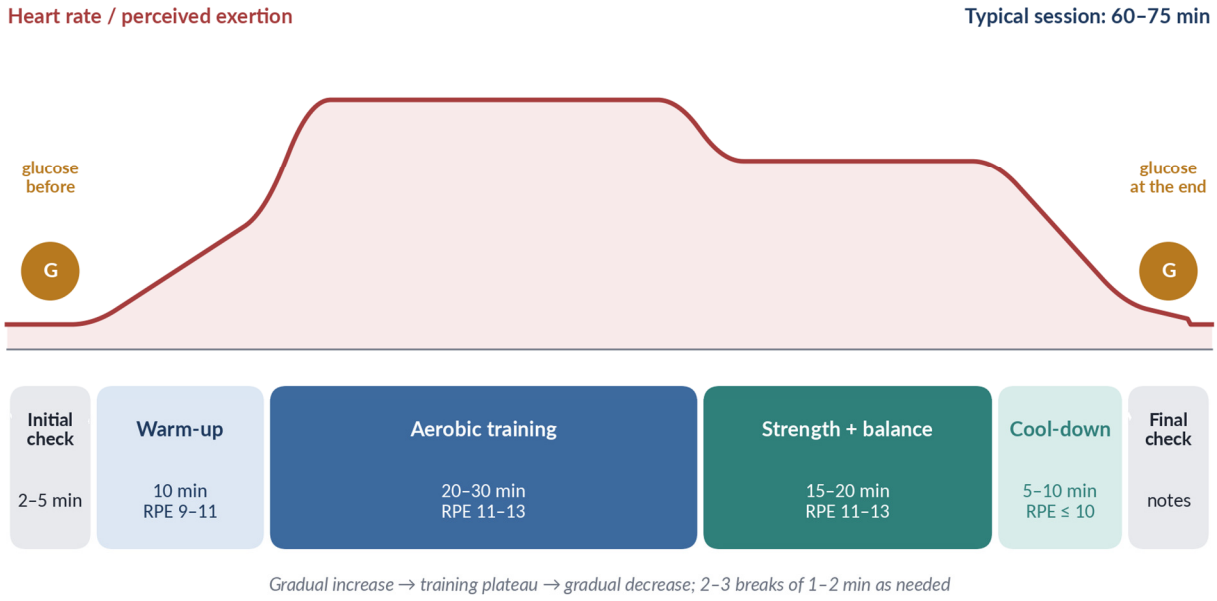


Figure 43 . Structure of a session: warm-up, aerobic training, strength and balance, cool-down; blood glucose is recorded at the beginning and end.

Table 74 . 12-week progression model (guideline)

Weeks	Objective	Aerobic (RPE 11–13)	Strength / Balance
1–2 (adaptation)	Learning blood glucose management rules and techniques	10–15 min, possibly intermittent; blood glucose before and after	1 set × 8 reps, very light load
3–6 (development)	Increasing duration	20–30 min continuously or with breaks	1–2 sets × 8–12 reps; supported balance
7–10 (progression)	Increasing intensity and strength volume	30–40 min; HIIT only for selected individuals	2 sets × 10–12 reps, 2–3 days/week
11–12 (consolidation)	Autonomy and maintenance	30–45 min, home program	Self-directed strength training program, self-managed blood glucose control

4.4. Coordination with the endocrinologist and adjustment of antidiabetic treatment

Any necessary adjustments to insulin and other antidiabetic medications at the start of the exercise program are determined by the patient's diabetes specialist, who is familiar with the patient's medical history, insulin type, and blood glucose variability. The role of the rehabilitation team is to communicate: the exercise schedule (days, times, duration, intensity), blood glucose events occurring around exercise sessions, and trends observed in the logbook or CGM. The endocrinologist must be informed of any events so that the patient's medical record and individualized treatment plan can be updated. As the patient becomes more active and fitter, insulin requirements and the risk of hypoglycemia may change; the plan should be reassessed every 2–4 weeks.

Note

The examples of insulin reductions in Section 5.8 are guidelines from consensus documents, not prescriptions. They should be applied only as directed by a physician or according to the diabetes specialist's written protocol.

4.5. Adapting to the Patient's Social Context and Resources

The best regimen is the one that can be followed. The following should be adapted: the timing of monitoring sessions relative to meals and doses (avoiding monitoring sessions at the peak of insulin action without adjustment), work schedule (shifts), transportation, costs (test strips, sensors, food), insulin storage, travel, and dietary habits. Patients who work shifts or drive vehicles need clear guidelines for checking their blood glucose before engaging in these activities. People who live alone need a plan for hypoglycemia (a contact person, a phone within reach).

4.6. Documenting the Recovery Plan

The joint statement recommends that the diabetes patient's medical record include a **section dedicated to** blood glucose management and medication: pre- and during, and after sessions (up to 24 hours in DM1), contraindicated activities, sensory-motor function, exercise-aggravated medication side effects, times of blood glucose events, and strategies implemented. The written plan (Appendix B) includes SMART goals, the prescription, personal blood glucose guidelines, stop signs, and team contact information; the patient receives a copy.

Key Points

- Goals include glycemic, cardiovascular, functional, and autonomy-related dimensions.
- Insulin adjustment is the physician's decision; the diabetes care team communicates and documents.
- Exercise ≥5 days/week and breaks from sedentary behavior help manage blood glucose in type 2 diabetes.
- The documentation includes a section dedicated to diabetes.

5. PRESCRIBING PHYSICAL EXERCISE FOR PATIENTS WITH DIABETES MELLITUS

Objectives:

- applying the FITT-VP principles to each type of exercise;
- planning warm-ups, aerobic training, strength training, balance training, flexibility training, and breathing exercises;
- determining intensity using the Borg scale, the talk test, and heart rate;
- safely progressing the program;
- monitoring the session and stopping the exercise when necessary

5.1. The FITT-VP Principles and Session Structure

The exercise program is multifaceted: aerobic, strength, balance, and flexibility, tailored to the cardiac diagnosis, type of diabetes, antidiabetic treatment, and complications. The prescription is described by FITT-VP: Frequency, Intensity, Time (duration), Type, Volume, and Progression. In addition, specific to diabetes, the session includes a glycemic plan. The 2026 ESC Guidelines indicate that, for lowering HbA1c in T2D, the frequency (≥5 days/week) and volume of resistance training (≥21 sets/week) are important, while in Type 1 diabetes, combined training (endurance + resistance) is most effective [10,11,12].

Table 75 . Exercise prescription: the ESC 2026 guidelines and the starting point for patients with diabetes

Component	ESC 2026 guideline reference (SCA/CCS; chronic heart failure)	Starting point (deconditioning or high risk)	Progression
Aerobic – frequency	≥3 to 5 days/week (CHF: from 2–3 to 3–5)	2–3 supervised sessions + short daily walks	Duration first, then frequency
Aerobic – duration	30–60 min/session (CI: 15–30 to 45–60)	10–15 min, possibly intermittent (2–3 min of exercise / 1–2 min of rest)	+2–5 min every 1–2 weeks
Aerobic – intensity	Moderate and moderate-to-high; "moderate" = Borg 12–17 or 40–85% of heart rate reserve; in IC, moderate (sometimes low); at low capacity, start at ~40% of peak VO_2, then toward ventilatory threshold 1 (VT1)	RPE 11–13 (lower end of the range), talk test; below VT1	Toward VT1; HIIT only in selected patients
Strength	≥2 days/week; ≥2 sets/major muscle group, 12–15 reps (IC: 8–15); 30–70% 1-RM for upper limbs, 40–80% for lower limbs (IC: 40–60%)	2 days/week, 1 set × 8–12 reps, 30–40% 1-RM or RPE 11–13, functional exercises	Repetitions → sets → load
T2D – glycemic target	Frequency ≥5 days/week; ≥21 strength training sets/week for lower HbA1c; aerobic exercise lowers HbA1c by 0.5–0.7% [3,13]	3 days/week initially + short walks after meals	Increase to 5 days/week
T1D – glycemic target	Combined training (endurance + resistance); lower glycemic effect than in DZ2, but reduces the risk of complications [1,13]	Individualized plan with a diabetes specialist; blood glucose before, during, and after	Slow increase in training volume
Balance	Combined with training, especially in cases of neuropathy and at risk of falls	≥3 days/week, 5–10 min, with support	Less support, dual tasks

Component	ESC 2026 guideline reference (SCA/CCS; chronic heart failure)	Starting point (deconditioning or high risk)	Progression
Flexibility / mobility	Part of a multi-component program	2–3 days/week, 10–30 s/position	Range of motion
Inspiratory muscles (IC)	3–5 times per week, 20–30 min, at 30% to 60% of maximum inspiratory pressure, if tolerated	Only as directed by a physician or physical therapist	Gradual increase in load

Two points from the 2026 ESC guidelines are worth noting. First: in programs for heart disease, approximately two-thirds of the session's duration is devoted to endurance, and strength exercises are added to make up the remaining third. Second: for setting aerobic intensity, **ventilatory thresholds** (VT1, VT2) are preferred over a percentage of maximum effort (%peak HR, %HR reserve, %peak VO_2), because the same percentage produces very different physiological responses from one patient to another; classification based on metabolic equivalents (METs) is discouraged, and 4–6 METs represent a supramaximal effort for many cardiac patients. If respiratory gas analysis is not available, heart rate at VT1 and VT2 can be estimated from resting HR and peak HR.

Practical Note

Typical session (60–75 min): initial assessment (2–5 min) → 10-min warm-up → 20–30 min of aerobic exercise → 15–20 min of strength and balance training → 5–10 min cool-down → final assessment and scoring. 2–3 breaks of 1–2 minutes are recommended, if the patient needs them.

Warm-up and Cool-down

The warm-up prepares the cardiovascular and musculoskeletal systems and lasts at least 10 minutes (longer and more gradual in cases of autonomic neuropathy). It includes light movement, joint rotations, and a gradual increase in exertion. Cool-down prevents a sudden drop in blood pressure after exercise and allows the heart rate to return to normal; it includes slow walking and stretching.

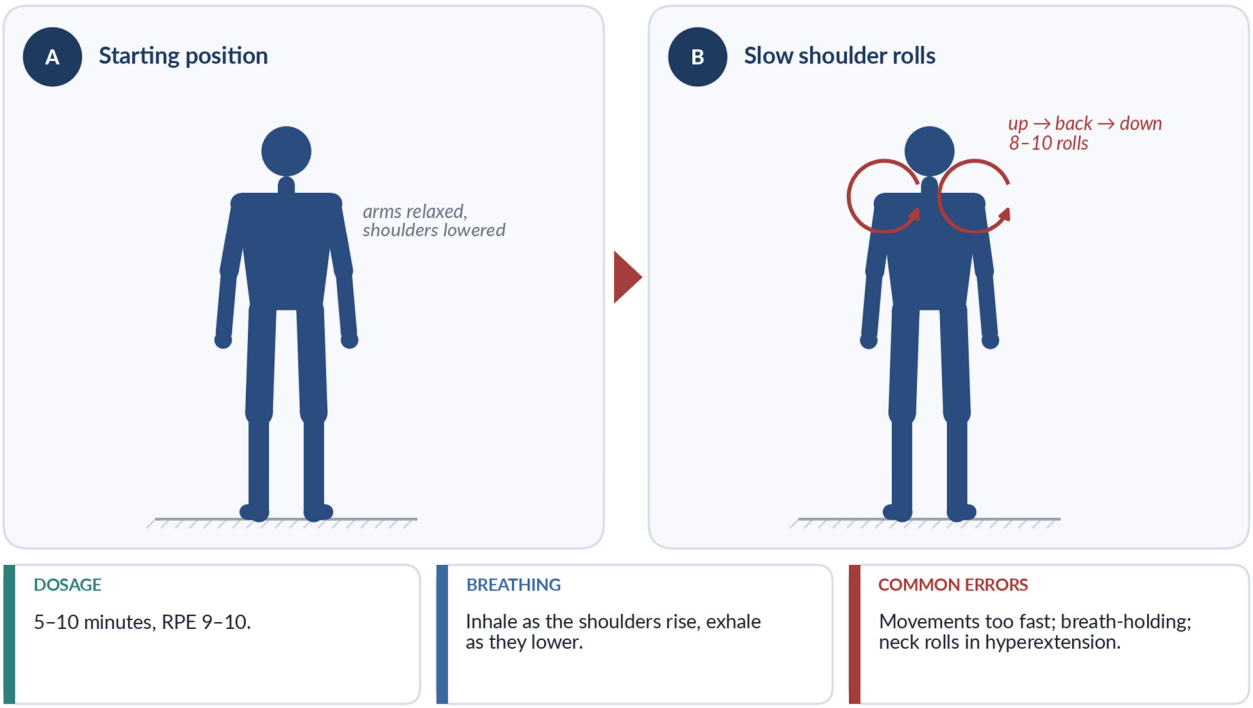


Figure 44 . Warm-up: shoulder rotations with calm breathing.

Table 76 . Exercise sheet—shoulder rotations and joint mobilization

Starting position	**Standing (or sitting), arms relaxed, looking straight ahead, shoulders down.**
Execution	Raise your shoulders toward your ears, bring them back, lower them; 8–10 slow rotations. Continue with ankle, hip, and neck rotations (small, pain-free).
Duration	5–10 minutes, RPE 9–10.
Breathing	Inhale as your shoulders rise, exhale as they lower.
Common Mistakes	Movements that are too fast; holding your breath; neck rotations in hyperextension.
Adaptation	Easier: sitting. Harder: rotations with arms bent and extended forward.

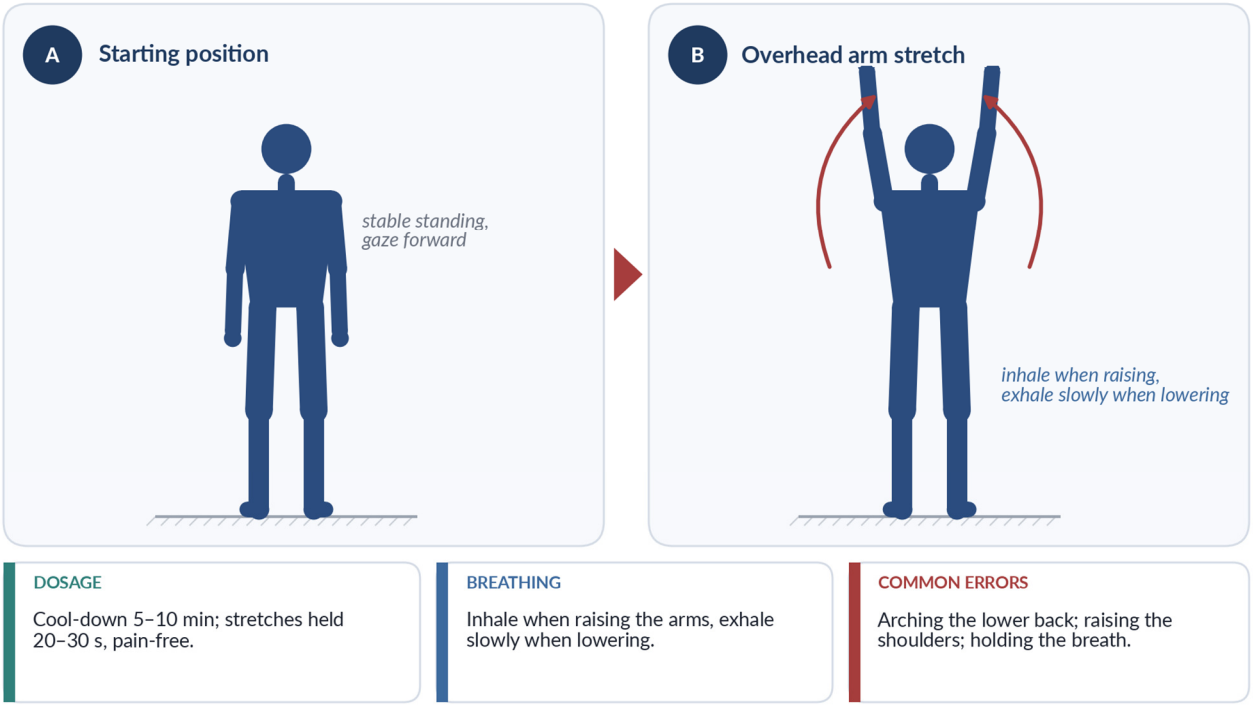


Figure 45 . Recovery: Stretch your arms overhead while breathing slowly.

5.2. Aerobic Training (Continuous and Interval)

Aerobic training improves exercise capacity, blood pressure, glycemic control, and mood. Start with a low volume and increase duration first, then frequency, and finally intensity. In patients who are severely deconditioned or have heart failure, intermittent exercise (2–3 minutes of exercise followed by a 1–2-minute rest) is better tolerated than continuous exercise. High-intensity interval training (HIIT) should be considered only in selected, stable, low-risk patients under experienced supervision. The 2026 ESC Guidelines concur: the estimated rate of serious adverse events is 1 per 11,333 patient-hours in center-based HIIT, compared with no reported events in center-based moderate-intensity continuous training, and the lack of safety data for unsupervised programs limits the use of HIIT to supervised settings for medically evaluated patients. For deconditioned or high-risk patients, continuous or short-interval moderate-intensity training remains the standard of care.

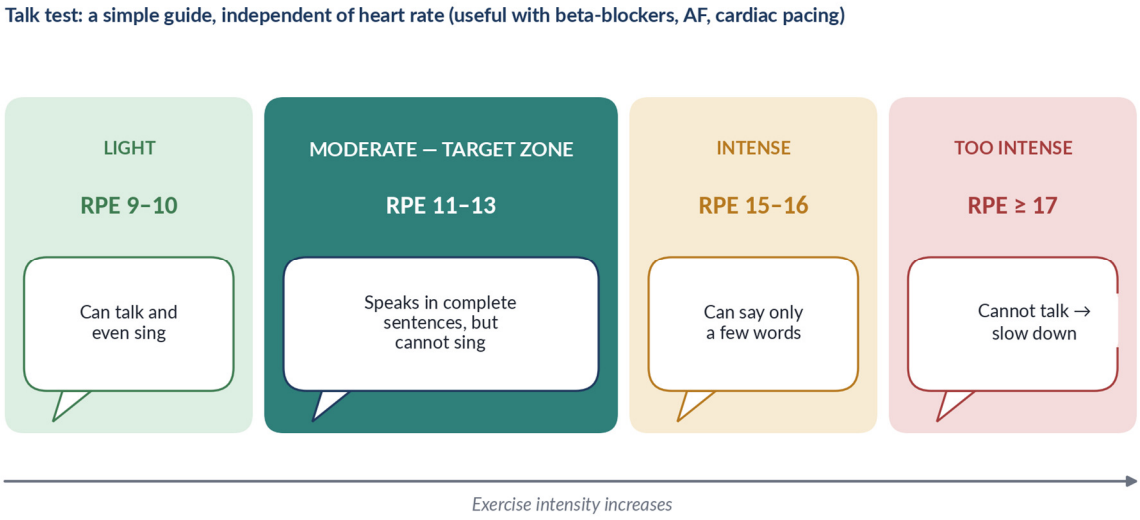


Figure 46 . The talk test: moderate intensity allows for conversation in complete sentences.

Table 77 . Exercise sheet—walking at a moderate pace (treadmill or hallway)

Starting position	**Stand upright, look straight ahead, arms relaxed, wear stable shoes.**
Execution	Walk with regular steps; arms swing freely; if necessary, hold onto the treadmill handrail. The pace should be chosen so that the patient can speak in complete sentences.
Duration	Initially 10–15 min; target 30–45 min; RPE 11–13; 3–5 days/week.
Breathing	Natural, rhythmic; avoid holding your breath.
Common errors	Strides too long, pace too fast at the start, reliance on the bar, looking down.
Adaptation	Easier: short intervals with breaks, walking with support. Harder: longer duration, slight incline on the treadmill.

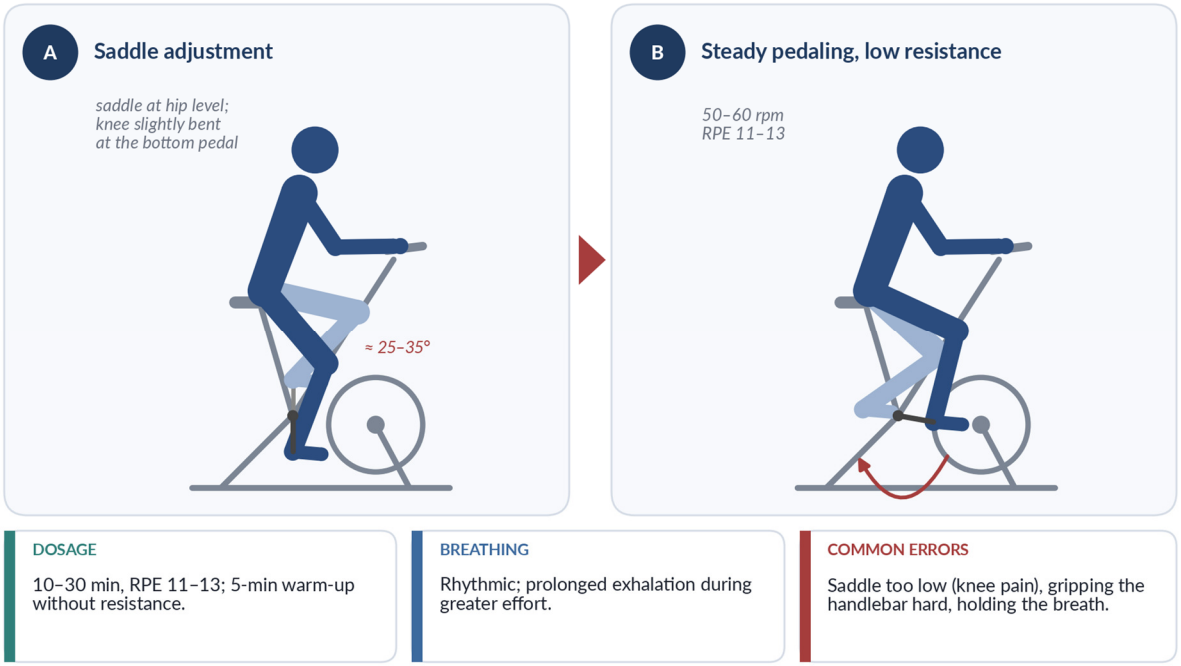


Figure 47 . Exercise bike: adjust the seat and start with low resistance.

Table 78 . Exercise Worksheet—Exercise Bike

Starting position	**Saddle at hip level; at the lowest point of the pedal stroke, knees slightly bent. Hands on the handlebars, back straight, looking forward.**
Execution	Pedal at a steady pace, 50–60 revolutions per minute, with low resistance at the start; gradually increase resistance.
Duration	10–30 min, RPE 11–13; 5-minute warm-up without resistance.
Breathing	Rhythmic; prolonged exhalation during higher-intensity effort.
Common mistakes	Saddle too low (knee pain), gripping the handlebars too tightly, holding one's breath.
Adaptation	Easier: intervals with breaks; recumbent bike. Harder: gradually increase resistance.

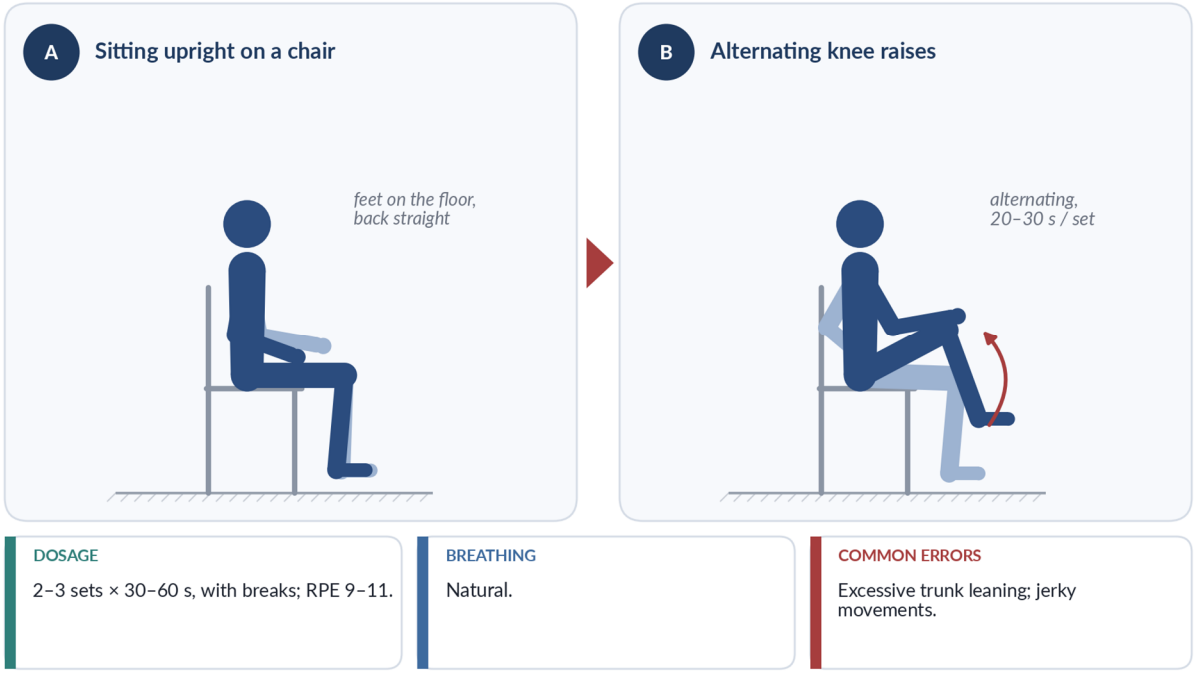


Figure 48 . Seated walking: a variation for the beginning of the program or for days with borderline blood sugar levels.

Table 79 . Exercise sheet—marching in place while seated on a chair

Starting position	**Sit upright on the edge of the chair, feet on the floor, hands on your thighs or arms slightly bent.**
Execution	Alternately lift your knees (marching), 20–30 seconds per set; arms move naturally, opposite the legs.
Intensity	2–3 sets × 30–60 s, with rest periods; RPE 9–11 (for patients who are very out of shape).
Breathing	Natural.
Common errors	Excessive trunk flexion; jerky movements.
Adaptation	Easier: small lifts. Harder: higher lifts with arms raised, walking while standing.

5.3. Strength and Muscle Power Training

Muscle strength is closely linked to independence, balance, and survival, and in patients with diabetes, it increases insulin sensitivity. Strength training is recommended 2–3 times per week, on non-consecutive days, with light-to-moderate loads, performed in a controlled manner and with rhythmic breathing (exhaling during exertion) to avoid the Valsalva maneuver. For deconditioned patients, functional exercises (standing up from a chair, stepping up a stair) are preferred. The load is ideally expressed as a percentage of 1-RM, but in cardiac patients, the 10-repetition maximum (10-RM) test is preferred, from which 1-RM is estimated using formulas, to avoid the Valsalva maneuver; the OMNI-RES scale is used as a subjective benchmark. The 2026 ESC Guidelines also discuss high intensities: in healthy older adults, training at 70–79% of 1-RM increases strength more than light training, and in clinical trial studies, high-intensity resistance training did not result in more adverse events; however, there are no safety analyses in patients with uncontrolled hypertension; Therefore, in clinical practice, high-intensity training is reserved for selected cases under close al supervision. The 2022 ACSM Consensus indicates that, in Type 2 diabetes, high-intensity resistance training has greater effects on blood glucose and insulin levels than light-to-moderate training; however, it should be used cautiously in cardiac patients, with monitoring of blood pressure and blood glucose. In frail or sarcopenic patients, resistance training of large muscle groups at at least moderate intensity must be combined with endurance training, and balance exercises help prevent falls. In very frail patients, electrical muscle stimulation may be considered initially, with precautions for those with implantable devices.

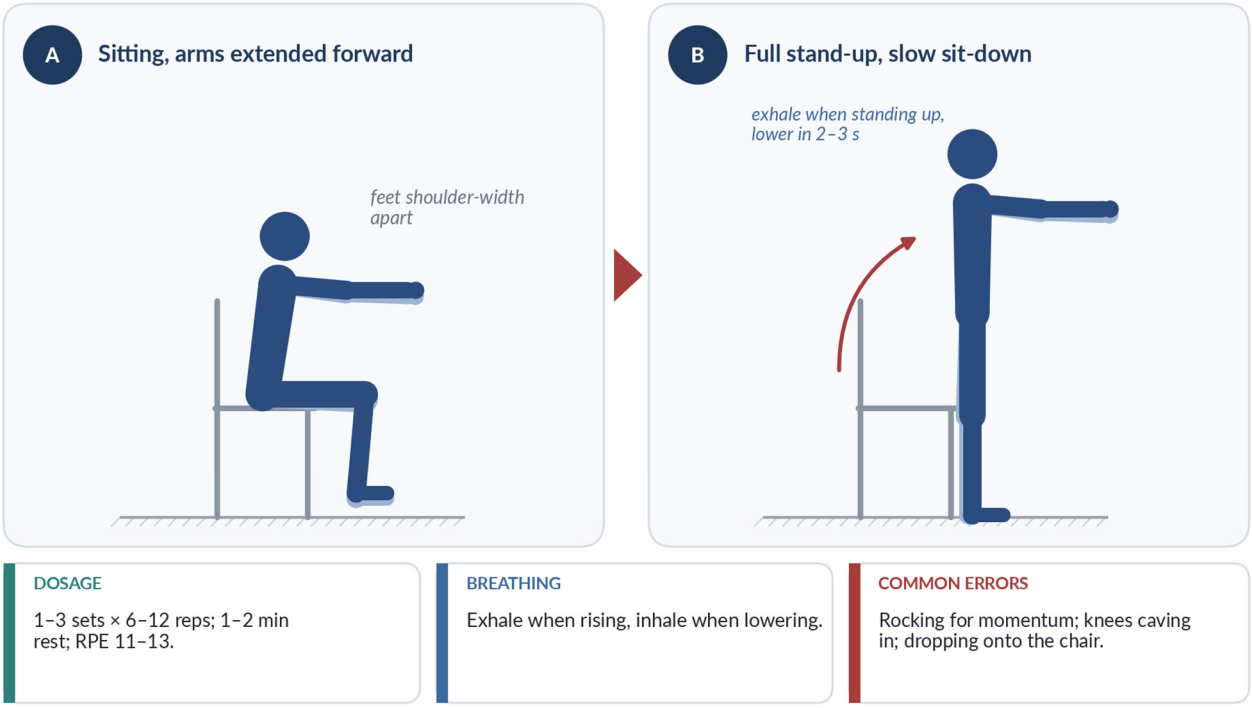


Figure 49 . Chair stands: a basic functional exercise for lower-body strength.

Table 80 . Exercise sheet—sit-to-stand

Starting Position	**Sitting on a stable chair (without wheels), feet flat on the floor, shoulder-width apart; arms extended forward or crossed.**
Execution	Lean your torso slightly forward, push through your legs, and stand up completely; lower yourself slowly (2–3 seconds), in a controlled manner, until you touch the chair.
Setup	1–3 sets × 6–12 repetitions; 1–2-minute rest periods; RPE 11–13.
Breathing	Exhale as you rise, inhale as you lower.
Common Mistakes	Swinging to gain momentum; knees caving in; collapsing onto the seat.
Adaptations	Easier: higher chair, use hands for support. Harder: lower chair, slower pace, hold weight in hands.

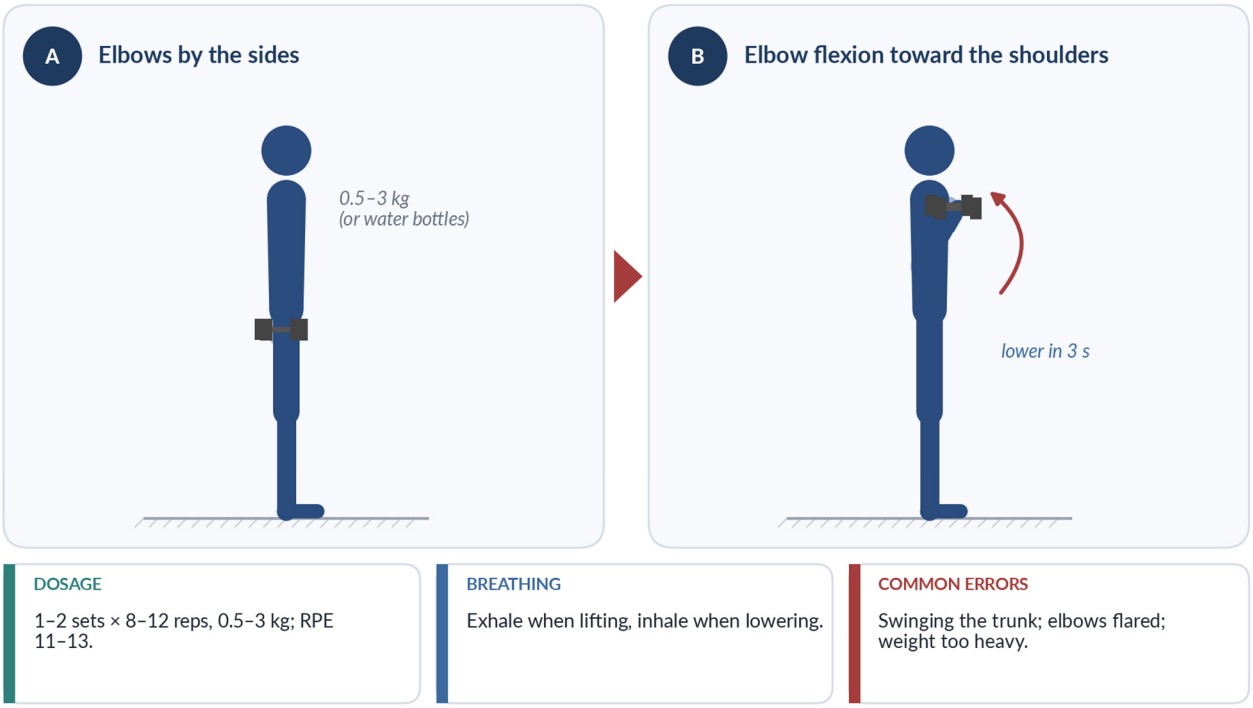


Figure 50 . Push-ups with light dumbbells (or water bottles).

Table 81 . Exercise sheet—push-ups with light dumbbells

Starting position	**Standing or sitting, elbows close to the body, dumbbells held in your hands with palms facing forward.**
Execution	Bend your elbows, bringing the dumbbells toward your shoulders, then lower them slowly (3 seconds).
Setup	1–2 sets × 8–12 reps, weight 0.5–3 kg; RPE 11–13.
Breathing	Exhale as you lift, inhale as you lower.
Common Mistakes	Tilting the torso; elbows splayed; weight too heavy.
Adaptation	Easier: no weight or with light bottles. Harder: heavier weight, alternating arms, slow pace.

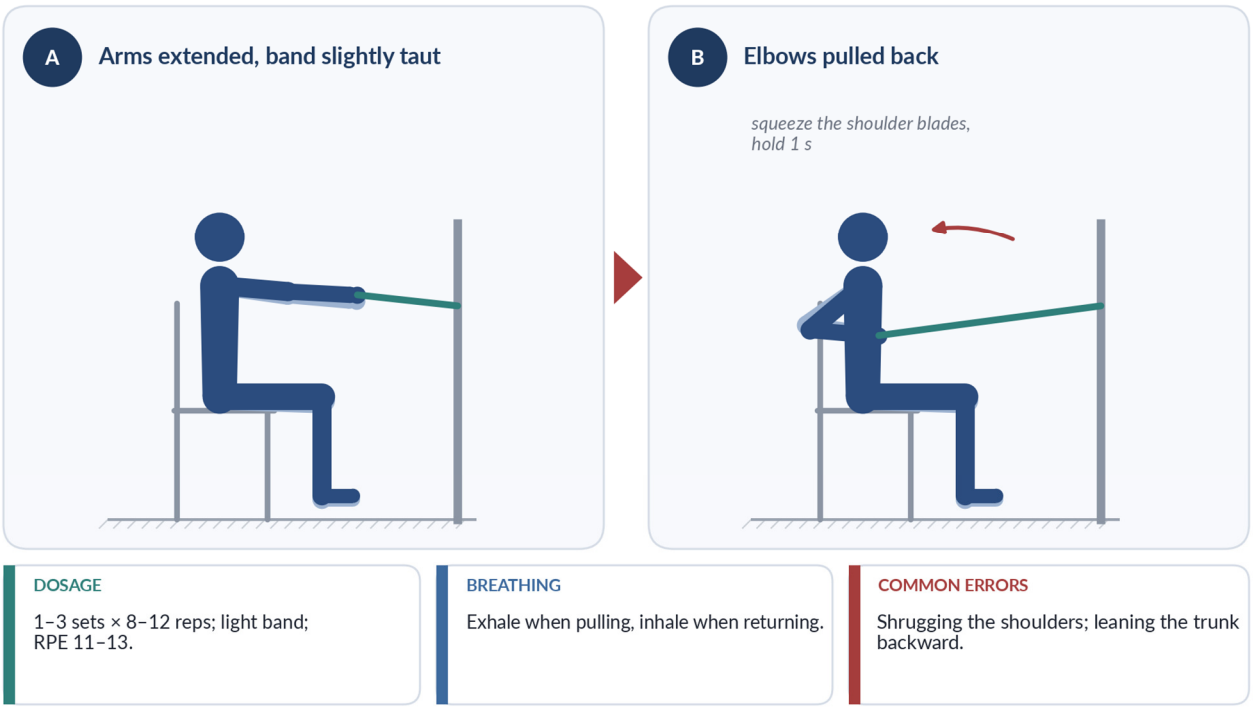


Figure 51 . Seated resistance band pull: strengthens the back and shoulders.

Table 82 . Exercise Worksheet – Resistance Band Pull-Up

Starting position	**Sit upright, with the band secured in front at chest level, arms extended forward, and the band slightly taut.**
Execution	Pull your elbows back, bring your shoulder blades together, hold for 1 second, then return slowly.
Setup	1–3 sets × 8–12 repetitions; light band; RPE 11–13.
Breathing	Exhale as you pull back, inhale as you return.
Common Mistakes	Shrugging the shoulders; leaning the torso backward.
Adjustment	Easier: use a weaker band. Harder: use a stronger band or do more repetitions.

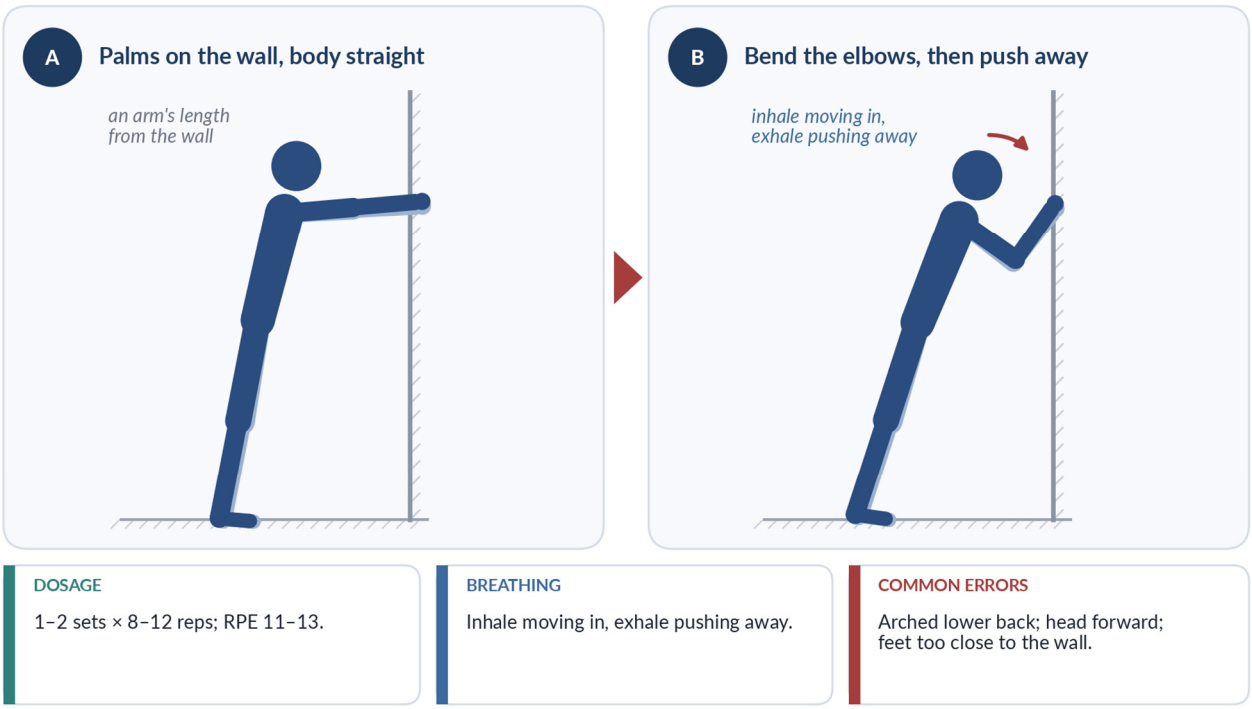


Figure 52 . Wall push-ups: a safe variation for building arm and chest strength.

Table 83 . Exercise Worksheet—Wall Push-Ups

Starting position	**Stand at arm's length from the wall, palms on the wall at shoulder level, body straight.**
Execution	Bend your elbows and bring your chest toward the wall, then push back until your arms are fully extended.
Setup	1–2 sets × 8–12 repetitions; RPE 11–13.
Breathing	Inhale as you bring your elbows in, exhale as you push back.
Common Mistakes	Arched lower back; head leaning forward; feet too close to the wall.
Modification	Easier: feet closer to the wall. Harder: feet farther away or push-ups on a raised surface.

5.4. High-Intensity Interval Training (HIIT) in Diabetes

HIIT can increase aerobic capacity more than moderate-intensity continuous training, including in the general population and in people with T1D and T2D, but caution is warranted in patients with diabetes: in T1D, it can cause post-exercise hyperglycemia and ketosis (monitoring, including for ketones, is recommended), and in those with musculoskeletal conditions, the risk of injury is higher. The 2026 ESC Guidelines permit HIIT only in selected patients, in supervised settings.

The time of day matters: in Type 2 diabetes, afternoon HIIT sessions are preferable to morning sessions for glycemic control, and morning HIIT on an empty stomach can raise blood glucose levels in both Type 1 and Type 2 diabetes.

Caution

Do not initiate HIIT in patients with unstable blood glucose levels, severe autonomic neuropathy, proliferative retinopathy, unevaluated ischemia, or significant musculoskeletal disease. The primary alternative remains continuous exercise or short-interval training of moderate intensity

5.5. Balance, Mobility, and Flexibility

Balance exercises reduce the risk of falls and fractures, which are more common in patients with peripheral neuropathy. They should be performed at least 3 times a week, first with support, then without. A 2025 RCT in patients with coronary artery disease (including 261 with T2D) compared a tailored program of postural balance exercises with aerobic training alone and with irregular exercise, using CPET for individualization. Mobility and flexibility (ankle, hip, shoulder) facilitate walking, climbing stairs, and daily activities [14].

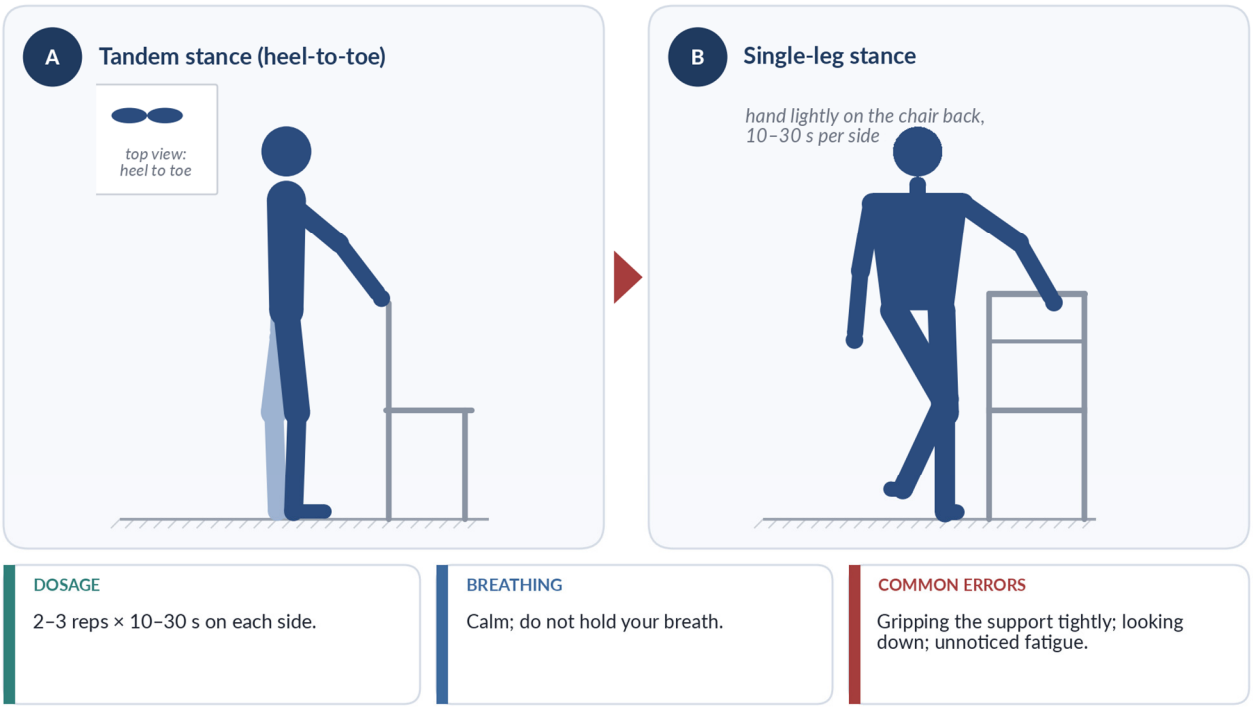


Figure 53 . Balance: tandem stance and one-leg stance, with a hand on the backrest.

Table 84 . Exercise sheet—standing in a tandem stance and on one leg

Starting position	**In front of a chair or next to a wall, hand lightly on the backrest (tiptoe grip, not a firm grip).**
Execution	Tandem: one foot in front of the other, heel touching the toe. Then gently lift one leg (10–30 s).
Intensity	2–3 repetitions × 10–30 s on each side; progression: without support, with eyes closed only under supervision.
Breathing	Calm; do not hold your breath.
Common errors	Gripping the support too tightly; looking down; unnoticed fatigue.
Adaptation	Easier: feet close together, both hands on the support. Harder: no hands, on a soft surface, double load (counting).

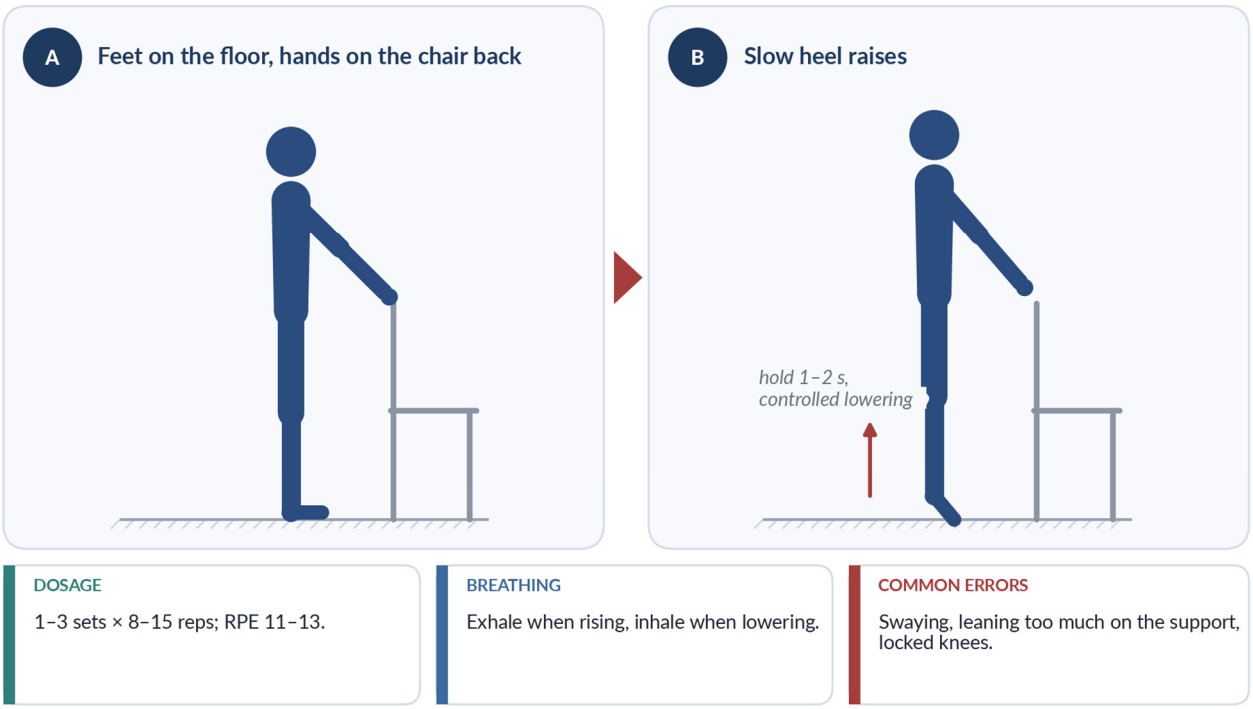


Figure 54 . Supported toe raises: strengthen the calves and improve gait.

Table 85 . Exercise Worksheet – Toe Raises

Starting position	**Standing, feet hip-width apart, hands on the back of a chair.**
Execution	Slowly rise onto your toes, hold for 1–2 seconds, and lower yourself in a controlled manner.
Setup	1–3 sets × 8–15 repetitions; RPE 11–13.
Breathing	Exhale as you rise, inhale as you lower.
Common Mistakes	Swaying, excessive support, locked knees.
Variations	Easier: both hands on the support, small range of motion. Harder: support with one finger, one foot.

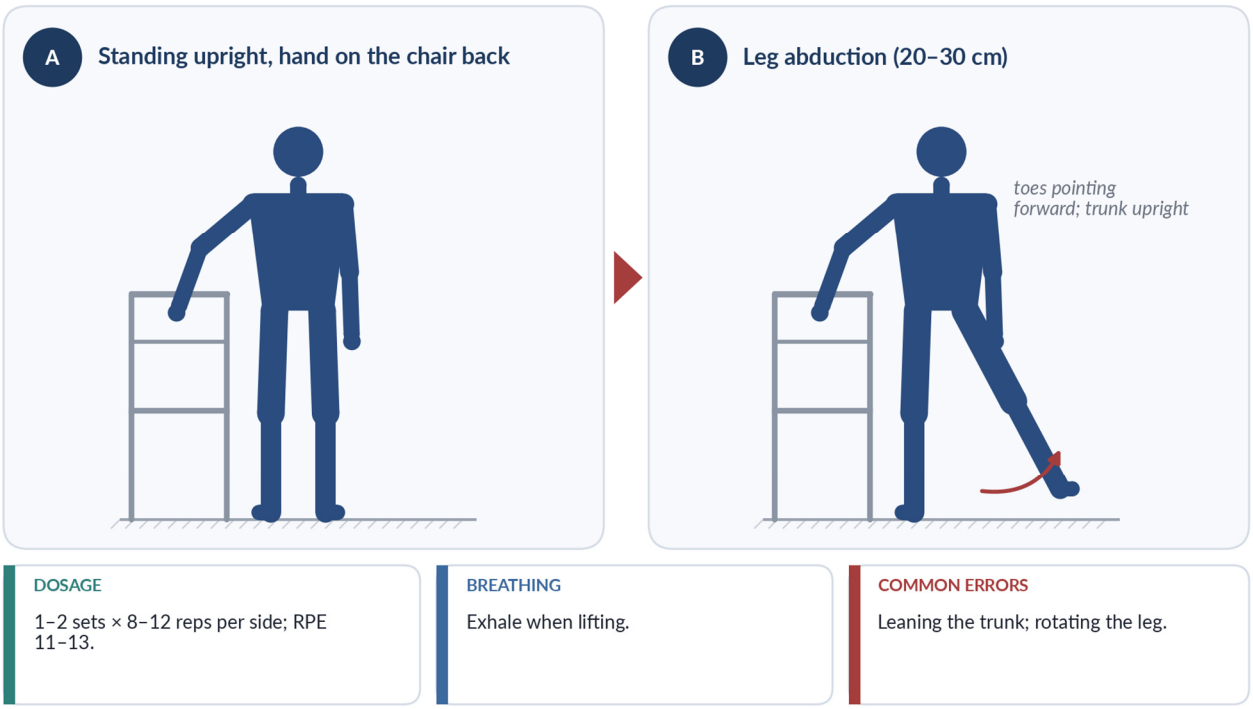


Figure 55 . Side leg lift: strengthens the hip muscles, which are important for balance.

Table 86 . Exercise sheet—side leg lift

Starting position	**Stand upright with one hand on the back of a chair.**
Execution	Slowly lift your leg to the side (20–30 cm), toes pointing forward; hold for 1 second; lower in a controlled manner.
Setup	1–2 sets × 8–12 repetitions per side; RPE 11–13.
Breathing	Exhale as you lift.
Common mistakes	Leaning the torso forward; rotating the foot.
Adaptation	Easier: smaller range of motion. Harder: hold for 2–3 seconds at the top, weight on the ankle (with the physical therapist's approval).

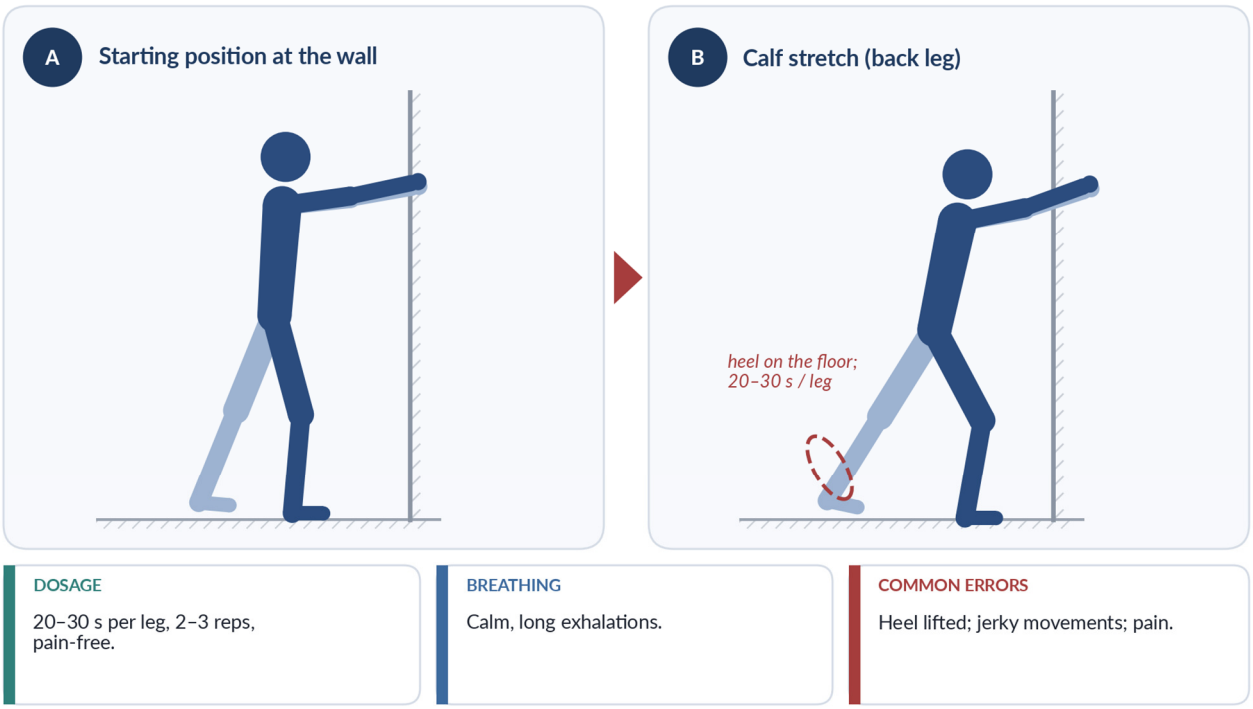


Figure 56 . Calf stretch against a wall.

Table 87 . Exercise sheet—calf muscle stretch

Starting position	**Facing the wall, palms on the wall, one foot forward, the other extended backward, heel on the floor.**
Execution	Gently bend your front knee and tilt your pelvis toward the wall until you feel a stretch in your back calf.
Intensity	20–30 seconds per leg, 2–3 repetitions, without pain.
Breathing	Calm, with long exhalations.
Common Mistakes	Heel raised; jerky movements; pain.
Adjustment	Easier: shorter distance from the wall. Harder: longer stride.

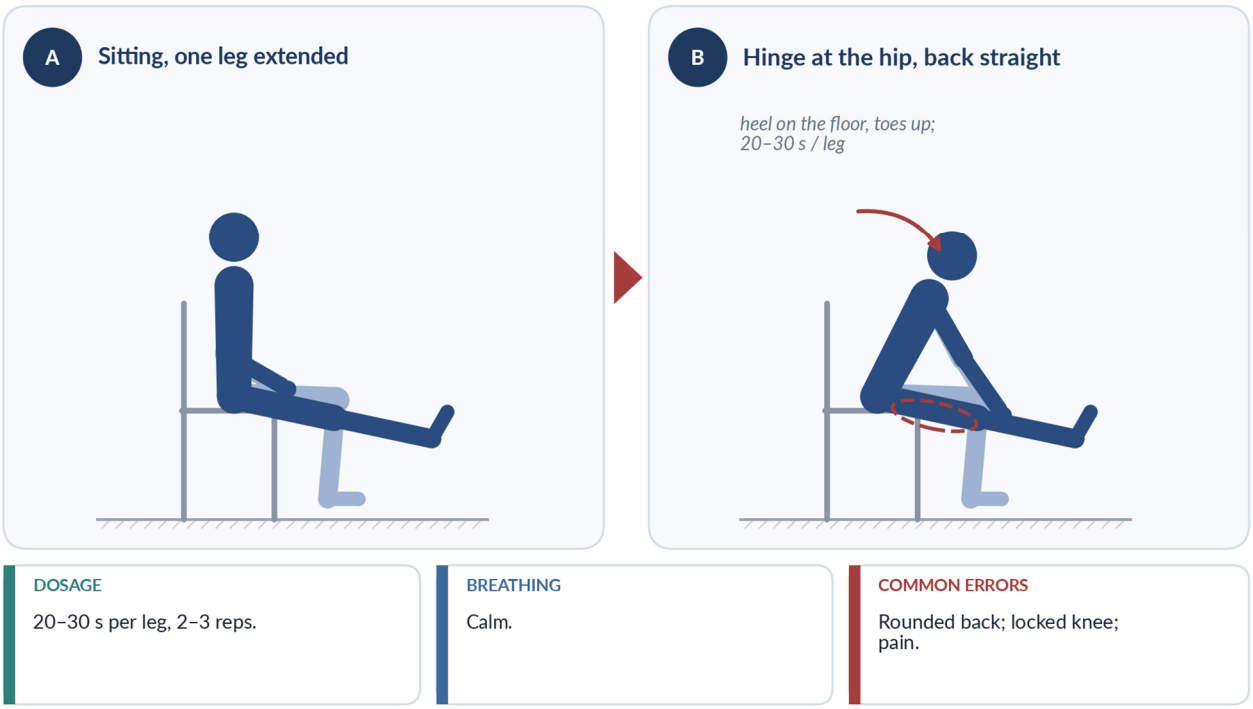


Figure 57 . Seated hamstring stretch.

Table 88 . Exercise sheet—seated hamstring stretch

Starting position	**Sitting on the edge of a chair, one leg extended forward, heel on the floor, toes pointing up.**
Execution	With your back straight, lean forward from the hips toward your foot until you feel a stretch in the back of your thigh.
Duration	20–30 seconds per leg, 2–3 repetitions.
Breathing	Steady.
Common Mistakes	Rounded back; locking the knee; pain.
Adaptation	Easier: knees slightly bent. Harder: greater range of motion.

5.6. Training the Respiratory Muscles

Diaphragmatic breathing and pursed-lip exhalation improve respiratory efficiency, reduce dyspnea, and promote relaxation; they are particularly useful after cardiac surgery and in heart failure. Specific training of the inspiratory muscles using a device may be recommended for selected patients, as indicated by a physician or physical therapist. The 2026 ESC Guidelines recommend, in chronic heart failure, combining inspiratory muscle training (3–5 times per week, 20–30 minutes, at 30% to 60% of maximum inspiratory pressure) with endurance and strength training, if tolerated: on its own, it improves peak VO_2, and when added to the other forms of exercise, it improves quality of life, cardiovascular fitness, and dyspnea.

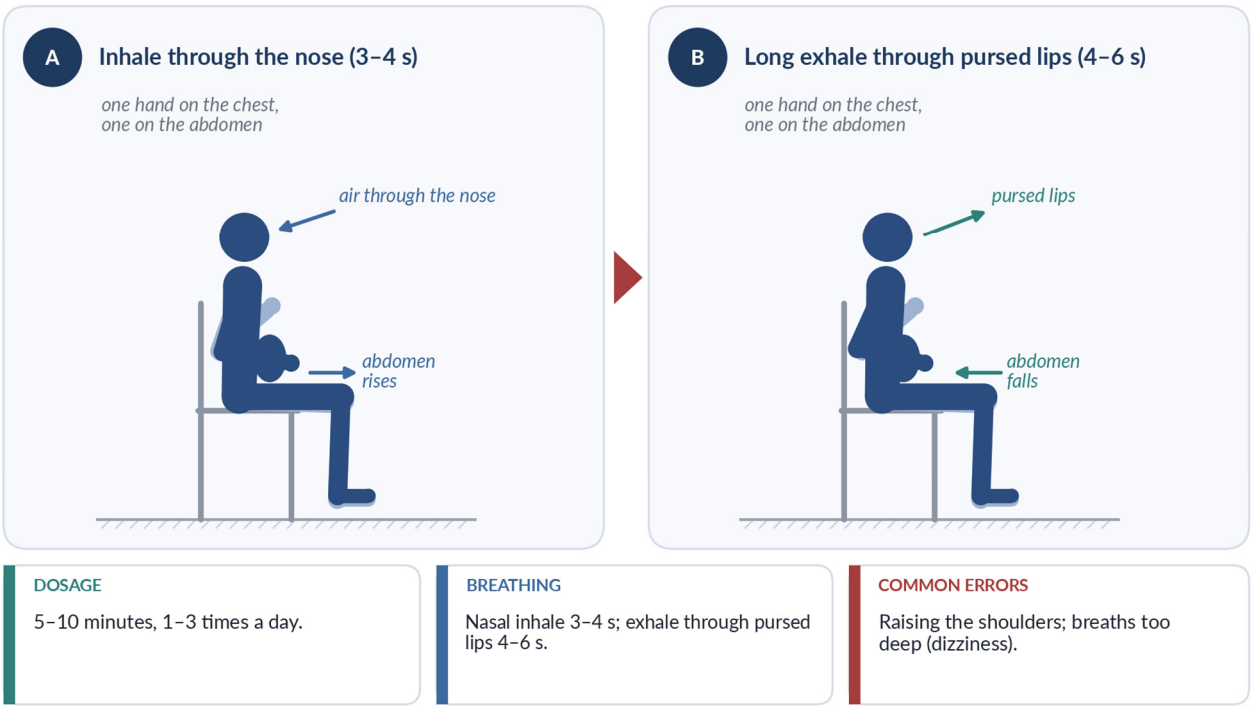


Figure 58 . Diaphragmatic breathing: inhale through the nose (the abdomen expands), exhale slowly through pursed lips.

Table 89 . *Worksheet—Diaphragmatic Breathing*

Starting position	**Sit comfortably or lie down, with one hand on your chest and one on your abdomen, shoulders relaxed.**
Execution	Inhale slowly through the nose for 3–4 seconds, allowing the abdomen to rise; exhale slowly through pursed lips for 4–6 seconds.
Frequency	5–10 minutes, 1–3 times a day.
Breathing	This is the exercise itself.
Common Mistakes	Shrugging the shoulders; breathing too deeply (dizziness).
Adaptation	Easier: lying down. Harder: while walking, climbing stairs.

5.7. Monitoring exercise intensity (Borg scale, talk test, ventilatory thresholds)

Diabetes reduces the heart rate response to exercise, and beta-blockers reduce it even further; in the absence of a measured maximum heart rate, the ACSM consensus recommends an RPE of 10–12 on a 6–20 scale for T2D. Heart rate is a less reliable indicator (beta-blockers, atrial fibrillation, pacemaker, high variability). Therefore, intensity is determined by combining three tools: the Borg scale (RPE), the talk test, and, where possible, heart rate. The 2026 ESC Guidelines recommend the Borg scale (6–20) or the talk test for endurance and the OMNI-RES scale for strength, especially at the start of the program or after a change in intensity, and then periodically (e.g., once a week).

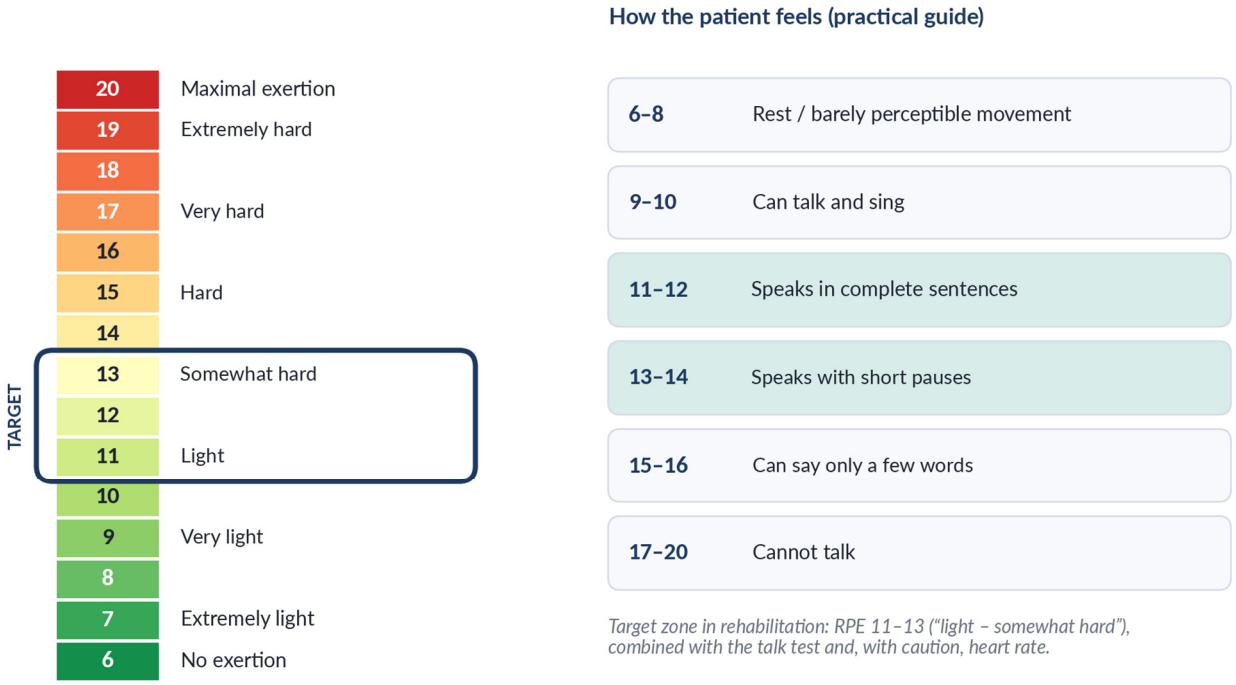


Figure 59 . Borg Scale (RPE 6–20): the target during recovery is zone 11–13 ("light–moderate," with light exertion).

Table 90 . Borg Scale (RPE)—Practical Guidelines

RPE	Description	How the patient feels
6–8	Very, very mild	Rest / almost imperceptible movement
9–10	Very light	Can talk and sing
11–12	Easy	Can speak in complete sentences
13–14	Somewhat difficult	Speaks with short pauses
15–16	Difficult	Can say only a few words
17–20	Very difficult – maximum	Cannot speak

Calculation of target heart rate. The classic reserve method (target HR = resting HR + percentage × (maximum HR − resting HR), with 40–60% for moderate intensity) is still used in practice, but the 2026 ESC guidelines consider it less reliable than ventilatory thresholds. When a cardiopulmonary test is not available, the heart rate at the first and second ventilatory thresholds can be estimated from values obtained during a maximal exercise test: **HR at VT1 = 4.866 + 0.405 × peak HR + 0.542 × resting HR**; **HR at VT2 = −2.606 + 0.773 × peak HR + 0.254 × resting HR**.

Example

A patient with a resting HR of 70 bpm and a peak HR of 130 bpm during an exercise test (while on current treatment). HR at VT1 = 4.866 + 0.405 × 130 + 0.542 × 70 ≈ **95 bpm**; HR at VT2 = −2.606 + 0.773 × 130 + 0.254 × 70 ≈ **116 bpm**. For an untrained patient, aerobic training begins below VT1 (e.g., 85–95 bpm) and approaches VT1 as tolerated. The reserve method would have yielded 94–106 bpm (40–60% of the 60-bpm reserve). If the patient is taking beta-blockers, these values are valid only if the test was performed while on the same medication; otherwise, an RPE of 11–13 remains the primary guideline.

5.8. Glycemic Management Before, During, and After Exercise

This is the section that distinguishes the recovery process for patients with diabetes. The guidelines below are derived from the joint statement by the CR associations and the consensus on T1D that it cites; they are applied **in accordance with the department's protocol and the diabetologist's instructions**. Conversion: 1 mmol/L ≈ 18 mg/dL [15].

Who Needs the Most Attention

Table 91 . Levels of monitoring for dysglycemia

Patient	Risk	Attention
T1D	Highest	Maximum individualization; ketones; CGM if unstable
T2D with sulfonylureas, glinides, or insulin	Moderate (close to T1D)	Blood glucose before, during, and after exercise; carbohydrates on hand
T2D with metformin, GLP-1 RA, DPP-4, SGLT2, or lifestyle changes alone	Low	Same as for patients without diabetes, plus occasional blood glucose monitoring; monitor for SGLT2 (ketones)

Blood glucose before the session

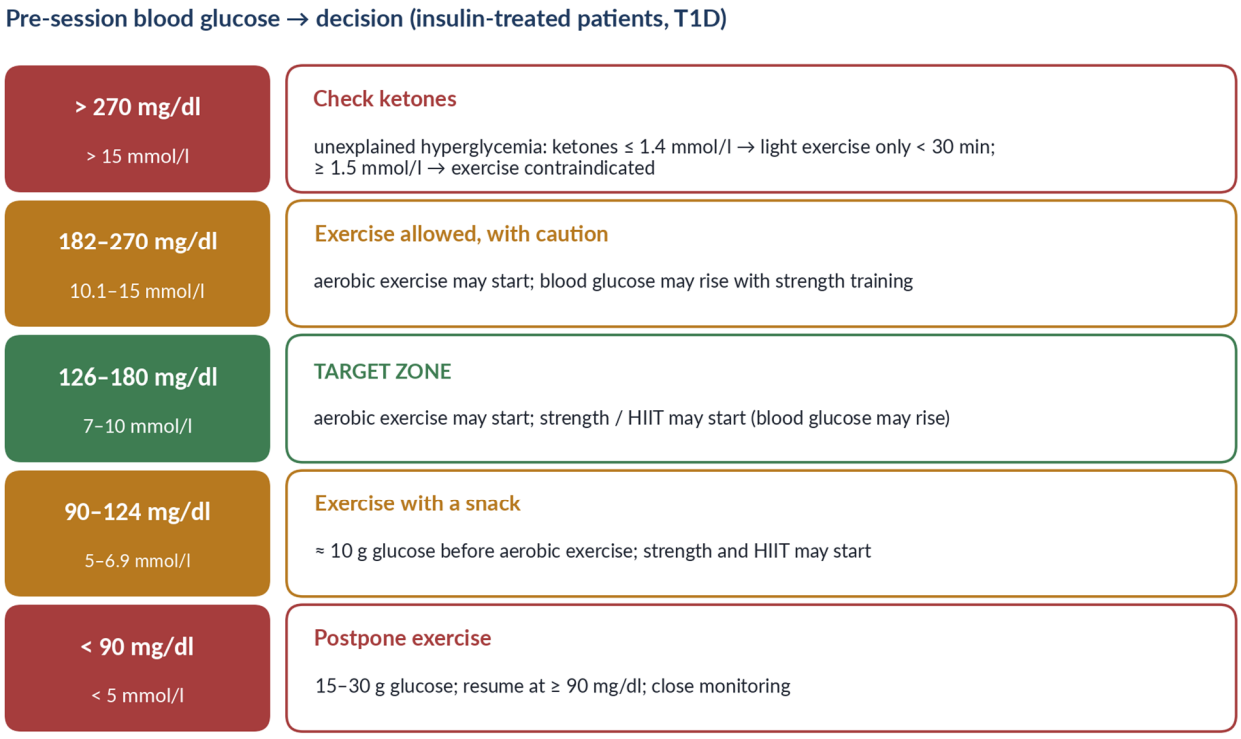


Figure 60 . Pre-exercise blood glucose: five zones and what to do in each (guidelines for patients on insulin).

Table 92 . Decisions based on baseline blood glucose (insulin-treated patients, T1D)

Initial blood glucose	What to do
<90 mg/dl (<5 mmol/l)	15–30 g glucose; postpone exercise until ≥90 mg/dl; monitor closely
90–124 mg/dl (5–6.9 mmol/l)	~10 g of glucose before aerobic exercise; strength training and HIIT can begin
126–180 mg/dl (7–10 mmol/l)	Target range: aerobic exercise may begin; strength training/HIIT may begin, but blood glucose may rise
182–270 mg/dl (10.1–15 mmol/l)	Aerobic exercise can begin; strength training can begin, but blood glucose may rise
>270 mg/dl (>15 mmol/l)	If hyperglycemia is unexplained (not postprandial), check for ketones: up to 1.4 mmol/l – only light exercise <30 min (possible correction with insulin); ≥1.5 mmol/l – **exercise is contraindicated**; light-to-moderate aerobic exercise is possible if ketones are <0.6 mmol/l or the urine test strip shows <2+

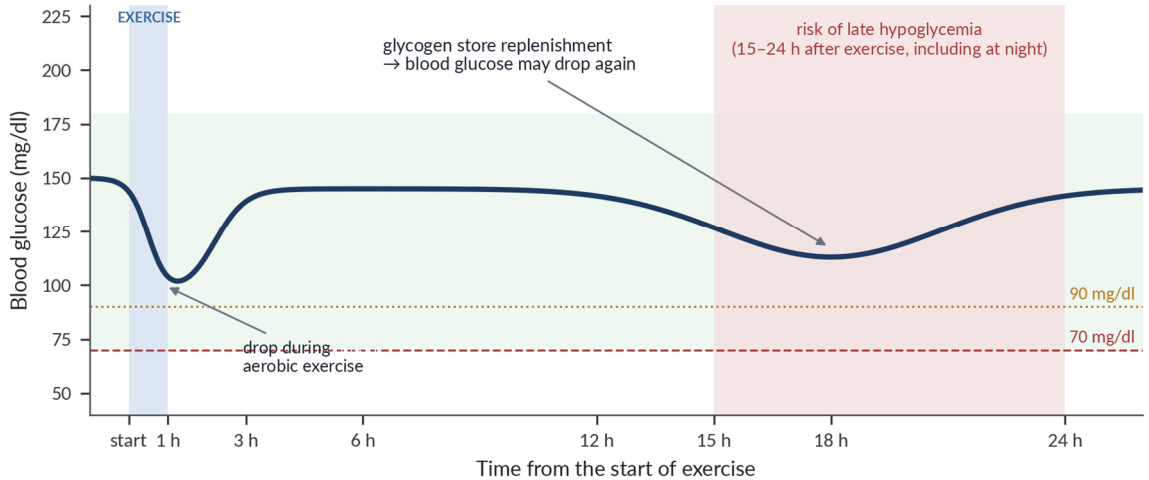
Order of exercises: if the patient starts out hyperglycemic, light aerobic activity is preferred; in T1D, if blood glucose is >10 mmol/l (180 mg/dl), the aerobic component is performed first; in euglycemic patients, performing resistance exercises before aerobic exercises reduces the risk of hypoglycemia.

Patients with Type 2 Diabetes

In type 2 diabetes, hyperglycemia >17 mmol/l (>306 mg/dl), without ketosis and without symptoms, is not a contraindication, but proceed with caution: 10–15 minutes of light activity (less than 40% of VO_2max or heart rate reserve, RPE <11), then recheck blood glucose. If blood glucose has risen, consult a specialist; if it has dropped to 13–15 mmol/l (234–270 mg/dl), continue with light activity; if it has dropped below 12 mmol/l (216 mg/dl), gradually resume the usual exercise routine, recheck blood glucose at the end, and encourage hydration; record the event and report it to the endocrinologist.

In type 2 diabetes, low blood glucose before exercise is a contraindication only if it cannot be raised above 5.5 mmol/l (≈99 mg/dl) with 15–30 g of fast-acting carbohydrates [1]. For those treated with insulin or sulfonylureas, 15–30 g of carbohydrates should be administered if blood glucose is below 5 mmol/l (90 mg/dl); if exercise lasts longer than 30 minutes, approximately 25–30 g per hour of exercise may be needed.

During and after exercise



Schematic curve (patient treated with insulin or a sulfonylurea); the actual profile varies individually.

Figure 61 . Blood glucose levels around exercise: a drop during exercise and a risk of delayed hypoglycemia, lasting up to 15–24 hours.

- **Hypoglycemia during exercise** is treated with 15–30 g of fast-acting carbohydrates (glucose tablets, juice); exercise can be resumed when blood glucose exceeds 5 mmol/l (90 mg/dl).
- **Delayed hypoglycemia** may occur up to 15–24 hours after exercise; after long (>60 min) or intense sessions (interval training, high-intensity resistance training), 10–30 g of carbohydrates are recommended during and in the first 30 minutes after exercise, and the patient should monitor their blood glucose more closely, including at night.
- **Time of the session:** for those prone to post-exercise hypoglycemia, the morning is preferred; for those prone to hyperglycemia, the afternoon or evening; in type 1 diabetes, the morning is safer than the evening due to the risk of nocturnal hypoglycemia.
- The decision **to reduce insulin** is made by the physician. As a guideline from consensus documents: the prandial dose may be reduced by 25–50% if exercise occurs within the first 2 hours after rapid-acting insulin; basal insulin by ~20% for regular exercise (multiple daily injections); with an insulin pump, the basal rate is reduced by 50–80% 60–90 minutes before exercise. Insulin is injected into the abdomen or the upper part of the buttocks, not into the limb being used for exercise.
- **Practical Note**
- **The decision chart (Appendix E)** can be displayed next to the blood glucose meter. Record blood glucose levels at the start, midway (if the session is long or the risk is high), and at the end, as well as what was administered. Inform your endocrinologist of any events.
- **Caution**
- If blood glucose is outside the target range or symptoms appear, follow the protocol (carbohydrates, rest, ketones) and call the nurse or doctor.

5.9. Adjustments in the Presence of Diabetes Complications

Table 93 . Exercise adjustments based on complications

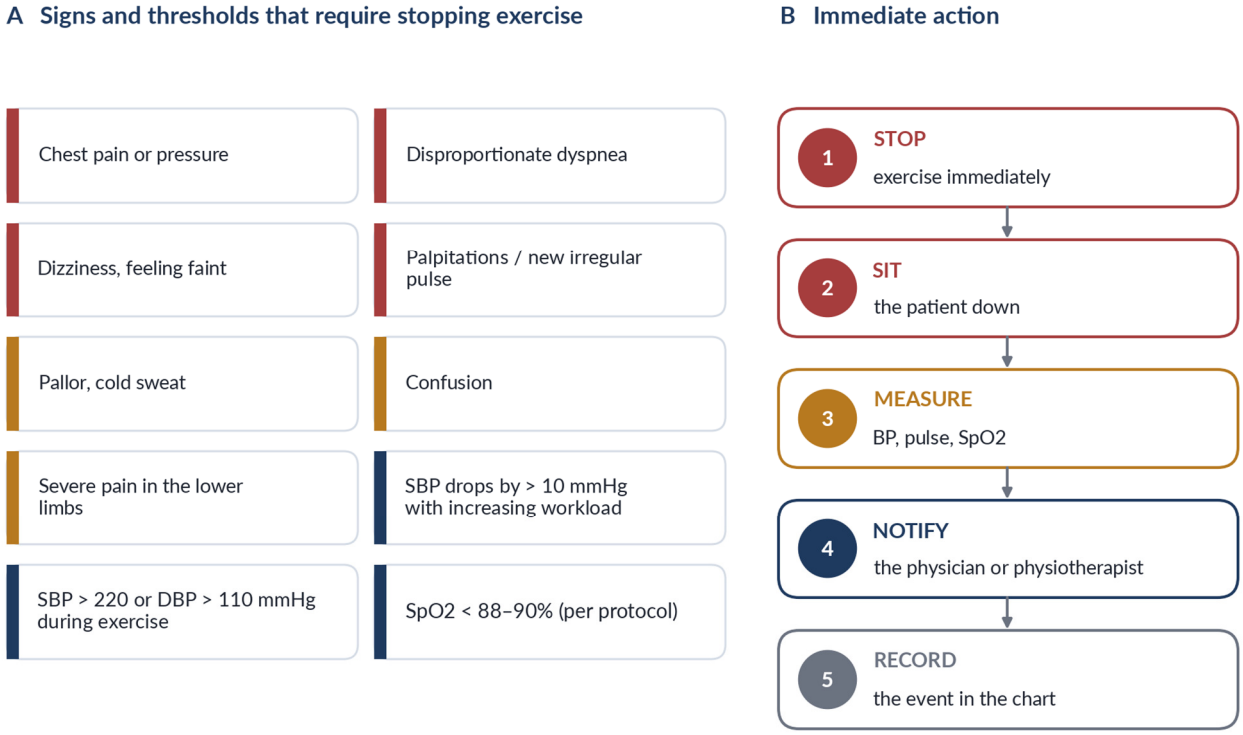
Complication	Risks	Adjustments
Peripheral neuropathy	Blisters and painless ulcers, falls, poor balance	Appropriate footwear and seamless socks; inspection of the feet after each session; non-impact, non-repetitive exercises (cycling, seated exercises) if there is an ulcer or loss of sensation; balance exercises
Autonomic neuropathy	Silent ischemia, reduced heart rate response, orthostatic hypotension, heat intolerance, unrecognized hypoglycemia	Intensity based on RPE; long warm-up and cool-down periods; orthostatic blood pressure; hydration; avoidance of heat; more frequent ECG and blood glucose monitoring
Retinopathy	Increased intraocular pressure, hemorrhages	Avoid the Valsalva maneuver, intense isometric exercise, and head-down positions in advanced stages; consult an ophthalmologist
Chronic kidney disease	Fatigue, anemia, dehydration, electrolyte imbalances	Moderate intensity, monitoring of hydration and vital signs [13]
Peripheral arterial disease	Claudication, ischemic ulcers	Supervised walking therapy [16]; foot care
Obesity, osteoarthritis	Joint pain, injuries	Low-impact, high-volume exercise, strength training to maintain muscle mass [13]

5.10. Progression of Load

The general rule is **"start slowly, progress slowly**." Every 1–2 weeks, change **only one parameter** (duration, then frequency, then intensity; for strength training—number of repetitions, then sets, then load). Progression should occur only if previous sessions were well tolerated: RPE within limits, no symptoms, rapid recovery of heart rate and blood pressure, and no excessive fatigue the following day. A temporary plateau or decrease in exercise dose is also acceptable following an illness, a bad day, or a change in medication. The 2026 ESC Guidelines recommend regular reassessment of intensity, as ventilatory thresholds and strength change with training; in chronotropic insufficiency (more common in heart failure), the heart rate–workload relationship should be periodically reassessed.

5.11. Monitoring During the Session and Criteria for Stopping Exercise

Monitoring includes: the patient's appearance (complexion, sweating, breathing), RPE, pulse, blood pressure (before, during, and after; in at-risk patients, also during exercise), SpO_2 in patients with lung disease or heart failure, and blood glucose in diabetics (before, as needed during exercise, and after). Each session is recorded in the patient's chart.



High-risk situations (ESC 2026): weight gain > 1.8 kg in 1–3 days, resting pulse > 100/min, new-onset AF/atrial flutter.

Figure 62 . Signs to stop the exercise: stop, help the patient sit down, and notify the physician or physical therapist.

Warning

Stop the exercise and immediately notify the physician/physical therapist if any of the following occur: chest pain or pressure, disproportionate shortness of breath, dizziness or a feeling of fainting, palpitations or a new irregular pulse, pallor and cold sweat, confusion, severe pain in the lower limbs, a drop in systolic blood pressure (SBP) of >10 mmHg during an increase in workload, systolic blood pressure (SBP) >220 mmHg or diastolic blood pressure (DBP) >110 mmHg during exercise, or SpO_2 below 88–90% (as per protocol). The patient should sit down, vital signs should be measured, and a decision should be made regarding whether to continue. The 2026 ESC Guidelines list the following among high-risk situations during exercise: weight gain of >1.8 kg in 1–3 days, a drop in systolic blood pressure during exercise, a resting heart rate >100/min in the supine position, and de novo atrial fibrillation or flutter.

Key Points

- The program is multifaceted: aerobic, strength, balance, flexibility, and respiratory training.
- Intensity is determined using an RPE of 11–13 + the talk test + heart rate (with caution).
- Progress on only one parameter at a time.

The signs indicating when to stop are well known

Reflection Assignment

Choose an exercise from this chapter and demonstrate it to a colleague: explain the execution, intensity, and adaptations in 60 seconds, then ask for feedback on clarity and safety.

6. SPECIFIC ASPECTS OF RECOVERY IN THE MAIN CLINICAL CONDITIONS IN PATIENTS WITH DIABETES

Objectives:

- adapt treatment in ischemic heart disease, heart failure, valvular heart disease, atrial fibrillation, hypertension, and peripheral arterial disease in patients with diabetes;
- understand the role of SGLT2 inhibitors, GLP-1 receptor agonists, and finerenone in cardiovascular disease associated with diabetes;
- apply precautions following cardiac surgery, with an emphasis on glycemic control;

recognize the specific features of type 1 diabetes in chronic kidney disease (CKD).

The general principles apply to all patients. This chapter addresses disease-specific considerations; the recommendations are advisory and align with the 2026 ESC guidelines on heart failure, the 2023 ESC guidelines on cardiovascular disease in diabetes, and disease-specific guidelines.

6.1. Ischemic heart disease (acute and chronic coronary syndromes, PCI, CABG)

RC is recommended following acute coronery syndrome (ACS) and in chronic coronary syndrome (CCS) to reduce cardiovascular mortality, myocardial infarction, and hospitalizations. In patients with diabetes, coronary artery disease is more extensive and more often multivascular, and ischemia may be **silent** due to autonomic neuropathy; therefore, exercise ECG, monitoring, and attention to atypical symptoms (fatigue, dyspnea, nausea) are important. In patients with diabetes and multivessel disease, surgical revascularization is often preferred, with the decision resting with the cardiology team. The ESC guidelines recommend cardioprotective therapy with SGLT2 inhibitors and/or GLP-1 RAs in patients with type 2 diabetes and atherosclerotic cardiovascular disease, regardless of HbA1c levels [17,18].

- **Intensity:** RPE 11–13; target heart rate below the ischemic or angina threshold; **nitroglycerin** on hand.
- **Beta-blockers:** reduce heart rate and may mask hypoglycemia; non-vasodilators (metoprolol, bisoprolol, atenolol) may worsen glycemic control, while carvedilol and nebivolol have a lesser effect—a matter to be discussed with the physician.
- **Sulfonylureas** (glibenclamide) may affect the "warming effect" and increase the risk of exertional angina.
- **Warning signs:** angina with minimal exertion, new-onset shortness of breath, palpitations, syncope—stop activity and seek medical evaluation.

6.2. Heart Failure (with Reduced or Preserved Ejection Fraction)

Diabetes, hypertension, obesity, and smoking together account for approximately 50% of HF events [2]. The 2026 ESC Guidelines on Heart Failure recommend: an SGLT2 inhibitor for patients with T2D at risk for HF or with chronic kidney disease; finerenone for patients with T2D and chronic kidney disease; GLP-1 receptor agonists should be considered in those with T2D and at least one cardiovascular risk factor; and antidiabetic drugs without proven safety in HF should be avoided. In patients with symptomatic heart failure, an FEVS ≥45%, and a BMI ≥30 kg/m², semaglutide or tirzepatide should be considered for weight loss and to improve exercise capacity and quality of life. Personalized exercise training, as part of cardiac rehabilitation, is recommended for all stable patients with heart failure [19].

- **Daily weight:** an increase of >1.8 kg in 1–3 days = increased risk in the cardiac rehabilitation (CR) unit.
- **SGLT2:** increased urine output, risk of dehydration, genital infections, and, rarely, ketoacidosis (including euglycemic ketoacidosis); explain the "sick-day rule" and the importance of hydration.
- **Diuretics + hyperglycemia:** polyuria, dehydration; adequate hydration during exercise, as directed by the physician.
- Avoid the Valsalva maneuver; exercise should begin at low intensity and progress slowly.

6.3. Valvular Diseases and Valvular Interventions

The 2026 ESC Guidelines recommend that cardiac rehabilitation be considered following any valvular intervention, whether surgical or percutaneous. The 2025 ESC/EACTS Guidelines lowered the age threshold for TAVI in aortic stenosis with a tricuspid valve from 75 to 70 . In patients with diabetes, glycemic control promotes wound healing and reduces the risk of infection (including prosthesis-related infections); the access site, heart rhythm, blood pressure, and anticoagulation should be monitored, and good dental hygiene is important for preventing endocarditis [20].

6.4. Atrial Fibrillation and Implantable Devices

Atrial fibrillation (AF) is common in diabetes, obesity, and sleep apnea; lifestyle management and control of risk factors, including exercise and glycemic control, are part of treatment. An irregular pulse requires RPE as the primary guide. Palpitations may also be caused by hypoglycemia; blood glucose and heart rhythm should be checked. In ICD recipients, the target heart rate should be maintained below the device's therapy threshold; exercise is recommended for ICD and CRT recipients [21].

6.5. Hypertension

Hypertension is present in most patients with diabetes and increases cardiovascular and renal risk. Aerobic exercise is the first-line treatment, and in type 2 diabetes, sessions lasting more than 30 minutes—at least at a moderate intensity—and an adequate volume of resistance training are associated with a reduction in blood pressure. Check for orthostatic hypotension (autonomic neuropathy, diuretics, ACE inhibitors/sartans) before each session. Avoid intense isometric exercise and the Valsalva maneuver. The 2026 ESC Heart Failure Guidelines recommend strict blood pressure control (systolic <130 mmHg) for the prevention of heart failure [22].

6.6. Peripheral Arterial Disease and the Diabetic Foot

Peripheral arterial disease is common and often more severe in diabetes. Supervised walking therapy is the first-line treatment: walk until moderate-to-severe discomfort in the calf, stop, repeat, for 30–60 minutes per session, at least 3 times a week, for a minimum of 12 weeks. Neuropathy can mask claudication and ischemic pain, so a foot examination is mandatory. **Active ulcers** should be treated by a specialist (offloading, dressing, revascularization); exercise should be performed without placing weight on the affected area (stationary bike, seated exercises), as advised by a podiatrist.

6.7. Recovery After Cardiac Surgery and Perioperative Glycemic Control

The 2026 ESC Guidelines emphasize that, in patients with diabetes undergoing cardiac surgery, adherence to a strict glycemic control protocol—particularly postoperatively—reduces surgical complications. Active mobilization should begin as early as possible, ideally within 4 weeks; Phase II rehabilitation should begin within 28 days and should not be delayed beyond 42 days. Diabetes increases the risk of infection and delayed healing of the sternal and saphenous incisions: monitor the incisions, fever, and blood glucose levels. Sternal precautions (approximately 6–8 weeks, according to protocol): no heavy lifting, use a pillow under the sternum when coughing, and avoid sleeping on the abdomen.

6.8. Chronic Kidney Disease and Diabetic Cardiomyopathy

Chronic kidney disease is a common complication of diabetes and a major risk factor for heart failure; the 2026 ESC guidelines on heart failure recommend SGLT2 inhibitors and finerenone for patients with type 2 diabetes and kidney disease [2]. Patients may experience fatigue, anemia, and electrolyte imbalances; exercise should be approached cautiously, with monitoring of vital signs and hydration. **Diabetic cardiomyopathy** (diastolic dysfunction, often with an HFpEF phenotype) manifests as exertional dyspnea and exercise intolerance; aerobic and strength training improve functional capacity, along with weight and blood pressure control.

6.9. Specifics of Recovery in Type 1 Diabetes

Patients with type 1 diabetes (T1D) are a minority in cardiac rehabilitation (less than 10% of those with diabetes), but they have **the highest risk** of exercise-related glycemic events and require the most individualized approach. Key points:

- **CGM** is recommended for those with unstable diabetes, and the pump's basal rate should be reduced in advance (60–90 minutes before aerobic exercise), in consultation with the endocrinologist;
- **ketones** should be checked when blood glucose is >270 mg/dl (>15 mmol/l); a level of ≥1.5 mmol/l contraindicates exercise;
- prolonged **aerobic** exercise promotes hypoglycemia, while short, intense exercise (sprints, strength training, circuit training) can cause hyperglycemia; the combination of strength training and aerobic exercise, in that order for euglycemic individuals, reduces both acute and delayed hypoglycemia;
- **late-onset/nocturnal** hypoglycemia is common, especially after evening exercise; mornings are generally safer;
- the risk of severe hypoglycemia increases with age and the duration of the disease;
- Exercise generally does not improve HbA1c in type 1 diabetes, but it reduces the risk of complications (retinopathy, albuminuria) and improves cardiovascular health; this is the message for the patient, not "lowering HbA1c";
- Diabetes care in type 1 diabetes is a team effort: patient, endocrinologist, and exercise specialist.

Key Points

- Diabetes increases the complexity of every clinical condition: silent ischemia, renal risk, and risk of wound infection.
- SGLT2 inhibitors, GLP-1 receptor agonists, and finerenone are cardioprotective agents, with precautions regarding exercise and hydration.
- After cardiac surgery, glycemic control reduces complications.

DZ1: maximum risk of a glycemic event; CGM, ketones, and a diabetes specialist involved.

7. INTERVENTIONS COMPLEMENTARY TO PHYSICAL EXERCISE

Objectives:

- providing therapeutic education on diabetes (teach-back method);
- to integrate nutritional recommendations (carbohydrates, weight, alcohol);
- explaining the interactions of antidiabetic and cardiovascular medications with exercise;
- supporting adherence, smoking cessation, and psychological support;
- promoting foot care and ophthalmological monitoring

7.1. Therapeutic Education and Self-Care in Diabetes

The ADA standards emphasize that education and support for diabetes self-care are essential for preventing acute and chronic complications. In CR, education focuses on: the effect of exercise on blood glucose (decrease during exercise, delayed hypoglycemia), personal blood glucose and carbohydrate guidelines, recognizing hypoglycemia, the "sick-day rule" (including for SGLT2 inhibitors), foot care, cardiac warning signs, and treatment adherence. Education on the acute and chronic effects of exercise on blood glucose has proven effective. **The "teach-back" method** is used: the patient explains what they would do if their blood glucose were 80 mg/dl before the session.

7.2. Nutritional Intervention (Mediterranean Diet, Carbohydrates, Weight, Alcohol)

The 2026 ESC Guidelines recommend nutritional counseling tailored to comorbidities and a Mediterranean-style or low-fat diet to reduce cardiovascular events. In patients with diabetes, diet is closely linked to treatment: meal times, the quantity and quality of carbohydrates, choosing foods with a low glycemic index, fiber, unsaturated fats, and limiting salt (<5 g/day), saturated fats, and added sugar [23].

- **Carbohydrates and exercise:** if pre-exercise blood glucose is low (<90 mg/dl) in a patient on insulin or sulfonylurea, 15–30 g of carbohydrates; for exercise lasting >30 min, approximately 25–30 g/hour; after prolonged or intense exercise, 10–30 g within the first 30 minutes.
- **Weight:** In cases of obesity, a high volume of exercise (250–420 min/week), combined with strength training and protein intake to preserve muscle mass on a low-calorie diet; modern pharmacological treatments (GLP-1 RAs, dual agonists) are effective, but up to half of patients discontinue them within the first year, particularly due to adverse effects, so monitoring tolerance is important.
- **Protein:** adequate intake to maintain muscle mass; in the elderly or those with sarcopenia, 1.2–1.5 g/kg/day, adjusted for renal function.
- **Alcohol:** maximum 100 g of pure alcohol per week (2021 ESC guidelines); alcohol increases the risk of late-onset hypoglycemia in those on insulin or sulfonylureas.

7.3. Antidiabetic and Cardiovascular Medications: Interactions with Exercise

Table 94 . Common medications and their effects in the context of exercise

Group	Effect / Risk	What We Are Looking For
Metformin	Low risk of hypoglycemia; transient glycemic effect during exercise; no additional carbohydrates	Gastrointestinal symptoms, renal function
Sulfonylureas, glinides	Hypoglycemia during exercise; glibenclamide affects the "warm-up effect" and negates the decrease in insulin levels during intense exercise	Blood glucose before/during/after exercise; additional carbohydrates
Insulin	Promotes hypoglycemia; possible dose reduction before exercise (at the physician's discretion)	Blood glucose before/during/after exercise; carbohydrates; injection site (abdomen, buttocks)
SGLT2 inhibitors	Interaction with exercise is poorly understood; risk of ketoacidosis, including euglycemic ketoacidosis; dehydration	Nausea, vomiting, malaise, thirst, abdominal pain; ketones as needed; hydration
GLP-1 RA, DPP-4	No additional carbohydrates; GLP-1 RA: gastrointestinal effects, weight loss	Gastrointestinal tolerance, appetite, hydration
Pioglitazone	No acute glycemic effect noted; fluid retention	Edema, weight
Beta-blockers	Decrease exercise heart rate (more so in diabetes), may mask hypoglycemia; non-vasodilator beta-blockers may worsen blood glucose	RPE; symptoms of hypoglycemia (sweating); consult your doctor
Statins, thiazides	May impair glycemic control	Blood glucose levels, HbA1c
ACE inhibitors/sartans, diuretics	Hypotension, dehydration, renal function, and potassium	Orthostatic blood pressure, hydration

7.4. Treatment adherence and polypharmacy

Patients with diabetes and heart disease take many medications. Solutions: a simplified written treatment plan, a pill organizer, an alarm, explaining the purpose of each medication, and a medication review by the doctor (deprescribing where appropriate). Check injection technique (rotating injection sites, needles), insulin storage, and supply of test strips and sensors.

7.5. Quitting Smoking and Reducing Alcohol Consumption

Smoking increases the risk of cardiovascular and microvascular complications in diabetes; quitting is beneficial at any age. Approach: ask, advise, assess readiness, and offer behavioral and pharmacological support (as prescribed by the doctor). Alcohol intake should be limited; in patients taking insulin or sulfonylureas, it increases the risk of delayed hypoglycemia.

7.6. Psychological and Social Support

Diabetes is frequently accompanied by disease-related distress, depression, and anxiety; fear of hypoglycemia may limit activity. Cognitive-behavioral interventions reduce distress, and support groups increase motivation. The PHQ-9, GAD-7, and diabetic distress scales are used, along with empathetic discussions, referrals to a psychologist, and peer support groups.

7.7. Foot Care and Ophthalmic Monitoring

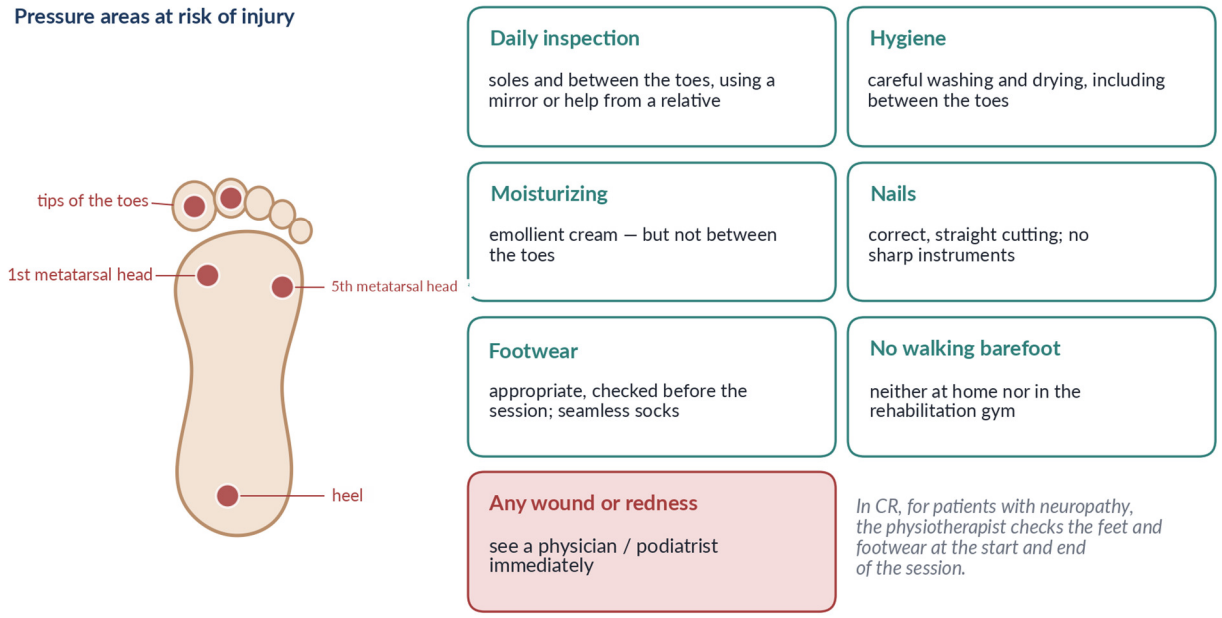


Figure 63 . Foot care in diabetes: daily inspection, hygiene, moisturizing, and appropriate footwear.

Diabetic foot is one of the most serious and preventable complications. Basic rules: daily inspection of the soles of the feet (using a mirror or with the help of a family member), careful washing and drying, moisturizing (not between the toes), proper nail trimming, appropriate footwear and seamless socks, no walking barefoot, and immediate medical attention for any wound or redness. In rehabilitation, the physical therapist checks the footwear and soles at the beginning and end of each session for patients with neuropathy. **An** annual **eye exam** (or more frequently, as directed by a doctor) is mandatory; any new blurred vision should be reported immediately.

7.8. Sleep, Driving, Work, and Resuming Daily Activities

Insufficient sleep and sleep apnea worsen glycemic and cardiovascular control; snoring accompanied by breathing pauses requires evaluation. **Driving**: Check blood glucose levels before driving and during long trips, in accordance with the law and your diabetes specialist's instructions; in case of hypoglycemia, stop the vehicle and treat it. At work, especially during shift work, plan meals, snacks, and blood glucose monitoring. Resume activities gradually, as directed by your doctor.

Key Points

- Diabetes education is part of self-care: physical activity affects blood glucose levels both immediately and over time.
- Antidiabetic medications have different effects during exercise: insulin and sulfonylureas require the most attention; SGLT2 inhibitors—ketoacidosis.
- Nutrition and weight management should focus on protein and strength training, not just restriction.
- Feet and eyes should be monitored systematically.

8. PATIENT SAFETY AND EMERGENCY MANAGEMENT

Objectives:

- recognizing possible adverse events during the program;
- treating hypoglycemia and preventing delayed hypoglycemia;
- recognizing hyperglycemia with ketosis, ketoacidosis (including euglycemic ketoacidosis), and hyperosmolar state;
- properly managing orthostatic hypotension, arrhythmia, ischemia, and cardiorespiratory arrest;
- prevention of falls and foot injuries

8.1. Adverse Events During Recovery

Supervised programs are, on the whole, safe: the 2026 ESC guidelines estimate the rate of serious adverse events at approximately 1 per 53,770 patient-hours in remotely supervised sessions, 1 per 11,333 patient-hours in center-based HIIT, and no reported events in center-based moderate continuous training. In patients with diabetes, the main acute risks are: hypoglycemia, hyperglycemia with ketoacidosis, events related to neuromotor, visual, or sensory deficits, and fatigue resulting from comorbidities (kidney disease, dehydration).

Practical Note

Record any incident, even minor ones: blood glucose level, what happened, when, actions taken, and who was notified. The endocrinologist should be informed of any events surrounding the session.

8.2. Hypoglycemia: Recognition, Prevention, and Treatment

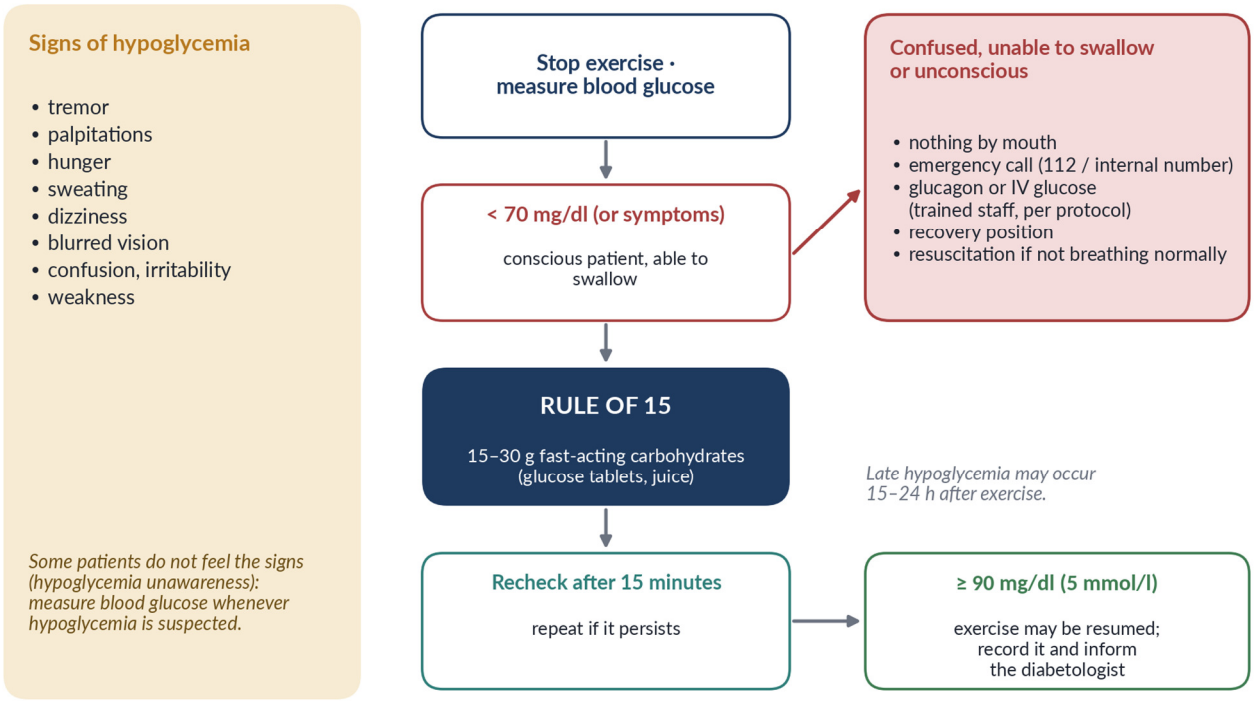


Figure 64 . Signs of hypoglycemia and the 15 rule: 15–30 g of fast-acting carbohydrates, followed by rechecking.

Signs: tremors, palpitations, hunger, sweating, dizziness, blurred vision, confusion, irritability, weakness; some patients do not experience these symptoms (asymptomatic hypoglycemia). The safest approach is to **measure** blood glucose whenever symptoms are present or hypoglycemia is suspected.

Table 95 . Treatment of hypoglycemia in the CR room

Situation	Action
Conscious patient, blood glucose <70 mg/dl (or symptoms)	Stop exercise; 15–30 g of fast-acting carbohydrates (glucose tablets, juice); recheck after 15 minutes; repeat if symptoms persist; exercise may be resumed when blood glucose exceeds 90 mg/dl (5 mmol/l)
Low blood glucose before exercise (<90 mg/dl, on insulin/sulfonylurea)	15–30 g of carbohydrates; postpone exercise until blood glucose reaches ≥90 mg/dl; if blood glucose does not correct within <30 min, exercise is contraindicated
Patient who cannot swallow, is confused, or is unconscious	**Nothing by mouth**; call emergency services (112/internal number); glucagon or IV glucose according to protocol by trained personnel; place in the recovery position; perform CPR if not breathing normally
After the episode	Record blood glucose levels and the cause; notify the endocrinologist; monitor more closely in the following hours

Delayed hypoglycemia may occur up to 15–24 hours after exercise, especially after long or intense sessions and after evening exercise; the patient is instructed to monitor their blood glucose more closely during this period and to keep carbohydrates on hand, including at night.

8.3. Hyperglycemia, ketoacidosis (including SGLT2-associated euglycemic ketoacidosis), and hyperosmolar state

Diabetic ketoacidosis occurs primarily in type 1 diabetes and is characterized by thirst, polyuria, nausea, vomiting, abdominal pain, rapid breathing, an "apple-like" odor, confusion, and fatigue. Exercise is contraindicated when ketone levels are ≥1.5 mmol/L. **Euglycemic ketoacidosis** associated with SGLT2 inhibitors may occur **without marked hyperglycemia**; therefore, patients on SGLT2 inhibitors are asked if they have experienced nausea, vomiting, or feeling unwell, and a sudden decline in exercise tolerance may be a sign; In these situations, exercise is contraindicated, and patients should be tested for ketones and seek medical advice.

Hyperosmolar state (especially in type 2 diabetes) is characterized by very high blood glucose levels, severe dehydration, drowsiness, or confusion and is a medical emergency. Hyperglycemia >270 mg/dl without ketosis and without symptoms does not contraindicate light exercise; in type 2 diabetes, >306 mg/dl (17 mmol/l) should be managed with light activity, rechecking blood glucose levels, and hydration (section 5.8). Fluid intake is encouraged, as hyperglycemia increases urine output.

Caution

Intense thirst, polyuria, nausea/vomiting, abdominal pain, rapid breathing, or confusion in a patient with diabetes = **check blood glucose and ketones, stop exercise**, **and call a doctor**, even if blood glucose is not very high (patients on SGLT2 inhibitors).

8.4. Orthostatic Hypotension, Arrhythmias, and Silent Ischemia

Autonomic neuropathy causes orthostatic hypotension, reduces the heart rate response to exercise, masks angina, and decreases heat tolerance. Measure orthostatic blood pressure, make slow transitions, limit exercise in hot environments, and use RPE. If any suggestive symptoms occur (unexplained fatigue, shortness of breath, nausea, dizziness), stop the exercise and notify the physician. The risk situations outlined in the 2026 ESC guidelines (weight gain >1.8 kg in 1–3 days, decreased systolic blood pressure during exercise, complex ventricular arrhythmia, de novo airway obstruction) also apply to patients with diabetes.



High-risk situations (ESC 2026): weight gain > 1.8 kg in 1–3 days, resting pulse > 100/min, new-onset AF/atrial flutter.

Figure 65 . Signs to stop exercise: stop, sit the patient down, measure blood glucose, and notify the physician or physical therapist.

8.5. Emergency Protocol and Basic Life Support

All team members are familiar with the basic resuscitation algorithm and the location of the equipment:

1. Check the safety of the area and **the patient's response**.
2. If the patient is unresponsive and **not breathing normally**: call for help, **dial 112 or the internal number**, and request an AED.
3. Begin **chest compressions**: center of the chest, depth 5–6 cm, rate 100–120 per minute.
4. **Apply the AED** immediately and follow the voice prompts.
5. Continue until medical personnel arrive or the patient shows signs of life [24].

Practical Note

In an unconscious patient with diabetes, measure blood glucose **without delaying** the emergency call or resuscitation; severe hypoglycemia can mimic unconsciousness, but if the patient is not breathing normally, begin resuscitation.

8.6. Prevention of Falls and Foot Injuries

Peripheral neuropathy, hypoglycemia, orthostatic hypotension, and retinopathy increase the risk of falls and foot injuries; global guidelines recommend risk assessment, balance and strength exercises, medication review, and environmental adaptations. The joint statement emphasizes balance assessment and regular foot examinations. In the gym: closed-toe, stable footwear; dry flooring; assistance when getting on exercise equipment; inspection of the soles of the feet at the end of the session for patients with neuropathy; at home: no walking barefoot; no loose rugs; night light [25].

Key Points

- Supervised programs are safe when patients are selected and monitored.
- Hypoglycemia should be measured, not assumed; the "rule of 15"; delayed risk up to 15–24 hours.
- Euglycemic ketoacidosis can occur with SGLT2 inhibitors without high blood glucose. Neuropathy masks ischemia, hypoglycemia, and foot injuries.

9. MODELS FOR PROVIDING CARDIOVASCULAR REHABILITATION

Objectives:

- to compare delivery models (in-center, at home, remote, hybrid) in the context of diabetes;
- to select the appropriate model based on glycemic and cardiac risk;
- planning a safe home-based program;
- using CGM and digital data for monitoring;

The 2026 ESC Guidelines recommend in-center rehabilitation (Class I) and propose that care be patient-centered, with multiple delivery modes (Class IIa); home rehabilitation without digital support may be considered for patients without high risk, and telerehabilitation or hybrid models may be considered after valve procedures or for patients with implantable devices (Class IIb). The rehabilitation team is responsible for the program regardless of the delivery method.

9.1. Outpatient Program at the Center

This is the reference model: direct supervision, a blood glucose meter and ketone test strip, monitoring, and rapid intervention in cases of hypoglycemia. It is particularly suitable for patients with Type 1 diabetes, those with Type 2 diabetes on insulin or sulfonylureas, those with complications or unstable blood glucose levels, as well as newcomers to the program. In heart failure, a network meta-analysis cited by the 2026 ESC guidelines showed that only center-based CR significantly reduced heart failure-related hospitalizations and mortality, with high heterogeneity among studies. Disadvantages: transportation, fixed schedule, costs.

9.2. Home-Based Rehabilitation

In patients with a low risk of dysglycemia (Type 2 diabetes without hypoglycemic agents) and low cardiac risk, home-based CR can be effective if properly **structured**. The 2026 ESC Guidelines note comparable safety between supervised home-based rehabilitation and center-based rehabilitation, provided there is appropriate patient selection, education, and remote monitoring; however, studies cannot rule out differences in rare complications. The 2023 Cochrane Review directly compares the two models. The patient has a blood glucose meter, fast-acting carbohydrates, a phone, and written guidelines [26].

Table 96 . Sample weekly home care plan (for guidance, DZ2)

Day	Activity	Duration	Effort (RPE)
Monday	Moderate-paced walking (preferably after a meal) + balance exercises	30 min + 5 min	11–12
Tuesday	Strength training with bottles/resistance band (chair lifts, push-ups)	20–30 min	11–13
Wednesday	Light walking + stretching + foot check	30 min	10–12
Thursday	Strength + balance	20–30 min	11–13
Friday	Moderate-paced walking	30 min	11–13
Saturday	Enjoyable activity (garden, park)	30–45 min	10–12
Sunday	Short walk after meals, breathing exercises, and stretching	15–20 min	≤10

Practical note

Requirements for the at-home program: low or stable risk, a blood glucose meter, fast-acting carbohydrates, knowledge of the signs of hypoglycemia and cardiac emergencies, a phone within reach, and scheduled contact with the team every 1–2 weeks.

9.3. Telerehabilitation, Continuous Glucose Monitoring, and Digital Technologies

Telerehabilitation uses videoconferencing, apps, wearable devices, and telephone consultations. For patients with diabetes, CGM, insulin pumps, and apps enable remote blood glucose monitoring; the 2026 ADA Standards recommend CGM for those on insulin or medications that cause hypoglycemia. The joint statement notes that continuous monitoring has been associated, in qualitative studies of type 1 diabetes (DZ1), with better management of physical exertion. Barriers include a lack of digital literacy and unequal access to technology. In telerehabilitation, the following are established: who views the data, at what thresholds the team is alerted, how carbohydrates are administered, and what actions are taken in the event of hypoglycemia [27].

9.4. Hybrid Models

The hybrid model combines in-center sessions (assessment, technique, devices, monitoring) with sessions at home or remotely. The 2026 ESC Guidelines describe a shift toward a patient-centered hybrid model. For patients with diabetes, in-center sessions at the beginning of the program allow for the calibration of glycemic targets, while at-home sessions increase the total amount of physical activity.

Table 97 . Comparison of diabetes care delivery models

Model	Advantages	Limitations	Suitable for
In-center	Monitoring, blood glucose/ketones, devices, group	Transportation, fixed schedule	DZ1, DZ2 on insulin/SU, complications, start of program
At home	Flexibility, low costs	No direct supervision	DZ2 without hypoglycemic agents, low cardiac risk
Telemonitoring + CGM	Remote access, continuous data	Digital skills, equipment	Stable, with CGM and internet access
Hybrid	Balance between safety and access	Requires coordination	Most patients after the first few weeks

9.5. Maintenance Phase and Continuity of Care

The benefits are lost if physical activity stops upon discharge. Maintenance involves regular activity (daily walking, strength training 2–3 times a week), reducing sedentary behavior (taking movement breaks during prolonged sitting), regular follow-ups with the endocrinologist, foot care, and contact with the care team and community groups. The 2026 ESC Guidelines emphasize that it is never too late to adopt an active lifestyle and recommend community or peer support groups. The written plan includes personalized blood glucose management guidelines to ensure the patient can be active safely and independently.

Key Points

- The model is chosen based on glycemic and cardiac risk, preferences, and resources.
- Type 1 and Type 2 diabetes patients on insulin or sulfonylureas typically begin treatment at a specialized center.
- CGM and digital data aid monitoring but require clear guidelines.
- Maintaining physical activity and reducing sedentary behavior sustain the benefits.

Objectives:

- planning follow-up evaluations and selecting glycemic, cardiovascular, and functional indicators;
- interpreting the response and adjusting the treatment plan;
- establishing discharge criteria and a maintenance plan;
- drafting documentation and the final report.

10. MONITORING, RE-EVALUATION, AND DISCHARGE OF THE PATIENT

10.1. Periodic Reevaluations

Reassessments are conducted every **4–6 weeks** and at **the end of the program**, using the same tests as at the beginning. At each session, cardiac parameters, blood glucose levels, and glycemic events are monitored. The 2026 ESC Guidelines recommend that results be described based on both functional assessments and patient-reported questionnaires. As the patient becomes more fit, treatment is reassessed together with the endocrinologist, since insulin requirements and the risk of hypoglycemia may change.

10.2. Glycemic, Cardiovascular, Functional, and Quality-of-Life Outcome Measures

Table 98 . Outcome indicators—dashboard model

Domain	Indicator	Guideline Values
Glycemic	HbA1c (at 3 months), TIR/TBR/TAR (CGM), number of hypoglycemic episodes	In type 2 diabetes, aerobic exercise reduces HbA1c by 0.5–0.7% [3]; in type 1 diabetes, a difference of ≥0.5% is clinically significant
Glycemic safety	Exercise-related hypoglycemic episodes, elevated ketones	Goal: zero severe episodes
Functional	6MWT	Increase of ≥30 m = MCID
Capacity	Peak VO_2 (CPET)	MCID ≈ 1 ml/kg/min
Strength	Grip strength, chair stands, 10-RM	Growth
Cardiovascular	BP, resting heart rate, LDL, weight, waist circumference	Individualized goals
Complications	Leg exam, UACR/eGFR (at the endocrinologist's office), vision	Stable or improved
Psychosocial	PHQ-9, GAD-7, diabetic distress, fear of hypoglycemia	Decrease in scores
Quality of life	EQ-5D / SF-12; KCCQ, MLHFQ in IC	A 5-point difference on the KCCQ/MLHFQ = significant
Adherence	Sessions attended (%), program completion	Key quality indicators; ≥80% attendance is a common goal

10.3. Program adjustment based on response

Table 99 . Guiding decisions based on response

Observed response	Interpretation	Action
Lower RPE for the same task, stable blood glucose levels	Good adaptation	Progress one parameter (duration → frequency → intensity)
Repeated hypoglycemia around training sessions	Inappropriate treatment dose/carbohydrate intake	Notify your endocrinologist; adjust the time or carbohydrate intake; temporarily reduce the volume
Hyperglycemia after HIIT or strength training (T1D)	Anaerobic effect on blood glucose	Change the order or intensity; check for ketones; discuss with your diabetes specialist
New symptoms (pain, shortness of breath, palpitations, dizziness)	Cardiac or glycemic issue	Stop, check blood glucose, notify your doctor
Plateau after 3–4 weeks	Plateau, adherence	Check adherence, diet, sleep, and technique; adjust the incentive
Foot injury, blurred vision	Diabetes complication	Referral to a podiatrist/ophthalmologist; adjust exercise intensity
Elevated PHQ-9 score/increased distress	Psychological distress	Referral to a psychologist; group support

10.4. Discharge Criteria and Maintenance Plan

Discharge occurs when the primary goals are met or a plateau is clearly established, the patient **independently** follows blood glucose management guidelines related to physical activity (checks blood glucose, chooses carbohydrates, recognizes and treats hypoglycemia), is aware of warning signs, and the maintenance plan is prepared. The written plan includes recommended activities, location, support person, follow-up appointments (cardiologist, endocrinologist, podiatrist, ophthalmologist), and team contact information; a copy is provided to the patient and a report is sent to the treating physicians.

10.5. Medical Documentation and Final Report

The documentation is **complete, accurate, legible, dated,** and **signed**, and adheres to confidentiality standards. A useful format is SOAP. The final report includes: diagnosis and risk, initial and final assessments, the program carried out, compliance, glycemic events and incidents, results, recommendations, and follow-up appointments.

Practical note

SOAP example: S: “I felt fine; I had a light breakfast.” O: blood glucose 128 mg/dl before, 104 midway, 96 at the end; BP 132/80, pulse 74; 25 min on stationary bike, RPE 12, no symptoms; 15 g of carbohydrates after the session. A: Good tolerance, tendency toward lowering blood glucose. P: Maintain the duration; inform the endocrinologist about the trend; monitor blood glucose that evening; re-evaluate in 1 week.

Key Points

- The reassessment uses the same tests as the initial evaluation, at 4–6 weeks and at the end; treatment is reassessed with the endocrinologist.
- Glycemic, cardiovascular, functional, and psychosocial indicators are monitored.
- Discharge requires glycemic self-management and a written maintenance plan.

11. CASE STUDIES

1. A 58-year-old man following acute coronary syndrome, with type 2 diabetes treated with insulin

Clinical Case

Patient A., 58 years old, professional driver. Non-ST-elevation myocardial infarction treated with PCI 4 weeks ago. Type 2 diabetes for 12 years, treated with metformin, evening basal insulin, and empagliflozin; hypertension, dyslipidemia, obesity (BMI 33). Beta-blocker (metoprolol), statin, dual antiplatelet therapy. Two mild hypoglycemic episodes in the past 3 months. Mild peripheral neuropathy. LVEF 50%. Goal: "to get back behind the wheel and lose weight."

Table 100 . Initial assessment—Patient A.

Parameter	Value
Resting BP / Orthostatic BP / Pulse	138/84 → 130/80 mmHg / 66 bpm
HbA1c / fasting blood glucose	8.1% / 152 mg/dl
eGFR / UACR	78 ml/min/1.73 m² / 45 mg/g (moderately elevated)
6MWT	320 m (RPE 14)
Grip strength	30 kg
Lower extremity examination	Low vibration sensitivity, no ulcers
PHQ-9 / GAD-7	7 / 6

Stratification: moderate cardiac risk; moderate risk of dysglycemia (basal insulin), plus risk of euglycemic ketoacidosis on SGLT2. **SMART goals:** (1) 30 minutes of continuous walking within 12 weeks; (2) 6MWT ≥350 m; (3) no exercise-related hypoglycemia; (4) HbA1c <7.5% (to be discussed with the endocrinologist); (5) 5% weight loss while maintaining muscle strength; (6) daily foot inspection.

Table 101 . Proposed Program – Patient A. (for guidance)

Element	Prescription
Frequency	3 supervised sessions/week during weeks 1–6, then 2 + 3 at home; sessions in the morning, 1–2 hours after breakfast
Aerobic	Stationary bike/treadmill 15 → 30 min, RPE 11–13 (HR is not a guide while on metoprolol or in diabetes); below the symptom threshold
Strength	2 days/week, large muscle groups, 1 → 2 sets × 10–12 reps; increase volume for blood glucose [13]
Blood glucose	Before, at 20 min, and at the end; <90 mg/dl: 15–30 g carbohydrates; 90–124: ~10 g; delayed hypoglycemia: monitoring in the evening and at night [1]
Diabetologist	Reassess basal insulin dose and sulfonylureas (if used) every 2–4 weeks; discuss the type of beta-blocker [1]
SGLT2	Guidelines for sick days; questions about nausea/vomiting; hydration [1]
Foot	Proper footwear; inspection at the beginning and end of the visit; podiatrist
Nutrition / Education	Mediterranean diet; protein; limited alcohol; teach-back for glycemic control

Progress at 12 weeks: 6MWT 395 m, HbA1c 7.4%, weight −4 kg, grip strength 33 kg, a single episode of blood glucose 84 mg/dL at the start of the session, treated with 15 g of glucose, no severe events. Applies the decision chart independently and transitions to a hybrid program.

Reflection Question

What would you do if the blood glucose level at the start were 82 mg/dl? What if nausea and vomiting occur without high blood glucose? How would you explain the risk of delayed hypoglycemia to a driver?

2. A 67-year-old woman with heart failure with preserved ejection fraction, obesity, type 2 diabetes, and neuropathy

Clinical Case

Patient B., 67 years old, retired, lives alone. HFpEF (LVEF 58%), NYHA Class II–III, BMI 38 kg/m², type 2 diabetes for 15 years with peripheral neuropathy (diminished sensation in the soles of the feet), hypertension, and knee osteoarthritis. Admitted for decompensation 8 weeks ago. Treatment: diuretic, empagliflozin, semaglutide, metformin, antihypertensive. Fatigue, fear of falling, social isolation.

Table 103. Initial assessment—Patient B.

Parameter	Value
Resting BP / Orthostatic BP / Pulse	140/82 → 122/74 mmHg / 76 bpm (significant orthostatic drop)
Weight	99 kg (lean body mass 98 kg)
6MWT	260 m (RPE 15, one break)
SPPB / grip strength	7/12/16 kg
HbA1c	7.4%
Foot examination	Loss of protective sensation; plantar callus; no ulcer
PHQ-9 / GAD-7	12 / 7

Stratification: moderate-to-high cardiac risk (recent HFpEF), low risk of dysglycemia (no insulin/sulfonylurea), high risk of falls and foot injuries. **SMART Goals:** (1) 6MWT ≥320 m; (2) 5% weight loss while maintaining muscle mass; (3) no falls and no foot injuries; (4) 20 minutes of walking daily; (5) PHQ-9 <10.

Table 102 . Proposed Program – Patient B. (indicative)

Element	Prescription
Frequency	3 sessions/week at the center; short walks after meals at home
Aerobic	Intervals of 3 min of exercise / 1–2 min of rest; 15 → 35 min; RPE 11–13; **no repetitive impact** (bicycle, walking in appropriate footwear)
Strength	2 days/week, 1–2 sets × 8–12 reps, large muscle groups; supported chair stands
Balance	With support, progressive; TUG assessment
Precautions	Slow transitions (orthostatic hypotension); daily weight monitoring, increased risk at +1.8 kg over 1–3 days; hydration while on SGLT2; occasional blood glucose monitoring
Foot	Inspection at the beginning/end of the session; orthopedic footwear as recommended by the podiatrist
Nutrition / Psychosocial	Mediterranean diet; protein; monitoring of digestive tolerance to semaglutide; psychologist for high PHQ-9; support group

Progress at 12 weeks (fictitious): 6MWT 330 m, weight 94 kg, SPPB 9, PHQ-9 8, no falls or foot injuries; continuing in a hybrid format.

Reflection Topic

Why isn't high-impact training used? How do you adjust the session on a day when weight has increased by 1.9 kg in two days? What additional risks does autonomic neuropathy pose?

A 44-year-old man with type 1 diabetes following aortocoronary bypass surgery

Clinical Case

Patient C., 44 years old, programmer. Has had type 1 diabetes (T1D) for 28 years, treated with an insulin pump and CGM. Underwent CABG (three grafts) 6 weeks ago. Autonomic neuropathy with reduced heart rate response to exercise and partially unrecognized hypoglycemia. Treatment: beta-blocker, vasodilator, ACE inhibitor, statin. Fear of hypoglycemia during exercise.

Table103 . Initial assessment – Patient C.

Parameter	Value
Resting BP / pulse	122/74 mmHg / 84 bpm
HbA1c / TIR / TBR	7.6% / 62% / 6%
Ketones (blood)	0.3 mmol/L
6MWT	410 m (reduced heart rate)
LVEF	52%
Sternal wound	Good healing; sternal precautions
PHQ-9 / fear of hypoglycemia	8 / elevated

Stratification: high risk of dysglycemia (T1D), moderate cardiac risk, autonomic neuropathy. **SMART goals:** (1) 30 minutes of cycling/walking within 12 weeks; (2) no severe hypoglycemia or ketosis; (3) TBR <4% on exercise days (goal discussed with the endocrinologist); (4) reduction in fear of hypoglycemia; (5) return to work in the third month.

Table 104 . Proposed program – Patient C. (indicative)

Element	Prescription
Coordination	Written plan with the endocrinologist to reduce basal rate before exercise (target: −50–80% 60–90 minutes beforehand) and at night following intense sessions [1]
Time of session	Morning; avoid evening sessions during the first few weeks [1]
Order	Strength training before cardio at euglycemic blood glucose levels; do cardio first if >180 mg/dl [1]
Blood glucose / ketones	CGM with alarms + glucometer; check for ketones if >270 mg/dl; check blood glucose at the beginning, middle, and end
Aerobic	15 → 30 min, RPE 11–13; HR is not a guide (autonomic neuropathy, beta-blocker); long warm-up
Carbohydrates	<90 mg/dl: 15–30 g; 90–124: ~10 g; after an intense session: 10–30 g within 30 min [1]
Sternal precautions	Place a cushion on the sternum when coughing; avoid heavy lifting
Psychosocial	Psychological consultation for fear of hypoglycemia; education on recognizing one's own symptoms within the safe range

Progress at 12 weeks (fictitious): 6MWT 470 m, HbA1c 7.3%, TBR 3%, one mild episode of hypoglycemia after an afternoon session, corrected by adjusting the nighttime basal rate; resumes work with a flexible schedule.

Reflection Question

Why is the morning safer in T1D? What do you check if blood glucose is 285 mg/dl? How do you explain to the patient that exercise won't lower their HbA1c, but is still beneficial?

11.4. Comparative Discussion and Key Points

Table 105 . Comparison of the three cases

Aspect	Patient A.	Patient B.	Patient C.
Type of diabetes / treatment	T2D, basal insulin + SGLT2	T2D, SGLT2 + semaglutide	Type 1 diabetes, insulin pump + CGM
Cardiac diagnosis	ACS + PCI	HFpEF	CABG
Risk of dysglycemia	Moderate	Low	High
Critical factor	Hypoglycemia, euglycemic ketoacidosis, neuropathy	Neuropathy, orthostatic hypotension, foot	Autonomic neuropathy, nocturnal hypoglycemia, ketones
Intensity Guide	RPE	RPE, thresholds	RPE
Continuation Model	Hybrid	Hybrid, group	Hybrid, with CGM

Key Points

- The same basic program is tailored to **the type of diabetes, treatment, complications, and cardiac risk**.
- Blood glucose targets follow the same principles, but insulin doses are determined by the endocrinologist.
- Neuropathy alters the guidelines regarding exercise intensity, safety, and foot care.

Fear of hypoglycemia is addressed through education and safe practices.

12. CLINICAL ROTATION GUIDELINES

Objectives:

- understanding the targeted competencies and how they are assessed;
- organizing the portfolio and practice journal;
- to conduct self-assessment and reflect on one's own work.

12.1. Targeted Professional and Transversal Competencies

Table 106 . Competencies Targeted During the Internship

Type	Competency	Evidence (indicator)
Professional	Performs an initial assessment of a patient with diabetes (type, treatment, hypoglycemia, complications)	Completed assessment forms (at least 3)
Professional	Stratifies the risk of dysglycemia and cardiovascular risk	Forms with justification
Professional	Applies the glycemic decision chart before, during, and after exercise	Direct observation, blood glucose log
Professional	Treat hypoglycemia and recognize ketoacidosis	Simulation, questionnaire
Professional	Set SMART goals and develop a plan in coordination with the endocrinologist	Written plan for each patient
Professional	Prescribe and monitor exercise, with adjustments for complications	Session Record
Professional	Applies current guidelines (ESC 2026, ADA 2026) and critically evaluates a study	Written commentary on a guideline and a study
Cross-Cutting	Communicates empathetically, uses teach-back, respects confidentiality (including CGM data)	Assessment by the supervisor
Cross-Cutting	Works as part of a team and respects the limits of their competence (does not adjust insulin)	Feedback from the team

12.2. Portfolio and Practice Journal

- **Practice journal:** daily activities, techniques observed/practiced, blood glucose events, questions;
- **Three complete** (anonymized) **patient records**: assessment, risk, goals, treatment plan, blood glucose log, reevaluation;
- **One** in-depth **case study** (6–8 pages), with critical discussion and Vancouver citations;
- **List** of **tests performed** and exercises conducted;
- **A written reflection** (1–2 pages) on a challenging issue (fear of hypoglycemia, communication, ethics);
- Final **self-assessment** and personal development plan.

12.3. Criteria and Evaluation Form for Master's Students

Table 107 . Sample Evaluation Form (indicative weightings)

Criterion	Weight	Level (1–5)	Comments
Patient assessment (completeness, accuracy)	20%		
Management of blood glucose and safety	25%		
Prescription and Program Adjustment	20%		
Patient Communication and Education	15%		
Documentation, Ethics, and Confidentiality	10%		
Teamwork and Respect for Boundaries of Competence	5%		
Portfolio and Reflection	5%		

12.4. Self-Assessment and Reflection Topics

Reflection Topic

- When did I feel unsure of what to do when a blood glucose level was outside the target range? What did I do?
- How did I explain to a patient why exercise is safe but requires following certain rules?
- What did I observe regarding the fear of hypoglycemia, and how did I address it?
- What skill do I want to develop over the next 6 months?

Key Points

- Practice is the best way to learn, provided it is observed, discussed, and reflected upon.
- A portfolio shows not only what you've done, but also what you've learned.

Respecting the limits of your competence is part of staying safe.

APPENDICES

Appendix A. Initial Assessment Form for Patients with Diabetes

Sample form to be completed at the first visit (anonymized data).

Table 108 . Appendix A — Initial Assessment Form for Patients with Diabetes

Section	Fields to be filled out
General Information	Patient ID: ____ Age: ____ Sex: ____ Date of evaluation: ____ Referring physician: ____
Cardiac Diagnosis	Diagnosis: ____ Date of event/procedure: ____ Type (ACS / PCI / CABG / HF / valvular heart disease / AF / hypertension / PAD / other): ____
Diabetes	Type: T1D / T2D / prediabetes Duration: ____ HbA1c: ____ Last blood glucose level: ____
Antidiabetic treatment	Insulin (type, doses, times): ____ Insulin pump: yes / no Sulfonylureas/glinides: ____ Metformin: ____ SGLT2 inhibitors: ____ GLP-1 receptor agonists: ____ Others: ____
Monitoring	Glucose meter / CGM: ____ Ketones (device): ____ Usual morning / evening values: ____
Hypoglycemia / ketoacidosis	Hypoglycemia in the last 3 months: ____ Severe: ____ Asymptomatic: yes / no Ketoacidosis in the last 12 months: ____
Complications	Neuropathy: ____ Retinopathy (last exam): ____ Kidney disease (eGFR/UACR): ____ Foot (ulcer/amputation): ____ BAP: ____
Cardiac medication	Beta-blocker (type): ____ Diuretic: ____ ACE inhibitor/sartan: ____ Statin: ____ Antiplatelet/anticoagulant: ____
Parameters	Resting/orthostatic BP: ____ HR: ____ SpO2: ____ Weight/BMI/waist circumference: ____
Tests	ECG: ____ FEV1: ____ LDL: ____ Lp(a): ____ Creatinine/eGFR: ____ UACR: ____
Functional	6MWT: ____ m CPET / VO_2: ____ Grip strength: ____ kg SPPB: ____/12 TUG: ____ s
Psychosocial	PHQ-9: ____ GAD-7: ____ Diabetic distress: ____ Fear of hypoglycemia: ____ Support: ____
Preferences and Barriers	"I wish I could…": ____ Barriers (meals, shift, costs, fear): ____
Risk stratification	Cardiac: low / moderate / high Dysglycemia: high (T1D) / moderate (T2D with SU/insulin) / low
Evaluator	Master's student: ____ Advisor: ____ Signature: ____

Appendix B. Sample Individualized Recovery Program

Table 109 . Appendix B — Sample Individualized Recovery Program

Element	Content
Patient (code) / Date	____
Cardiac diagnosis and diabetes; risk	____
SMART Goals	1. ____ 2. ____ 3. ____
Frequency and duration	___ sessions/week × ___ weeks; session time: ____ Home activity ___ days/week
Aerobic	Type: ____ Duration: ____ Intensity (RPE / VT1): ____
Strength / balance	Exercises: ____ Sets × repetitions: ____
Personal blood glucose guidelines	Blood glucose at start / midpoint / end; carbohydrates: ____ Insulin adjustments (by a doctor only): ____
Precautions	Foot / retinopathy / autonomic neuropathy / SGLT2: ____
Warning Signs	Chest pain, shortness of breath, dizziness, palpitations, tremors/sweating/hunger, blurred vision, thirst/nausea/vomiting
Contact in case of problems	Name / phone number: ____
Follow-up visits	At 4–6 weeks: ____ At the end: ____

Appendix C. Scales and questionnaires used (Borg, PHQ-9, GAD-7, diabetic distress scale, hypoglycemia perception questionnaire)

Table 110 . ***Instruments and Guideline Thresholds***

Instrument	Range / Threshold	Interpretation
Borg Scale (RPE)	6–20	Usual target: 11–13; ESC 2026 guidelines: "moderate" = 12–17; ACSM (DZ2): RPE 10–12 if maximum heart rate is not measured [3,13]
PHQ-9	0–27; ≥10	0–4 minimal, 5–9 mild, 10–14 moderate, 15–19 moderate-severe, 20–27 severe
GAD-7	0–21; ≥10	0–4 minimal, 5–9 mild, 10–14 moderate, 15–21 severe
Diabetic distress (e.g., PAID, DDS)	as per the instrument	High score = referral to a psychologist/educator
perception of hypoglycemia (Gold, Clarke)	according to the instrument	Suggestive score = unrecognized hypoglycemia; close monitoring
Hypoglycemia	<70 mg/dl level 1; <54 mg/dl level 2; severe = external assistance	Treatment as per Section 8.2
CGM	TIR (70–180 mg/dl), TBR, TAR	Targets set by the endocrinologist [9]
MCID	6MWT ≈30 m; VO_2 ≈1 ml/kg/min; KCCQ/MLHFQ 5 points; HbA1c (DZ1) ≥0.5%	[13]

The complete questionnaires are used in their validated versions, with the official instructions for administration and scoring.

Appendix D. Sample Informed Consent Form

This is a sample template that should be adapted to the institution's forms and procedures.

I, the undersigned, _____, have been informed, in a manner I can understand, about the cardiovascular rehabilitation program: its purpose (improving exercise capacity, quality of life, and reducing the risk of events), its conduct (assessments, supervised exercises, blood glucose monitoring, education), possible benefits, the risks (rare but possible: fatigue, muscle pain, dizziness, arrhythmias, chest pain, falls, hypoglycemia during or after exercise), the alternatives, and the fact that I may ask any questions and may withdraw at any time without any consequences for my care.

I agree to allow the staff to measure my blood glucose and, if necessary, my ketones; to administer carbohydrates in the event of hypoglycemia; and to communicate with my diabetes doctor. I understand that my health data, including data from my glucose meter or CGM, will be processed confidentially (including in accordance with Regulation (EU) 2016/679) and that it may be used for educational or scientific purposes only in an anonymized form, with my consent.

I agree to participate in the program: YES □ NO □

I agree to communication with my diabetes specialist: YES □ NO □

I consent to the use of anonymized data for educational/scientific purposes: YES □ NO □

Date: _____
Signature of the patient / legal representative: _____
Signature of the physician / therapist: _____

Appendix E. Decision Chart: Blood Glucose Before, During, and After Exercise
Guideline for patients on insulin (Type 1 and Type 2 diabetes on insulin), based on the joint statement by diabetes associations; to be displayed next to the blood glucose meter and applied ***only in accordance with the department's protocol and the diabetes specialist's instructions****.*

Table 111 . Appendix E — Decision Chart: Blood Glucose Before, During, and After Exercise

Blood Glucose Before Exercise	**What to do**
<90 mg/dl (<5 mmol/l)	15–30 g of glucose; wait until ≥90 mg/dl; recheck; monitor closely
90–124 mg/dl (5–6.9)	~10 g of glucose before aerobic exercise; strength training/HIIT can begin
126–180 mg/dl (7–10)	Target range: begin; blood glucose may rise during strength training/HIIT
182–270 mg/dl (10.1–15)	Aerobic exercise: start; strength training: blood glucose may rise
>270 mg/dl (>15)	If unexplained: check for ketones. <0.6 mmol/l: light-to-moderate aerobic exercise, with monitoring. 0.6–1.4: light exercise only for <30 min. ≥1.5 mmol/l: DO NOT exercise; call a doctor
During exercise	Hypoglycemia: 15–30 g of fast-acting carbohydrates; resume exercise when blood glucose is >90 mg/dl. Exercise lasting >30 min: approximately 25–30 g of carbohydrates per hour (if you start below your target range)
After exercise	10–30 g of carbohydrates within 30 min after prolonged/intense exercise; monitor for up to 15–24 h; inform your endocrinologist about any events
Type 2 diabetes, blood glucose >306 mg/dl (>17 mmol/l), no ketosis and no symptoms	10–15 min of light activity (RPE <11), recheck; if it has risen—consult a doctor; if it has dropped to 234–270, continue gently; <216: gradually return to your usual routine; stay hydrated
Type 2 diabetes, low blood glucose before exercise	Contraindicated only if blood glucose cannot be raised above 99 mg/dl (5.5 mmol/l) with 15–30 g of fast-acting carbohydrates

Appendix F. Self-Assessment Questionnaire with Answer Key
Select the correct answer (one option only). The answer key is at the end.

1. What is the approximate percentage of RC participants who have diabetes? **(a)** 1%; **(b)** approximately 25%; **(c)** 80%; **(d)** 0.1%.
2. Which patients are at the highest risk for exercise-induced dysglycemia? **(a)** Untreated type 2 diabetes; **(b)** type 1 diabetes; **(c)** prediabetes; **(d)** no diabetes.
3. In Type 1 diabetes, with unexplained blood glucose >270 mg/dl and ketones ≥1.5 mmol/l: **(a)** perform HIIT; **(b)** exercise is contraindicated; **(c)** double the insulin dose without consultation; **(d)** ignore it.

4. A patient on insulin has a blood glucose level of 82 mg/dl before exercise. What should be done according to the guidelines? **(a)** Start immediately; **(b)** Administer 15–30 g of glucose and postpone exercise until blood glucose reaches ≥90 mg/dl; **(c)** Permanently discontinue the exercise program; **(d)** Administer insulin.
5. Hypoglycemia can occur later, up to: **(a)** 1 hour; **(b)** 15–24 hours; **(c)** 3 days; **(d)** it does not occur later.
6. Treatment of hypoglycemia in a conscious patient: **(a)** 15–30 g of fast-acting carbohydrates, recheck after 15 min; **(b)** water; **(c)** coffee; **(d)** rest without any intervention.
7. For an unconscious patient with diabetes, DO NOT administer: **(a)** call 112; **(b)** anything by mouth; **(c)** oxygen; **(d)** resuscitation if not breathing normally.
8. What specific risk do patients on SGLT2 inhibitors face? **(a)** ketoacidosis, including euglycemic ketoacidosis; **(b)** severe hypoglycemia with metformin; **(c)** hypertension; **(d)** no risk.
9. Autonomic neuropathy: **(a)** does not affect exercise; **(b)** masks ischemia and hypoglycemia and decreases the heart rate response; **(c)** increases maximum heart rate; **(d)** reduces the risk of falls.
10. Which beta-blockers are least likely to impair glycemic control? **(a)** metoprolol; **(b)** atenolol; **(c)** carvedilol/nebivolol; **(d)** all are equally likely.
11. The correct order of exercises to reduce hypoglycemia in an euglycemic patient: **(a)** aerobic followed by strength training; **(b)** strength training before aerobic exercise; **(c)** only long-duration aerobic exercise; **(d)** HIIT on an empty stomach.
12. Who determines the reduction in insulin doses? **(a)** the graduate student; **(b)** the physician/diabetologist; **(c)** the caregiver; **(d)** the physical therapist alone.
13. According to the 2026 ESC guidelines, what frequency is associated with greater reductions in HbA1c in type 2 diabetes? **(a)** ≥5 days/week; **(b)** 1 day/week; **(c)** only on weekends; **(d)** it doesn't matter.
14. For type 1 diabetes, the long-term effect of exercise: **(a)** normalizes HbA1c; **(b)** reduces the risk of complications and improves cardiovascular health, with a limited effect on blood glucose; **(c)** is harmful; **(d)** replaces insulin.
15. What do you do if a patient arrives with a blood glucose level slightly outside the target range? **(a)** Send them home; **(b)** correct the condition (carbohydrates, light activity) and shorten the session, but do not cancel it; **(c)** ignore the reading; **(d)** redouble your efforts.

Key Points

Answer key: 1-b; 2-b; 3-b; 4-b; 5-b; 6-a; 7-b; 8-a; 9-b; 10-c; 11-b; 12-b; 13-a; 14-b; 15-b.

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CHAPTER 4. CARDIOVASCULAR RECOVERY IN FEMALE PATIENTS

Ana-Maria Pah

INTRODUCTION

Cardiovascular diseases are the leading cause of death among women, yet they continue to be perceived—by patients and sometimes even by physicians—as "men's diseases." The consequences are evident in clinical practice: women are diagnosed later, are less likely to receive the recommended treatment, are less likely to be referred for rehabilitation, and, once enrolled, are more likely to drop out of the program. Cardiovascular rehabilitation (CR) is an intervention with strong evidence of benefit for both sexes, and the 2025 AHA statement indicates that women may benefit even more than men, yet have reduced access to it.

Objectives:

- to conduct a structured initial assessment of the patient, including obstetric and hormonal history, psychosocial status, and barriers to participation;
- to identify the clinical characteristics of the main cardiovascular diagnoses in women and adapt the program accordingly;
- to formulate, together with the patient, SMART goals and a flexible plan compatible with her roles in the family and at work;
- prescribe and monitor a multicomponent exercise program (aerobic, strength, balance, pelvic floor, and respiratory), using the FITT-VP principles;
- recognize atypical symptoms and signs that exercise should be stopped, and respond appropriately in emergencies;
- provide therapeutic education and counseling tailored to women (nutrition, medication, sexual health, menopause, pregnancy);
- to contribute to a gender-sensitive recovery environment and to reducing disparities in access;
- document the case, reassess outcomes, and prepare for discharge and follow-up care.

1. FUNDAMENTALS OF CARDIOVASCULAR RECOVERY IN FEMALE PATIENTS

Objectives:

- to describe the biological characteristics of the female cardiovascular system and their implications for exercise;
- to explain why cardiovascular diseases are underdiagnosed in women and how they often present atypically;
- to list risk factors specific to women and emerging risk factors;
- to define physical activity and cite its benefits for women;
- to describe disparities in access, participation, and adherence, and the solutions proposed by guidelines

1.1. Characteristics of the Female Cardiovascular System (hormones, menopause, small vessels, arterial stiffness)

A woman's heart and blood vessels are not simply a "smaller" version of a man's. Before menopause, estrogens have beneficial effects: they promote vasodilation, influence the lipid profile, and limit vascular inflammation. After menopause, these effects are lost, and cardiovascular risk increases: blood pressure and lipid levels tend to rise, abdominal fat accumulates, a y arteries become stiffer, and bone and muscle mass decrease. The 2026 ESC Guidelines specifically emphasize that postmenopausal women are prone to increases in blood pressure and dyslipidemia.

Women's coronary arteries are, on average, smaller, and coronary artery disease is more frequently associated with microvascular dysfunction and non-obstructive lesions, which explains the frequency of ischemia or myocardial infarction without coronary obstruction (INOCA, MINOCA). During exercise, women have, in absolute terms, a lower maximum oxygen consumption than men (smaller stature and muscle mass, lower hemoglobin levels), but their relative adaptation to training

is significant. Some studies have, however, reported smaller improvements in exercise capacity in women with CHD, and the guidelines note that men may respond better to higher intensities; for this reason, the type and intensity of exercise are adjusted, but women should not be "under-prescribed" as a matter of principle.

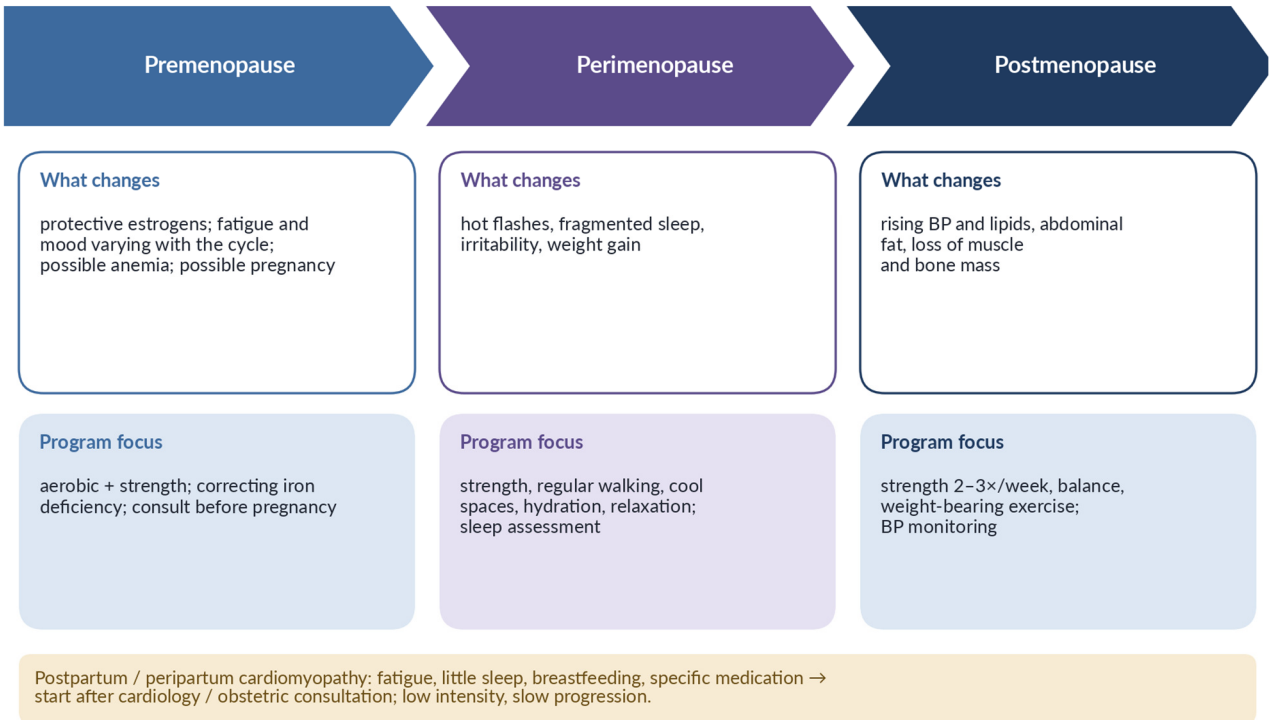


Figure 66 . Life stages and the female heart: what changes and what we emphasize in the program.

Table 112 . Female-specific characteristics and practical implications

Characteristic	Consequence	Implication for the program
Decrease in estrogen during menopause	Increased blood pressure, lipids, and abdominal fat; arterial stiffness	Strict control of blood pressure and lipids; regular aerobic exercise [1]
Small coronary arteries, microvascular dysfunction	Ischemia without obstructive lesions; symptoms difficult to "capture" on tests	Careful evaluation, tolerance for atypical symptoms, individualized approach
Reduced muscle and bone mass, especially after menopause	Risk of sarcopenia, osteoporosis, and fractures	Strength and balance training are mandatory
Lower hemoglobin and iron stores	Fatigue, low exercise tolerance, shortness of breath	Hemoglobin and ferritin testing before the program
Dual role: family care and work	Limited time, fatigue, and program interruptions	Flexible schedule, home-exercise, social support

1.2. Epidemiology of cardiovascular disease in women: underdiagnosis and atypical presentation

Globally, cardiovascular diseases are the leading cause of death among women, although public perception often associates heart disease with men. Women assess their cardiovascular risk as lower than men's and, as a result, are less likely to adhere to treatment. Within the healthcare system,

women undergo invasive testing less frequently, are less likely to receive the recommended treatment following a coronary event (antiplatelet agents, beta-blockers, ACE inhibitors, statins), and are less likely to achieve target LDL-cholesterol levels. One example cited by the 2026 ESC guidelines is the underprescription of beta-blockers to women in the REBOOT study [2].

The clinical presentation may be less "classic": in addition to chest pain, women frequently describe unusual fatigue, shortness of breath, nausea, pain in the jaw, neck, shoulder, or back, and a feeling of restlessness. Young women (under 55 years of age) who have a heart attack often have less typical causes, such as spontaneous coronary artery dissection (SCAD), and are even less likely to be referred for rehabilitation. **The symptoms reported by a woman should be taken seriously even when they do not match the textbook description**.

1.3. Gender-Specific Risk Factors and Emerging Risk Factors

In addition to the classic risk factors (hypertension, dyslipidemia, diabetes, smoking, obesity, physical inactivity), the evaluation of women must include gender-specific factors. The 2026 ESC Guidelines recommend investigating these factors in women as part of the initial evaluation in the emergency department.

1.3.1. Obstetric complications (preeclampsia, gestational diabetes, preterm birth)

Hypertensive disorders of pregnancy (including preeclampsia), gestational diabetes, and preterm birth do not end with pregnancy: they signal an increased long-term cardiometabolic risk and are recognized as factors that increase a woman's cardiovascular risk. Therefore, the question "Did you have high blood pressure or diabetes during pregnancy?" is part of the medical history of any cardiac patient.

1.3.2. Early Menopause, Polycystic Ovary Syndrome, and Endometriosis

Early menopause, polycystic ovary syndrome (PCOS), and endometriosis are listed in the 2026 ESC guidelines among the gynecological and endocrine conditions that increase cardiovascular risk [1]. They are frequently associated with insulin resistance, obesity, dyslipidemia, or chronic inflammation, which necessitates attention to nutrition, weight, and physical activity.

1.3.3. Autoimmune and Inflammatory Diseases, Psychosocial Stress

Autoimmune diseases (lupus, rheumatoid arthritis, thyroiditis) are more common in women and increase cardiovascular risk; depression, anxiety, chronic stress, loneliness, and domestic violence, in turn, have cardiovascular effects and influence treatment adherence. Cancer treatments (anthracyclines, anti-HER2 therapies, thoracic radiation therapy) can affect the heart, especially in breast cancer.

Practical Note

Key questions for the first visit: Have you ever had high blood pressure, diabetes, or preeclampsia during pregnancy? At what age did menopause begin, and was it natural or surgically induced? Are you taking birth control or hormone therapy? Have you had breast cancer or undergone other cancer treatment? Who helps you at home, and whom do you help? Record the answers in the chart; they affect your risk and treatment plan.

1.4. Definition, Components, and Benefits of Cardiovascular Rehabilitation for Women

Cardiovascular rehabilitation is a **complex, multidisciplinary**, **and personalized** intervention that includes assessment, supervised exercise, risk factor management, nutritional counseling, psychosocial intervention, education, and support for adherence and self-care. Meta-analyses show that exercise-based CR improves functional capacity and quality of life and reduces hospitalizations in patients with coronary artery disease, with evidence of reduced cardiovascular mortality [3,4,5,6,7].

For women, the 2025 AHA statement concludes that CR provides health benefits, fewer cardiovascular events, and cost savings, and that, in large cohort studies, participating women experience an even greater relative reduction in mortality than men; CR also improves risk factors (smoking cessation, blood pressure, cholesterol, blood glucose). The ESC Guidelines 2026 are more cautious: CR is effective in both sexes, but evidence regarding its effects on clinical outcomes in women is still limited for conditions that predominantly affect them, such as SCAD, NOCA, or congenital heart disease in adults.

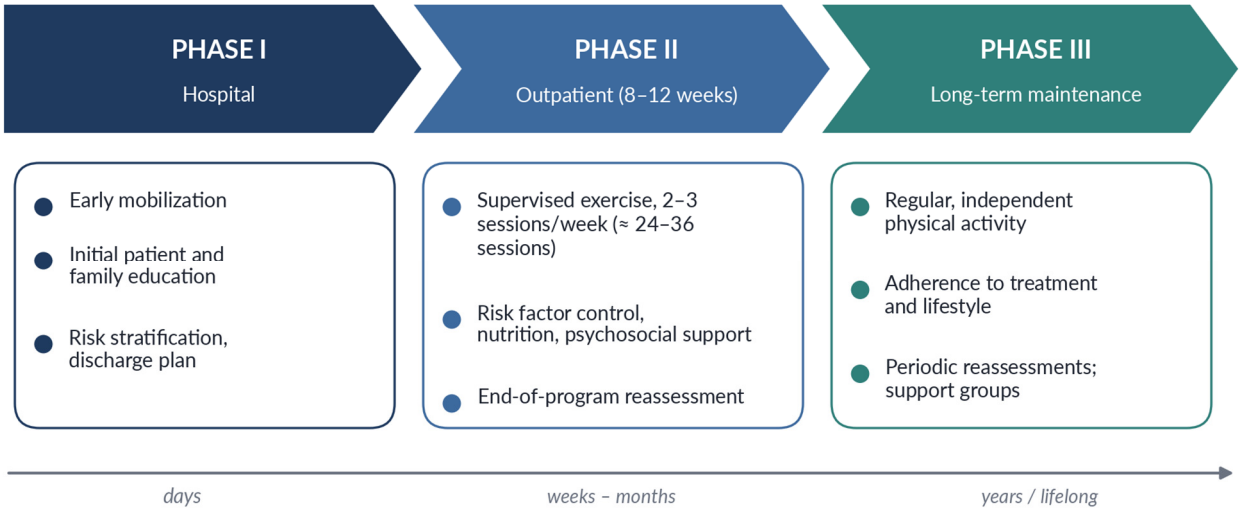


Figure 67 . Stages of cardiovascular recovery: from the hospital to long-term maintenance.

Key Points

- Cardiovascular diseases are the leading cause of death in women, but they are underdiagnosed and undertreated.
- Menopause, obstetric history, and gynecological/endocrine diseases are risk factors that are systematically investigated.
- Cardiovascular rehabilitation (CVR) is effective in women and is the only intervention that combines exercise, education, nutrition, and psychological support.
- Women are not "under-treated" in the program; it is tailored to each individual

1.5. Gender Disparities in Referral, Enrollment, Adherence, and Program Completion

Participation in RC is generally low (in international surveys, between 9% and 50% of eligible patients), but it is disproportionately low among women. The 2026 ESC Guidelines describe the profile: women in CR are, on average, older than men, more often widowed, and have greater functional limitations; they are less frequently referred to CR (especially after Takotsubo syndrome); they adhere less due to caregiving responsibilities, transportation issues, financial constraints, and a greater burden of anxiety and depression following the event. The barriers reported by women have not changed significantly over time.

Table 113 . Proposed actions to reduce disparities (based on the 2026 ESC guidelines)

Issue	Proposed Solutions
Insufficient referral	Training staff on barriers specific to women; informing women about cancer screening while still in the hospital; automatic referral triggers in the electronic health record; monitoring referrals and attendance by gender
Access	Transportation assistance, tele-recovery options, partnerships with community centers, patient ambassadors or mentors
Adherence	Flexible schedule, childcare support, mental health resources, supervised telerehabilitation at home
Effectiveness	Personalized interventions, taking into account the woman's risk factors, needs, and preferences (women-centered programs)

Based on this, the guideline recommends (Class IIa, Level B1) that **adapting CR for women be considered** for women with ACS, CAD, SCAD, and heart failure to increase enrollment and adherence. A Cochrane review cited in the guidelines shows that gender-tailored, motivational-based programs can increase women's use of CR [8].

1.6. Recent guidelines and statements (2021–2026) on women's rehabilitation

Table 114 . Recent documents relevant to CR for women

Document	Key takeaway for practice
ESC 2026 – Cardiac Rehabilitation [1]	Sex-related risk factors to investigate; gender-specific personalization; tailoring cardiac rehabilitation for women (Class IIa); sexuality, hormone therapy, pregnancy, and teratogenic medications
AHA 2025 – Cardiac Rehabilitation in Women [3]	First dedicated AHA statement; barriers to access, mental health needs and social support, implementation strategies
ICCPR 2022 – Women-centered cardiac rehabilitation [8]	First guidelines for women-centered programs, endorsed by 24 societies; low–moderate certainty of evidence, mostly strong recommendations
2025 Synthesis – Gender Differences After a Heart Attack [7]	Home-based rehabilitation, telerehabilitation, and women-only programs provide modest benefits; studies are small and often non-randomized
The Lancet Commission 2021 – Women and Cardiovascular Disease [2]	Global burden, underdiagnosis, insufficient research in women
ESC 2021 – Prevention [9]	Gender-specific risk factors, Mediterranean diet, alcohol, physical activity
ESC 2025 – Cardiovascular Disease and Pregnancy [10]	Preconception counseling, medication during pregnancy, heart disease in pregnant women
ESC 2023 – ACS [11]; ESC 2024 – CCS [12]; ESC 2026 – HF [13]; ESC 2022 – cardio-oncology [14]	Common Diagnoses in Women (MINOCA, INOCA, HFpEF, cardiotoxicity) and the Role of Cardiac Rehabilitation/Exercise

Topic for Reflection

Think of a woman in your family who has had a heart problem or who might have one. What barriers would she face in participating in a 12-week rehabilitation program? What could the team do to reduce these barriers?

2. THE ORGANIZATIONAL, ETHICAL, AND LEGAL FRAMEWORK OF THE INTERNSHIP

Objectives:

- to describe the roles within the multidisciplinary team and the limits of the master's student's responsibility;
- to distinguish the phases of the menstrual cycle and the indications for inclusion, including those common in women;
- list the temporary, relative, and absolute contraindications to exercise;
- explain the principles of informed consent and data protection, including sensitive data regarding reproductive health;
- organizing a gender-sensitive and safe recovery environment

2.1. The Multidisciplinary Team and the Master's Student's Role

Rehabilitation is a "team sport," and the patient is an active partner. The 2026 ESC Guidelines list the following as potential team members: a cardiologist, a rehabilitation physician, a nurse specializing in cardiovascular diseases, an exercise specialist, a nutritionist, a psychologist, an occupational therapist, a clinical pharmacologist, an internist, an oncologist, a geriatrician, and a social worker.

For female patients, the following may also be included, as appropriate:

- **a gynecologist or endocrinologist** (menopause, contraception, hormone therapy),
- **an obstetrician from the cardio-obstetrics team**,
- **a physical therapist specializing in pelvic floor therapy**
- **patient ambassadors or mentors**, proposed as a strategy to increase participation.

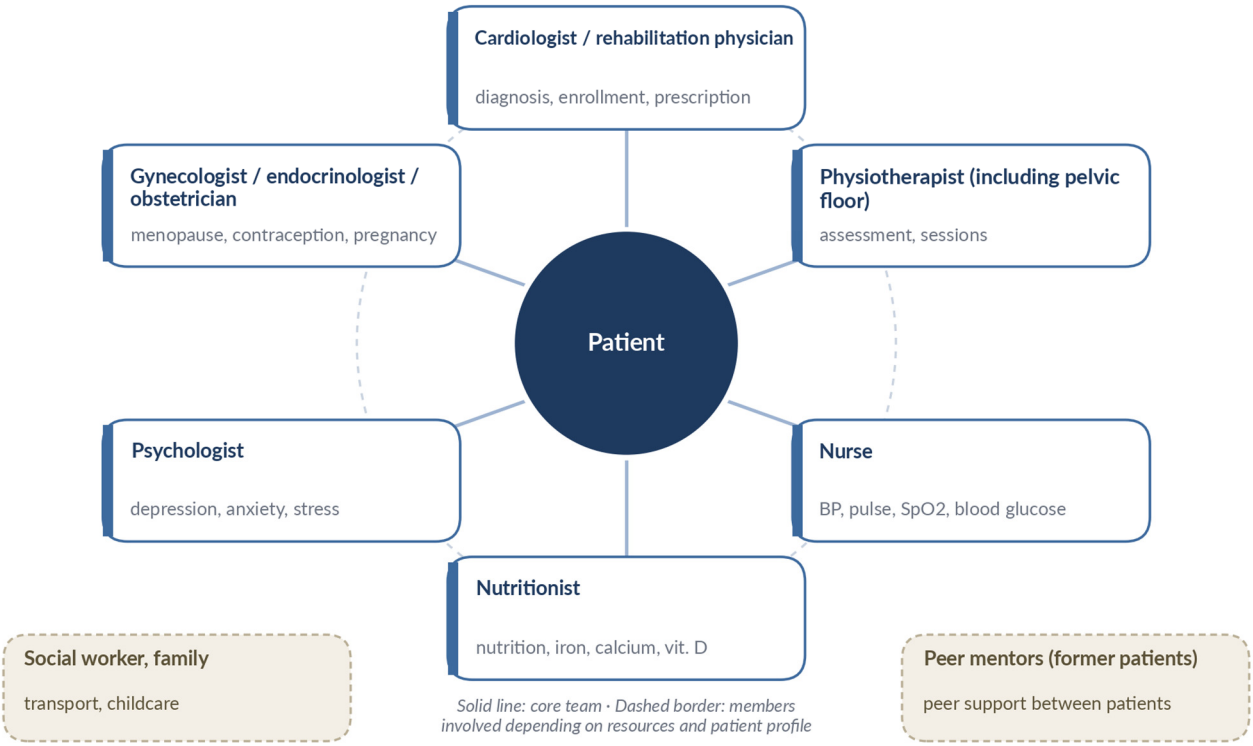


Figure 68 . The multidisciplinary cardiovascular rehabilitation team surrounding the patient.

Table 115 . Team roles and the interface with the master's student

Member	Primary Role	What the master's student does
Cardiologist / Rehabilitation Physician	Diagnosis, treatment, decision to enroll, stratification, medical prescription	Presents the case, receives instructions, reports any clinical changes
Physical Therapist	Functional assessment, prescribing, and leading sessions	Assists, performs demonstrated exercises, monitors the patient
Nurse	Measurements, monitoring, medication, emergencies	Assists with blood pressure, pulse, SpO2, and blood glucose
Dietitian	Nutritional assessment and meal plan	Conducts screenings and reports findings
Psychologist	Depression, anxiety, stress, psychological support	Identifies emotional symptoms, supports motivation
Gynecologist / Endocrinologist	Menopause, contraception, hormone therapy, pregnancy	Relays the patient's questions and the need for a consultation
Social worker, mentor, family	Social resources, transportation, childcare, peer support	Identify barriers and resources

2.2. Phases of cardiovascular recovery

Phase I takes place in the hospital (early mobilization, education, preparation for discharge).

Phase II is a supervised outpatient program, typically lasting 8–12 weeks, with 2–3 sessions per week.

Phase III (maintenance) is the long-term continuation of an active lifestyle. The 2026 ESC Guidelines recommend early initiation: after ACS, ideally within the first 14 days and no later than 30 days; after CABG, within 28 days and no later than 42 days; in decompensated heart failure, after decongestion and stabilization. The benefit increases with the number of sessions attended, so regular attendance is a goal in itself. In women, the transition between phases is more fragile: many patients do not receive a referral upon discharge from the hospital. For this reason, the guidelines recommend that the attending physician support the rehabilitation program, provide an automatic referral accompanied by an individual discussion, and invite the patient to the initial evaluation (Class I recommendations).

2.3. Indications, Contraindications, and Inclusion Criteria for the Program

Women who are candidates for CR include those who have experienced acute coronary syndrome or revascularization, those with stable heart failure, those who have undergone valve surgery, those with atrial fibrillation, peripheral arterial disease, chronic coronary artery disease, and, in general, those with an increased cardiovascular risk. Common or women-specific indications include: **SCAD, NOCA/MINOCA, Takotsubo syndrome, peripartum cardiomyopathy, and cardiotoxicity following breast cancer treatment**. Age, weight, frailty, or comorbidities are not grounds for exclusion.

Table 116 . Situations in which exercise testing is postponed or contraindicated (based on Table 4 of the 2026 ESC Guidelines)

Category	Examples
Contraindications for exercise testing and training	Early phase after ACS (first 2 days); untreated life-threatening arrhythmias; decompensated heart failure during the unstable phase; recent embolism; thrombophlebitis; acute myocarditis or pericarditis; symptomatic aortic stenosis; acute systemic disease; intracardiac thrombus
Contraindications for exercise	Progressive worsening of exercise tolerance or dyspnea at rest over the past 3–5 days; significant ischemia with very minimal exertion; uncontrolled diabetes; uncontrolled hypertension
Increased risk during exercise	Weight gain >1.8 kg in 1–3 days; decreased systolic blood pressure during exertion; NYHA Class IV; complex ventricular arrhythmia; resting heart rate >100/min; advanced AV block; de novo atrial fibrillation/flutter; critical coronary stenosis; severe obstructive hypertrophic cardiomyopathy
Gender-Specific Considerations	Active pregnancy is not an indication for standard cardiac rehabilitation and should be managed by a cardio-obstetric team [10]; severe anemia, heavy menstrual bleeding, and intense fatigue require evaluation prior to exercise

Practical note

Before each session: **How are you feeling today?** (new symptoms, sleep, infection, medications taken, heavy menstrual bleeding, blood glucose in diabetic patients) and resting vital signs (BP, pulse, SpO2). Two minutes that prevent many incidents.

2.4. Informed Consent, Confidentiality, and Personal Data Protection

Participation is based on **informed consent**: the patient receives clear explanations about the purpose, procedure, risks (rare but real), benefits, alternatives, and the right to withdraw, and the decision is documented in writing, in accordance with patient rights legislation (Law No. 46/2003) and Regulation (EU) 2016/679 (GDPR). Data regarding reproductive health (pregnancies, abortions, infertility, contraception, menopause, cancer treatments) is **highly sensitive**: only the necessary information is collected, it is recorded discreetly in the medical record, it is not discussed in front of others, and it is not disclosed to the family without the patient's consent.

If signs of **domestic violence** emerge during the evaluation, questions are asked in private, the patient's wishes are respected, and the supervisor and social worker are notified immediately, in accordance with local protocol. The data in the master's thesis is completely anonymized (no names, locations, exact dates of birth, or other identifying information).

2.5. Gender-Sensitive Environment: Privacy, Flexible Hours, and Women's Facilities

The ESC 2026 guidelines and the AHA 2025 statement recommend designing services to meet women's needs: flexible hours, childcare support, mental health resources, remote options, and community partnerships. Specifically, the master's student may refer to the list below (see also Appendix F).

Table 117 . Elements of a Gender-Sensitive Environment

Element	Practical Example
Privacy	Separate changing rooms, privacy screens during measurements, the option to be examined by female staff; discretion regarding sternotomy scars
Schedule	Appointments at times compatible with school/preschool hours, without overlapping with peak family care hours; option to reschedule appointments
Facilities	Space for children or support for their care; nearby parking; transportation
Communication	Simple language, materials with examples from women's daily lives; time for questions about pregnancy, menopause, and sexuality
Group	Women's groups, peer support, mentors [1]
Equipment	Appropriate sizing (elastic band, light dumbbells, adjustable bike seat), stable footwear

2.6. Safety Standards, Room Setup, and Monitoring Equipment

The room must allow for direct supervision of all patients and rapid intervention: a functional AED, first-aid kit, oxygen, validated blood pressure cuff, pulse oximeter, glucose meter, heart rate monitors, or telemetry (the latter may be considered for high-risk patients), non-slip flooring, stable chairs, drinking water, and a comfortable temperature (20–23 °C). The emergency protocol and emergency phone numbers must be clearly displayed.

Key Points

- The team is led by a physician; the master's student integrates into the team and works under supervision.
- Age, weight, and comorbidities are not contraindications; most contraindications are temporary.
- Reproductive data are sensitive; confidentiality is strictly maintained.

A gender-sensitive environment (privacy, flexible scheduling, support for caregiving) increases participation and adherence.

3. INITIAL PATIENT EVALUATION

Objectives:

- conducting a gender-sensitive medical history and cardiovascular physical examination;
- ordering and reviewing relevant laboratory tests (including hemoglobin, ferritin, and TSH);
- performing and interpreting functional tests, taking into account reference values for women;
- apply depression, anxiety, and stress scales and recognize signs of domestic violence;
- stratifying risk and identifying the patient's preferences and barriers

The assessment is the "compass" of the program. For women, it must be **cardiac, hormonal, and psychosocial** all at once. It is conducted over 1–2 visits, in a quiet setting, with respect for privacy. The ESC 2026 Guidelines call for a patient-centered initial assessment that includes medical history, lifestyle, culture, education, and social determinants of health.

3.1. Gender-Specific Medical History: Obstetric History, Menstrual Cycle, Menopause, Contraception, Hormone Therapy

The standard cardiovascular history (diagnosis and date of the event, symptoms, comorbidities, medication, smoking, alcohol, physical activity, falls, social support) is supplemented with specific questions. The 2026 ESC Guidelines recommend investigating gender-specific risk factors: cardiometabolic disorders during pregnancy, early menopause, polycystic ovary syndrome, and endometriosis; sexual function, which influences mental health and quality of life, may also be assessed.

Table 118 . Questions Specific to Women and Their Purpose

Question	Why it matters
How many pregnancies, births, and abortions? Preeclampsia, gestational diabetes, preterm birth?	Long-term cardiometabolic risk factors [9]
Regular menstrual cycle? Heavy bleeding?	Anemia, iron deficiency, fatigue on exertion
Menopause: age-related, natural, or surgical (hysterectomy, oophorectomy)?	Early menopause increases the risk; affects blood pressure, lipids, and bone health
Contraceptives or hormone therapy? What type?	Thrombotic risk; interactions; the decision is up to the physician [1]
PCOS, endometriosis, thyroid disorders, autoimmune diseases?	Cardiometabolic and inflammatory comorbidities
Breast cancer or other cancers; chemotherapy, radiation therapy?	Cardiotoxicity; shoulder and arm limitations [14]
Planned or possible pregnancy?	Teratogenic medication, preconception counseling [1,10]
Urinary leakage during exertion, coughing, or sneezing?	Indication for pelvic floor exercises (Chapter 5)
Who takes care of the children/parents? What are your work hours?	Planning the schedule and ensuring adherence

3.2. Clinical examination and diagnostic tests (ECG, echocardiography, lab tests, anemia, and iron deficiency)

The clinical examination includes blood pressure in both arms (first visit), in the supine and standing positions, heart rate and rhythm, SpO_2, weight, height, BMI, waist circumference, signs of congestion, cardiac auscultation, peripheral pulses, wounds (sternotomy, femoral puncture), and a

brief musculoskeletal examination (including the ipsilateral shoulder and arm following breast surgery). The graduate student **reviews** the medical record, while the clinical interpretation is left to the physician.

Useful tests: resting ECG, echocardiography (LVEF, valves, pulmonary pressures), complete blood count, ferritin and transferrin saturation, creatinine/eGFR, electrolytes, blood glucose and HbA1c, lipid profile, lipoprotein (a) if not previously tested, TSH, NT-proBNP in heart failure [1]. Iron deficiency is common in women and is associated with fatigue and reduced exercise tolerance; in heart failure, ESC guidelines define it as ferritin <100 µg/L or 100–299 µg/L with transferrin saturation <20% and recommend treatment. Uninvestigated anemia may be mistaken for "deconditioning."

3.3. Functional Testing and Reference Range Characteristics in Women

The cardiopulmonary exercise test (CPET) is the gold standard for risk stratification and prescribing exercise intensity, but it is less accessible; the 6-minute walk test (6MWT) or another validated test is used when a graded exercise test is not available. Normal values differ between the sexes, so results are reported relative to predicted values for women, not those for men; peak VO_2 is interpreted in relation to age, weight, and muscle mass.

3.3.1. Cardiopulmonary exercise testing and the 6-minute walk test

CPET provides exercise capacity, ventilatory thresholds (VT1, VT2), and chronotropic response; the 2026 ESC guidelines prefer ventilatory thresholds for setting training intensity. In the 6MWT, blood pressure and heart rate are measured before and after the test, and distance, RPE, SpO_2, and symptoms are recorded. A difference of approximately 30 m in the 6MWT is considered the minimum clinically significant difference (MCID).

3.3.2. Muscle Strength, Balance, and Physical Performance

Table119 . Useful functional tests for women

Test	What it measures	Preliminary interpretation
6MWT	Submaximal functional capacity	MCID ≈ 30 m [1]; reported relative to predicted values for women
CPET	Peak VO_2, ventilatory thresholds	MCID ≈ 1 ml/kg/min [1]
Grip strength	Overall muscle strength	Low values: <16 kg in women (criterion for sarcopenia)
SPPB (0–12)	Balance, gait, rising from a chair	≤9 = reduced performance
TUG	Mobility, dynamic balance	≥12 s = risk of falling (especially in older women)
10-RM	Maximum strength, without Valsalva maneuver	1-RM is estimated using formulas [1]

3.4. Psychosocial assessment: depression, anxiety, stress, caregiving role, domestic violence

Women are more likely to experience depression, anxiety, and social isolation following a cardiac event, which affects adherence and prognosis. Validated short scales are used: **the PHQ-9** (a score of ≥10 suggests moderate depression) and **the GAD-7** (a score of ≥10 suggests significant anxiety), supplemented by questions about stress, sleep, loneliness, and the burden of caregiving (children, parents, sick spouse). Positive scores warrant referral to a psychologist or physician. Screening for domestic violence is conducted through simple, empathetic questions in private.

Caution

A high PHQ-9 score or any mention of **thoughts of self-harm** must be reported **immediately** to the physician; the patient must not be left alone until an evaluation is completed. If domestic violence is suspected, the department's protocol must be followed, and the abuser must not be contacted.

3.5. Nutritional Assessment, Body Composition, and Bone Health

Weight, BMI, waist circumference, and, if possible, body composition are measured; the 2026 ESC guidelines recommend considering body composition assessment for all patients in the RC and screening for malnutrition, sarcopenia, and sarcopenic obesity. In women, a normal BMI may mask low muscle mass and high body fat (sarcopenic obesity), especially in postmenopausal women. Protein, calcium, and iron intake, unintentional weight loss (especially >5%), and the risk of osteoporosis (early menopause, corticosteroid therapy, previous fractures) are assessed, as these factors influence the selection of strength and impact exercises [15,16,17].

3.6. Cardiovascular and Exercise Risk Stratification

Stratification combines clinical, functional, and laboratory data to determine the level of monitoring and the pace of progression; it is periodically reassessed.

Table 120 . Risk stratification—guideline model

Level	Criteria (examples)	Monitoring
Low	LVEF >50%, no ischemia or significant arrhythmias, good functional capacity, uncomplicated course	Initial monitoring, followed by a partial home care program
Moderate	LVEF 40–50%, symptoms on intense exertion, comorbidities, stable SCAD or INOCA, anemia/iron deficiency being corrected	Regular supervision, blood pressure/pulse monitoring, occasionally ECG
High	LVEF <40%, symptomatic heart failure, complex ventricular arrhythmias, ischemia on minimal exertion, implantable devices, active cardiotoxicity, severe depression	Close supervision, ECG monitoring, initially very short sessions

3.7. Patient Preferences, Barriers to Participation, and Quality of Life

Quality of life can be assessed using the EQ-5D or SF-12, and in heart failure, using the KCCQ or MLHFQ (MCID ≈ 5 points). Beyond the scores, the central question is: **"What would you like to be able to do again?"** Barriers are explored: transportation, costs, schedule, caring for children or parents, fear of exertion, fatigue, pain, fear of being "a burden," and shame regarding scars or one's body. The Cardiac Rehabilitation Barriers Scale is a useful tool for assessing perceived barriers. The guidelines also recommend screening for sexual function in women and men with cardiovascular disease (Class I); the question should be asked tactfully, once a relationship of trust has been established.

Key Points

- The assessment of women with heart disease is cardiac, hormonal, and psychosocial.
- Ferritin, hemoglobin, and TSH should be measured before assessing "deconditioning."
- Test results are compared to reference ranges for women; MCID: 6MWT ≈30 m, VO2 ≈1 ml/kg/min.
- PHQ-9 and GAD-7 at the initial evaluation; domestic violence is assessed tactfully

Clinical Case

Exercise: For a 51-year-old perimenopausal patient with a recent myocardial infarction, preeclampsia during a pregnancy 20 years ago, and marked fatigue, select the investigations, functional tests, and psychosocial scales for the first two visits and justify the order.

4. SETTING GOALS AND PLANNING AN INDIVIDUALIZED PROGRAM

Goals:

• implementing the shared decision between the patient and the team;
• Formulating functional, clinical, and psychosocial SMART goals;
• structuring an 8–12-week program with progressive steps;
• adapting the plan to the patient's family and professional roles;
• incorporating elements of women-centered programs;
• clearly documenting the plan

4.1. Shared Decision-Making Between Patient and Team

The program works if the patient **understands** it**, wants it, and can carry it out**. Shared decision-making involves presenting options in plain language, exploring values and constraints (family, work, transportation), and choosing the plan together. **The "teach-back" method** is used: the patient repeats in her own words what she has understood. The ESC 2026 Guidelines include, among their recommendations, person-centered behavioral interventions that address barriers and increase motivation (Class IIb).

Practical Note

Helpful questions: "What is most important to you over the next few months?", "What might prevent you from attending sessions?", "What might help you at home?". Write down the answers; they become goals and strategies.

4.2. Formulating SMART Goals (Functional, Clinical, Psychosocial)

A SMART goal is Specific, Measurable, Achievable, Relevant, and Time-bound. For women, role-related goals ("to be able to carry my baby in my arms," "to do the grocery shopping on my own," "to return to work") are often more motivating than clinical figures.

Table 121 . Examples of SMART Goals

Area	Example	Indicator
Functional	"In 12 weeks, I will climb 3 flights of stairs without stopping to reach my mother"	Floors climbed; 6MWT +30 m
Role in the family	"To be able to carry 5 kg bags and play with my grandchildren for 30 minutes"	Practical test; RPE
Daily activity	"To walk for 30 minutes on 5 out of 7 days"	Walking log; pedometer
Clinical	"BP below 130/80 mmHg on home measurements; LDL within target range"	Blood pressure log; lab tests
Psychosocial	"PHQ-9 score below 10; attend the patient support group once a week"	PHQ-9; participation
Nutritional	"Eat a source of protein at every meal and reduce salt intake"	Food diary; weight
Pelvic	"No urine leakage when coughing or exerting myself in 12 weeks"	Journal; questionnaire
Work	"Return to work on a reduced schedule in the 3rd month"	Date of return

4.3. Program structure: duration, frequency, and phases

The standard Phase II program lasts 8–12 weeks, with 2–3 supervised sessions per week, supplemented by home exercises, for a total of 3–5 days of physical activity per week. The reported median duration of exercise programs is 3–4 months, and participating in more sessions yields greater benefits. In the first few weeks, the number of exercises, sets, and repetitions is gradually increased; subsequently, training focuses on functional exercises related to the demands of daily life.



Figure 69 . Structure of a session: warm-up, aerobic training, strength and balance, cool-down.

Table 122 . 12-week progression model (guideline)

Weeks	Objective	Aerobic (RPE 11–13)	Strength / Balance
1–2 (adaptation)	Technique training, endurance	10–15 min, possibly intermittent	1 set × 8 reps, very light load; balance with support
3–6 (development)	Increasing duration	20–30 min continuously or with breaks	1–2 sets × 8–12 reps; daily pelvic floor exercises
7–10 (progression)	Increasing intensity and complexity	30–40 min, toward the upper limit of the moderate range	2 sets × 10–12 reps; balance without support
11–12 (consolidation)	Transition to maintenance	30–45 min, home workout	Strength training program 2×/week, self-directed

4.4. Adapting to family and professional roles (flexible schedule, caring for children and relatives)

The best program is the one you can actually stick to. Women consistently cite caregiving responsibilities, transportation, and financial constraints as reasons for dropping out. Solutions: sessions at times compatible with children's schedules, regional groups, telerehabilitation or a hybrid program, childcare support, provided transportation, short and frequent sessions, exercises using

household items (water bottles, a chair, stairs), and the involvement of a partner or a friend. For working patients, discuss flexible scheduling and, if appropriate, a gradual return to work.

4.5. Elements of Women-Focused Programs

The 2022 ICCPR Guidelines are the first document to describe how to deliver women-focused RC programs to better engage women and improve their quality of life; the certainty of the evidence is low to moderate, and the recommendations are largely strong. The 2025 AHA Statement proposes multifaceted approaches: gender-sensitive programs, integration of mental health, peer support, self-referral systems, and gender-specific exercise prescriptions. However, a 2025 review shows that the benefits of women-only programs, home-based rehabilitation, and telerehabilitation are modest, and the studies are small and often non-randomized. The recommended elements can be implemented gradually, even in mixed-gender settings.

- support groups or sessions dedicated to women, with the option to choose;
- specific educational content: menopause, pregnancy, medication, sexual health, risks following preeclampsia;
- an explicit psychosocial component (stress, anxiety, caregiving role);
- flexible scheduling, childcare facilities, and remote options;
- ambassadors or mentors from among former patients;
- exercise methods preferred by women (dancing, group walks, exercises set to music), in addition to traditional ones.

4.6. Documenting the Recovery Plan

The plan is documented on a **single form**, with a copy for the patient: diagnosis and risk, SMART goals, exercise prescription (FITT), restrictions and precautions (including teratogenic medication, shoulder limitations), signs to stop exercise, contact person, and reevaluation dates (Appendix B). Clear documentation ensures continuity and protects both the patient and the team.

Key Points

- Decisions are made collaboratively; role-based goals are the most motivating.
- Standard program: 8–12 weeks, 2–3 supervised sessions + home exercises.
- Adherence among women depends on flexibility, childcare, transportation, and psychosocial support.

A written plan, with a copy for the patient, is mandatory.

5. PRESCRIBING PHYSICAL EXERCISE FOR FEMALE PATIENTS

Objectives:

- apply the FITT-VP principles to each type of exercise;
- plan warm-ups, aerobic training, strength training, balance exercises, flexibility exercises, and breathing exercises;
- determine intensity using the Borg scale, the talk test, and heart rate;
- safely progress the program;
- monitor the session and stop the exercise when necessary.

5.1. The FITT-VP Principles and Session Structure

The exercise program is **multifaceted**: aerobic, strength, balance, flexibility, pelvic floor, and breathing exercises, tailored to the patient's capacity, diagnosis, life stage, and preferences. The prescription is described using FITT-VP: Frequency, Intensity, Time (duration), Type, Volume, and Progression. The 2026 ESC Guidelines require that the prescription be tailored to the patient's cardiovascular and functional risk profile and preferences; for postmenopausal women, the type and intensity of exercise should be adapted to their tendency toward increases in blood pressure and dyslipidemia.

Table 123 . Exercise prescription: the ESC 2026 guidelines and the starting point for the deconditioned patient

Component	Reference: ESC Guideline 2026 (ACS/CCS; chronic heart failure)	Starting point (deconditioning or high risk)	Progression
Aerobic – frequency	≥3 to 5 days/week (CHF: from 2–3 to 3–5)	2–3 supervised sessions + short daily walks	Duration first, then frequency
Aerobic – duration	30–60 min/session (CHF: 15–30 to 45–60)	10–15 min, possibly intermittent (2–3 min of exercise / 1–2 min of rest)	+2–5 min every 1–2 weeks
Aerobic – intensity	Moderate and moderate-to-high; "moderate" = Borg 12–17 or 40–85% of heart rate reserve; in CHF, moderate (sometimes low); at low capacity, start at ~40% of peak VO_2, then toward ventilatory threshold 1 (VT1)	RPE 11–13 (lower end of the range), talk test; below VT1	Toward VT1; HIIT only in selected patients
Strength	≥2 days/week; ≥2 sets/major muscle group, 12–15 reps (CHF: 8–15); 30–70% 1-RM for upper limbs, 40–80% for lower limbs (CHF: 40–60%)	2 days/week, 1 set × 8–12 reps, 30–40% 1-RM or RPE 11–13, functional exercises	Repetitions → sets → load
Balance	Incorporate into training, especially in postmenopausal women and those at risk of falls	≥3 days/week, 5–10 min, with support	Less support, double- e tasks
Flexibility / Mobility	Component of a multicomponent program	2–3 days/week, 10–30 s/position	Range of motion
Inspiratory muscles (IC)	3–5 times per week, 20–30 min, at 30% to 60% of maximum inspiratory pressure, if tolerated	Only as directed by a physician or physical therapist	Gradual increase in load

Two points from the 2026 ESC guidelines are worth noting. First: in programs for heart disease, approximately two-thirds of the session's duration is devoted to endurance, and strength exercises are added to make up the remaining third. Second: for setting aerobic intensity, **ventilatory thresholds** (VT1, VT2) are preferred over a percentage of maximum effort (%peak HR, %HR reserve, %peak VO_2), because the same percentage produces very different physiological responses from one patient to another; classification based on metabolic equivalents (METs) is discouraged, and 4–6 METs constitute a supramaximal effort for many cardiac patients. If respiratory gas analysis is not available, heart rate at VT1 and VT2 can be estimated from resting HR and peak HR (Section 5.7).

Practical Note

Typical session (60–75 min): initial assessment (2–5 min) → 10-min warm-up → 20–30 min of aerobic exercise → 15–20 min of strength and balance training → 5–10 min cool-down → final assessment and scoring. 2–3 breaks of 1–2 minutes are recommended, if the patient needs them.

Warm-up and Cool-down

The warm-up prepares the cardiovascular and musculoskeletal systems and **lasts at least 10 minutes**. It includes light movement, joint rotations, and a gradual increase in exertion. The cool-down prevents a sudden drop in blood pressure after exercise and allows the heart rate to return to normal; it includes slow walking and stretching.

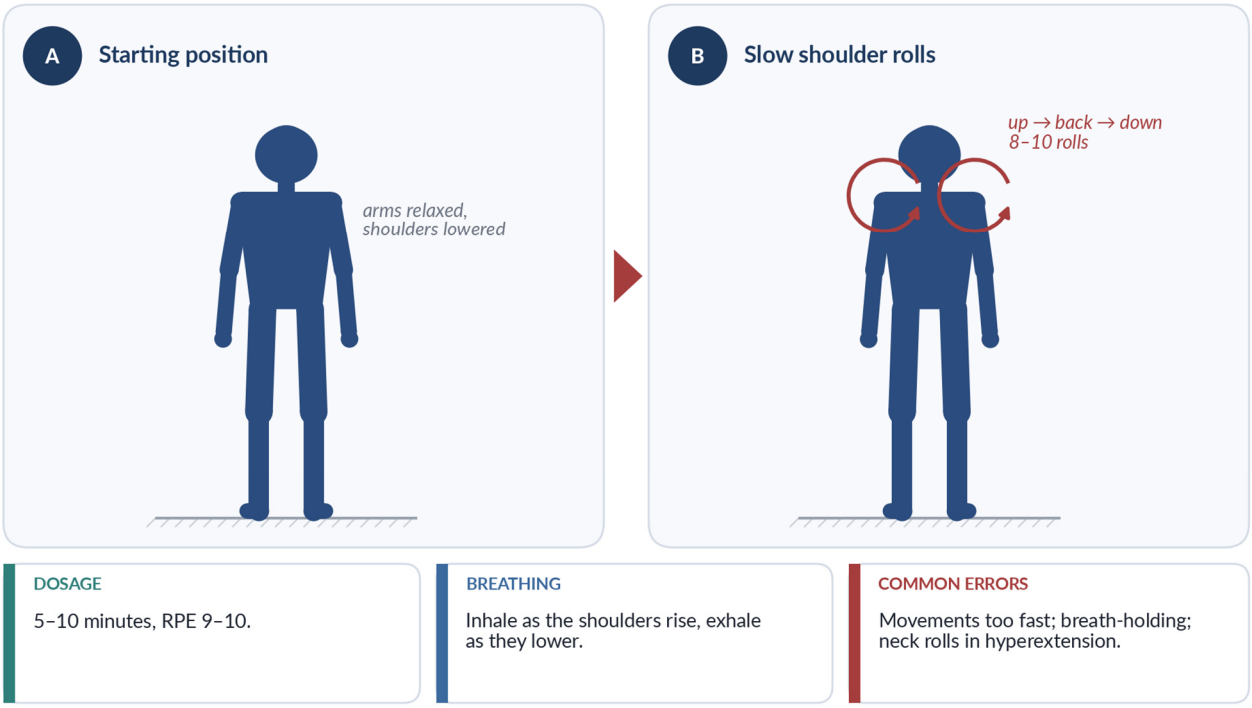


Figure70 . Warm-up: shoulder rotations with calm breathing.

Table 124 . Exercise sheet—shoulder rotations and joint mobilization

Starting position	**Standing (or sitting), arms relaxed, looking straight ahead, shoulders down.**
Execution	Raise your shoulders toward your ears, bring them back, lower them; 8–10 slow rotations. Continue with ankle, hip, and neck rotations (small, pain-free).
Duration	5–10 minutes, RPE 9–10.
Breathing	Inhale as your shoulders rise, exhale as they lower.
Common Mistakes	Movements that are too fast; holding your breath; neck rotations in hyperextension.
Adaptation	Easier: sitting. Harder: rotations with arms bent and extended forward.

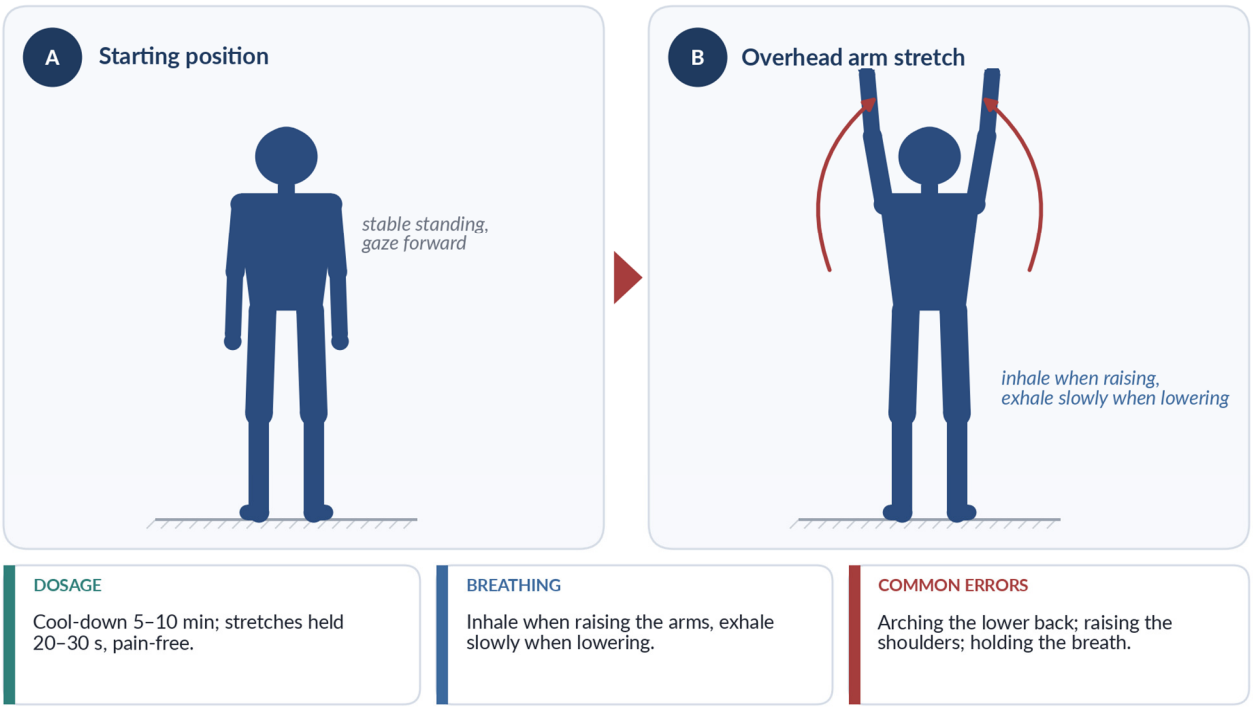


Figure 71 . Recovery: stretch your arms overhead while breathing slowly.

5.2. Aerobic Training (Continuous and Interval)

Aerobic training improves exercise capacity, blood pressure, glycemic control, and mood. Start with a low volume and increase **duration** first, then frequency, and finally intensity. In patients who are severely deconditioned or have heart failure, intermittent exercise (2–3 minutes of exercise followed by a 1–2-minute rest) is better tolerated than continuous exercise. High-intensity interval training (HIIT) should be considered only in selected, stable, low-risk patients under experienced supervision. The 2026 ESC Guidelines concur: the estimated rate of serious adverse events is 1 per 11,333 patient-hours in center-based HIIT, compared with no reported events in center-based continuous moderate-intensity training, and the lack of safety data for unsupervised programs limits the use of HIIT to supervised settings for medically evaluated patients. For deconditioned or high-risk patients, continuous or short-interval moderate-intensity training remains the standard of care.

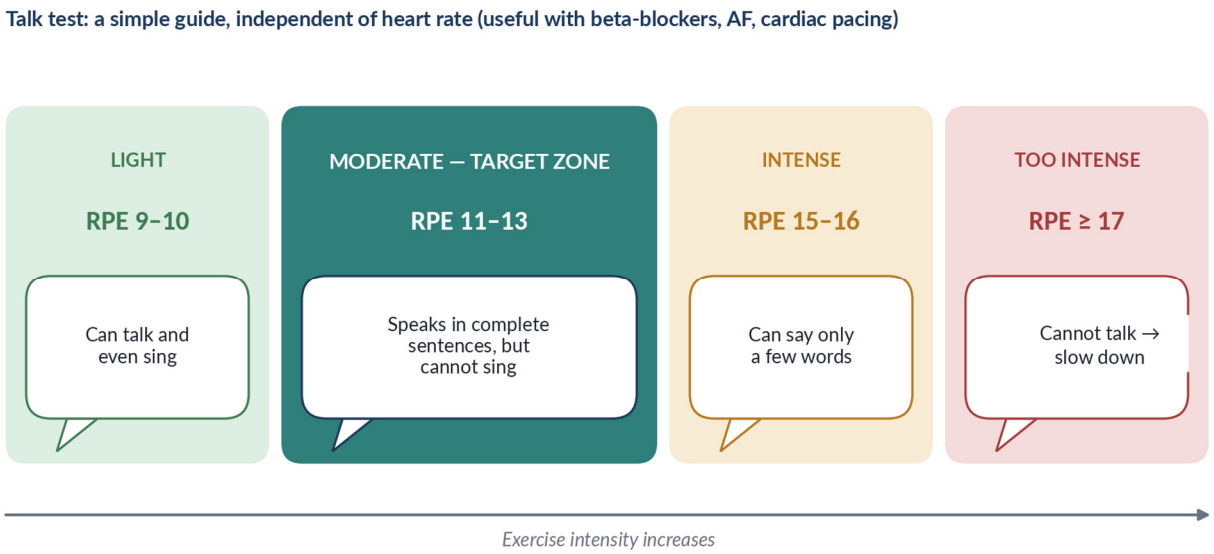


Figure 72 . The talk test: moderate intensity allows for conversation in complete sentences.

Table 125 . Exercise sheet—walking at a moderate pace (treadmill or hallway)

Starting position	**Stand up straight, look ahead, keep your arms relaxed, and wear stable shoes.**
Execution	Walk with regular steps, arms swinging freely; if necessary, hold onto the treadmill handrail. The pace should be chosen so that the patient can speak in complete sentences.
Duration	Initially 10–15 min; target 30–45 min; RPE 11–13; 3–5 days/week.
Breathing	Natural, rhythmic; avoid holding your breath.
Common errors	Strides too long, pace too fast at the start, reliance on the bar, looking down.
Adaptation	Easier: short intervals with breaks, walking with support. Harder: longer duration, slight incline on the treadmill.

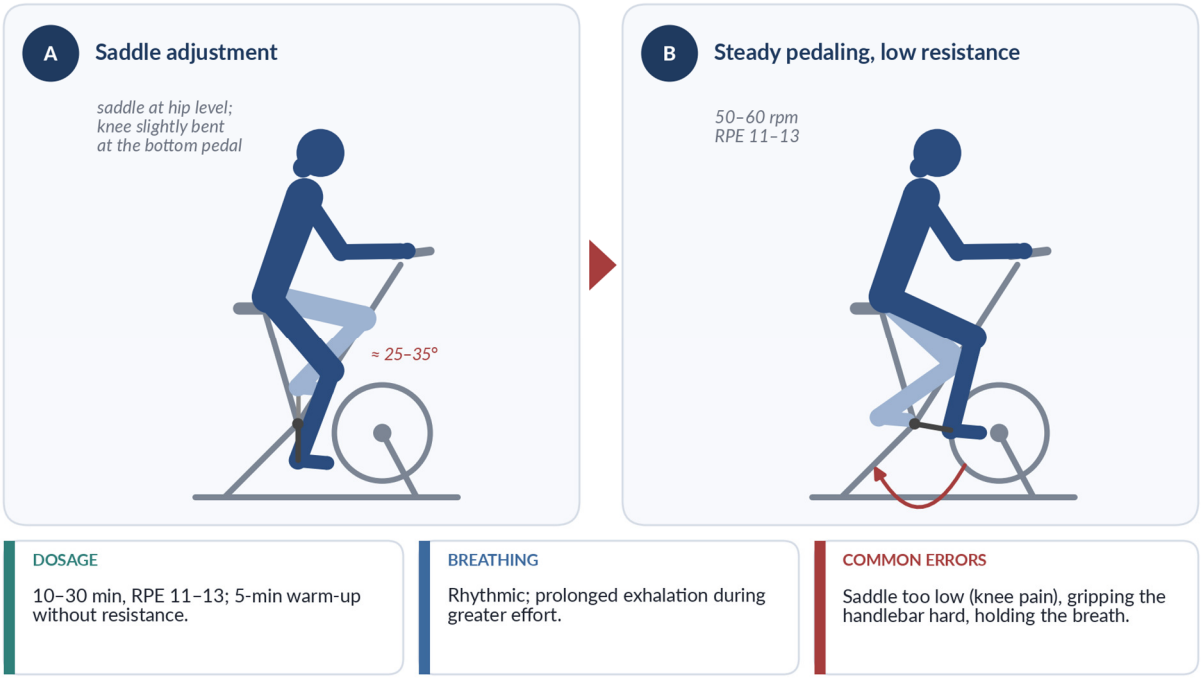


Figure 73 . Exercise bike: adjust the seat and start with low resistance.

Table 126 . Exercise Worksheet – Exercise Bike

Starting position	**Saddle at hip level; at the lowest point of the pedal stroke, knees slightly bent. Hands on the handlebars, back straight, looking forward.**
Execution	Pedal at a steady pace, 50–60 revolutions per minute, with low resistance at the start; gradually increase resistance.
Duration	10–30 min, RPE 11–13; 5-minute warm-up without resistance.
Breathing	Rhythmic; prolonged exhalation during higher-intensity effort.
Common mistakes	Saddle too low (knee pain), gripping the handlebars too tightly, holding one's breath.
Adaptation	Easier: intervals with breaks; recumbent bike. Harder: gradually increase resistance.

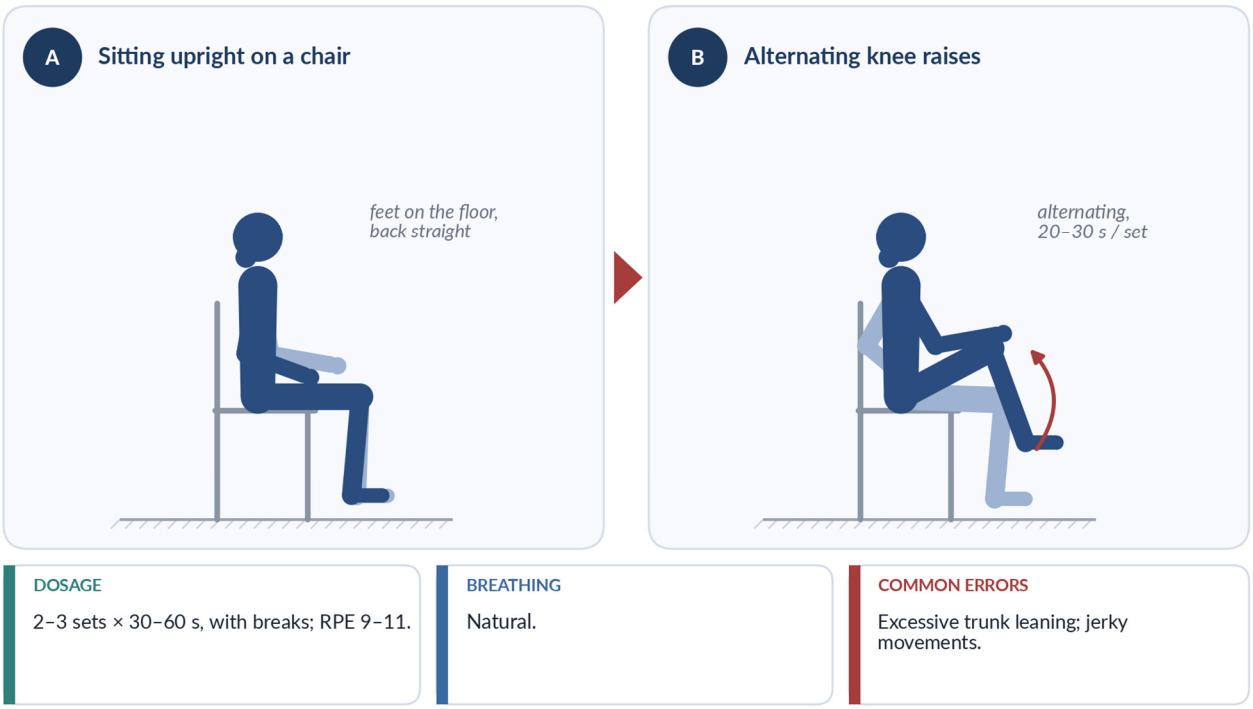


Figure 74 . Seated marching: a variation for the beginning of the program or for days when you're tired.

Table 127 . Exercise sheet—marching in place while seated on a chair

Starting position	**Sit upright on the edge of the chair, feet on the floor, hands on your thighs or arms slightly bent.**
Execution	Alternately lift your knees (marching), 20–30 seconds per set; arms move naturally, opposite the legs.
Intensity	2–3 sets × 30–60 s, with rest periods; RPE 9–11 (for patients who are very out of shape).
Breathing	Natural.
Common errors	Excessive trunk flexion; jerky movements.
Adaptation	Easier: small lifts. Harder: higher lifts with arms raised, walking while standing.

5.3. Strength and Power Training

Muscle strength is closely linked to independence, balance, and survival, and in women it declines particularly after menopause, along with bone mass. Strength training is recommended 2–3 times per week, on non-consecutive days, using light-to-moderate loads, performed in a controlled manner with rhythmic breathing (exhaling during exertion) to avoid the Valsalva maneuver. For patients who are out of shape, functional exercises (standing up from a chair, climbing stairs) are preferred. The load is ideally expressed as a percentage of 1-RM, but for cardiac patients, the 10-repetition maximum (10-RM) test is preferred, from which 1-RM is estimated using formulas to avoid the Valsalva maneuver; the OMNI-RES scale is used as a subjective benchmark. The 2026 ESC Guidelines also discuss high intensities: in healthy older adults, training at 70–79% of 1-RM increases strength more than light training, and in clinical trial studies, high-intensity resistance training did not result in more adverse events; however, there are no safety analyses for patients with uncontrolled hypertension; Therefore, in clinical practice, high-intensity training is reserved for selected cases,

under close supervision. In frail patients, resistance training of large muscle groups at at least moderate intensity must be combined with endurance training, and balance exercises help prevent falls. In very frail patients, electrical muscle stimulation may be considered initially, with precautions for those with implantable devices.

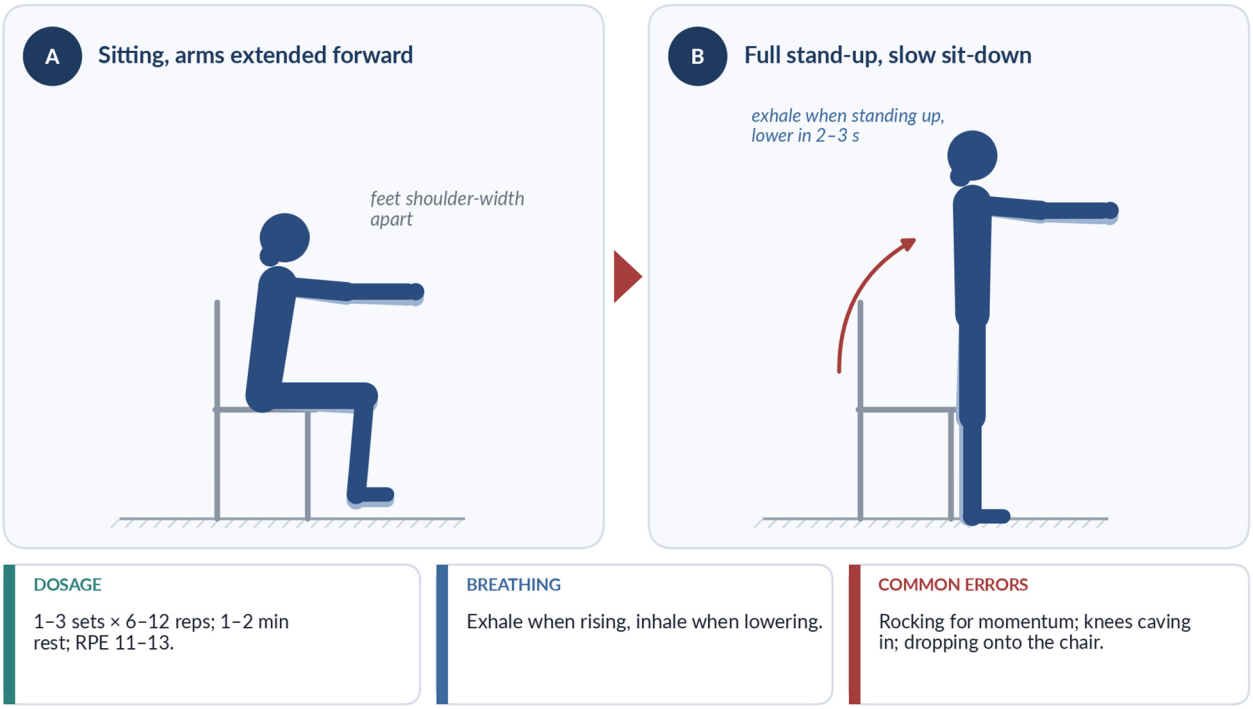


Figure 75 . Standing up from a chair: a basic functional exercise for leg strength.

Table 128 . Exercise sheet—sit-to-stand

Starting Position	**Sitting on a stable chair (without wheels), feet flat on the floor, shoulder-width apart; arms extended forward or crossed.**
Execution	Lean your torso slightly forward, push through your legs, and stand up completely; lower yourself slowly (2–3 seconds), in a controlled manner, until you touch the chair.
Setup	1–3 sets × 6–12 repetitions; 1–2-minute rest periods; RPE 11–13.
Breathing	Exhale as you rise, inhale as you lower.
Common Mistakes	Swinging to gain momentum; knees caving in; collapsing onto the seat.
Adaptations	Easier: higher chair, use your hands for support. Harder: lower chair, slower pace, hold weight in your hands.

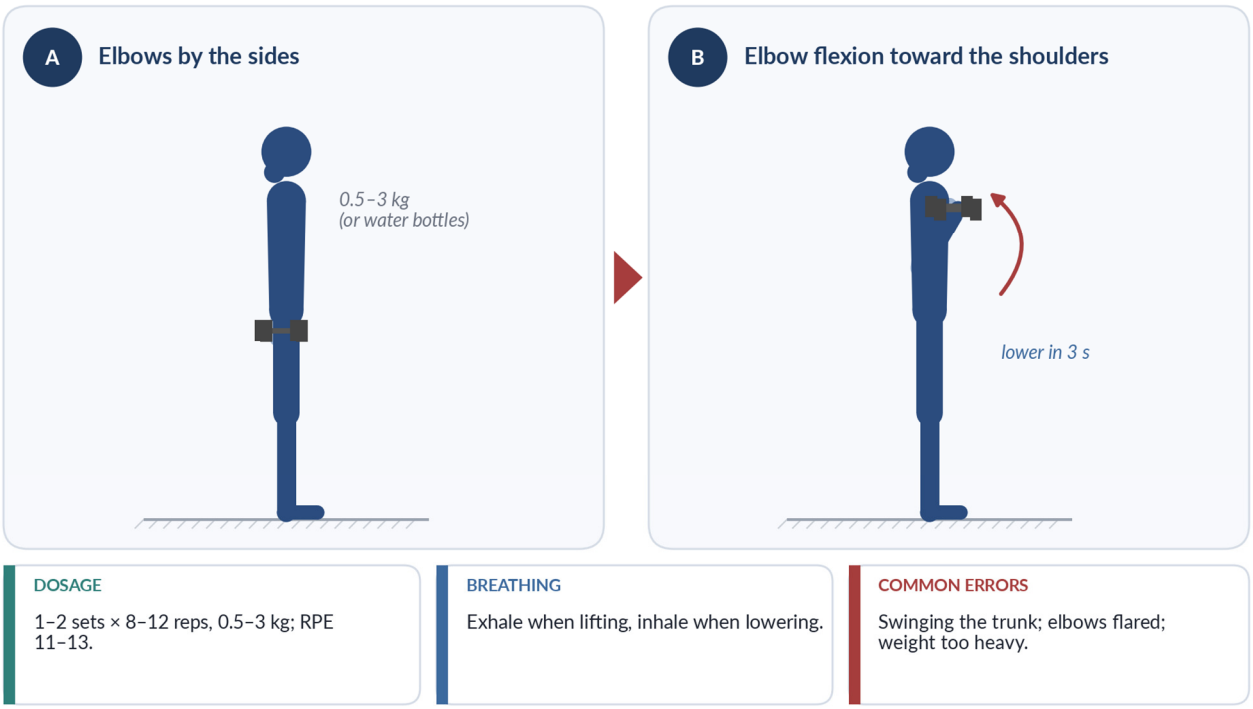


Figure 76 . Push-ups with light dumbbells (or water bottles).

Table 129 . Exercise sheet—push-ups with light dumbbells

Starting position	**Standing or sitting, elbows close to the body, dumbbells held in your hands with palms facing forward.**
Execution	Bend your elbows, bringing the dumbbells toward your shoulders, then lower them slowly (3 seconds).
Setup	1–2 sets × 8–12 repetitions, weight 0.5–3 kg; RPE 11–13.
Breathing	Exhale as you lift, inhale as you lower.
Common Mistakes	Tilting the torso; elbows splayed; weight too heavy.
Adaptation	Easier: no weight or with light bottles. Harder: heavier weight, alternating arms, slow pace.

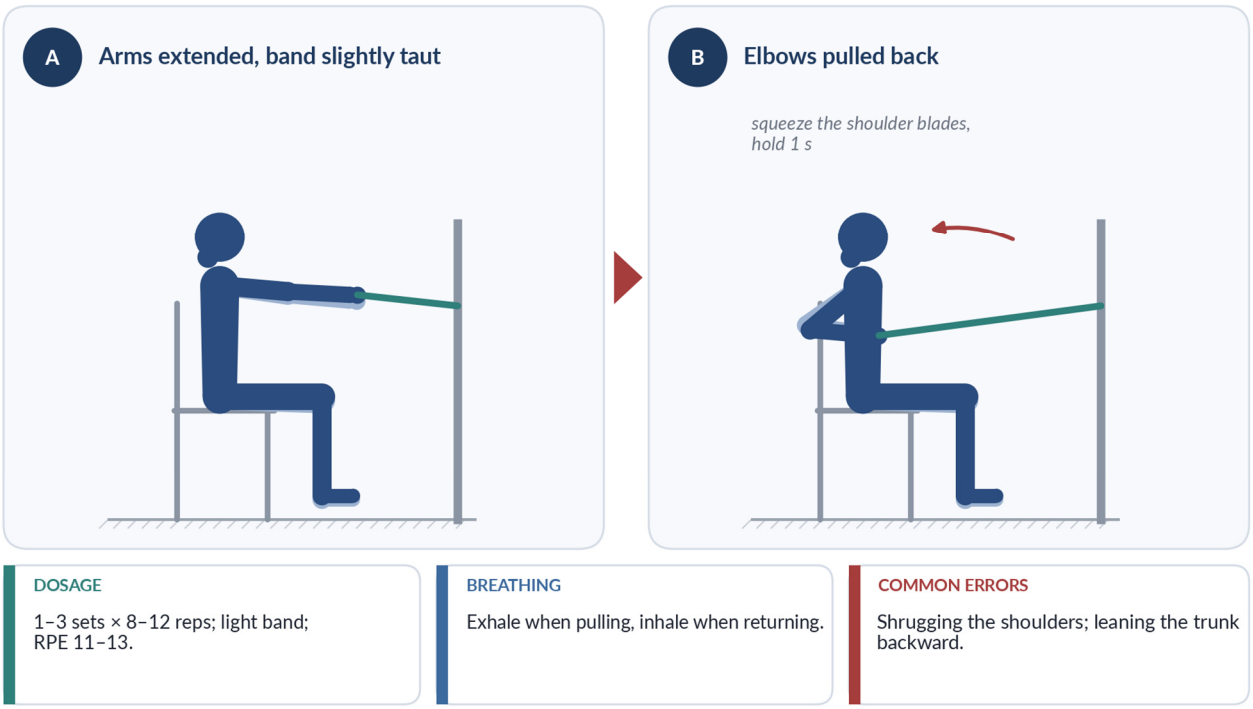


Figure 77 . Seated resistance band pull: strengthens the back and shoulders.

Table 130 . Exercise Worksheet – Resistance Band Pull-Up

Starting position	**Sit upright, with the band secured in front at chest level, arms extended forward, and the band slightly taut.**
Execution	Pull your elbows back, bring your shoulder blades together, hold for 1 second, then return slowly.
Setup	1–3 sets × 8–12 repetitions; light resistance band; RPE 11–13.
Breathing	Exhale as you pull back, inhale as you return to the starting position.
Common Mistakes	Shrugging the shoulders; leaning the torso backward.
Adjustment	Easier: use a weaker band. Harder: use a stronger band or do more repetitions.

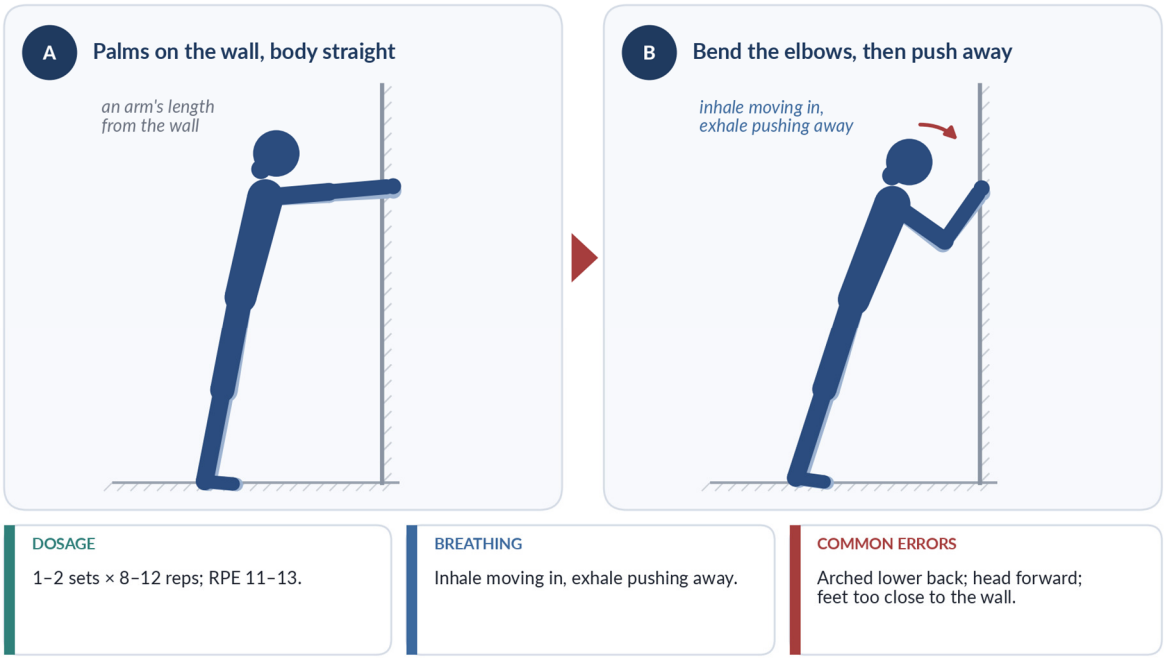


Figure 78 . Wall push-ups: a safe variation for building arm and chest strength.

Table 131 . Exercise Worksheet—Wall Push-Ups

Starting position	**Stand at arm's length from the wall, palms on the wall at shoulder level, body straight.**
Execution	Bend your elbows and bring your chest toward the wall, then push back until your arms are fully extended.
Setup	1–2 sets × 8–12 repetitions; RPE 11–13.
Breathing	Inhale as you bring your elbows in, exhale as you push back.
Common Mistakes	Arched lower back; head leaning forward; feet too close to the wall.
Adjustment	Easier: feet closer to the wall. Harder: feet farther away or push-ups on a high surface.

5.4. Balance, Mobility, and Flexibility

Balance exercises reduce the risk of falls and fractures, which are more common in postmenopausal women due to osteoporosis. Perform these exercises at least 3 times a week, first with support, then without. Mobility and flexibility (ankle, hip, shoulder) make walking, climbing stairs, and daily activities easier [18].

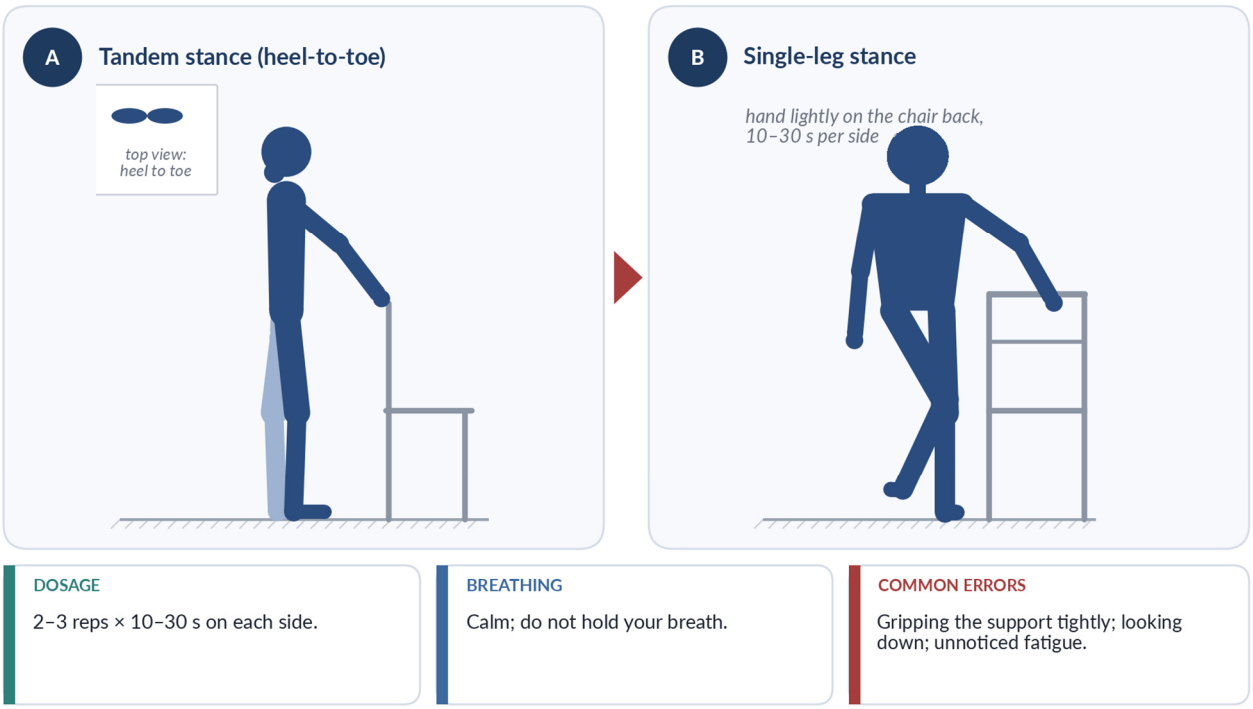


Figure 79 . Balance: tandem stance and standing on one leg, with a hand on the backrest.

Table 132 . Exercise sheet—standing in tandem and on one leg

Starting position	**In front of a chair or next to a wall, hand lightly on the backrest (tiptoe grip, not a firm grip).**
Execution	Tandem: one foot in front of the other, heel touching the toe. Then gently lift one leg (10–30 s).
Intensity	2–3 repetitions × 10–30 s on each side; progression: without support, with eyes closed only under supervision.
Breathing	Calm; do not hold your breath.
Common errors	Gripping the support too tightly; looking down; unnoticed fatigue.
Adaptation	Easier: feet close together, both hands on the support. Harder: no hands, on a soft surface, double load (counted).

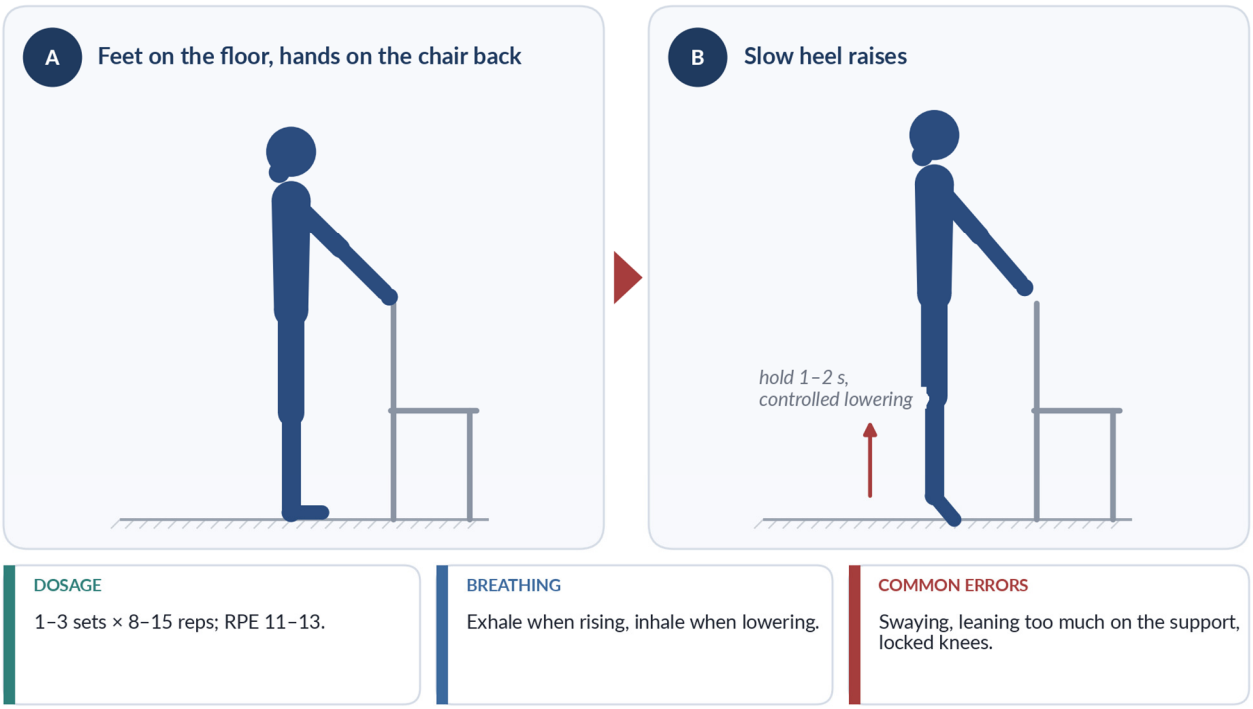


Figure 80 . Supported toe raises: strengthens the calves and improves gait.

Table 133 . Exercise Worksheet – Toe Raises

Starting position	**Standing, feet hip-width apart, hands on the back of a chair.**
Execution	Slowly rise onto your toes, hold for 1–2 seconds, and lower yourself in a controlled manner.
Setup	1–3 sets × 8–15 repetitions; RPE 11–13.
Breathing	Exhale as you rise, inhale as you lower.
Common Mistakes	Swaying, excessive support, locked knees.
Variations	Easier: both hands on the support, small range of motion. Harder: support with one finger, one foot.

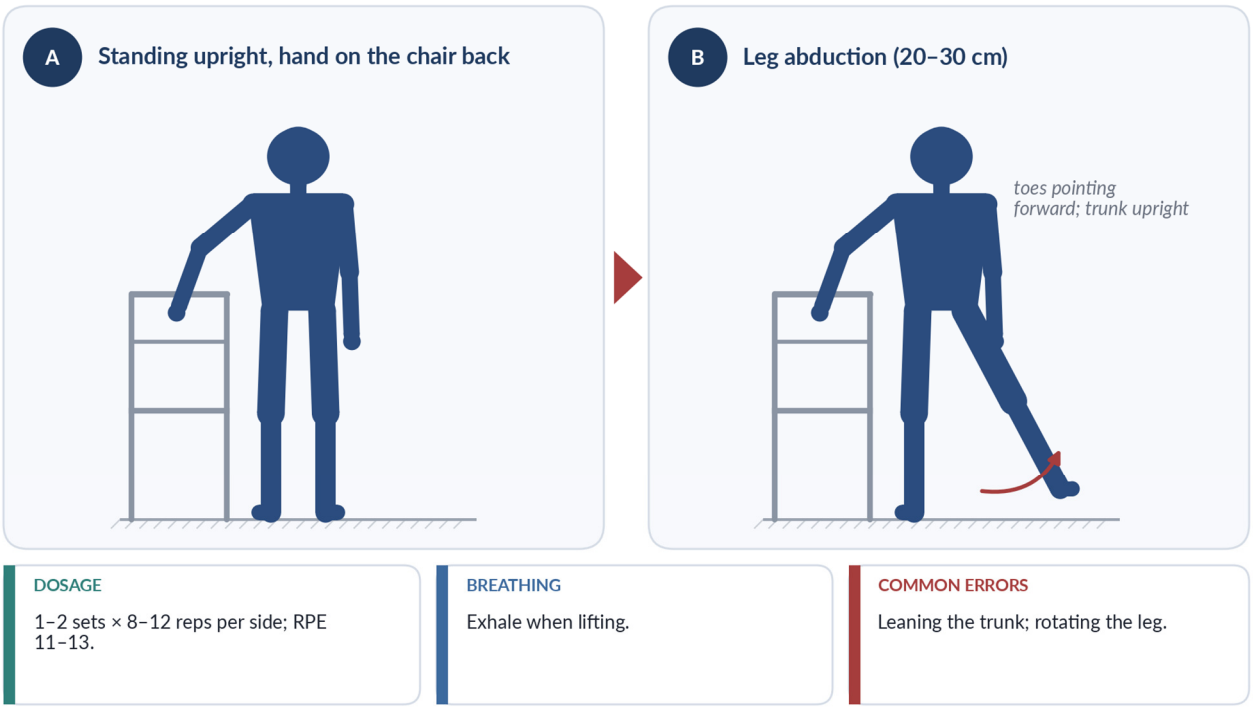


Figure 81 . Side leg lift: strengthens the hip muscles, which are important for balance.

Table 134 . Exercise sheet—side leg lift

Starting position	**Stand upright with one hand on the back of a chair.**
Execution	Slowly lift your leg to the side (20–30 cm), toes pointing forward; hold for 1 second; lower in a controlled manner.
Setup	1–2 sets × 8–12 repetitions per side; RPE 11–13.
Breathing	Exhale as you lift.
Common mistakes	Leaning the torso forward; rotating the foot.
Adaptation	Easier: smaller range of motion. Harder: hold for 2–3 seconds at the top, weight on the ankle (with the physical therapist's approval).

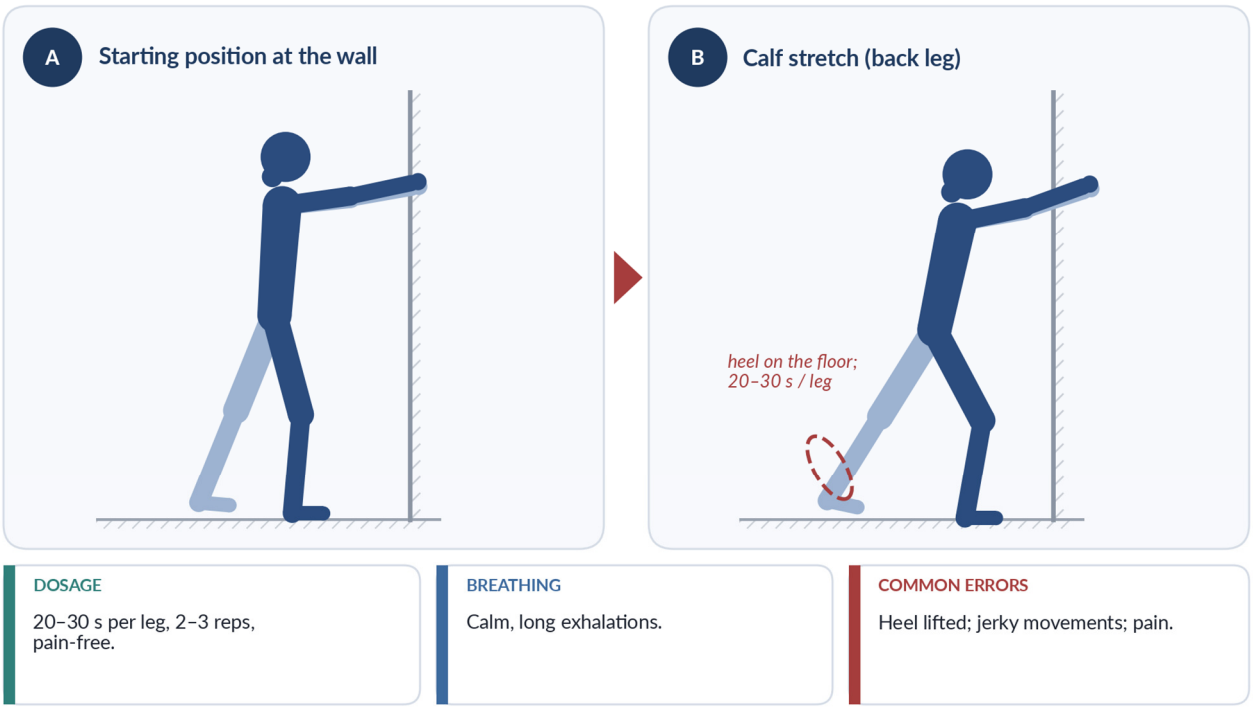


Figure 82 . ***Calf stretch against a wall.***

Table 135 . Exercise sheet—calf muscle stretch

Starting position	**Face the wall, palms against the wall, one foot forward, the other extended backward, heel on the floor.**
Execution	Gently bend your front knee and tilt your pelvis toward the wall until you feel a stretch in your back calf.
Duration	20–30 seconds per leg, 2–3 repetitions, without pain.
Breathing	Calm, with long exhalations.
Common Mistakes	Heel raised; jerky movements; pain.
Adaptation	Easier: Stand closer to the wall. Harder: Take a longer step.

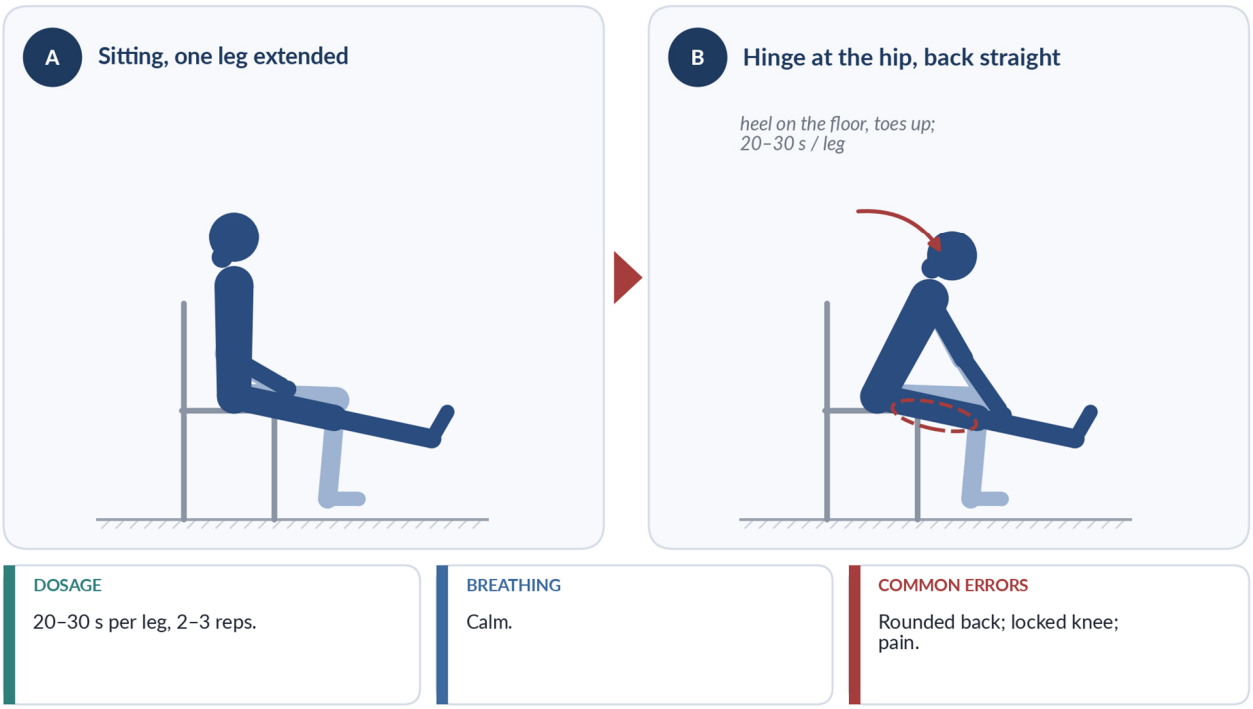


Figure 83 . Seated hamstring stretch.

Table 136 . Exercise sheet—seated hamstring stretch

Starting position	**Sitting on the edge of a chair, one leg extended forward, heel on the floor, toes pointing up.**
Execution	With your back straight, lean forward from the hips toward your foot until you feel a stretch in the back of your thigh.
Duration	20–30 seconds per leg, 2–3 repetitions.
Breathing	Steady.
Common Mistakes	Rounded back; locking the knee; pain.
Adaptation	Easier: knees slightly bent. Harder: greater range of motion.

5.5. The Pelvic Floor and Exercise (Stress Incontinence, Postpartum, Postmenopausal)

The pelvic floor is the group of muscles that supports the bladder, uterus, and rectum. Pregnancy and childbirth, menopause, chronic cough, constipation, and obesity can weaken it. Urine leakage when coughing, sneezing, or exerting oneself is common in women but rarely reported spontaneously; it discourages physical activity and reduces quality of life. Dedicated training of the pelvic floor muscles is, in physical therapy practice, the first-line treatment for stress incontinence.

There are also links to heart disease: the Valsalva maneuver (straining with the glottis closed) strains both the heart and the pelvic floor, so exhaling during exertion protects both; coughing caused by certain medications or lung diseases should be reported to the doctor; Diuretics increase urinary urgency, so plan bathroom breaks before and during the session.

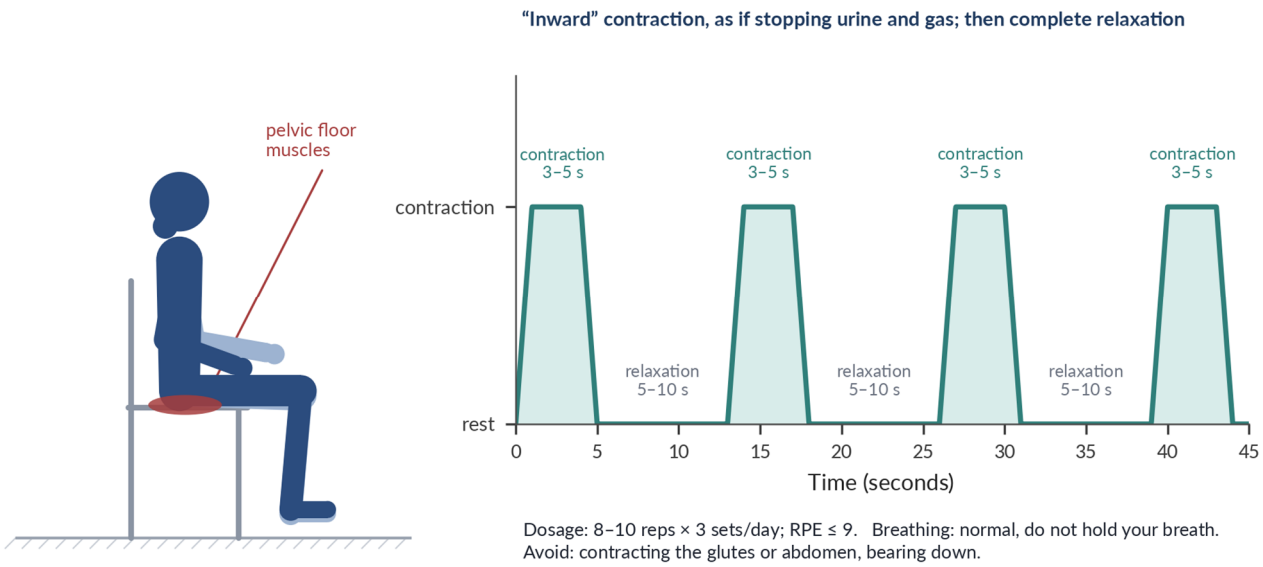


Figure 84 . Pelvic floor exercises: contraction, followed by complete relaxation.

Table 137 . Exercise sheet—pelvic floor exercises

Starting position	**Sitting or lying down, knees bent, back straight, shoulders relaxed.**
Execution	Contract the muscles as if you were stopping urine or gas, lifting gently "inward"; hold for 3–5 seconds, then relax completely for 5–10 seconds.
Frequency	8–10 repetitions × 3 sets/day; RPE ≤9; progress according to the physical therapist's instructions.
Breathing	Normal; do not hold your breath.
Common errors	Contraction of the glutes or abdomen; pushing down; holding your breath.
Adaptation	Easier: short contractions lasting 1–2 seconds. Harder: while standing, when getting up from a chair, before coughing.

Caution

Pelvic pain, unusual bleeding, a sensation of "something falling" (prolapse), or significant urinary leakage require **a gynecological or urogynecological evaluation**; these exercises do not replace a medical evaluation

5.6. Training the Respiratory Muscles

Diaphragmatic breathing and pursed-lip exhalation improve respiratory efficiency, reduce dyspnea, and promote relaxation; they are particularly useful after cardiac surgery and in heart failure. Specific training of the inspiratory muscles using a device may be recommended for selected patients, as indicated by a physician or physical therapist. The 2026 ESC Guidelines recommend, in chronic heart failure, combining inspiratory muscle training (3–5 times per week, 20–30 minutes, at 30% to 60% of maximum inspiratory pressure) with endurance and strength training, if tolerated: on its own, it improves peak VO_2, and when added to the other forms of exercise, it improves quality of life, cardiovascular fitness, and dyspnea.

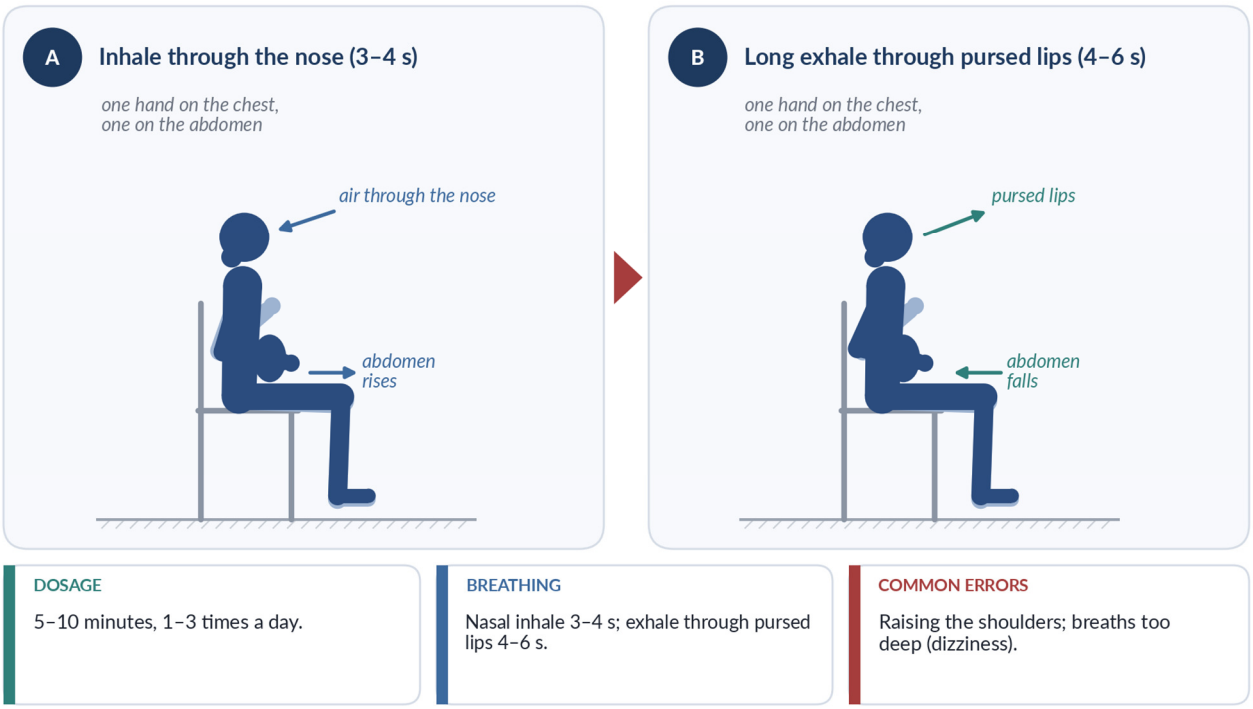


Figure 85 . Diaphragmatic breathing: inhale through the nose (the abdomen expands), exhale slowly through pursed lips.

Table 138 . Exercise sheet—diaphragmatic breathing

Starting position	**Sit comfortably or lie down, with one hand on your chest and one on your abdomen, shoulders relaxed.**
Execution	Inhale slowly through the nose for 3–4 seconds, allowing the abdomen to rise; exhale slowly through pursed lips for 4–6 seconds.
Frequency	5–10 minutes, 1–3 times a day.
Breathing	This is the exercise itself.
Common Mistakes	Shrugging the shoulders; breathing too deeply (dizziness).
Adaptation	Easier: lying down. Harder: while walking, climbing stairs.

5.7. Monitoring exercise intensity (Borg scale, talk test, ventilatory thresholds)

Heart rate is a less reliable indicator (due to beta-blockers, atrial fibrillation, pacemakers, and high variability). Therefore, intensity is assessed by combining three tools: the Borg scale (RPE), the talk test, and, where possible, heart rate. The 2026 ESC Guidelines recommend the Borg scale (6–20) or the talk test for endurance and the OMNI-RES scale for strength, especially at the start of the program or after a change in intensity, and then periodically (for example, once a week).

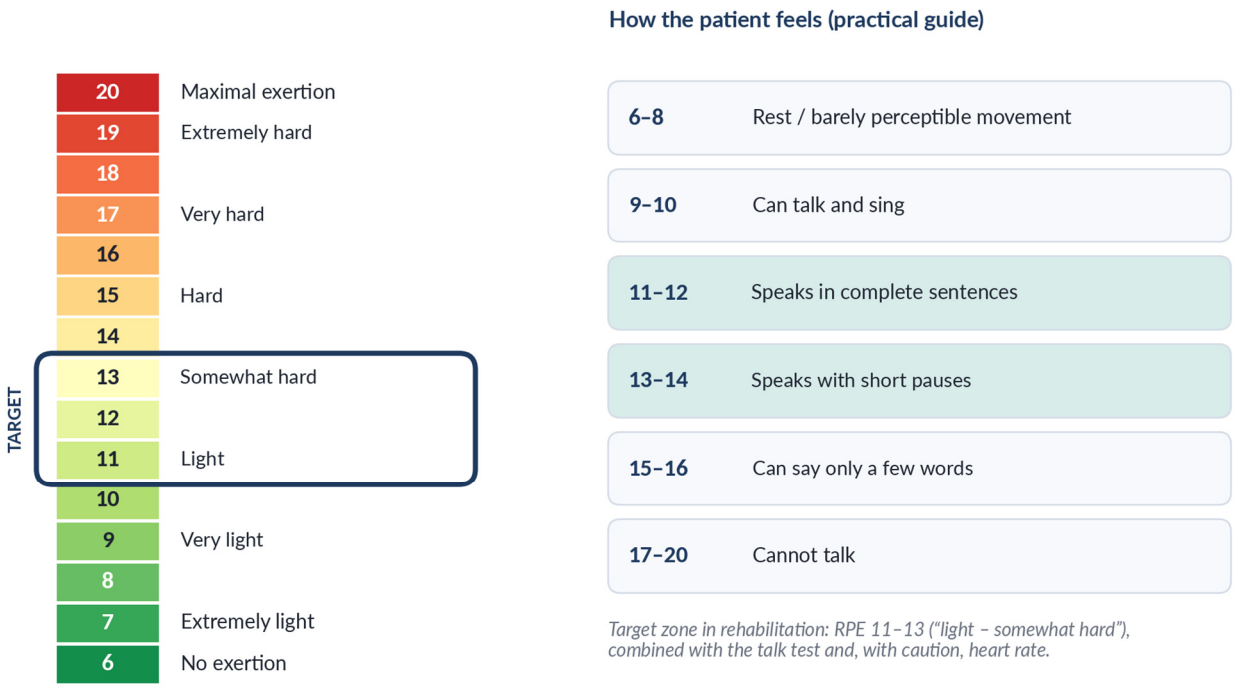


Figure 86 . Borg Scale (RPE 6–20): the target during recovery is zone 11–13 ("light–moderate," with light exertion).

Table 139 . Borg Scale (RPE)—Practical Guidelines

RPE	Description	How the patient feels
6–8	Very, very mild	Rest / almost imperceptible movement
9–10	Very light	Can talk and sing
11–12	Easy	Can speak in complete sentences
13–14	Somewhat difficult	Speaks with short pauses
15–16	Difficult	Can say only a few words
17–20	Very difficult – maximum	Cannot speak

Calculation of target heart rate. The classic reserve method (target HR = resting HR + percentage × (maximum HR − resting HR), with 40–60% for moderate intensity) is still used in practice, but the 2026 ESC guidelines consider it less reliable than ventilatory thresholds. When a cardiopulmonary test is not available, the heart rate at the first and second ventilatory thresholds can be estimated from values obtained during a maximal exercise test: **HR at VT1 = 4.866 + 0.405 × peak HR + 0.542 × resting HR**; **HR at VT2 = −2.606 + 0.773 × peak HR + 0.254 × resting HR**.

Example

A female patient with a resting HR of 70 bpm and a peak HR of 130 bpm during an exercise test (while on current treatment). HR at VT1 = 4.866 + 0.405 × 130 + 0.542 × 70 ≈ **95 bpm**; HR at VT2 = −2.606 + 0.773 × 130 + 0.254 × 70 ≈ **116 bpm**. For an untrained patient, aerobic training begins below VT1 (e.g., 85–95 bpm) and approaches VT1 as tolerated. The reserve method would have yielded 94–106 bpm (40–60% of the 60 bpm reserve). If the patient is taking beta-blockers, these values are valid only if the test was performed while on the same medication; otherwise, an RPE of 11–13 remains the primary guideline.

5.8. Individualization Based on Life Stage (Premenopause, Perimenopause, Postmenopause) and Comorbidities

The same FITT-VP principles are adapted to the patient's hormonal stage and comorbidities. The 2026 ESC guidelines recommend that exercise be tailored to the patient's risk profile (blood pressure, body fat, lipids, blood glucose) and her preferences [19].

Table 140 . Adapting the Program to Life Stages

Stage	Characteristics	Program Focus
Premenopause	Protective estrogen; fatigue and mood swings related to the menstrual cycle; possible anemia due to heavy bleeding; possible pregnancy	Aerobic + strength training; correction of iron deficiency; pre-pregnancy consultation
Perimenopause	Hot flashes, fragmented sleep, irritability, weight gain	Strength training, regular walking, cool environments, hydration, relaxation techniques; sleep assessment
Postmenopause	Rising blood pressure and lipids, abdominal fat, loss of muscle and bone mass	Strength training 2–3 times per week, balance, weight-bearing exercises (walking, standing up from a chair), blood pressure monitoring
Postpartum / peripartum cardiomyopathy	Fatigue, poor sleep, breastfeeding, specific medication	Start after cardiological/obstetric consultation; low intensity, slow progression

Table 141 . Adjustments based on risk factors (ESC 2026 guidelines)

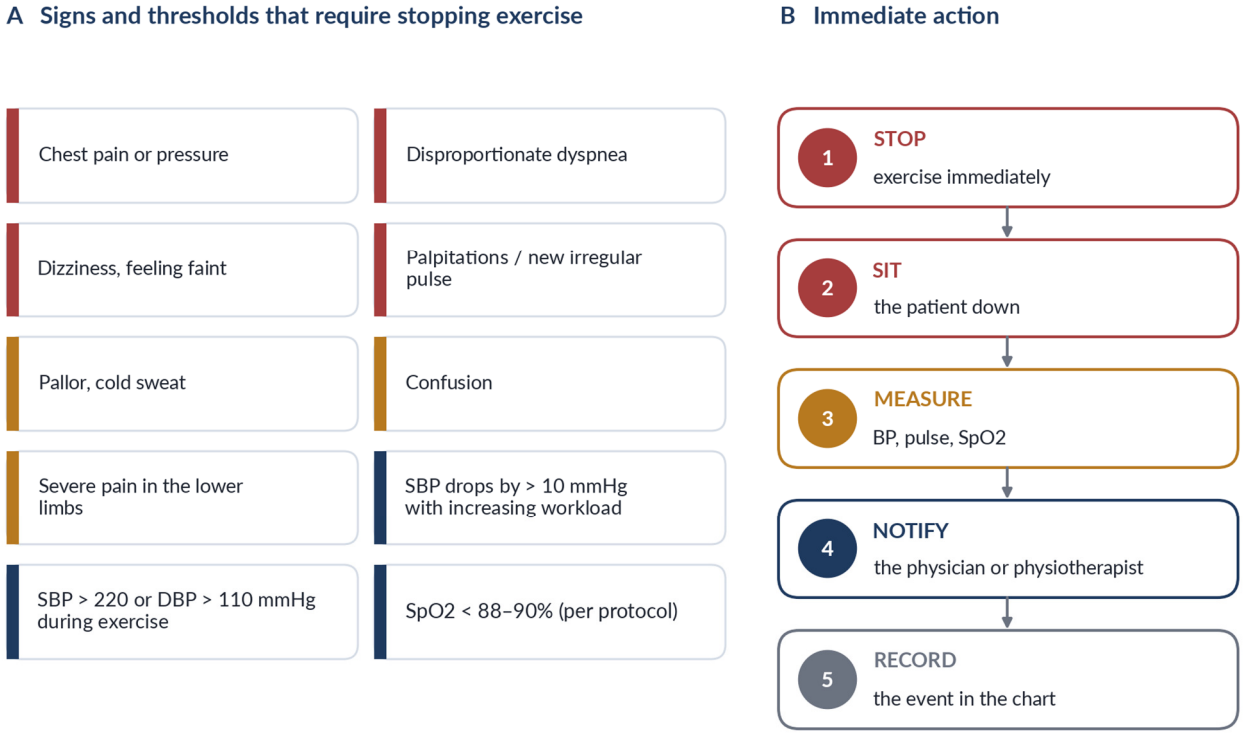
Situation	Prescription adjustment
Obesity	High volume of exercise (approx. 250–420 min/week) to reduce visceral fat; strength training to maintain muscle mass while on a low-calorie diet
Type 2 diabetes	Frequency ≥5 days/week; strength training volume ≥21 sets/week to reduce HbA1c
Hypertension	Aerobic exercise as the first choice; sessions >30 min, at least moderate intensity; ≥8 sets of resistance training per session
Dyslipidemia	Aerobic or combined training; higher frequency for total cholesterol
Sarcopenia / low muscle strength	Large-muscle-group resistance training, at least moderate intensity, plus adequate protein
Depression, anxiety	Exercise in the CR alleviates symptoms; psychological support is recommended
Osteoarthritis, joint pain	Low-impact exercises, adapted to individual limitations

5.9. Progression of Load

The general rule is **"start slowly, progress slowly**." Every 1–2 weeks, change **only one parameter** (duration, then frequency, then intensity; for strength training—number of repetitions, then sets, then load). Progression should occur only if previous sessions were well tolerated: RPE within limits, no symptoms, rapid recovery of heart rate and blood pressure, and no excessive fatigue the following day. A temporary plateau or decrease in exercise dose is also acceptable following an illness, a bad day, or a change in medication. The 2026 ESC Guidelines recommend regular reassessment of intensity, as ventilatory thresholds and strength change with training; in chronotropic insufficiency (more common in heart failure), the heart rate–workload relationship should be periodically reassessed.

5.10. Monitoring During the Session and Criteria for Stopping Exercise

Monitoring includes: the patient's appearance (complexion, sweating, breathing), RPE, pulse, blood pressure (before, during, and after; in at-risk patients, also during exercise), SpO_2 in patients with lung disease or heart failure, and blood glucose in diabetics (before, as needed during exercise, and after). Each session is recorded in the chart.



High-risk situations (ESC 2026): weight gain > 1.8 kg in 1–3 days, resting pulse > 100/min, new-onset AF/atrial flutter.

Figure 87 . Signs to stop the exercise: stop, sit the patient down, and notify the physician or physical therapist.

Warning

Stop the exercise and immediately notify the physician/physical therapist if any of the following occur: chest pain or pressure, disproportionate shortness of breath, dizziness or a feeling of fainting, palpitations or a new irregular pulse, pallor and cold sweats, confusion, severe pain in the lower limbs, a drop in systolic blood pressure (SBP) of >10 mmHg during an increase in workload, systolic blood pressure (SBP) >220 mmHg or diastolic blood pressure (DBP) >110 mmHg during exercise, or SpO_2 below 88–90% (as per protocol). The patient should sit down, vital signs should be measured, and a decision should be made regarding whether to continue. The 2026 ESC Guidelines list the following among high-risk situations during exercise: weight gain of >1.8 kg in 1–3 days, a drop in systolic blood pressure during exercise, a resting heart rate >100/min in the supine position, and de novo atrial fibrillation or flutter.

Key Points

- The program is multifaceted: aerobic, strength, balance, flexibility, and respiratory training.
- Intensity is determined using an RPE of 11–13 + the talk test + heart rate (with caution).
- Progress on only one parameter at a time.

The signs indicating when to stop are known by heart.

Reflection Assignment

Choose an exercise from this chapter and demonstrate it to a classmate: explain the execution, intensity, and adaptations in 60 seconds, then ask for feedback on clarity and safety.

6. SPECIFIC ASPECTS OF RECOVERY IN MAJOR CLINICAL CONDITIONS IN WOMEN

Objectives:

- adapt treatment recommendations for ischemic heart disease in women, including SCAD, INOCA/MINOCA, and Takotsubo;
- take into account the specific characteristics of heart failure, valvular heart disease, arrhythmias, hypertension, and peripheral arterial disease;
- applying precautions following cardiac surgery;
- to recognize specific needs in cardio-oncology and during childbearing years (contraception, pregnancy, teratogenic medications).

The general principles (Chapters 3–5) apply to all female patients. This chapter adds **disease-specific considerations**, particularly for conditions that predominantly affect women. The recommendations are general in nature and align with the 2026 ESC guidelines on cardiovascular risk and disease-specific guidelines.

6.1. Ischemic Heart Disease in Women

6.1.1. Acute and Chronic Coronary Syndromes, Revascularization (PCI, CABG)

RC is recommended following ACS and in chronic coronary syndrome (CCS) to reduce cardiovascular mortality, myocardial infarction, and hospitalizations; strength training is combined with endurance training to achieve greater gains in exercise capacity. However, women are less likely to receive the recommended treatment and are less likely to achieve LDL targets; in RC, the prescription of and adherence to antiplatelet agents, statins, beta-blockers, and ACE inhibitors are actively monitored. Attention is paid to atypical symptoms, depression, and barriers to care, and exercise intensity is guided by RPE and the symptom threshold [11,12].

6.1.2. Spontaneous Coronary Artery Dissection (SCAD)

SCAD is a cause of myocardial infarction in young women, often without classic atherosclerotic risk factors. The 2026 ESC Guidelines recommend considering rehabilitation programs tailored to women with SCAD to increase enrollment and adherence, and expert consensus statements propose an individualized program: aerobic exercise, preferably started after a stress test, under antihypertensive and heart rate control medication, with **limited increases in blood pressure during exercise** and gradual progression of strength training, under medical supervision [20].

Table 142 . Expert-recommended guidelines based on SCAD (Van Iterson et al., 2022)

Element	Guidance Guidelines
Aerobic	≥150 min/week on ≥3 days; progression to ≥300 min/week, if tolerated; stationary bike with gradual increase
Blood pressure during exercise	Intensities at which blood pressure during exercise remains <150/<90 mmHg; avoid an increase in systolic blood pressure of >10 mmHg compared to rest
Medication	Training while on optimal treatment for heart rate and blood pressure control
Strength	Introduced gradually, with light loads and blood pressure monitoring; avoid intense isometric exercise and the Valsalva maneuver
Psychological	Anxiety and stress are common; provide psychological support

Note

There is no RCT-validated protocol for SCAD. The exercise program should be established **only with the cardiologist's approval**, with clear limits on blood pressure and heart rate, and should

be stopped immediately upon any chest pain, unusual shortness of breath, or blood pressure readings above the established limits.

6.1.3. Ischemia without coronary obstruction (INOCA, MINOCA) and Takotsubo syndrome

INOCA and MINOCA are common in women; favorable outcomes of cardiac rehabilitation have also been reported in MINOCA. Takotsubo syndrome is a stress-induced cardiomyopathy with a particularly low referral rate for CR; exercise may be introduced after ventricular function has recovered, with an emphasis on stress management. Symptoms may persist despite "clean" arteries on angiography; validation of these symptoms is part of the intervention.

6.2. Heart Failure (including Heart Failure with Preserved Ejection Fraction) and Peripartum Cardiomyopathy

Heart failure with preserved ejection fraction (HFpEF) is more common in women, who are older at onset; in a Swedish registry, the mean age at onset of HFpEF was 77 years, and 55% of patients were women. The 2026 ESC Guidelines recommend personalized exercise training, within multidisciplinary care teams, for all stable patients (Class I). In HFpEF, the phenotype characterized by obesity and diabetes is common, and in heart failure, iron deficiency is screened for and treated. Weight (weight gain >1.8 kg in 1–3 days = increased risk), edema, and dyspnea are monitored, and exercise begins at low intensity, with slow progression and without the Valsalva maneuver [21].

Peripartum cardiomyopathy occurs during the last month of pregnancy or in the months following delivery. Exercise is resumed after stabilization, with the cardiologist's approval and without neglecting the mother's sleep and fatigue. Medications for heart failure (angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, sacubitril/valsartan, mineralocorticoid antagonists, ivabradine, SGLT2 inhibitors) are not used during pregnancy, and preconception counseling is recommended for all women with heart failure; Decisions regarding future pregnancies are made by a cardiology-obstetrics team.

6.3. Valvular Heart Disease and Valvular Interventions

The 2026 ESC Guidelines recommend that cardiac rehabilitation be considered after any valvular intervention—whether surgical or percutaneous—to improve exercise capacity. The 2025 ESC/EACTS Guidelines lowered the age threshold for TAVI in aortic stenosis with a tricuspid valve from 75 to 70 years. The access site, heart rhythm, blood pressure, and anticoagulation are monitored. In women of childbearing age with prosthetic valves or valvular heart disease, valve selection and anticoagulation therapy are discussed prior to a potential pregnancy [22].

6.4. Atrial Fibrillation, Arrhythmias, and Implantable Devices

In atrial fibrillation, exercise is part of lifestyle management and risk factor control; the 2026 ESC guidelines assign a Class IIb recommendation to exercise for reducing symptoms and recurrences. The pulse is irregular, so RPE is the primary guide. For ICD recipients, the target heart rate is maintained 10–20 bpm below the therapy threshold; exercise is recommended for ICD and CRT recipients to improve exercise capacity. Palpitations and anxiety may overlap: assess the heart rhythm before attributing them to stress [23].

6.5. Hypertension, including post-pregnancy hypertension

Women with a history of preeclampsia or pregnancy-induced hypertension are at increased risk for subsequent hypertension. Aerobic exercise is the first choice; sessions lasting more than 30 minutes (which can be broken up), at least moderate in intensity, and at least 8 sets of resistance training per session are associated with a decrease in blood pressure. The general rule remains to avoid intense isometric exercise and the Valsalva maneuver. Blood pressure is measured before and after exercise; orthostatic hypotension is checked [24].

6.6. Peripheral Arterial Disease

In patients with claudication, supervised walking therapy is the first-line treatment: walk until moderate-to-severe discomfort in the calf is felt, stop, repeat, for 30–60 minutes per session, at least 3 times a week, for a minimum of 12 weeks. Check the feet (for wounds), footwear, and manage risk factors [25].

6.7. Recovery after cardiac surgery in women (sternal precautions, healing, pain)

The 2026 ESC Guidelines recommend starting active mobilization as early as possible after cardiothoracic surgery, ideally within the first 4 weeks; Phase II rehabilitation should begin within 28 days and should not be delayed beyond 42 days. After sternotomy, **sternal precautions** are followed for approximately 6–8 weeks (according to the department's protocol): no heavy lifting, pulling, or pushing; a pillow placed on the sternum when coughing or standing up; and no sleeping on the abdomen. For women, a supportive bra without back straps can reduce pressure on the sternum and alleviate pain; the scar should be treated with care. The wound, fever, arrhythmias, pain, and mood are monitored.

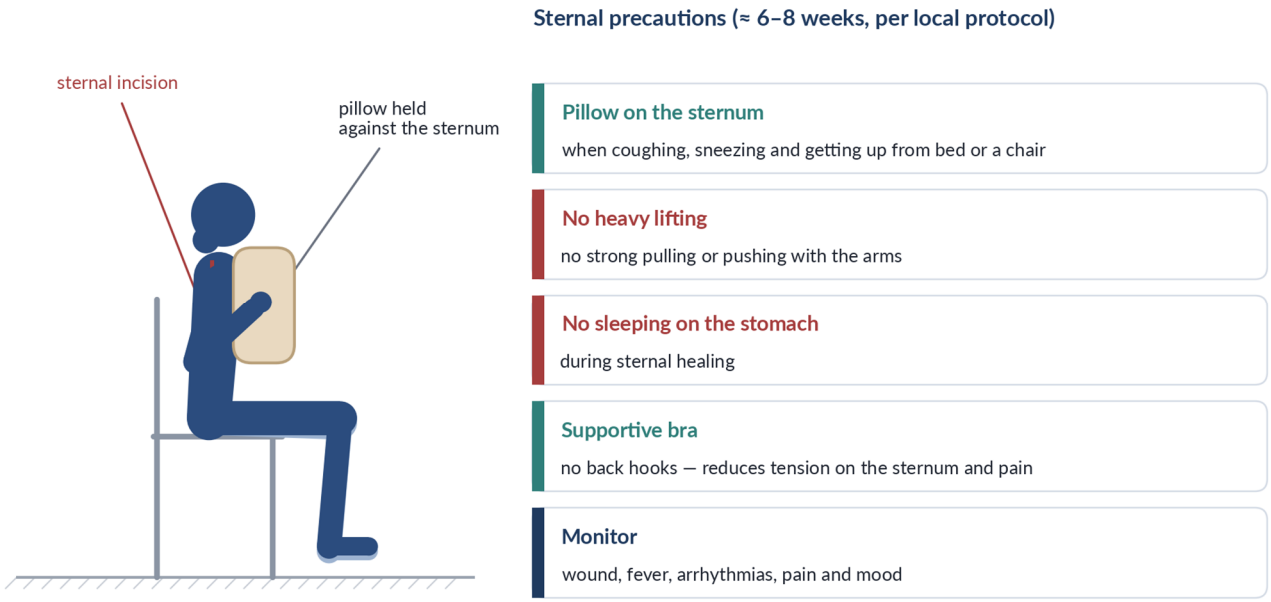


Figure 88 . After sternotomy: hold a pillow tightly against the chest when coughing, sneezing, or lifting.

6.8. Cardio-Oncology: Recovery After Breast Cancer Treatment

Breast cancer treatments (anthracyclines, anti-HER2 agents, thoracic radiation therapy) can cause cardiotoxicity; the 2022 ESC guidelines recommend stratification of cardiovascular and toxicity risk (HFA-ICOS score). The 2026 ESC guidelines indicate that exercise has a favorable safety profile in cancer patients and that cardio-oncological rehabilitation (CORE) should be considered for patients with cancer and survivors, particularly those at high risk of cardiotoxicity, to improve strength, exercise capacity, quality of life, and risk profile; It may also be considered to prevent or mitigate cardiotoxicity, particularly that caused by anthracyclines.

- Close coordination with the oncologist and cardio-oncologist (timing of treatment cycles, complete blood count, risk of infection);
- Pay attention to the ipsilateral shoulder and arm after surgery or radiation therapy (mobility, lymphedema, implanted catheter);
- cancer-related fatigue: short sessions, breaks, intensity adjusted according to RPE;
- Monitoring of FEVS, blood pressure, and symptoms of heart failure throughout the program.

6.9. Heart Disease in Women of Childbearing Age: Contraception, Pregnancy Planning, and the Postpartum Period

Women of childbearing age with heart disease require **preconception counseling**, as many cardiovascular medications are teratogenic or contraindicated during pregnancy; the 2026 ESC guidelines emphasize the need for preconception counseling when such medications are discontinued, and the 2025 ESC guidelines on cardiovascular disease and pregnancy detail the risks and management. The choice of contraceptive method is made by the cardiologist in consultation with the gynecologist; in established cardiovascular disease, estrogen-containing contraceptives are

generally avoided, and the decision is made on an individual basis. The resident neither recommends nor discontinues contraceptives or hormone therapy: they refer the patient's questions to the team.

Key Points

- SCAD, INOCA/MINOCA, Takotsubo, and HFpEF are common in women, and guidelines for their management are still evolving; treatment should be individualized.
- In SCAD, blood pressure and heart rate limits are determined in consultation with a cardiologist.
- Teratogenic medications and planned pregnancy require preconception counseling.
- After sternotomy: a cushion on the sternum, a supportive bra, and discretion.

In breast cancer: coordinate with the oncologist; pay attention to the shoulder and to infections.

7. INTERVENTIONS COMPLEMENTARY TO PHYSICAL EXERCISE

Objectives:

- providing therapeutic education tailored to women (the "teach-back" method);
- incorporating nutritional recommendations, including iron, calcium, and vitamin D;
- identifying adherence issues and pharmacological considerations;
- supporting smoking cessation and limiting alcohol consumption;
- recognizing psychosocial needs, sleep needs, menopause-related needs, sexual health needs, and needs related to returning to work.

7.1. Therapeutic Education and Self-Care

Education transforms the patient from a "recipient" into a partner. The 2026 ESC Guidelines show that materials tailored to women's experiences and knowledge levels increase understanding and adherence. Topics: the disease and its treatment, warning signs (including atypical ones), blood pressure and weight monitoring at home, nutrition, daily physical activity, medication, sleep, stress, menopause, pregnancy, and sexuality. **The teach-back method** is used. The guide also recommends counseling on physical activity and sedentary behavior, in line with WHO recommendations, the use of activity monitors (Class I), and reducing sedentary time.

7.2. Nutritional Intervention (Mediterranean Diet, Iron, Calcium, and Vitamin D)

The 2026 ESC Guidelines recommend nutritional counseling tailored to comorbidities and a Mediterranean-style or low-fat dietary pattern to reduce cardiovascular events and mortality- . The Mediterranean diet includes vegetables, fruits, whole grains, legumes, fish, olive oil, and nuts, with limited intake of salt (less than 5 g/day), saturated fats, added sugar, and processed meats.

- **Iron:** Ferritin and hemoglobin levels are monitored; sources include lean meat, legumes, and leafy greens, along with vitamin C; supplementation is done as directed by a doctor.
- **Calcium and vitamin D:** important for bone health in postmenopausal women; doses are determined by a doctor or endocrinologist, and calcium supplementation should not be started arbitrarily.
- **Protein:** Adequate intake at every meal to maintain muscle mass; for older women or those with sarcopenia, 1.2–1.5 g/kg/day, adjusted for kidney function.
- **Weight:** In sarcopenic obesity, the goal is to reduce body fat while preserving muscle mass through moderate calorie restriction, protein intake, and strength training.
- **Alcohol:** a maximum of 100 g of pure alcohol per week (ESC 2021 guidelines), with recommendations tailored to the individual.

7.3. Treatment Adherence and Pharmacological Considerations in Women

Women are less likely to receive the recommended therapy following a coronary event, have a lower perception of their own risk, and exhibit lower adherence. Solutions: a simplified written treatment plan, a pill organizer, an alarm, explaining the purpose of each medication, and involving the family. The medical student does not change the medication but **reports** any observed issues.

Table 143 . Considerations for the Treatment of Women with Heart Disease

Situation	What we aim for
Statins, ACE inhibitors/sartans, mineralocorticoid antagonists, ivabradine, SGLT2 inhibitors, and other medications	Contraindicated or to be avoided during pregnancy; need for reliable contraception and preconception counseling [1,13]
Beta-blockers	Fatigue, bradycardia, cold extremities; heart rate is no longer a reliable guide
Diuretics	Urinary urgency, urinary leakage, dehydration, hypokalemia
Angiotensin-converting enzyme inhibitors	Persistent cough (more common in women), which requires reporting
Anticoagulants	Heavy menstrual bleeding, bleeding following trauma
Hormone therapy, contraceptives	Discuss with your doctor; do not stop or start these medications without their approval

7.4. Quitting Smoking and Reducing Alcohol Consumption

Quitting smoking provides cardiovascular benefits at any age, and smoking has a significant impact on women, especially when combined with estrogen-based contraceptives. Recommended approach: ask, advise, assess readiness, offer behavioral support and, as directed by the doctor, pharmacological support, and plan follow-up. Limit alcohol intake according to the doctor's recommendations; for those with heart failure, fibrinogen abnormalities, or on anticoagulants, extreme moderation or abstinence is recommended.

7.5. Psychological and Social Support: Depression, Anxiety, Stress, Peer Support

Women are more likely to experience depression, anxiety, and social isolation following a cardiac event; in those who have undergone revascularization, the initial psychosocial status may be poorer, and the improvement in quality of life may be less pronounced. Cognitive-behavioral interventions reduce distress, and support groups increase engagement and motivation. Psychological stress can trigger cardiac events, including SCAD. The PHQ-9 and GAD-7 scales, empathetic discussion, referral to a psychologist, support groups, and peer mentors are utilized.

7.6. Sleep, Menopausal Symptoms, and Hormone Therapy

Insufficient sleep reduces exercise tolerance and mood; during perimenopause, hot flashes and night sweats disrupt sleep. Sleep hygiene tips: maintain a regular schedule, keep the bedroom cool, avoid caffeine in the evening, and get physical activity during the day; snoring with breathing pauses requires evaluation for sleep apnea. The 2026 ESC Guidelines indicate that hormone replacement therapy in women with cardiovascular disease is a nuanced issue, depending on the timing of initiation, the formulation, and individual risks, and may be considered for symptoms in carefully selected women, **with the decision resting with the physician**.

7.7. Counseling on Sexual Health

Women with cardiovascular disease have a higher risk of sexual dysfunction than those without, and the issue has been less studied in women than in men. The guidelines recommend screening for sexual function (Class I) and consider rehabilitation and sexual counseling to be useful (Class IIa); physical activity and the Mediterranean diet may help. Topics such as fear of exertion, the effects of medications, menopause, and the couple's relationship are discussed with tact and in private. Key points: if the patient can climb two flights of stairs without symptoms, normal sexual activity is generally well tolerated, provided there are no other medical restrictions.

7.8. Returning to Work and Family Roles

Returning to work and family roles is part of recovery. This is planned gradually, depending on the type of work, the individual's capacity for effort, and the available support; for women who care for children or parents, the division of tasks and family support are discussed. The ESC 2026 Guidelines include support interventions for returning to work in the context of mental health recovery.

Key Points

- Effective education is brief, repeated, verified through teach-back, and tailored to women.
- The Mediterranean diet, adequate protein, iron, and calcium/vitamin D should be assessed on an individual basis.
- Teratogenic medications and planned pregnancy require counseling; hormone therapy and contraception are medical decisions.
- Depression, anxiety, and isolation are actively screened for and treated; peer support among patients is effective.

8. PATIENT SAFETY AND EMERGENCY MANAGEMENT

Objectives:

- recognizing possible adverse events during the program;
- applying initial measures for hypotension, hypoglycemia, angina, and arrhythmia;
- recognizing atypical symptoms in women;
- describe the steps of basic life support and the use of an AED, including privacy considerations;
- implement measures to prevent falls and fractures.

8.1. Adverse Events During Recovery

Supervised programs are, on the whole, safe. The 2026 ESC Guidelines estimate the rate of serious exercise-related adverse events at approximately 1 per 53,770 patient-hours in remotely supervised sessions, 1 per 11,333 patient-hours in center-based HIIT, and no reported events in center-based moderate continuous training; Certain clinical conditions increase the risk and warrant in-center exercise, ECG monitoring, and lower intensities. The most common issues are minor: fatigue, musculoskeletal pain, dizziness, cramps, mild hypotension, and palpitations.

Practical Note

Record **any incident**, even minor ones: what happened, when, parameters, actions taken, and who was notified. Analyzing incidents as a team helps prevent them.

8.2. Orthostatic Hypotension, Hypoglycemia, and Exercise-Induced Arrhythmias

Table 144 . Common situations and first steps (according to local protocol)

Situation	Signs	Initial Intervention
Orthostatic hypotension / presyncope	Dizziness upon standing, blurred vision, pallor	Sit or lie the patient down with their legs elevated; measure blood pressure and pulse; provide fluids if there are no contraindications; notify the doctor
Hypoglycemia (blood glucose <70 mg/dl)	Tremors, sweating, hunger, confusion	If conscious: 15 g of fast-acting carbohydrates; repeat blood glucose test in 15 minutes; notify the doctor. If unresponsive: call emergency services
Angina	Chest pain or pressure, shortness of breath	Stop physical activity, have the patient sit down, measure blood pressure and pulse, administer nitroglycerin according to protocol, call the doctor; if symptoms do not subside within a few minutes—call emergency services
Arrhythmia	Palpitations, dizziness, shortness of breath	Stop physical activity, have the patient sit down, check pulse and blood pressure, perform an ECG if necessary, notify the doctor
Heart Failure Exacerbation	Dyspnea at rest, cough, low SpO_2, weight gain >1.8 kg in 1–3 days	Semi-sitting position, oxygen per protocol, notify the physician
Symptomatic anemia / profuse bleeding	Pallor, tachycardia, dyspnea with minimal exertion	Stop the activity, measure vital signs, notify the doctor

8.3. Atypical Symptoms in Women and Warning Signs

Women may experience a heart attack or ischemia with symptoms different from the “classic chest pain”: unusual fatigue, shortness of breath, nausea or vomiting, pain in the jaw, neck, shoulder,

or back, dizziness, cold sweats, or anxiety. These symptoms are sometimes mistakenly attributed to stress, menopause, or fatigue. **Rule of thumb:** any new, intense, or persistent symptom during physical exertion should prompt you to stop and assess the situation; if you cannot quickly identify the cause, call a doctor or dial 112.

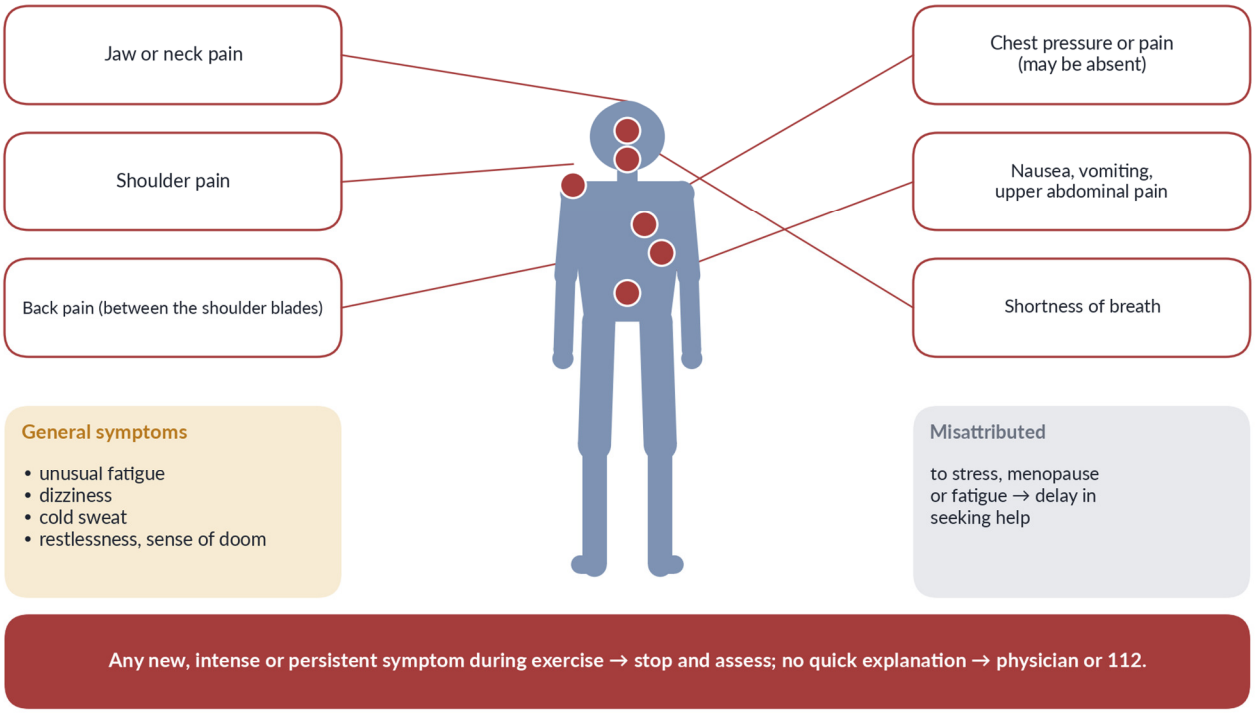


Figure 89 . Common symptoms of a heart attack in women: do not expect the "classic pain."



High-risk situations (ESC 2026): weight gain > 1.8 kg in 1–3 days, resting pulse > 100/min, new-onset AF/atrial flutter.

Figure 90 . Signs to stop exercise: stop, have the patient sit down, and notify the doctor or physical therapist.

8.4. Emergency Protocol and Basic Life Support

All team members know the basic life support algorithm and the location of the equipment:

1. Check the safety of the area and **the patient's response**.
2. If she is unresponsive and **not breathing normally**: call for help, **dial 112 or the internal number,** and request an AED.
3. Begin **chest compressions**: center of the chest, depth 5–6 cm, rate 100–120 per minute.
4. **Attach the AED** immediately and follow the voice prompts.
5. Continue until medical personnel arrive or the patient shows signs of life [26].

Note

Modesty should not delay resuscitation. In women, compressions and AED electrodes should be applied without delay to the exposed chest; the electrode should be placed as shown in the pictogram, beneath the breast, and the team should provide privacy once the situation is under control. There is a known tendency to hesitate when resuscitating women; the master's student must not hesitate.

8.5. Prevention of Falls and Fractures (Osteoporosis)

After menopause, bone loss increases the risk of fracture from a fall. Global guidelines recommend assessing the risk of falls and implementing interventions that include balance and strength exercises, reviewing medications, correcting sensory deficits, and adapting the environment. In geriatric care, weight-bearing and balance exercises are combined with muscle strength training; movements involving sudden trunk flexion are avoided in patients with known osteoporosis. At home: no loose rugs, night lights, grab bars in the bathroom, and stable footwear.

Key Points

- Supervised programs are safe when patients are carefully selected and monitored.
- Atypical symptoms in women should be taken seriously and not automatically attributed to stress.
- CPR: response—call—compressions—AED, without hesitation due to modesty.
- Osteoporosis requires weight-bearing, strength, and balance exercises.

9. MODELS FOR PROVIDING CARDIOVASCULAR REHABILITATION

Objectives:

- compare delivery models (in-center, at home, remote, hybrid);
- select the appropriate model for a patient based on risk and context;
- plan a safe home exercise program;
- describe the role of support groups and peer support;
- prepare for the transition to maintenance

There is no one-size-fits-all model. The 2026 ESC Guidelines recommend in-center rehabilitation (Class I) and propose patient-centered care using multiple modalities (face-to-face, virtual, remote) to increase participation and equity (Class IIa); home-based rehabilitation without digital support may be considered for patients who are not at high risk, while telerehabilitation or hybrid models may be considered following valve procedures or for patients with implantable devices (Class IIb). The rehabilitation team is responsible for the program regardless of the delivery method. For women, the guidelines recommend considering telerehabilitation or hybrid models to increase enrollment and adherence in ACS, CAD, revascularization, and HF.

9.1. In-Center Outpatient Program

Reference model: direct supervision, equipment, monitoring, group setting, rapid intervention. Suitable for patients at moderate and high risk and for those new to the program. Disadvantages: transportation, fixed schedule, costs. In heart failure, a network meta-analysis cited in the 2026 ESC guidelines compared in-center rehabilitation, full telerehabilitation, hybrid telerehabilitation, and technology-assisted rehabilitation: all modalities exceeded the MCID for peak VO_2, and only in-center rehabilitation significantly reduced heart failure-related hospitalizations and mortality, with high heterogeneity.

9.2. Home-Based Rehabilitation

For low-risk, motivated patients in a safe environment, home-based rehabilitation exercise (RE) can be effective if it is **structured** (written plan, diary, regular follow-ups). The 2026 ESC Guidelines note comparable safety between supervised home-based CR and center-based CR, with appropriate patient selection, education, and remote monitoring; however, the studies lack sufficient power to rule out differences in rare complications. The 2023 Cochrane Review directly compares the two models [27].

Table 145 . Sample weekly home care plan (for guidance)

Day	Activity	Duration	Effort (RPE)
Monday	Moderate-paced walking + pelvic floor exercises	30 min + 5 min	11–12
Tuesday	Strength training with bottles/resistance band (chair lifts, push-ups)	20–30 min	11–13
Wednesday	Light walking + stretching + breathing exercises	30 min	10–12
Thursday	Strength + balance	20–30 min	11–13
Friday	Moderate-paced walking or dancing at home	30 min	11–13
Saturday	Enjoyable activity with the family (park, garden)	30–45 min	10–12
Sunday	Active rest, breathing exercises, and stretching	10–15 min	≤10

Practical Note

Conditions for the at-home program: low or stable risk, awareness of warning signs, phone within reach, safe space, scheduled contact with the team every 1–2 weeks.

9.3. Telerehabilitation and digital technologies

Telerehabilitation uses videoconferencing, apps, wearable devices, and telephone consultations. The 2026 ESC Guidelines note that adherence to remote programs is high and that mobile apps increase adherence, but also that digital illiteracy and unequal access to technology are barriers. For women, telerehabilitation can eliminate transportation and scheduling barriers, but for those who are isolated or have limited resources, human contact remains essential [28].

9.4. Hybrid Models

The hybrid model combines in-center sessions (assessment, technique, equipment, social interaction) with sessions at home or remotely. The ESC 2026 Guidelines describe a shift toward a patient-centered hybrid model. It is a realistic solution for many women: in-center sessions provide safety and support, while at-home sessions fit the family's schedule.

Table 146 . Comparison of Delivery Models

Model	Advantages	Limitations	Suitable for
In the city center	Surveillance, devices, group	Transportation, fixed schedule	Moderate/high risk, early in the program
At home	Flexibility, low costs	No direct supervision	Low risk, motivated, safe environment
Telerehabilitation	Remote access, monitoring	Digital skills, equipment	Stable, internet access
Hybrid	Balance between security and access	Requires coordination	Most women with family responsibilities

9.5. Programs and groups for women, peer support

The ICCPR guidelines and the AHA statement propose programs or sessions dedicated to women, with a focus on psychosocial needs, specific educational content, and peer support. The 2026 ESC guidelines also recommend patient ambassadors or mentors and partnerships with community organizations. A 2025 review warns that the measured benefits of women-only programs are modest and that the studies are small, so "women-focused" elements are introduced as options, not requirements.

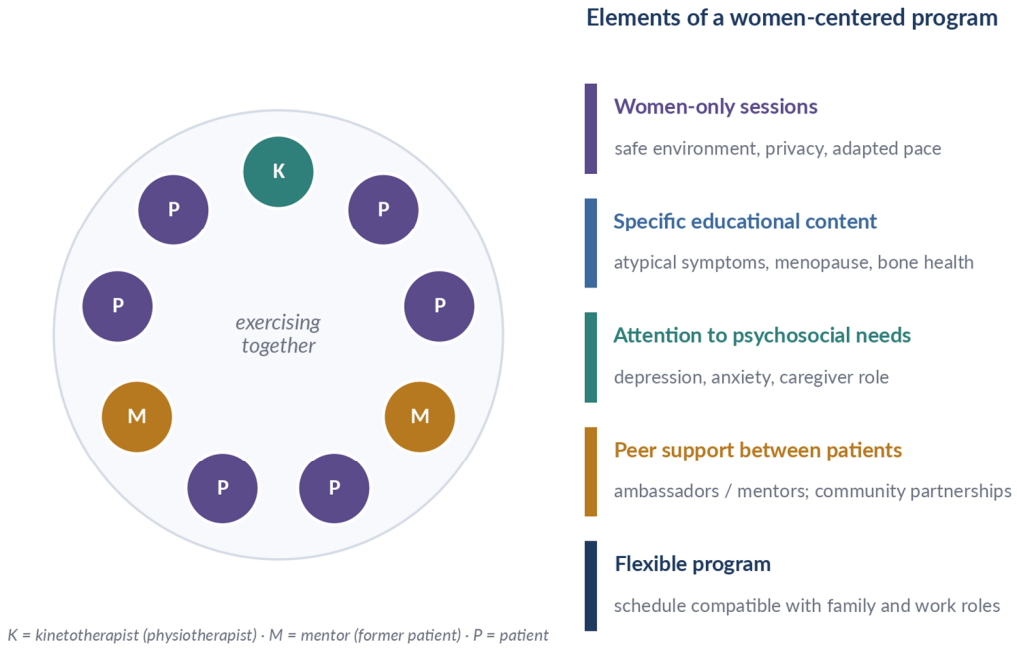


Figure 91 . Women's group session: exercising together and peer support among patients.

9.6. Maintenance Phase and Continuity of Care

The benefits are lost if physical activity stops upon discharge. Maintenance involves regular activity (daily walking, strength training twice a week, balance exercises), social support (walking group, club, community), medical checkups, and periodic contact with the care team. The 2026 ESC Guidelines emphasize that it is never too late to adopt an active lifestyle and recommend community or peer groups.

Key Points

- The model should be chosen based on risk, preferences, resources, and context; for women, flexibility is particularly important.
- Home-based exercise should be structured and monitored.
- Groups and mentors increase adherence, but the evidence is still limited.
- Maintenance is the most important stage for sustaining the benefits.

10. MONITORING, RE-EVALUATION, AND DISCHARGE OF THE PATIENT

Objectives:

- planning reassessments and selecting outcome measures;
- interpreting the response and adjusting the program;
- establishing discharge criteria and the maintenance plan;
- drafting documentation and the final report.

10.1. Periodic Reassessments

Reassessments are conducted every **4–6 weeks** and at **the end of the program**, repeating the same tests as at the beginning for comparability. At each session, parameters, symptoms, and tolerance are monitored; information is also requested regarding changes in menstrual cycle, medication, sleep, and stress. The ESC 2026 Guidelines recommend that results be described in terms of functioning (body functions, activities, participation) and through patient-reported questionnaires.

10.2. Clinical, Functional, Psychosocial, and Quality-of-Life Outcome Indicators

Table 147 . ***Outcome Indicators – Dashboard Model***

Domain	**Indicator**	**Indicative significance**
Functional	6MWT	Increase ≥30 m = MCID [1]
Exercise capacity	Peak VO_2 (if CPET is available)	MCID ≈ 1 ml/kg/min [1]
Mobility and strength	TUG, SPPB, grip strength, chair stands	Improvement in values
Clinical	BP, resting pulse, weight, symptoms	Screening, absence of symptoms
Risk factors	LDL, HbA1c, smoking, diet	Individualized targets; monitoring achievement of LDL targets in women [1]
Psychosocial	PHQ-9, GAD-7	Decrease in scores
Quality of life	EQ-5D / SF-12; KCCQ, MLHFQ in IC	A 5-point difference on the KCCQ/MLHFQ = significant [1]
Adherence and completion	Sessions attended (%), program completion	Key quality indicators [1]; ≥80% attendance is a common goal
Pelvic health	Urinary leakage diary	Reduction
Safety	Falls, incidents, readmissions	Number and Causes

The service monitors, by gender, referrals, enrollments, attendance, and program completion to identify disparities and take action to address them.

10.3. Adjusting the program based on response

Table 148 . Guiding Decisions Based on Response

Observed response	Interpretation	Action
Lower RPE for the same task, rapid recovery	Good adaptation	Increase one parameter (duration → frequency → intensity)
Excessive fatigue the next day	Too high a dose or anemia/insufficient sleep	Reduce volume by 20–30%; check hemoglobin/ferritin and sleep
New symptoms (pain, shortness of breath, palpitations)	Possible clinical problem	Stop treatment, inform the doctor
Stagnation after 3–4 weeks	Plateau, adherence, external factors	Check adherence, stress, sleep, diet, technique
Elevated PHQ-9/GAD-7 score	Psychological distress	Referral to a psychologist; group support
Repeated absences	Barriers (care, transportation, work)	Open discussion; flexible, hybrid schedule, transportation

10.4. Discharge Criteria and Maintenance Plan

Discharge occurs when the main goals are achieved or a plateau is clearly established, the patient independently follows the program, is aware of warning signs, understands her medication and dietary plan, and is prepared for the transition to maintenance care. The written maintenance plan includes recommended activities, the setting (group, home, community), the person providing support, the follow-up date, and the team's contact information. A copy is provided to the patient, and a report is sent to the attending physician.

10.5. Medical Documentation and Final Report

The documentation is **complete, accurate, legible, dated,** and **signed**, and respects confidentiality. A useful format is SOAP. The final report includes: diagnosis and risk, initial and final assessments, the program carried out, compliance, incidents, results, maintenance recommendations, and follow-up appointments.

Practical Note

SOAP Example: S: "I felt fine, I slept a little, my child was sick." O: BP 128/78, pulse 74, SpO2 97%, 25 min on exercise bike (RPE 12), maximum heart rate 106, no symptoms. A: Good tolerance, insufficient sleep. P: Maintain duration, add 1 strength set; discuss a hybrid schedule for the week with the child at home; reassess in 1 week.

Key Points

- The reassessment uses the same tests as at the beginning, at 4–6 weeks, and at the end.
- Results are also tracked by gender at the department level.
- Progression occurs only if the sessions are well tolerated.
- Discharge requires a written maintenance plan.

11. CASE STUDIES

11.1. A 52-year-old woman following spontaneous coronary artery dissection

Clinical Case

Patient A., 52 years old, a teacher and mother of two teenagers. Five weeks ago, she had a non-ST-elevation myocardial infarction; coronary angiography revealed SCAD in the left anterior descending artery, which was treated conservatively. No classic atherosclerotic risk factors; perimenopausal. Medication: antiplatelet agent, beta-blocker. LVEF 55%. She is afraid to move and "hears" her heartbeat at night. Personal goal: "to return to the classroom and be able to go hiking in the mountains with my children again."

Table 149 . Initial evaluation—Patient A.

Parameter	Value
Resting BP / Pulse / SpO2	128/78 mmHg / 62 bpm / 98%
CPET (on medication)	Peak VO_2 24 ml/kg/min; maximum blood pressure 148/82 mmHg; no ischemia or arrhythmias
6MWT	480 m
Gripping force	24 kg
Hemoglobin / ferritin	11.4 g/dl / 22 µg/l (iron deficiency)
PHQ-9 / GAD-7	11 / 13
Other	Does not smoke; fragmented sleep; no hormone therapy

Stratification: moderate risk (recent SCAD, anxiety, iron deficiency being corrected). **SMART Goals:** (1) 40 minutes of moderate cycling/walking within 12 weeks; (2) return to work on a reduced schedule by week 8; (3) PHQ-9 and GAD-7 scores below 10 within 12 weeks; (4) participation in the patient support group once a week.

Table 150 . Proposed Program – Patient A. (indicative)

Element	Prescription
Frequency	3 supervised sessions/week in weeks 1–6, then 2 + 2 at home
Aerobic	Ergometer with gradual increase, 20 → 40 min, RPE 11–13, below the symptom threshold; BP and heart rate limits established with the cardiologist (expert guidelines: exercise BP <150/<90 mmHg [29])
Strength	Introduced in weeks 3–5, with light loads, 10–15 repetitions, exhaling during exertion, without intense isometric effort and without the Valsalva maneuver
Other	Breathing, relaxation; balance; pelvic floor exercises
Psychosocial	Psychological consultation; patient support group; education about SCAD; follow-up every 2 weeks
Medical	Treatment for iron deficiency as prescribed by the doctor; discussion about contraception/menopause with the gynecologist

Progress at 12 weeks (fictitious): 6MWT 545 m, peak VO2 28 ml/kg/min, PHQ-9 6, GAD-7 7; no new symptoms; ferritin 41 µg/l; returns to work on a reduced schedule in week 8. Transitions to a hybrid maintenance program.

Reflection Question

Why isn't high-intensity strength training used at the beginning? What would you do if her blood pressure during exercise exceeds the established limit? How would you help her overcome her fear of moving?

11.2. 66-year-old woman with heart failure with preserved ejection fraction, obesity, and diabetes

Clinical Case

Patient B., 66 years old, retired, cares for her ailing husband. Heart failure with an ejection fraction of 58% (HFpEF), NYHA Class II–III, BMI 37 kg/m², type 2 diabetes, hypertension, knee osteoarthritis, menopause at age 51. Hospitalized for decompensation 8 weeks ago. Medications: diuretic, SGLT2 inhibitor, mineralocorticoid antagonist, antihypertensive, metformin. Fatigue, fear of falling, social isolation.

Table 151 . Initial assessment—Patient B.

Parameter	Value
Resting BP / Pulse / SpO2	136/80 mmHg / 74 bpm / 95%
Weight	98 kg (dry weight 97 kg)
6MWT	290 m (RPE 14, 1-minute break)
Grip strength / SPPB	17 kg / 8/12
Ferritin / transferrin saturation	60 µg/l / 15% (iron deficiency)
HbA1c	7.6%
PHQ-9 / GAD-7	12 / 8

Risk **stratification:** moderate-to-high risk (recent decompensated heart failure, obesity, diabetes). **SMART goals:** (1) 6MWT ≥340 m; (2) 5% weight loss in 12 weeks, while maintaining muscle strength; (3) HbA1c <7.2% (to be discussed with the doctor); (4) 30 minutes of walking on 5 out of 7 days; (5) group participation.

Table 152 . Proposed Program – Patient B. (guideline)

Element	Prescription
Frequency	3 sessions/week with monitoring of blood pressure, pulse, and SpO2; simple home program
Aerobic	3-minute intervals of exercise / 1–2-minute rest, then continuous; 15 → 40 min; RPE 11–13, below VT1; low-impact (biking, walking on flat terrain, water exercises) for the knees
Strength	2 days/week, 1–2 sets × 8–12 reps, large muscle groups; gradual increase in volume for glycemic control [1]
Precautions	Daily weight monitoring; increased risk with weight gain >1.8 kg in 1–3 days [1]; blood glucose before/after; gradual transitions
Nutrition	Mediterranean diet; adequate protein; the physician may consider pharmacological treatment of obesity ( ) in HFpEF [13]
Medical	Assessment and treatment of iron deficiency [13]
Psychosocial	High PHQ-9 score: referral to a psychologist; patient support group; support for caring for a spouse

Progress at 12 weeks (fictitious): 6MWT 345 m, weight 93 kg, SPPB 10, PHQ-9 7; no decompensation. Continue with a hybrid approach.

Reflection Question

How do you adjust the intensity on days when weight increases by 1.9 kg in two days? How do you combine weight loss with maintaining muscle mass?

11.3. 48-year-old woman with cardiotoxicity following breast cancer treatment

Clinical Case

Patient C., 48 years old, office worker. Stage II breast cancer treated with mastectomy, anthracyclines, and trastuzumab; during treatment, LVEF decreased from 60% to 47%, asymptomatic. Currently on an ACE inhibitor and a beta-blocker. Marked fatigue, incipient lymphedema in the left arm, anxiety. The oncologist has approved exercise.

Table 153 . Initial Assessment – Patient C.

Parameter	Value
FEVS / NT-proBNP	47% / slightly elevated
BP / pulse	118/72 mmHg / 82 bpm
6MWT	410 m
Left shoulder mobility	Moderate limitation
PHQ-9 / GAD-7	9 / 10
Complete blood count	Hemoglobin 11.8 g/dl; no neutropenia

Stratification: moderate risk (mild ventricular dysfunction under treatment, cancer-related fatigue). The principles of cardio-oncology apply [14].

Table 154 . Proposed treatment plan—Patient C. (indicative)

Item	Prescription
Coordination	Oncologist and cardio-oncologist; schedule adjusted to treatment cycles and complete blood count
Aerobic	Walking/cycling 15 → 35 min, RPE 11–13, with breaks as needed
Strength	Large muscle groups, 2 days/week, light loads; take care with the arm affected by lymphedema (gradual progression, compression sleeve if indicated)
Mobility	Shoulder and chest exercises; stretching; breathing
Monitoring	Blood pressure, pulse, symptoms of heart failure; FEVS at cardiology follow-up
Psychosocial	Psychological consultation; survivor support group; education on long-term cardiovascular risk

Progress at 12 weeks (fictitious): 6MWT 470 m, reduced fatigue, improved shoulder mobility, FEVS 55% at cardiology follow-up. The 2026 ESC Guidelines support cardio-oncological rehabilitation to improve physical function and quality of life.

11.4. Comparative Discussion and Key Points

Table 155 . ***Comparison of the three cases***

Aspect	**Patient A.**	**Patient B.**	**Patient C.**
Primary diagnosis	SCAD	HFpEF, obesity, diabetes	Cardiotoxicity, breast cancer
Age / hormonal stage	52, perimenopause	66, postmenopausal	48, cancer treatment
Risk	Moderate	Moderate-high	Moderate
Critical factor	Blood pressure limits during exercise, anxiety	Weight, blood glucose, iron deficiency	Oncology coordination, shoulder, fatigue
Psychosocial support	Group, psychologist	Caregiver, isolation	Anxiety, body image
Continuation model	Hybrid	Hybrid, group	Survivors' group

Key Points

- The same core program is tailored based on diagnosis, risk, hormonal stage, and context.
- "Unexplained" symptoms and anxiety in young women after SCAD are addressed with empathy and support.
- Iron deficiency and weight are monitored, not assumed.
- In cardio-oncology, coordination with the oncologist is mandatory.

12. CLINICAL ROTATION GUIDE

Objectives:

- understand the targeted competencies and how they are assessed;
- organize the portfolio and practice notebook;
- conduct self-assessment and reflect on one's own work.

12.1. Targeted Professional and Transversal Competencies

Table 156 . Competencies targeted during the practicum

Type	Competency	Evidence (indicator)
Professional	Performs a structured initial assessment of the patient, including obstetric and hormonal history	Complete assessment forms (at least 3)
Professional	Administers functional tests and psychosocial scales (PHQ-9, GAD-7)	Correct protocols, recorded values
Professional	Establishes SMART goals and an individualized, flexible plan	Written plan for each patient
Professional	Prescribes, performs, and adapts supervised exercises, including pelvic floor exercises	Session log, direct observation
Professional	Recognizes atypical symptoms and applies initial measures	Simulation, questionnaire, observation
Professional	Applies current guidelines (ESC 2026) and critically evaluates a recent study	Written commentary on a guideline and a study
Cross-Cutting	Communicates empathetically, uses teach-back, respects privacy	Assessment by the supervisor
Cross-Cutting	Work in a multidisciplinary team and contribute to a gender-sensitive environment	Feedback from the team; Appendix F
Cross-Cutting	Adheres to ethics, confidentiality, and GDPR, especially regarding reproductive data	Anonymization of documents

12.2. Portfolio and practice journal

- **Practice journal:** daily activities, techniques observed/practiced, questions, incidents;
- **Three complete** (anonymized) **patient records**: assessment, risk, goals, plan, re-evaluation;
- **One** in-depth **case study** (6–8 pages), with critical discussion and Vancouver citations;
- **List** of **tests performed** and exercises conducted;
- **Written reflection** (1–2 pages) on a challenging issue (communication, gender, ethics);
- Final **self-assessment** and personal development plan.

12.3. Criteria and Evaluation Form for Master's Students

Table 157 . Sample evaluation form (indicative weightings)

Criterion	Weight	Level (1–5)	Comments
Patient assessment (completeness, accuracy)	20%		
Prescription and program adaptation	20%		
Safety and monitoring	20%		
Communication, education, and gender sensitivity	15%		
Documentation, ethics, and confidentiality	10%		
Teamwork, professional attitude	10%		
Portfolio and Reflection	5%		

12.4. Self-Assessment and Reflection Topics

Reflection Topic

- What barriers did I observe among patients, and how did I respond to them?
- When did I feel that a patient was not believed or listened to? What would I do differently?
- What ethical or confidentiality issues did I encounter (reproductive health data, violence)?
- What skill do I want to develop over the next 6 months, and how?

Key Points

- Practice is the best way to learn, provided it is observed, discussed, and reflected upon.
- Your portfolio shows not only what you've done, but also what you've learned.
- Honest self-assessment is a sign of professionalism.

APPENDICES

Appendix A. Initial Patient Assessment Form

Sample form to be completed at the first visit (anonymized data).

Table 158 . Appendix A — Initial Patient Assessment Form

Section	Fields to be filled out
General Information	Patient ID: ____ Age: ____ Date of evaluation: ____ Referring physician: ____
Diagnosis and Event	Primary diagnosis: ____ Date of event/procedure: ____ Type (ACS / SCAD / INOCA-MINOCA / PCI / CABG / HF / valvular heart disease / FiA / hypertension / PAD / cardio-oncology / other): ____
Obstetric History	Pregnancies/births: ____ Preeclampsia / gestational diabetes / preterm birth: yes / no
Hormonal history	Menopause: no / yes (age ____, natural / surgical) Contraceptives / hormone therapy: ____ PCOS / endometriosis: ____
Comorbidities	Diabetes / thyroid disorders / autoimmune diseases / breast cancer / osteoarthritis / osteoporosis: ____
Medications	Complete list: ____ Allergies: ____
Current symptoms	Chest pain / shortness of breath / fatigue / palpitations / dizziness / swelling / urinary incontinence: ____
Parameters	Resting BP / orthostatic BP: ____ HR: ____ SpO2: ____ Weight / BMI / waist circumference: ____
Tests	ECG: ____ Echocardiogram / LVEF: ____ Hb: ____ Ferritin / TSAT: ____ LDL / HbA1c: ____ TSH: ____
Functional	6MWT: ____ m CPET / VO_2: ____ Grip strength: ____ kg SPPB: ____/12 TUG: ____ s
Psychosocial	PHQ-9: ____ GAD-7: ____ Caregiver for: ____ Support: ____ Domestic violence (screening): ____
Preferences and Barriers	“I wish I could…”: ____ Barriers (transportation, schedule, children, costs, fear): ____
Risk stratification	Low / Moderate / High Proposed delivery model: center / home / hybrid
Evaluator	Graduate student: ____ Advisor: ____ Signature: ____

Appendix B. Sample Individualized Recovery Program

Table 159 . Appendix B — Sample Individualized Remedial Program

Element	Content
Patient (code) / Date	____
Diagnosis and Risk	____
SMART Goals	1. ____ 2. ____ 3. ____
Frequency and Duration	___ sessions/week × ___ weeks; home activity ___ days/week
Aerobic	Type: ____ Duration: ____ Intensity (RPE / HR / VT1): ____
Strength	Exercises: ____ Sets × repetitions: ____ Load: ____
Balance / Pelvic Floor / Breathing	____
Precautions and Restrictions	BP/HR Limits: ____ Teratogenic Medication: ____ Shoulder/Arm: ____
Signs to Stop Exercise	Chest pain, disproportionate shortness of breath, dizziness, palpitations, pallor, cold sweat, unusual fatigue, pain in the jaw/shoulder/back
Contact in case of problems	Name / phone: ____
Follow-up visits	At 4–6 weeks: ____ At the end: ____

Appendix C. Scales and questionnaires used (Borg, PHQ-9, GAD-7, MNA-SF, EQ-5D)

Table 160 . Guideline thresholds – screening instruments

Instrument	Range / Threshold	Interpretation
Borg Scale (RPE)	6–20	Typical recovery target: 11–13 (ESC 2026 guidelines: “moderate” = 12–17) [1]
PHQ-9	0–27; ≥10	0–4 minimal, 5–9 mild, 10–14 moderate, 15–19 moderate-severe, 20–27 severe
GAD-7	0–21; ≥10	0–4 mild, 5–9 moderate, 10–14 severe, 15–21 very severe
MNA-SF	0–14	12–14 normal; 8–11 at risk; 0–7 malnutrition (useful for older women)
EQ-5D / SF-12	—	Overall quality of life; compared at baseline and follow-up
KCCQ / MLHFQ	—	Quality of life in heart failure; a 5-point difference = significant [1]
Grasp strength	kg	<16 kg = weakness in women
6MWT	m	MCID ≈ 30 m [1]

The complete questionnaires (PHQ-9, GAD-7, MNA-SF, EQ-5D) are used in their validated versions, with the official administration and scoring instructions. For the Borg scale, see Chapter 5, Section 5.7.

Appendix D. Sample Informed Consent Form

This is a sample template that should be adapted to the institution's forms and procedures.

I, the undersigned, _____, have been informed, in a manner I can understand, about the cardiovascular rehabilitation program: its purpose (improving exercise capacity, quality of life, and reducing the risk of events), its structure (assessments, supervised exercises, education), the possible benefits, the risks (rare but possible: fatigue, muscle pain, dizziness, arrhythmias, chest pain, falls), the alternatives, and the fact that I may ask any questions and may withdraw at any time without any consequences for my care.

I understand that my health data, including data regarding my reproductive health, will be processed confidentially in accordance with applicable law (including Regulation (EU) 2016/679), and that it may be used for educational or scientific purposes only in an anonymized form, with my consent.

I agree to participate in the program: YES □ NO □

I consent to the use of anonymized data for educational/scientific purposes: YES □ NO □

Date: _____ Signature of the patient / legal representative: _____ Signature of the physician / therapist: _____

Appendix E. Self-Assessment Questionnaire with Answer Key

Select the correct answer (one option only). The answer key is at the end.

1. Which of the following is a cardiovascular risk factor specific to women? **(a)** preeclampsia; **(b)** age 30; **(c)** height; **(d)** coffee consumption.
2. The 2026 ESC Guidelines recommend that the use of randomization in women (SCA, CCS, SCAD, HF) should be: **(a)** prohibited; **(b)** considered to increase enrollment and adherence; **(c)** mandatory for all; **(d)** limited to women under 40 years of age.
3. What is a common atypical symptom of a heart attack in women? **(a)** unusual fatigue, nausea, jaw/back pain; **(b)** fever; **(c)** dry cough; **(d)** headache.
4. Which of the following is a common barrier to adherence in women? **(a)** caregiving responsibilities; **(b)** too much free time; **(c)** excess resources; **(d)** lack of need for support.
5. For a patient with SCAD, exercise prescription: **(a)** is prescribed without limits; **(b)** has BP/HR limits established with the cardiologist and intensity introduced gradually; **(c)** requires intense isometric exercise; **(d)** is contraindicated in all cases.
6. Ferritin <100 µg/L in heart failure is: **(a)** normal; **(b)** the definition of iron deficiency in the ESC guidelines for heart failure; **(c)** an error; **(d)** irrelevant to exercise.
7. What is the usual threshold on the PHQ-9 scale that suggests moderate depression? **(a)** ≥3; **(b)** ≥10; **(c)** ≥25; **(d)** ≥0.
8. What do you do if a patient with HF gains 1.9 kg in two days? **(a)** continue exercise; **(b)** consider her at high risk and notify the physician; **(c)** increase the intensity; **(d)** do nothing.
9. Which heart failure medications should not be used during pregnancy? **(a)** ACE inhibitors/ARBs/ARNI, mineralocorticoid antagonists, ivabradine, SGLT2 inhibitors; **(b)** none; **(c)** only diuretics; **(d)** only aspirin.
10. Hormone replacement therapy in a woman with cardiovascular disease: **(a)** is decided by the graduate student; **(b)** is a nuanced decision made by the physician, depending on the timing of initiation and the risks; **(c)** is mandatory; **(d)** is prohibited for everyone.
11. After sternotomy, the "sternum pillow" is used: **(a)** when coughing and when getting up; **(b)** only when sleeping; **(c)** only when bathing; **(d)** not at all.
12. Pelvic floor exercises are useful for: **(a)** stress incontinence; **(b)** hypertension, exclusively; **(c)** diabetes, exclusively; **(d)** hypotension.

13. During resuscitation of a woman: **(a)** AED use is delayed out of modesty; **(b)** chest compressions and AED are administered without hesitation; **(c)** evidence of pain is awaited; **(d)** only relatives are called.
14. The 2026 ESC Guidelines recommend the following for setting aerobic intensity: **(a)** 220 – age; **(b)** ventilatory thresholds (VT1/VT2); **(c)** METs only; **(d)** the patient's subjective sensation only.
15. What is the primary goal of a gender-sensitive recovery environment? **(a)** to increase participation and adherence; **(b)** to reduce the number of sessions; **(c)** to eliminate assessment; **(d)** to replace the physician.

Key Points

Answer Key: 1-a; 2-b; 3-a; 4-a; 5-b; 6-b; 7-b; 8-b; 9-a; 10-b; 11-a; 12-a; 13-b; 14-b; 15-a.

Appendix F. Checklist for a Gender-Sensitive Environment

Table 161 . Appendix F — Checklist for a Gender-Sensitive Environment

Element	Yes / No / Partially	Improvement Action
Privacy during measurements and in the changing room		
Option for female staff upon request		
Flexible schedule, make-up sessions		
Support for childcare or caregiving		
Remote options (remote recovery, hybrid)		
Women-specific educational content (menopause, pregnancy, medication, sexuality)		
Psychosocial screening (PHQ-9, GAD-7) for all		
Support group or peer mentors from among patients		
Tracking referrals and attendance by gender		
Protocol for signs of domestic violence		

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CHAPTER 5. CARDIOVASCULAR RECOVERY IN PATIENTS WITH ARRHYTHMIA AND AN IMPLANTABLE DEVICE

Ana-Maria Pah

1. INTRODUCTION

1.1. Clinical Context

For healthcare professionals encountering cardiovascular rehabilitation for the first time, patients with arrhythmia and an implantable cardiac device represent a natural source of uncertainty: information about the device may seem technical and inaccessible, and the fear of triggering device therapy through an incorrect prescription is real and understandable. This chapter aims to transform this uncertainty into solid practical competence, structured around a simple principle—no prescription decision is made without precise knowledge of the device's parameters and without active communication with the electrophysiology team.

The number of patients entering a cardiovascular rehabilitation program who are simultaneously affected by significant arrhythmia and have an implantable cardiac device has risen steadily over the past decade, driven by the expansion of indications for cardiac pacing, implantable defibrillation, and resynchronization therapy, as well as the general aging of the cardiovascular population. This category of patients essentially combines two sets of characteristics that must be managed simultaneously: those related to the arrhythmia itself (risk of hemodynamic instability, impact on exercise tolerance) and those related to the implanted device (safety thresholds, specific precautions, psychological aspects) [1,2].

1.2. The Specific Role of Rehabilitation for This Type of Patient

Cardiovascular rehabilitation for patients with arrhythmia and an implantable device aims not only to improve overall functional capacity but also to achieve specific goals: reducing the arrhythmic burden whenever possible, increasing the patient's confidence in their own body and in the implanted device, reducing anxiety related to the possibility of therapy being triggered by the device, and safely integrating physical exercise into daily life without exceeding the programmed safety thresholds.

Objectives:

- to recognize the main types of arrhythmias and implantable cardiac devices encountered in the rehabilitation unit;
- obtaining and interpreting essential information about an implanted device that is relevant to exercise prescribing;
- developing a safe exercise prescription, adhering to the specific thresholds for each device and each arrhythmia;
- actively monitor the patient throughout the program and recognize specific warning signs;
- responding appropriately in the event of device-triggered therapy during an exercise session;
- providing appropriate therapeutic education, including regarding the psychological impact of the device.

1.4. The Scope of the Phenomenon—Epidemiological Highlights

The global number of electronic cardiac device implants is steadily increasing, driven by an aging population and the expansion of indications for pacing, defibrillation, and resynchronization. Atrial fibrillation, the most common sustained arrhythmia, affects a significant proportion of the elderly population, and its coexistence with coronary artery disease or heart failure—conditions that represent the main indications for cardiovascular rehabilitation—means that the patient "with arrhythmia and a device" is no longer an exception but a common sight in any rehabilitation unit.

2. CONCEPTS OF CARDIAC ELECTROPHYSIOLOGY RELEVANT TO REHABILITATION

2.1. The normal cardiac conduction system

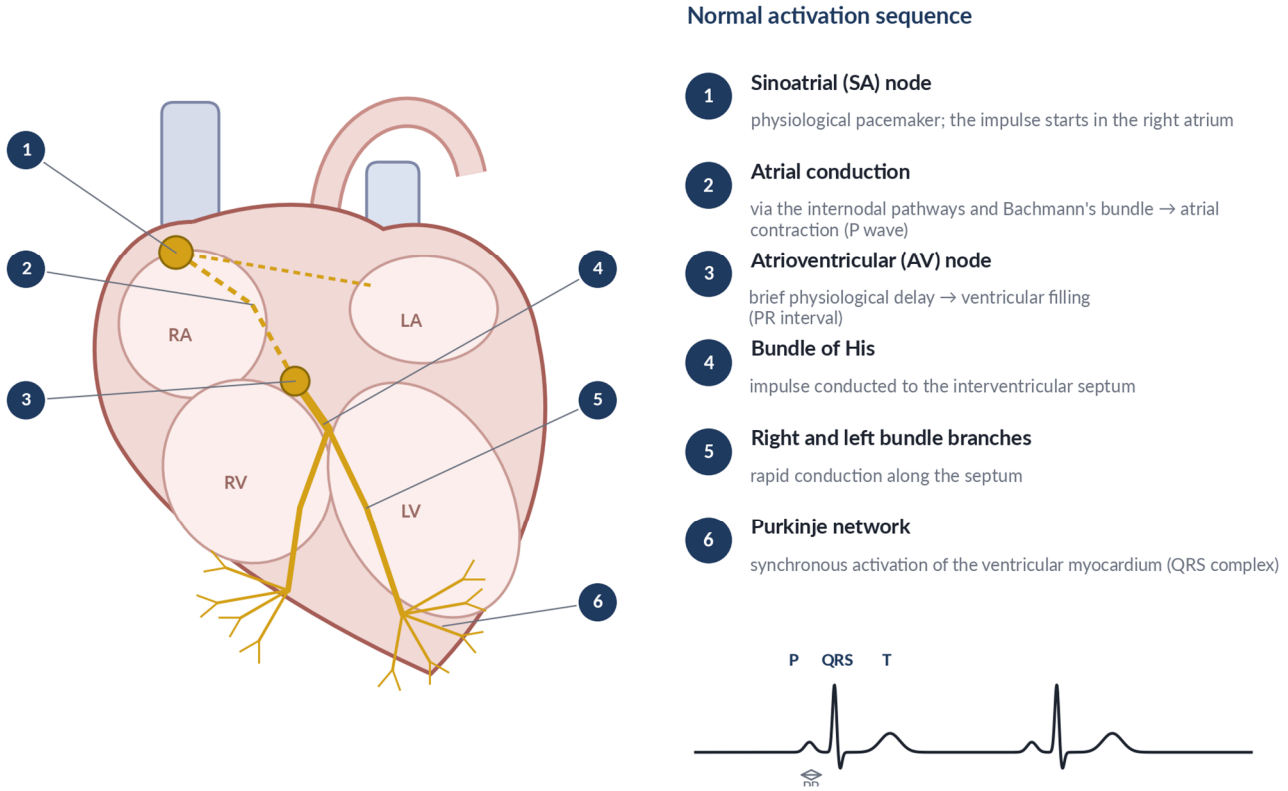


Figure 92 . The normal cardiac conduction system. It illustrates the path of the electrical impulse from the sinoatrial node, through the atrioventricular node, the His bundle, and the Purkinje network, to the ventricular myocardium, ensuring the coordinated contraction of the heart.

The heart's electrical activity originates in the sinoatrial node, located in the right atrium, which functions as a natural pacemaker, generating impulses at a rate that adapts to the body's metabolic needs. The impulse propagates through the atrial muscle, reaches the atrioventricular node, where it undergoes a physiological delay, and is then rapidly conducted through the His bundle and the Purkinje network to the ventricular myocardium, ensuring a coordinated and efficient contraction of the ventricles.

2.2. Mechanisms of Arrhythmias

Cardiac arrhythmias arise through three main electrophysiological mechanisms, an understanding of which helps predict their behavior during physical exertion:

- re-entry—an abnormal, closed electrical circuit that allows for the repetitive propagation of the impulse, underlying most sustained supraventricular and ventricular tachycardias;
- abnormal automaticity—the emergence of ectopic foci that generate impulses independently of the sinoatrial node, frequently influenced by sympathetic tone and thus potentially exacerbated by exertion;
- triggered activity — post-depolarizations that can generate extrasystoles or tachyarrhythmias, sometimes favored by certain metabolic or medication-related conditions.

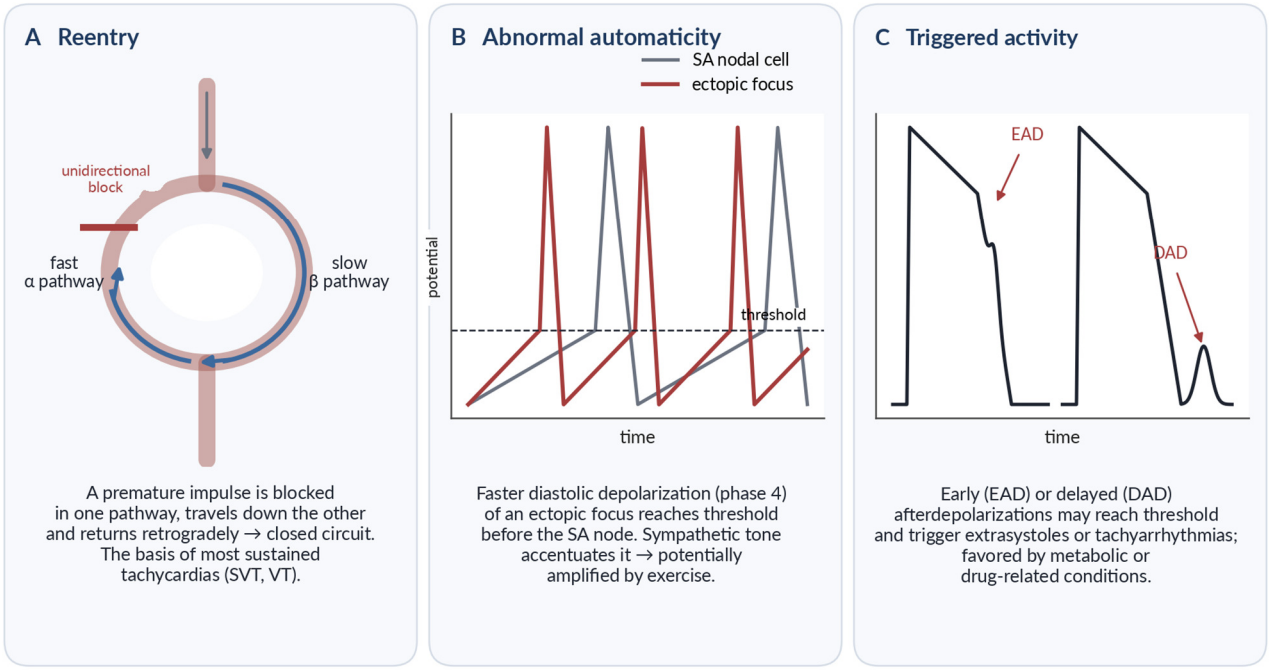


Figure 93 . The electrophysiological mechanisms of cardiac arrhythmias. This figure schematically illustrates the three main mechanisms underlying arrhythmias—reentry, abnormal automaticity, and triggered activity—whose understanding helps predict arrhythmia behavior during physical exertion.

2.3. Classification of Arrhythmias Relevant to Rehabilitation Practice

Table 162 . Classification of arrhythmias relevant to rehabilitation practice. This table summarizes the main categories of arrhythmias (supraventricular tachyarrhythmias, ventricular tachyarrhythmias, bradyarrhythmias, and extrasystoles), with examples and the relevance of each to physical exertion.

Category	Examples	Relevance to exercise
Supraventricular tachyarrhythmias	Atrial fibrillation, atrial flutter, paroxysmal supraventricular tachycardia	Often exacerbated by intense exercise or stress; impact on target heart rate
Ventricular tachyarrhythmias	Sustained/non-sustained ventricular tachycardia, ventricular fibrillation	Major risk; often an indication for an ICD; requires special caution during exercise
Bradyarrhythmias	Sinus node disease, high-degree atrioventricular block	Limited chronotropic response to exercise; often an indication for cardiac pacing
Extrasystoles	Atrial premature beats, ventricular premature beats	Usually benign; requires individualized assessment of clinical significance

2.4. The Effect of the Autonomic Nervous System on Arrhythmias During Exercise

Physical exertion activates the sympathetic nervous system and reduces vagal tone, changes that affect various types of arrhythmias differently: some arrhythmias, particularly those based on abnormal automaticity or triggered activity, tend to worsen with exercise, while others, which depend on increased vagal tone (common at rest or during sleep), may improve. This distinction explains why certain arrhythmias, which appear to be well-controlled at rest, become apparent or worsen during a exercise session, and vice versa.

2.5. Exercise Electrocardiogram—Key Points for Interpretation in Patients with Arrhythmias

In patients with a history of arrhythmias, the interpretation of the exercise electrocardiogram must go beyond simply looking for ischemic ST-segment changes, paying explicit attention to the onset or worsening of ectopic beats, the behavior of atrioventricular conduction during exercise, and the overall chronotropic response—elements that are often just as relevant to the decision to prescribe treatment as the classic signs of ischemia.

Practical note: In a patient with atrial fibrillation, the apparent "normalization" of the rhythm during exercise is not a sign of improvement but may simply reflect a ventricular rate so high that the irregularity becomes difficult to detect clinically—an additional reason not to rely exclusively on palpation of the pulse in this population.

3. THE MAIN TYPES OF ARRHYTHMIAS ENCOUNTERED IN THE RECOVERY UNIT

3.1. ATRIAL FIBRILLATION

Atrial fibrillation, the most common sustained arrhythmia encountered in clinical practice, is characterized by chaotic atrial electrical activity with an irregular ventricular response. In patients enrolled in a rehabilitation program, the key factors to assess are ventricular rate control (both at rest and during exercise) and anticoagulation status, which are relevant to thromboembolic risk and management in the event of a potential injury [3,4].

3.2. Atrial Flutter

Atrial flutter, generated by a well-defined reentry circuit in the atria, is often characterized by a regular ventricular response, with a rate proportional to the degree of atrioventricular conduction. Similar to atrial fibrillation, it requires attention to rate control and anticoagulation status, and many patients benefit from curative ablation, which can significantly alter the arrhythmic prognosis.

3.3. Ventricular Tachycardia

Ventricular tachycardia, particularly the sustained form, is a life-threatening arrhythmia frequently associated with structural heart disease (post-infarction, cardiomyopathies). Most patients with a history of sustained ventricular tachycardia have an ICD, and exercise prescriptions must strictly adhere to the heart rate threshold at which the device intervenes [5,6].

3.4. Bradyarrhythmias and Atrioventricular Blocks

Sinus node disease and high-degree atrioventricular blocks limit the heart's ability to adequately increase its rate during exercise (chronotropic failure) or may cause symptomatic episodes of severe bradycardia. Most of these patients have a pacemaker, and assessment of the chronotropic response—with or without the device's activity sensor—is essential for prescribing the correct exercise regimen.

3.5. Ventricular and Supraventricular Premature Beats

Extrasystoles, whether atrial or ventricular, are common and, in the absence of significant structural heart disease, are generally of limited clinical significance. However, in patients with structur e heart disease, frequent or complex ventricular premature beats (pairs, triplets) require further evaluation before initiating an intense exercise program to rule out a more significant arrhythmic risk.

Practical Note: The diagnosis of "arrhythmia" alone is insufficient for establishing a rehabilitation program: the exact type of arrhythmia, the clinical context (whether or not associated with structural heart disease), and the treatment administered (pharmacological, ablation, or device-based) radically alter the approach and must be explicitly clarified prior to the initial evaluation.

3.6. EHRA Symptomatic Classification of Atrial Fibrillation

The EHRA scale, widely used in clinical practice, classifies atrial fibrillation based on its symptomatic impact on the patient—information that is useful for predicting exercise tolerance and for tailoring the goals of the rehabilitation program.

Table 163 . EHRA Symptomatic Classification of Atrial Fibrillation. It presents the five EHRA classes used to assess the symptomatic impact of atrial fibrillation on the patient and to predict exercise tolerance.

EHRA Class	Description
1	No symptoms
2a	Mild symptoms; normal daily activities are not affected
2b	Moderate symptoms, but normal daily activities are not affected; the patient is bothered by the symptoms
3	Severe symptoms; normal daily activities are affected
4	Disabling symptoms; normal daily activities are disrupted

3.7. Thromboembolic Risk and the CHA2DS2-VA Score

In patients with atrial fibrillation or flutter, thromboembolic risk is estimated using the CHA2DS2-VA score (heart failure, hypertension, age, diabetes, history of stroke, vascular disease), which guides the decision to initiate oral anticoagulation. Knowing this score and the patient's anticoagulation status is important for the rehabilitation team, particularly regarding how to manage the risk of bleeding in the event of an injury during exercise.

4. IMPLANTABLE CARDIAC DEVICES—TYPES AND PRINCIPLES OF OPERATION

4.1. Pacemaker

A pacemaker is indicated for patients with significant, symptomatic bradyarrhythmias; it generates electrical impulses when the heart's intrinsic activity falls below a programmed minimum rate. Modern devices often feature an activity sensor, which allows the pacing rate to increase in proportion to the detected level of exertion—a function that must be verified and, if necessary, optimized before starting an exercise program [7].

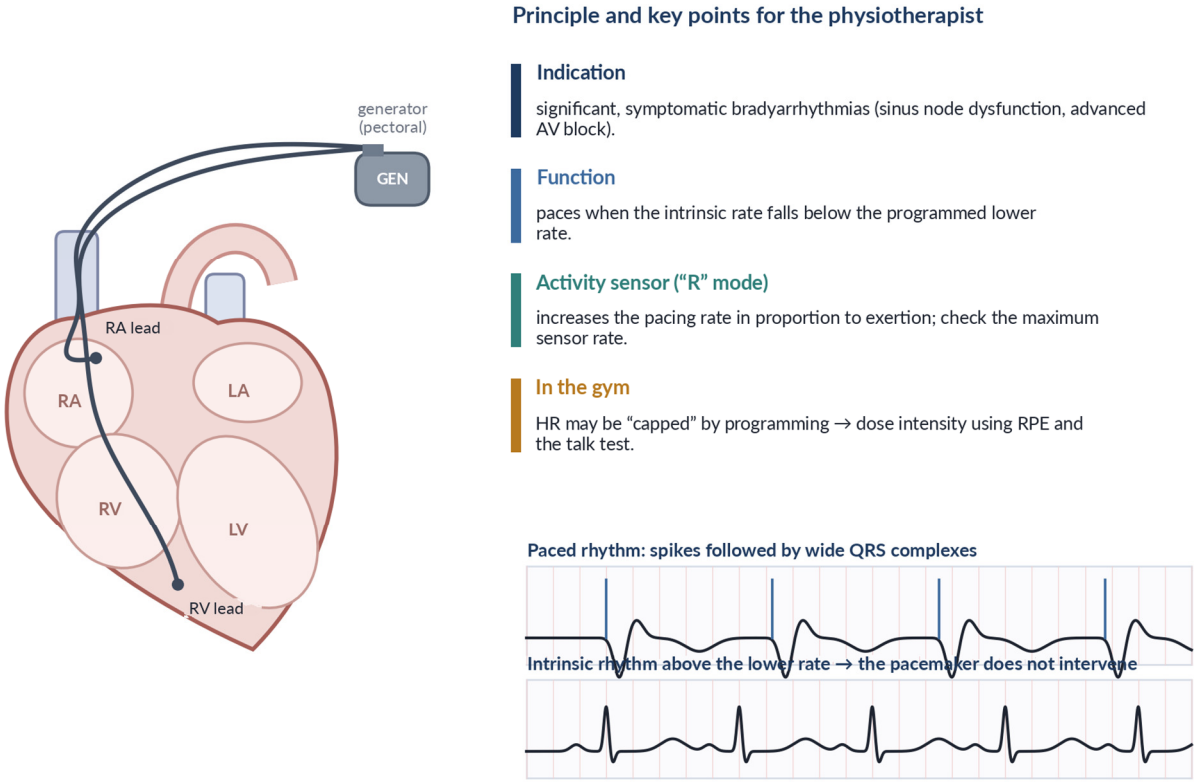


Figure 94 . The pacemaker. It illustrates the structure and operating principle of the pacemaker, which is indicated for patients with significant bradyarrhythmias and is capable of generating electrical pulses when the heart's intrinsic rate falls below the programmed threshold.

4.2. Implantable Cardioverter-Defibrillator (ICD)

An ICD is indicated for the primary or secondary prevention of sudden arrhythmic death in patients at significant risk of ventricular tachycardia or ventricular fibrillation. The device continuously monitors the heart rhythm and, when it detects a ventricular arrhythmia that exceeds the programmed rate threshold, delivers therapy—antitachycardia pacing, initially, or an electric shock, if that is unsuccessful or if the arrhythmia is immediately life-threatening.

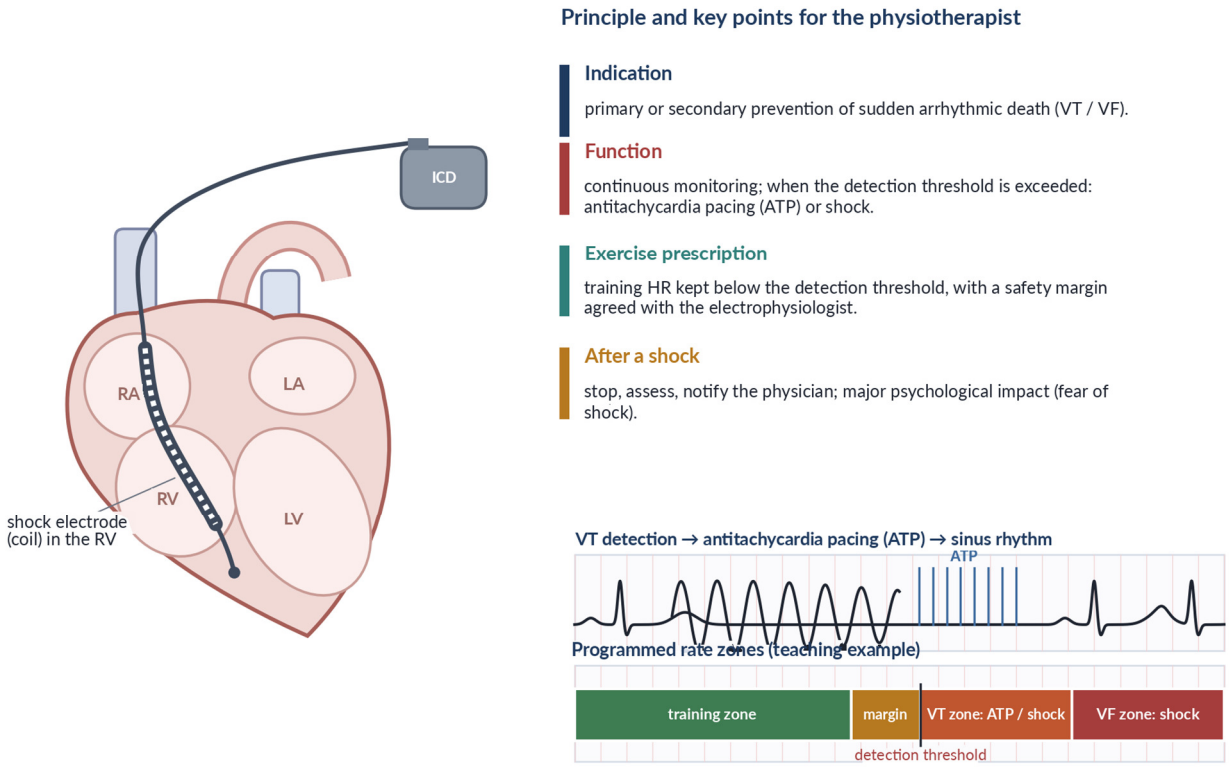


Figure 95 . The implantable cardioverter-defibrillator (ICD). This illustrates how the ICD works: it continuously monitors the heart rhythm and delivers therapy—antitachycardia pacing or an electric shock—when the tachycardia detection threshold is exceeded.

4.3. Cardiac Resynchronization Therapy (CRT/CRT-D)

CRT is indicated in patients with heart failure and significant left bundle branch block, aiming to resynchronize ventricular contraction through biventricular pacing. Many CRT devices are combined with a defibrillator function (CRT-D), thus addressing both resynchronization considerations and those related to the ventricular arrhythmia detection threshold in the same patient.

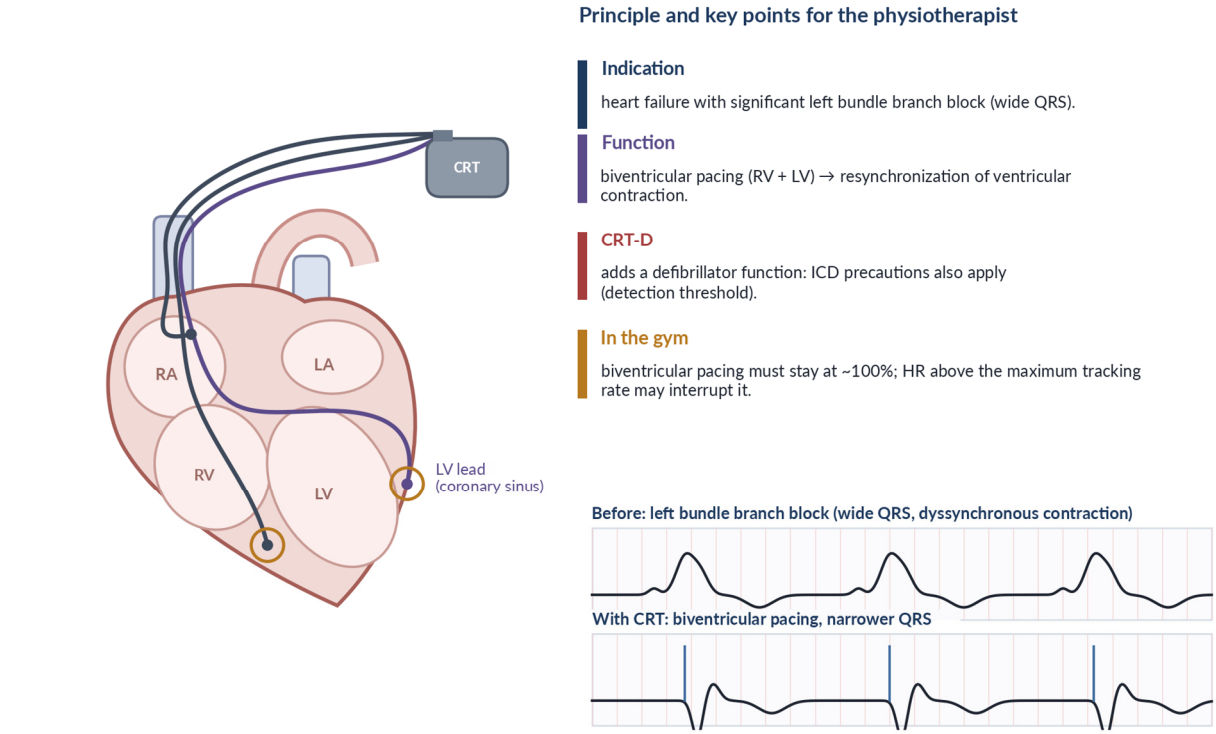


Figure 96 . Cardiac resynchronization therapy (CRT/CRT-D). Illustrates the principle of resynchronizing ventricular contraction through biventricular pacing, used in patients with heart failure and significant left bundle branch block.

4.4. Implantable cardiac monitor (loop recorder)

Unlike the other devices discussed, the implantable cardiac monitor does not deliver any therapy; its role is exclusively diagnostic—the continuous recording of the heart rhythm, which is particularly useful in investigating syncope or palpitations of unknown cause. The presence of this device does not impose any specific exercise restrictions.

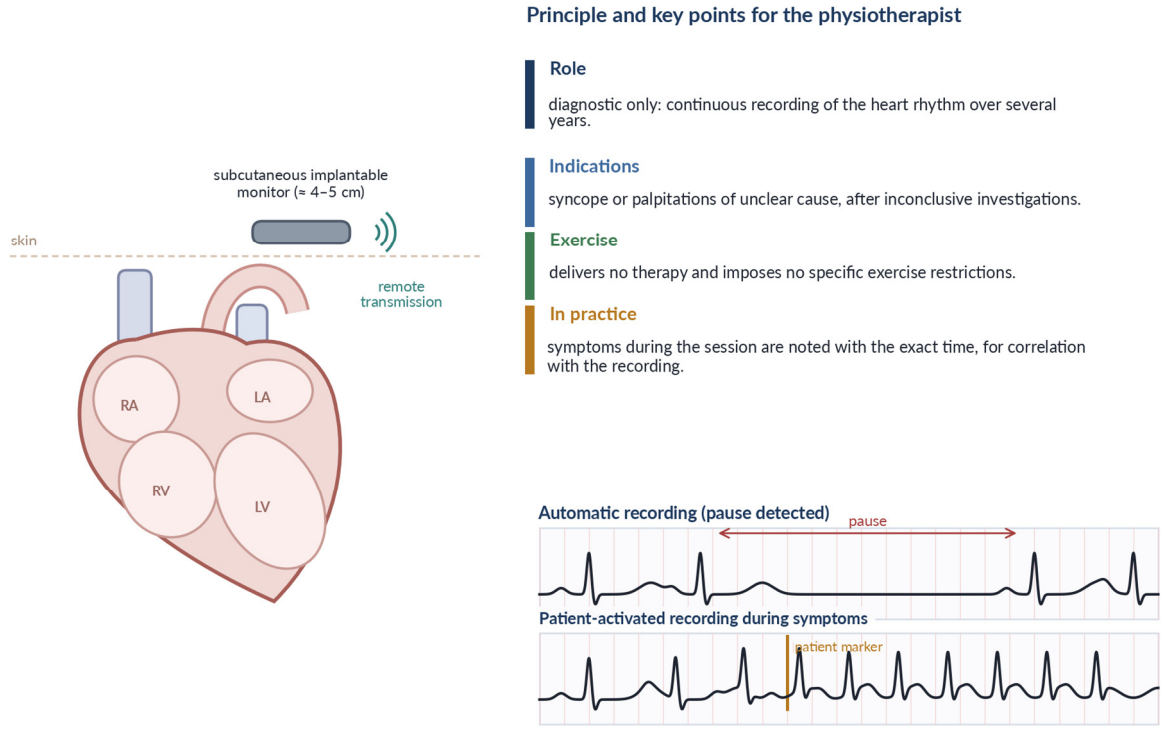


Figure 97 . Implantable cardiac monitor (loop recorder). This figure illustrates a device used exclusively for diagnostic purposes, particularly useful in investigating syncope or palpitations of unknown cause, which does not require specific exercise restrictions.

4.5. Programming Parameters Relevant to the Physical Therapist

Table 164 . Programming parameters relevant to physical therapists. Lists the essential parameters of the implantable cardiac device (minimum pacing rate, maximum sensor rate, tachycardia detection zone, number of detection intervals, type of programmed therapy) and their relevance to exercise prescription.

Parameter	Meaning	Relevance to Exercise Prescription
Minimum pacing rate	The heart rate below which the device takes over pacing (in a pacemaker/CRT)	Benchmark for expected resting heart rate
Maximum sensor rate	Maximum rate at which the activity sensor can increase pacing	Upper limit of device-induced chronotropic response
Tachycardia detection zone (ICD)	Heart rate above which the device recognizes a possible ventricular arrhythmia	Absolute upper limit for training heart rate
Number of detection intervals	Number of rapid beats required to confirm an arrhythmia	Affects the time until therapy is triggered
Type of programmed therapy	Antitachycardia pacing and/or shock	Relevant for anticipating symptoms experienced by the patient

Practical note: All these parameters must be obtained directly from the electrophysiologist or from the device interrogation report; they should never be assumed based on the general type of device, as programming is always individualized

4.6. Pacing Modes – Guideline

The international pacing code (consisting of 3–5 letters) describes the paced chamber, the sensed chamber, and the device's response mode—information useful for anticipating the device's behavior during exercise.

Table 165 . Cardiac Pacing Modes. Describes the main pacing modes (VVI, DDD, VVIR/DDDR), the meaning of the code, and the implications for the chronotropic response to exercise.

Mode	Meaning	Relevance to exercise
VVI	Ventricular pacing and sensing, inhibition upon detection of an intrinsic impulse	No atrioventricular synchronization; limited chronotropic response without a sensor
DDD	Pacing and sensing in both chambers, with dual response	Maintains atrioventricular synchronization; chronotropic response dependent on intrinsic atrial activity or sensor input
VVIR / DDDR	As above, with an activity sensor (rate-responsive)	The pacing rate increases proportionally to the exertion detected by the sensor

4.7. Local complications of implantation, relevant to the physical therapist

- hematoma at the device implantation site—usually requires postponing intense mobilization of the ipsilateral arm;
- Pocket infection — a warning sign (redness, localized warmth, fever) requiring prompt medical evaluation, not merely cautious continuation of the program;
- electrode displacement (dislocation)—may result in loss of signal acquisition or accurate detection, sometimes indicated by a sudden change in the device's behavior during exercise.

Practical note: Any local sign suggestive of a device pocket complication, observed by the physical therapist during a session, must be reported immediately to the medical team, even if the patient does not consider it significant. Each type of implantable cardiac device—pacemaker, ICD, CRT/CRT-D, or implantable monitor—has a specific purpose and specific programming parameters; precise knowledge of these, obtained directly from the electrophysiology team, is an essential prerequisite for safely establishing a rehabilitation program.

5. INITIAL EVALUATION OF PATIENTS WITH ARRHYTHMIA AND A DEVICE

5.1. SPECIFIC MEDICAL HISTORY

The medical history must clarify the exact type of arrhythmia, the context in which it occurred, the date of device implantation and the indication for it, any previously triggered therapies (antitachycardia pacing or shock) and the circumstances surrounding them, as well as the psychological impact experienced by the patient following such events.

5.2. Obtaining Device Information from the Electrophysiologist

Before prescribing any exercise regimen, the rehabilitation team must obtain—through direct communication with the electrophysiologist or via the report from the device's most recent interrogation—all the parameters discussed in Section 4.5, as well as information about any recent arrhythmias recorded by the device, even if they did not require therapy.

5.3. Exercise Testing in Patients with Implantable Devices

Exercise testing—whether standard or cardiopulmonary—remains the test of choice for assessing functional capacity and chronotropic response in this patient population, with one essential precaution: the maximum intensity of the test must be stopped with a safety margin below the tachycardia detection threshold in patients with an ICD, a margin agreed upon in advance with the electrophysiologist.

5.4. Echocardiographic Evaluation

In patients with CRT, a follow-up echocardiogram performed 3–6 months after implantation allows for the assessment of the response to resynchronization (improvement in ejection fraction and ventricular volumes), information that is relevant for establishing realistic goals for the rehabilitation program.

5.5. Risk Stratification

Risk stratification in this population must incorporate both classic factors (ejection fraction, functional capacity, comorbidities) and specific factors—the type of arrhythmia, its stability under treatment, the type of therapies previously triggered by the device, and the time elapsed since the last such event.

Practical note: An incomplete initial assessment that omits device-specific parameters is the most common cause of unsafe exercise prescribing in this patient population; this step should never be skipped due to time constraints.

For patients for whom maximal exercise testing is not immediately available or is considered premature (e.g., in the first few weeks after implantation), the 6-minute walk test offers a useful submaximal alternative for establishing an initial functional baseline, although it cannot fully substitute for the information regarding the cardiac safety threshold provided by formal testing.

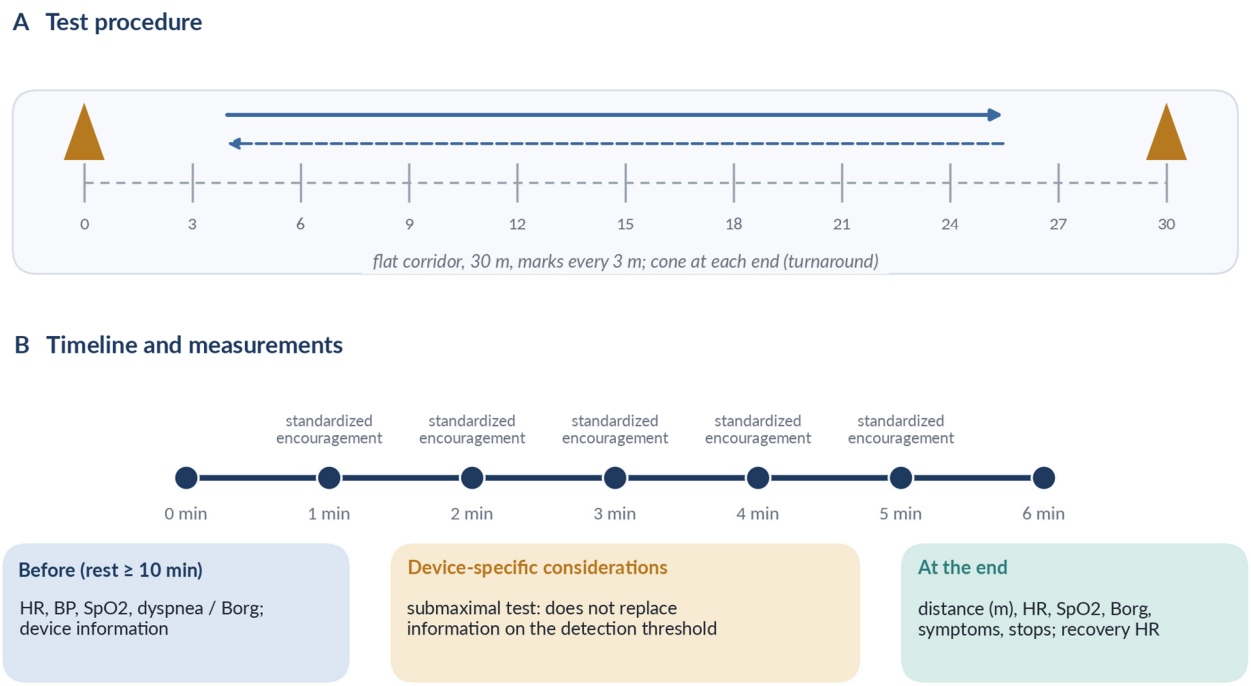


Figure 98 . The 6-minute walk test. Schematically illustrates the procedure for the 6-minute walk test, a submaximal alternative for functional assessment when maximal exercise testing is not available or is considered premature.

5.7. Summary of Minimum Information Required Prior to Program Enrollment

Practical note: The absence of any of this information should delay the initiation of the supervised exercise program, not merely result in a “conservative” prescription based on assumptions.

Table 166. Summary of the minimum information required prior to program enrollment. It lists the mandatory categories of information—type and date of implantation, programming parameters, treatment history, anticoagulation status, and exercise test results—and the sources from which they must be obtained.

Information Category	Source
Device Implantation Type and Date	Medical record / discharge summary
Current programming parameters	Latest interrogation report / electrophysiology report
Device therapy history	Electrophysiology / interrogation report
Anticoagulation status (if applicable)	Medical history, current treatment
Recent stress test results	Cardiologist / Exercise testing lab

6. SPECIFIC CONTRAINDICATIONS AND PRECAUTIONS

6.1. Absolute and relative contraindications for exercise

Table 167. Absolute and relative contraindications for exercise. Compare the conditions that absolutely and relatively contraindicate participation in an exercise program for patients with arrhythmia and an implantable device.

Absolute Contraindications	Relative contraindications
Unstable, uncontrolled ventricular arrhythmia	Frequent ventricular extrasystoles of uncertain significance
ICD (shock) therapy within the last 24–48 hours, without reevaluation	Atrial fibrillation with controlled incomplete ventricular response
Recent syncope of unknown cause	Recent device programming, not confirmed by testing
Active hemodynamic instability	Marked, untreated anxiety related to the device

6.2. Precautions Related to Device Type

- ICD/CRT-D: Maintain the training heart rate below the detection threshold, with a safety margin;
- any recently implanted device: avoid extensive movements of the arm on the same side as the implant site for 4–6 weeks;
- pacemaker with an activity sensor: verify that the sensor-induced chronotropic response is appropriate for the prescribed type of exercise.

6.3. Precautions Related to the Type of Arrhythmia

- atrial fibrillation/flutter: verify that heart rate is controlled during exercise, not just at rest;
- history of ventricular tachycardia: avoid very high-intensity training, even just below the detection threshold, in patients with a residual risk considered high by the medical team;
- Bradyarrhythmias: Watch for symptoms of low cardiac output at the onset of exercise, before an adequate increase in heart rate occurs.

6.4. Temporary Restrictions During the Post-Implantation Period

During the first 4–6 weeks following the implantation of any type of device, it is recommended to avoid raising the ipsilateral arm above shoulder level and lifting weights with that arm to prevent electrode displacement or local complications at the device site.

6.5. Relevant Drug Interactions

Antiarrhythmic medications (e.g., amiodarone, sotalol) and those used to control heart rate (beta-blockers, non-dihydropyridine calcium channel blockers) directly influence the chronotropic response to exercise, which is why the target heart rate must be recalculated or reinterpreted each time the background therapy is modified; it should not be considered fixed for the entire duration of the program.

Summary: Contraindications and precautions for patients with arrhythmia and an implantable device fall into three categories that must be evaluated simultaneously: those related to arrhythmia stability, those related to the device itself, and those related to concomitant pharmacological treatment; furthermore, the post-implantation period requires additional temporary mechanical precautions, regardless of the type of device.

7. PRESCRIPTION OF PHYSICAL EXERCISE

7.1. FITT PRINCIPLES ADAPTED TO THIS POPULATION

The FITT principles (Frequency, Intensity, Time, Type) remain the general framework for exercise prescription, but for this population, intensity must always be determined by explicitly referring to the device-specific safety thresholds, not just to the classic formulas based on theoretical maximum heart rate.

7.2. Determining Safe Intensity—Below the Device's Detection Threshold

In patients with an ICD, the training heart rate should be set with a safety margin below the device's tachycardia detection threshold—as a guideline, 20–30 beats per minute below this threshold, with the exact margin agreed upon with the electrophysiologist, taking into account heart rate variability during exercise and the risk of a false detection triggered by intense but physiologically normal exercise [8].

7.3. Recommended Types of Exercise

- continuous, moderate-intensity aerobic training—the standard, low-risk form;
- light-to-moderate-intensity resistance training, avoiding heavy loads on the arm ipsilateral to the device, especially during the first few months;
- high-intensity interval training—reserved, with caution, for stable, low-risk patients, and with a generous safety margin relative to the detection threshold.

7.4. Specifics by Device Type

Table 168 . Specifics by device type. This table summarizes the specific exercise prescription guidelines based on the type of implanted device—simple pacemaker, ICD, CRT/CRT-D.

Device	Prescription Consideration
Simple pacemaker	Verify the adequacy of the chronotropic response; adjust sensor programming, if necessary
ICD	Training rate strictly below the detection threshold, with an agreed-upon margin
CRT/CRT-D	Combining ICD precautions (if applicable) with prescribing principles for heart failure

7.5. Specific Considerations by Arrhythmia Type

In patients with atrial fibrillation, the prescription must explicitly verify that the ventricular rate remains controlled throughout the proposed intensity range, not just at a single measurement; in patients with a history of ventricular tachycardia, even just below the ICD detection threshold, a slower progression of intensity is prudent compared to patients without this history.

Practical note: The Borg Scale for subjective perception of exertion is a particularly useful complementary tool in this population, especially when the heart rate is simultaneously influenced by beta-blocker therapy and device behavior, making the isolated interpretation of heart rate unreliable.

7.6. Illustrative Example of Calculating the Target Heart Rate in a Patient with an ICD

Practical note: This example is strictly for educational purposes; the actual safety margin must always be determined on an individual basis, taking into account each patient's heart rate variability and the explicit recommendation of the treating electrophysiologist.

Table 169 . Illustrative example of calculating the target heart rate for a patient with an ICD. This example, provided strictly for educational purposes, illustrates how to calculate the training heart rate based on the tachycardia detection threshold and the safety margin agreed upon with the electrophysiologist.

Parameter	**Example Value**
Programmed tachycardia detection threshold	180 bpm
Safety margin agreed upon with the electrophysiologist	25 bpm
Maximum permissible heart rate during training	155 bpm
Recommended target heart rate (moderate zone)	120–140 bpm

7.7. Intensity progression during Phase II

Intensity progression should be more conservative in this population than in patients without an implantable device or significant arrhythmia, with small, systematic increases relative to the established safety margin, rather than a standardized progression that is identical for all patients in the program.

Summary: Exercise prescribing for patients with arrhythmia and an implantable device follows the general FITT principles but requires, as a central element, the establishment of a training heart rate with an explicit safety margin below the device's detection threshold, individualized for each patient in collaboration with the electrophysiologist.

8. STRUCTURING THE PROGRAM INTO PHASES

8.1. Phase I – the post-implantation period

In Phase I, the primary objective is early mobilization, while observing the mechanical precautions related to the device's housing, as discussed in Chapter 6.4, and carefully monitoring for any residual arrhythmias or local complications from the implantation.

8.2. Phase II – Supervised Program

Phase II applies the prescribing principles discussed in Chapter 7, with a gradual progression in intensity, under continuous supervision during the first sessions, which is gradually expanded as the patient's stability under the proposed exercise load is confirmed.

8.3. Phase III – Long-Term Maintenance

In Phase III, the patient must have sufficiently mastered the principles of self-regulation of intensity (using the Borg scale and knowledge of their own device-related limits) to safely continue exercising, with periodic reassessments of the device and arrhythmic status, coordinated with the electrophysiologist.

8.4. Guideline Criteria for Transition Between Phases

Summary: The phased structure of the rehabilitation program for this population follows the general framework of cardiovascular rehabilitation, but each phase explicitly incorporates specific objectives related to device safety and the patient's arrhythmic stability, with the transition between phases guided by explicit clinical criteria.

Table170 . Guideline criteria for transitioning between phases. This table presents the clinical criteria that guide the patient's transition from Phase I to Phase II and from Phase II to Phase III, as well as the situations that require returning to a previous phase.

Transition	Guidance Criteria
Phase I → Phase II	Absence of local pocket complications, arrhythmia stability, confirmation of programming parameters
Phase II → Phase III	Completion of the planned progression, absence of device-triggered therapies, demonstrated ability to self-regulate intensity using the Borg scale
Resumption of a previous phase	Device-triggered therapy, newly developed or worsening arrhythmia, local implant site complication

9. PATIENT MONITORING THROUGHOUT THE PROGRAM

9.1. Clinical parameters to monitor

- heart rate, systematically compared to the established safety threshold;
- pulse regularity, especially in patients with atrial fibrillation/flutter;
- Borg scale score for subjective perception of exertion;
- symptoms suggestive of arrhythmia (palpitations, dizziness) or device therapy (shock-like sensation).

9.2. Device-Specific Monitoring

Many modern devices allow for remote monitoring (telemonitoring), automatically transmitting information to the electrophysiology team regarding any detected arrhythmias or delivered therapies; when available, this information should be actively correlated with the progress of the recovery program, not treated separately [9,10].

9.3. Warning Signs and Recommended Course of Action

Table171 . Warning signs and recommended actions. Lists the main warning signs that may occur during exercise, along with the recommended immediate action for each.

Warning sign	Action
Heart rate approaching the detection threshold	Immediately reduce intensity; record the episode
Feeling of intense or irregular heart palpitations	Stop exercising; assess heart rhythm if possible
A sensation described as a “shock” felt in the chest	Immediately stop the activity; seek prompt medical evaluation
Dizziness or presyncope at the onset of exertion	Suspected inappropriate chronotropic response; evaluate device programming

9.4. Periodic device interrogation, correlated with the progress of the program

It is recommended that periodic device interrogation (whether routine or at the conclusion of certain stages of the rehabilitation program) be timed to coincide with the patient’s functional reassessments, allowing for an integrated interpretation of any arrhythmic episodes recorded by the device in relation to periods of exercise.

Practical note: Any discrepancy between the patient’s reported sensations and the device’s objective data should be explicitly discussed with the electrophysiology team, rather than downplayed or interpreted unilaterally by the rehabilitation team.

9.5. Guideline for Escalation Protocol

Table 172 . Guideline for escalation. Classifies clinical situations by severity level—mild, moderate, severe—with examples and the appropriate course of action for each level.

Severity Level	Example Situation	Course of Action
Mild	Heart rate close to the safety margin, with no symptoms	Reduce intensity, record the episode, continue monitoring
Moderate	Sustained palpitations, without device-triggered therapy	Interrupt the session, perform a clinical evaluation, and contact the electrophysiologist if the episode recurs
Severe	Device-triggered therapy (antitachycardia pacing or shock)	Emergency protocol (Chapter 10), prompt medical evaluation

10. MANAGEMENT OF EMERGENCY SITUATIONS

10.1. ICD-triggered therapy during exercise—management

1. Immediately stop exercise at the first sign or upon the patient's report of a shock-like sensation;
2. Seat the patient in a safe position, assess their level of consciousness and vital signs;
3. Immediately notify the on-call physician of the department;
4. Carefully monitor for any repeated shocks (electrical storm), which constitute a major medical emergency;
5. Promptly refer the patient for medical evaluation, even if the patient's general condition appears to return to normal after treatment.

10.2. Specific Emergency Protocol

In addition to the department's general emergency protocol, centers treating patients with ICDs must have a clear procedure for the specific situation of repeated therapies triggered by a device-e (electrical storm), which requires emergency transport to a facility capable of immediate electrophysiological intervention.

10.3. Communication with the Electrophysiology Team

Any device-triggered therapy during a rehabilitation session must be promptly reported to the electrophysiology team, both for the patient's clinical evaluation and for verification and possible reprogramming of the device, if the therapy was found to have been inappropriately triggered by intense physiological exertion.

Summary: The management of device-triggered therapy during exercise must follow a clear protocol, known in advance by the entire team, with prompt communication to the electrophysiologist, as both repeated therapy and inappropriate therapy (triggered by normal physiological exertion) are situations that require rapid intervention.

11. PATIENT EDUCATION

11.1. ESSENTIAL INFORMATION ABOUT THE DEVICE

The patient should know the type of device they are wearing, the reason for its implantation, and—in layman's terms—the general principle of how it works; this information helps reduce anxiety and increase adherence to exercise recommendations.

11.2. Recognizing Warning Signs

Education must explicitly cover the correct course of action in the event of a perceived therapy event (remaining calm, moving to a safe place, notifying a close friend or family member or medical services, depending on the context), as well as the difference between a normal sensation of intense exertion and a genuine warning sign.

11.3. Activities to Avoid or Precautions to Take

- prolonged exposure to strong electromagnetic fields (certain industrial machinery, high-power anti-theft systems);
- contact sports, which carry a risk of direct trauma to the device's housing;
- driving a motor vehicle, which is subject to specific temporary restrictions that vary depending on the type of device and local regulations, especially following recent ICD therapy;
- medical procedures that may interfere with the device (certain types of MRI, electrocautery), which require special precautions to be communicated in advance to the medical team involved.

Practical Note: Information regarding electromagnetic interference should be presented in a balanced manner, without causing exaggerated or unjustified fear of ordinary daily activities (cell phones, standard household appliances), which, in the vast majority of cases, do not pose a real risk to modern devices.

11.4. Guidelines Regarding Driving

Restrictions on driving vary significantly depending on the type of device, the indication for implantation (primary versus secondary prevention), and whether recent therapy has been administered, as well as specific national regulations, which is why the rehabilitation team should refer the patient to the electrophysiologist for an explicit recommendation, rather than providing a definitive answer on this sensitive topic themselves.

11.5. Written Educational Materials

Providing simple, written material that summarizes the type of device the patient has, warning signs, and the contact person in case of questions complements the verbal discussion and remains available to the patient and their family after discharge or upon completion of the supervised phase of the program.

11.6. Summary of Key Messages to Convey to the Patient

Table 173 . Summary of key messages to convey to the patient. This summarizes the essential therapeutic education messages regarding the device's role, the benefits of exercise, and how to proceed in the event of potential therapy.

Topic	Key Message
Role of the device	The device is a safety measure, not a limitation on an active lifestyle
Physical exercise	Properly prescribed exercise is beneficial, not dangerous, for your heart
Possible therapy	If therapy is required for the device, it is a sign that it is working properly, not a failure
Daily Activities	Most common electronic devices do not pose a real risk
Who to Contact	The name and contact information of the medical team should be known from day one

12. SPECIFIC PSYCHOLOGICAL ASPECTS

12.1. Device-Related Anxiety (Fear of Shock)

The fear of experiencing a device-delivered therapy, particularly an electric shock, is common among ICD patients and can lead to avoidance of physical activity, even in the absence of any actual contraindications—a phenomenon documented in the literature that requires an active approach, not merely passive information [11].

12.2. The Psychological Impact of ICD Deliveries

Patients who have actually experienced one or more device shocks frequently exhibit increased anxiety and, in some cases, symptoms suggestive of post-traumatic stress; these issues must be actively explored during the psychosocial evaluation and should not be assumed to be absent simply because the patient does not mention them spontaneously [12].

12.3. Supportive Interventions

- realistic, balanced information about the device's protective role;
- gradual, supervised exposure to increasing levels of exertion to rebuild confidence;
- involvement of a clinical psychologist for patients with significant anxiety or suspected post-traumatic stress;
- support groups consisting of other patients with similar devices, when available.

12.4. The Role of the Partner/Family in the Process of Rebuilding Confidence

Anxiety related to the device affects not only the patient but often also family members, who may, in turn, become overly protective, inadvertently discouraging a return to physical activity. Involving a family member in educational discussions and, when possible, in the initial exercise sessions, can contribute to a faster and more solid rebuilding of trust on both sides.

12.5. Signs Indicating the Need for a Specialized Psychological Evaluation

- persistent avoidance of any form of physical activity, beyond medical recommendations;
- nightmares or intrusive memories related to device therapy;
- marked hypervigilance regarding one's own heart sensations, with repeated, excessive checking of the pulse;
- associated depressive symptoms that impact daily functioning.

Summary: The psychological impact of an implantable cardiac device, particularly an ICD, is a real and frequently underestimated component of recovery in this population, requiring an active, structured approach—including family involvement and recognition of signs that go beyond normal anxiety—rather than just standard medical information.

13. PRACTICAL ORGANIZATION OF THE CLINICAL ROTATION

13.1. The role of the student intern

The student on clinical rotation participates, under direct supervision, in the initial assessment, exercise sessions, and the completion of documentation specific to this patient population, with an emphasis on systematically verifying device information prior to any session.

13.2. Workflow for This Type of Patient

The workflow must include, as a mandatory and explicit step, verifying that the patient's record contains complete information about the device (type, programming parameters, date of the last interrogation) before initiating any exercise session, not just during the initial assessment.

13.3. Interdisciplinary Collaboration

Managing this category of patients requires close collaboration between the cardiologist, electrophysiologist, physical therapist, and, when relevant, clinical psychologist; direct and documented communication among these specialties is more important than for most other categories of patients in cardiovascular rehabilitation.

Practical Note: The student intern must know exactly whom to contact (name, contact information) to obtain additional information about the device when the available documentation is incomplete, rather than beginning the exercise based on assumptions.

13.4. Suggested Workflow Model for a Newly Enrolled Patient

Table 174 . Indicative workflow model for a newly enrolled patient. Describes the successive stages of integrating a new patient into the program, the primary person responsible for each stage, and the items that must be verified.

Step	Primary Responsible Party	Items to Verify
Receive medical records and referral	Cardiologist / Referring Physician	Complete diagnosis, device type specified, and explicit
Request for device information	Coordinating physical therapist / student	Programming parameters, therapy history
Initial assessment	Rehabilitation team	As per the form in Chapter 14.1
First supervised session	Physical therapist + student	Practical confirmation of the safety margin established theoretically
Reassessment at the end of Phase II	Multidisciplinary team	Decision to transition to Phase III, according to the criteria in Chapter 8.4

14. WORKSHEETS AND STANDARD DOCUMENTS

14.1. Initial Assessment Form

Table 175 . Initial Assessment Form. This table presents the standard structure of the initial assessment form, including the sections and fields to be completed for each patient.

Section	Items to Be Completed
Arrhythmia diagnosis	Type of arrhythmia, context of onset, associated pharmacological treatment
Device	Type, date of implantation, indication, programming parameters (detection threshold, minimum/maximum rate)
Treatment history	Previous device therapies (type, date, context), reported psychological impact
Anticoagulation status	Present/absent, type of anticoagulant, relevant to AF/flutter
Exercise testing	Result, maximum heart rate reached, margin relative to the detection threshold
Psychological status	Reported anxiety level, particularly related to the device
Individual goals	Functional goals discussed and agreed upon with the patient

14.2. Session Monitoring Form

In addition to standard parameters (heart rate, blood pressure, Borg scale score), the monitoring form must include a column explicitly dedicated to verifying the margin relative to the device's detection threshold at the peak of exertion during each session.

14.3. Protocol for Communicating with the Electrophysiologist

It is recommended to have a standardized, written format for requesting device information from the electrophysiology team, which systematically covers all relevant parameters discussed in this manual, thereby reducing the risk of incomplete or omitted information.

14.4. Report Form for an Arrhythmic Event or Device Therapy

Practical Note: Prompt and complete completion of this form immediately following any event provides the electrophysiology team with information that is far more useful for interpretation than a subsequent verbal account based on an approximate recollection of the event

Table 176 . Report Form for an Arrhythmic Event or Device-Triggered Therapy. Lists the fields that must be completed promptly after any arrhythmic event or device-triggered therapy to ensure accurate interpretation by the electrophysiology team.

Field	Details to be filled in
Date and time of the event	___
Activity at the time of the event	Type of exercise, estimated intensity
Symptoms reported by the patient	___
Recorded objective parameters (if available)	Heart rate, rhythm
Type of device therapy (if applicable)	Antitachycardia pacing / shock / no therapy
Immediate action taken	___
Person/team notified and time of notification	___

15. APPLIED CASE STUDIES

Case 1

A 58-year-old patient with a history of sustained ventricular tachycardia following a myocardial infarction, who received an ICD implant 5 weeks ago, programmed with a detection threshold of 180 bpm. The patient has been referred to a Phase II rehabilitation program and has not yet experienced any device-triggered therapies.

Requirements for the Master's student

1. Determine the target heart rate for aerobic training, with an appropriate safety margin.
2. Specify the mechanical precautions still in effect, given the date of implantation.
3. List the signs that the team must actively monitor during the sessions.

Case 2

A 71-year-old female patient with permanent atrial fibrillation, who has a pacemaker for sinus node disease with a programmed activity sensor. She reports marked fatigue at the onset of any exertion, even mild exertion, although a recent exercise test did not reveal ischemia.

Requirements for the master's student

1. Formulate a hypothesis regarding the possible cause of the reported fatigue, related to the device's functioning.
2. Specify to whom this suspicion should be referred for further evaluation.
3. Propose a provisional approach to exercise intensity until the situation is clarified. **Practical Note**: The second case illustrates a common situation: functional limitation in a patient with an implantable device may actually be caused by the device's programming (inappropriate chronotropic response of the sensor), an aspect that must be actively considered, rather than simply attributed to the patient's general "deconditioning."

Case 3

A 45-year-old female patient with paroxysmal atrial fibrillation, no structural heart disease, treated with an antiarrhythmic drug and an oral anticoagulant, with no implanted device (periodic Holter monitoring). She requests enrollment in an exercise program to improve her overall physical condition, expressing anxiety about the possibility of triggering an episode of atrial fibrillation during exercise.

Requirements for Master's Students

1. Discuss whether the absence of an implanted device fundamentally changes the approach, compared to the first two cases.
2. Propose a strategy for addressing the anxiety expressed by the patient, applying the principles from Chapter 12.
3. Develop an initial exercise prescription appropriate for this patient profile.

Practical Note: This third case demonstrates that the precautionary principles discussed in this manual (verifying heart rate control, monitoring symptoms, addressing anxiety) remain relevant even for patients with arrhythmia who do not have an implanted device, even though device-specific precautions do not apply.

15.1. Guidelines for Solving Case Studies

Guidelines for Case 1

- target heart rate: with a safety margin of approximately 20–30 bpm below the 180 bpm threshold, thus a maximum of approximately 150–160 bpm, as confirmed by the electrophysiologist;
- Active mechanical precautions: Avoid wide movements of the ipsilateral arm and lifting weights with that arm, as it has not yet been 6 weeks since implantation;
- Signs to monitor: the heart rate approaching the safety threshold, any sensation of palpitations or a "shock," and local signs at the implant site.

Key Points for Case 2

- Hypothesis: possible improper programming of the pacemaker's activity sensor, which does not sufficiently increase the pacing rate at the onset of exertion;

- Referral: to an electrophysiologist, for verification and possible reprogramming of the sensor parameters;
- Temporary approach: reduced intensity, very slow progression, until the device programming is clarified and, if necessary, optimized.

Case 4

A 63-year-old patient, 3 weeks after catheter ablation for typical atrial flutter, without an implanted device but with home monitoring via a wearable smartwatch-type device with rhythm irregularity detection. Two days ago, the device signaled a brief episode of possible arrhythmia while the patient was at home, at rest.

Requirements for the Master's student

1. Discuss the likely significance of this episode, considering the time elapsed since the ablation.
2. Specify whether this episode, in and of itself, should lead to the interruption of the recovery program, and justify your answer.
3. Explain the role, in this specific case, of the distinction between a certified medical device and a consumer wearable device.

Practical Note: This final case combines elements discussed in Chapters 17 and 18: an arrhythmic episode during the post-ablation "blanking" period, detected by a consumer wearable device rather than a certified medical telemonitoring system—an important distinction to keep in mind, discussed in Chapters 9.2 and 18, regarding the reliability of the information and appropriate management.

16. CONCLUSIONS

Establishing a rehabilitation program for a patient with arrhythmia and an implantable cardiac device combines, in a single decision-making process, the general principles of cardiovascular rehabilitation with a set of specific precautions derived from the exact type of arrhythmia and the device's programming parameters.

None of these elements can be assumed or generalized from one patient to another; each case requires an individualized assessment and active communication with the electrophysiology team. The key message is that the presence of an arrhythmia or an implantable device is not, except in specific and well-defined situations, a contraindication for physical exercise—but rather an additional reason for a careful, informed, and closely coordinated across disciplines, allowing the patient to safely benefit from the proven effects of cardiovascular rehabilitation.

Appendix 1. Pre-session checklist for patients with arrhythmia and an implantable device

This checklist must be reviewed by the student or physical therapist before each supervised exercise session, especially during the first few weeks of the program.

Practical note: Any "No" answer to one of these checks must result in the session being postponed and the situation clarified with the coordinating physical therapist or the department physician before resuming the program.

Table 177 . Pre-session checklist for patients with arrhythmia and an implantable device (Appendix 1). This checklist lists the mandatory checks that must be completed before each supervised exercise session.

Check	Confirmed (Yes/No)
The device type and date of implantation are known	___
The detection threshold/maximum permitted rate is documented in the medical record	___
There have been no device therapies since the last session	___
The maintenance therapy (antiarrhythmic, beta-blocker) has not been changed recently	___
The patient reports no new symptoms (palpitations, dizziness, shortness of breath)	___
The unit's emergency equipment is available and in working order	___

Appendix 2. Sample template for a written request for information to the electrophysiologist

A standardized format, sent to the electrophysiologist upon the patient's inclusion in the program, may include the following elements, adapted to each department's visual identity and administrative procedures:

- the patient's identifying information and the type of implanted device;
- an explicit request for the tachycardia detection threshold and the recommended safety margin for exercise;
- a request for information regarding the minimum/maximum pacing rate and activity sensor programming, if applicable;
- a direct question regarding any additional restrictions that the electrophysiologist deems necessary for this specific patient;
- a request to be informed of any subsequent changes to the device's programming during participation in the program.

Appendix 3. Guidelines for Monitoring the Exercise Session

Practical Note: The column for the margin relative to the detection threshold must be explicitly filled out at each session for patients with ICDs or CRT-Ds; it should not merely be estimated mentally by the physical therapist.

Table 178 . Guideline for Monitoring Exercise Sessions (Appendix 3). It organizes the parameters to be monitored—heart rate, margin relative to the detection threshold, pulse regularity, Borg scale score, and symptoms—into the three phases of the session: pre-exercise, peak exercise, and recovery.

Parameter	Pre-exercise	Peak exertion	Recovery (2 min)
Heart rate	___ bpm	___ bpm	___ bpm
Margin relative to the detection threshold (if applicable)	—	___ bpm	—
Pulse regularity (if AF/flutter)	___	___	___
Borg score	—	___ / 20	—
Reported Symptoms	—	_____	_____

Practical note: *The column for the margin relative to the detection threshold must be explicitly filled out at each session for patients with an ICD or CRT-D, not merely estimated mentally by the physical therapist.*

17. THE ROLE OF CATHETER ABLATION IN THE MANAGEMENT OF ARRHYTHMIAS IN PATIENTS IN THE REHABILITATION PROGRAM

17.1. The principle of catheter ablation

Catheter ablation involves interrupting, through radiofrequency energy or cryoablation, the electrical circuit responsible for an arrhythmia (for example, isolation of the pulmonary veins in atrial fibrillation, or ablation of a re-entry circuit in atrial flutter or certain ventricular tachycardias), with the goal of eliminating or significantly reducing the recurrence of the arrhythmia, sometimes eliminating the need for an implantable device or long-term antiarrhythmic therapy.

17.2. The Impact of a Successful Ablation on the Recovery Program

In a patient in whom ablation has eliminated or significantly reduced the arrhythmic burden, the goals and precautions of the rehabilitation program must be reassessed: a patient previously limited by atrial fibrillation with a poorly controlled ventricular response may, following successful ablation, tolerate higher exercise intensities than those initially planned, and this must be actively confirmed, not automatically assumed based on the procedure performed.

17.3. Post-ablation period—specific precautions

- Avoid intense exercise in the first few days after the procedure, as directed by the electrophysiologist, due to the risk of vascular complications at the puncture site;
- the possible temporary persistence of certain arrhythmias in the first weeks after ablation (the "blanking" period), which does not necessarily indicate a failure of the procedure;
- the need to continue anticoagulant therapy for a specified period, even in the absence of arrhythmic recurrence, as determined by the electrophysiologist.

Practical Note: An arrhythmic recurrence during the "blanking" period following ablation should not automatically be interpreted as a failure of the procedure and does not, in and of itself, require interruption of the rehabilitation program; however, it must be reported to the electrophysiologist for proper interpretation within the context

Summary: Catheter ablation can significantly and favorably alter the arrhythmic risk profile of a patient in a recovery program, but this potential benefit must be actively confirmed through communication with the electrophysiologist, especially during the "blanking" period following the procedure, before adjusting the exercise prescription.

18. TELEMONITORING OF CARDIAC DEVICES AND ITS IMPACT ON THE REHABILITATION PROGRAM

18.1. The principle of telemonitoring of cardiac devices

Most modern implantable cardiac devices can automatically transmit data—via a communication unit at the patient's home or through an associated mobile app—regarding heart rate, any detected arrhythmias, and administered therapies directly to the electrophysiology center, without requiring an in-person visit for each checkup.

18.2. Benefits for the rehabilitation team

- easier access, through collaboration with the electrophysiologist, to recent data on any arrhythmic episodes that occurred between scheduled visits;
- the ability to correlate this data over time with the progression of the exercise program, including sessions conducted at home during Phase III;
- faster detection of any deterioration in device parameters (e.g., battery depletion or electrode problems), which is relevant to the safety of continuing the program.

18.3. Limitations and Precautions

Telemonitoring does not replace direct clinical evaluation of the patient and should not create a false sense of absolute safety; data transmission may be delayed or incomplete, and its interpretation remains the responsibility of the electrophysiology team, not the rehabilitation team, which can, however, actively report any relevant clinical observations.

Summary: Telemonitoring is a valuable, complementary tool for correlating arrhythmic progression with the rehabilitation program, especially in Phase III; however, it remains a supportive tool, not a substitute for direct clinical evaluation and active communication with the electrophysiology team.

APPENDIX 4. SELF-ASSESSMENT QUESTIONS BY CHAPTER

The set of questions below is intended for master's students to use for self-assessment as they work through the textbook; each question is phrased so that the correct answer can be found directly in the corresponding chapter.

Electrophysiology, Arrhythmias, Devices

1. What are the three main electrophysiological mechanisms of arrhythmias?
2. What is the key difference between an ICD and a simple pacemaker?
3. What is the "tachycardia detection threshold" in an ICD?
4. Which EHRA class would correspond to a patient with atrial fibrillation whose daily activities are affected by symptoms?

Assessment, precautions, prescription, phases

5. What information must be obtained from the electrophysiologist before prescribing exercise?
6. What is the approximate margin below the detection threshold used to set the training heart rate for a patient with an ICD?
7. What mechanical precaution is common to all types of devices during the first few weeks after implantation?
8. What guidelines mark the transition from Phase II to Phase III?

Monitoring, Emergencies, Education, Psychology

9. What steps should be taken if a patient experiences an ICD shock during a session?
10. What is an "electrical storm," and why is it considered an emergency?
11. What activities require special caution in patients with an ICD, beyond physical exercise itself?
12. What signs suggest the need for a specialized psychological evaluation in a patient with an ICD?

Organization, charts, case studies, ablation, telemonitoring

13. Why is the temporal correlation between telemonitoring data and the exercise program important?
14. What is the post-ablation "blanking" period, and why should it not automatically be interpreted as a procedure failure?
15. What essential elements must an arrhythmia event report form contain?

GLOSSARY OF TERMS AND ABBREVIATIONS

Abbreviations (alphabetical order)

Table 179. Abbreviations used in the manual. Lists, in alphabetical order, the main abbreviations used in the text and their full meanings.

Abbreviation	Meaning
CRT	Cardiac Resynchronization Therapy
CRT-D	Cardiac resynchronization therapy with defibrillator function
AF	Atrial Fibrillation
ICD	Implantable Cardioverter-Defibrillator
VT	Ventricular Tachycardia

Terms (alphabetical order)

Table 180 . Glossary of Terms. Defines, in alphabetical order, the technical terms frequently used throughout the manual.

Term	Meaning
Catheter ablation	A procedure to interrupt an arrhythmic circuit using radiofrequency or cryoablation
Abnormal automaticity	An arrhythmic mechanism caused by the generation of impulses from ectopic foci
Blanking (period)	Post-ablation interval during which arrhythmic recurrences do not necessarily indicate procedure failure
CHA2DS2-VASc	Risk score for estimating thromboembolic risk in patients with atrial fibrillation or flutter
EHRA (classification)	Symptomatic classification scale for atrial fibrillation
Electrical storm	Three or more ICD shocks within 24 hours; major medical emergency
Chronotropic incompetence	The heart’s inability to adequately increase its rate during exercise
Tachycardia detection threshold	The heart rate above which an ICD recognizes a possible ventricular arrhythmia
Reentry	An arrhythmic mechanism based on an abnormal, closed electrical circuit
Activity sensor	A component of a pacemaker that adjusts the pacing rate based on the level of exertion
Antitachycardic pacing	ICD therapy using rapid pulses, intended to terminate an arrhythmia without a shock
Telemonitoring	The automatic, remote transmission of data from a cardiac device to a medical center

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