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# EXERCISE PRESCRIPTION FOR CARDIAC PATIENTS WITH MULTIPLE COMORBIDITIES

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## Abstract
***Background:*** *Modern cardiac caseloads are increasingly defined by clinical complexity rather than discrete pathology. Patients often present with intersecting conditions, such as heart failure with preserved ejection fraction (HFpEF), valvular disease, left ventricular hypertrophy, pulmonary hypertension, and geriatric syndromes like frailty and sarcopenia. Despite this shift, existing exercise data predominantly stems from cohorts with single diagnoses, leaving physiotherapists with limited guidance for patients managing multiple comorbidities. This scoping review aimed to critically evaluate current literature to map available evidence regarding exercise prescription for these complex cardiac populations, focusing specifically on optimal modalities, training intensities, safety protocols, and reported functional outcomes.*

***Methodology:*** *A scoping review was carried out in accordance with JBI Manual for Evidence Synthesis and reported in accordance with PRISMA-ScR. Indexed literature was searched and screened from January 2020 to December 2025.*

***Results:*** *Evidence suggests that supervised exercise improves peak oxygen uptake and quality of life in HFpEF; in certain patients, high-intensity interval training (HIIT) provides a little advantage over moderate continuous training (MCT); the strongest trial supports combined endurance-plus-resistance training. Exercise-based rehabilitation focuses on functional decline and frailty in valvular/post-TAVR populations. Individualised, resistance-inclusive prescriptions for elderly, fragile, multimorbid patients are consistent with guidelines and review sources. There is very little evidence specific to mixed comorbidity profiles (e.g., HFpEF with valvular illness and LVH).*

***Conclusion:*** *Exercise remains highly beneficial across underlying cardiac conditions. A customised, frailty-aware, and resistance-inclusive prescription is well-supported by current literature. Nevertheless, the clinical literature suffers from a notable lack of targeted trials involving multi-comorbid cardiac* *patients, necessitating future research to better inform real-world rehabilitation strategies.*

## Introduction

Clinical overlap and complexity, rather than discrete pathology, are increasingly defining modern cardiac caseloads. More than half of all cases of heart failure are now heart failure with preserved ejection fraction (HFpEF), which often coexists with pulmonary hypertension, valvular diseases, hypertension-driven left ventricular hypertrophy, and the geriatric syndromes of frailty and sarcopenia (1, 2). Complex exercise intolerance results from this multifactorial presentation, caused by a combination of skeletal-muscle abnormalities, systemic vascular dysfunction, and reduced cardiac output reserve that are common to these various disorders and made worse by ageing (3).

Multimorbidity is becoming more prevalent in the clinical setting, particularly regarding the high-burden overlap between heart failure (HF) and chronic obstructive pulmonary disease (COPD). According to recent consensus data from 2025, HF is one of the most common comorbidities in COPD, with an annual incidence of 3–4% and prevalence estimates ranging from 20% to 70% (4). In resource-constrained environments like South Asia, which makes up about 25% of the world's population but has about 60% of the world's heart disease burden, this HF-COPD multimorbidity is especially severe (5). Despite this, clinical trials are usually limited to single-diagnosis populations, and the current body of exercise research is still mostly isolated.

As integrated or "blended" service models, which have been identified as a significant gap in 2025 research, remain largely unexplored, this fragmented knowledge base puts physiotherapists in a challenging situation. It is critical to close this gap; recent 2024 AHA/AACVPR updates and 2025 state-of-the-art syntheses emphasise the need for customised, frailty-aware, and resistance-inclusive prescriptions that go beyond conventional boundaries (7). To guide clinical practice for the multimorbid cardiac patient, this scoping review mapped the available data, assessed the quality of the current research landscape, and assessed the safety and effectiveness of current rehabilitation techniques.

## Review Questions

The following questions were attempted to answer in this scoping review:

1. What exercise modalities and intensities are evidenced across the constituent conditions?
2. What safety considerations and adaptations are reported?
3. What outcomes are measured?
4. What is the methodological quality of the evidence?
5. Is there direct evidence for combined multi-comorbidity profiles, and where are the gaps?

## Methods

This review was conducted through a structured search of the published literature (PubMed/MEDLINE and PEDro) executed in December 2025, with title/abstract and full-text screening against the eligibility criteria. PRISMA-ScR explains the methodology.

**Population:** Adults (≥18 y) with cardiac disease and one or more relevant comorbidities: HFpEF, valvular disease (including post-TAVR/TAVI), LVH, pulmonary hypertension, and frailty/sarcopenia.

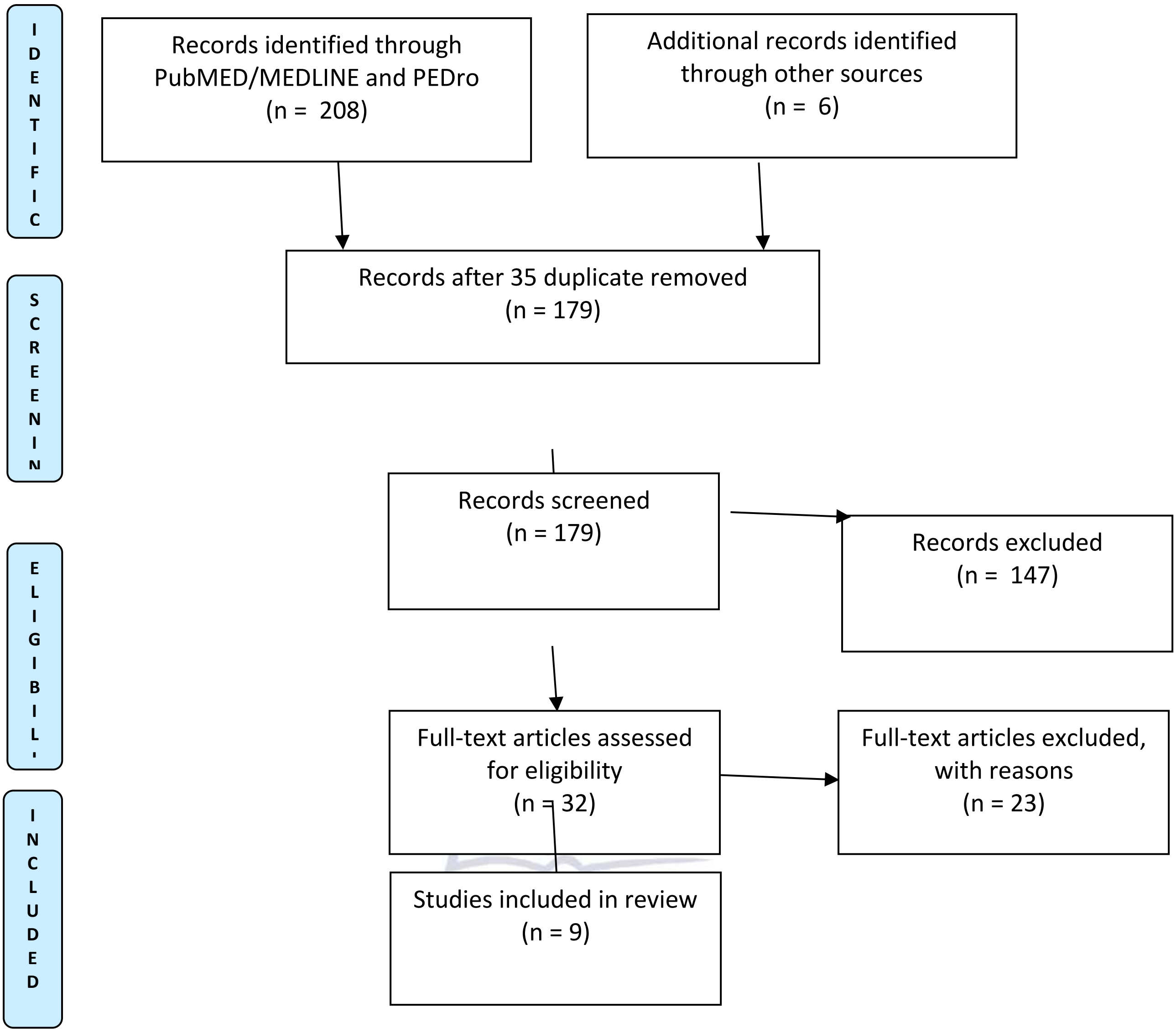
**Concept:** Exercise prescription (modality, intensity, frequency, progression, supervision) and its safety and outcomes.

**Context:** Inpatient, outpatient, or home cardiac rehabilitation settings; any country; records from January 2020 to March 2026.

## Results

Nine substantive sources met the inclusion criteria and were charted (Table 1). Refer to Fig. 1 for the PRISMA-ScR flow diagram.

**Figure 1: PRISMA flowchart of the selection of studies**




Supervised exercise improved peak oxygen uptake (mean difference ≈1.96 mL/kg/min) and the Minnesota Living with Heart Failure score (mean difference ≈−12) in HFpEF, according to a meta-analysis of 14 randomised trials (629 patients). High-intensity interval training (HIIT) produced a small but significant additional peak-$VO_2$ gain over moderate continuous training (MCT) (6). According to state-of-the-art synthesis, the largest HFpEF RCT (Ex-DHF, 322 patients) assessed combined endurance-plus-resistance training. MCT offers the strongest evidence base for improving peak oxygen consumption and symptoms, while HIIT benefits certain individuals (8). A low-intensity exercise added along a respiratory programme was evaluated in HFpEF complicated by pulmonary hypertension, and two protocols compared HIIT along with strength against MCT along with strength in HFpEF (9, 10). Rehabilitation is multimodal and frailty-targeted rather than intensity-driven in valvular/post-TAVR populations (11). Progressive resistance training enhances strength, balance, and functional independence and is frequently the first step for weak, deconditioned patients who are unable to withstand aerobic loads, according to guidelines and review sources (12, 13).

Safety framing was consistent among the included studies. Resistance training started on two non-consecutive days per week and progressed to three, tailored to the patient's deconditioning, frailty, and sarcopenia; supervised, individualised, and progressive prescription with monitoring; and an in-hospital start for the most vulnerable (12). For the higher-risk, multimorbid phenotype in HFpEF-PH, a purposefully low-intensity exercise, along with a respiratory and an inpatient mental gait programme, was selected (9). Exercise does not reduce mechanical blockage in valvular diseases; in cases of substantial aortic stenosis, rehabilitation is primarily a post-intervention (post-TAVR) technique rather than a replacement for valve treatment (11).

Peak oxygen uptake, six-minute walk distance, diastolic function and echocardiographic parameters, biomarkers, frailty indicators, falls risk, and readmission were among the outcomes (7, 9, 10, 11). This breadth is instructive in and of itself, indicating that function and frailty endpoints may be just as important as cardiorespiratory fitness for the multi-comorbid patients.

The quality of the methodology varied. Reproducible search, RevMan-based pooling, and clinically significant effect sizes made the HFpEF meta-analysis a relative strength. However, because it was based on small, heterogeneous trials with variable exercise prescriptions and limited blinding, pooled estimates had a moderate level of certainty at best, and differences between HIIT and MCT should be interpreted with caution (7). Two of the most relevant multimorbidity sources were published protocols that needed to be regarded as planned trials because they lacked outcome data (9, 10).

The TAVR, resistance-training, and multimorbidity sources were narrative or state-of-the-art reviews and scientific statements (8, 11, 12, 14); they integrated evidence authoritatively but were not systematic and were vulnerable to bias in selection and interpretation. The AHA/AACVPR core-components statement, although having a high level of clinical authority, was derived from experts and consensus rather than from a single graded synthesis (13). When using AMSTAR-2 and GRADE lenses, certainty was poor for combined-comorbidity, valvular, and LVH-specific prescriptions, where there was virtually no direct trial data, and moderate for the HFpEF aerobic/peak $VO_2$ result.

The data were gathered by analogy among single-condition cohorts; no included source reported a trial of exercise prescription for a defined combination profile, such as HFpEF with concurrent valvular illness and LVH. There is a growing focus on frailty and ageing (11, 12, 13, 14), but there is a dearth of data from LMICs and South Asia, and little is known about how various cardiac diseases affect exercise safety and dosage.

**Table 1: Included Studies**

| Study (first author, year) | Type / N | Key findings | Appraisal note |
|---|---|---|---|
| Baral, 2024 (7) | SR/MA (14 RCTs, 629) | HFpEF: ↑peak $VO_2$ (≈1.96), ↑QoL; HIIT slight edge over MCT. | Reproducible, small heterogeneous trials; moderate certainty. |
| Bjarnason-Wehrens, 2022 (12) | Review | Resistance training across CAD/HF/valvular with frailty focus. | Authoritative but non-systematic. |
| Brown TM, 2024 (13) | Scientific statement | Individualized, resistance-inclusive prescription; 2→3 d/wk progression. | Consensus/expert-derived; high clinical authority. |

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|---|---|---|---|
| Bunsawat, 2024 (15) | Narrative review | Mechanisms of exercise intolerance in HFpEF; training improves function/QoL. | Mechanistic; not systematic. |
| Damluji, 2025 (14) | Review | Multimorbidity, frailty, sarcopenia; aggregate-risk rationale for CR. | Narrative. |
| Duan, 2025 (11) | Review (TAVR) | CR targets frailty/function post-TAVR; exercise not a valve substitute. | Narrative; valvular evidence still maturing. |
| Gasser, 2021 (10) | RCT protocol (86) | HIIT+strength vs MCT+strength in HFpEF. | Protocol only—no results yet. |
| Mirzai, 2025 (8) | Review | MCT strongest base; HIIT selected; Ex-DHF (322) combined training. | Narrative synthesis. |
| Palevičiūtė, 2023 (9) | RCT protocol (90) | Low-intensity exercise+respiratory+gait in HFpEF-PH; in-hospital start. | Protocol; directly multimorbid design (strength of concept). |

**Discussion**

The conducted map yielded a clear practical message despite a fragmented evidence base. Exercise is beneficial across every constituent condition of the multi-comorbid cardiac patient. The prescription that best fits this population is individualised, supervised, frailty-aware, and resistance-inclusive, often beginning with resistance exercises to build tolerance for subsequent aerobic loading. It is consistently endorsed across the strongest available sources (7, 11, 12). In HFpEF specifically, supervised aerobic training (MCT as the default, HIIT for selected, robust patients) improves the outcomes that matter most to patients, and combined endurance-plus-resistance training has the strongest trial support (7, 8).

Three guidelines showed up for the physiotherapist handling overlap. Resistance and functional training are the safest universal entry points, so start by prescribing based on the patient's frailty and minimising comorbidities rather than focusing on a single diagnosis. Second, sequencing is important in valvular diseases. Exercise rehabilitation is not a substitute for valve treatment but rather a post-intervention technique with severe stenosis (11). Third, outcome evaluation should go beyond peak $VO_2$ to include strength, balance, fall risk, and independence. These measures are more actionable in a multimorbid, older, resource-constrained caseload because function and frailty endpoints repeat throughout the evidence.

Trials that recruit multi-comorbid cardiac patients (such as HFpEF with valvular disease and LVH) and report safety, dose-response, and function/frailty outcomes, ideally with practical, resource-sensitive designs relevant to South Asian practice, should be given attention.

As modern caseloads are characterised by clinical overlap rather than isolated disease, the therapeutic requirement of going beyond siloed rehabilitation paradigms is becoming more and more evident. New research from 2025 and 2026 indicates that integrated or "blended" delivery approaches are essential for successful care, particularly for coexisting illnesses like COPD and heart failure (16). Integrated cardiac and pulmonary rehabilitation (CR+PR) has not received much attention, despite heart failure being acknowledged as one of the most common comorbidities in COPD patients (prevalence estimates range from 20% to 70%) (17).

In high-burden, resource-constrained environments like South Asia (18) and Pakistan, where the HF-COPD multimorbidity overlap is substantial and access to specialised, single-disease programmes is frequently restricted, this integration is especially pertinent (19). In these settings, where South Asia already accounts for about 60% of the world's heart disease burden, future research must put context-specific frameworks and practical, integrated delivery strategies ahead of conventional single-condition efficacy trials to more accurately represent clinical caseloads in the real world.

Strengths include critical appraisal, PRISMA-ScR alignment, and a purposefully cross-condition scope tailored to actual caseloads. A strong dependence on narrative reviews and protocols due to the lack of combined-comorbidity trials, indexed rather than full database exports, and limited LMIC representation are some of the limitations.

## Conclusion

An individualised, frailty-aware, resistance-inclusive prescription is well established, and exercise is beneficial for all conditions that converge in the multi-comorbid cardiac patient. Small trials, narrative syntheses, and incomplete protocols moderate current assurance, and direct evidence for combined comorbidity profiles, as well as for valvular- and LVH-specific prescriptions, remains the core need.

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