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Physical Activity in Cardiovascular Disease Prevention: A Narrative Review

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Abstract

Background. Cardiovascular disease (CVD) remains the leading global cause of death and a major source of disability despite advances in pharmacological and interventional care. Since a substantial part of the remaining burden is still related to modifiable behaviors, physical activity continues to play a central role in prevention.

Aim. To summarize current evidence on physical activity as a non-pharmacological intervention in the primary and secondary prevention of CVD, with particular attention to dose-response relationships, sedentary behavior, major cardiometabolic risk factors and exercise-based cardiac rehabilitation.

Material and methods. This narrative review used the uploaded outline as the organizing framework. PubMed and major society sources were searched for English-language publications from January 2018 to March 2026 using combinations of terms related to physical activity, cardiovascular prevention and sedentary behavior. International guidelines and scientific statements were prioritized.

Results. Higher physical activity levels are consistently associated with lower all-cause and cardiovascular mortality, with the largest relative gains usually seen when people move from inactivity to modest activity. Device-based studies make this message easier to translate into practice through step counts and habitual movement patterns, while also showing that sedentary time is an in dependent cardiovascular risk exposure. Physical activity favorably affects endothelial function, inflammation, insulin sensitivity, adiposity, blood pressure, and lipid metabolism. In secondary prevention, exercise-based cardiac rehabilitation improves health-related quality of life and reduces hospital admissions, and telehealth-supported models can widen access for selected patients.

Conclusions. Physical activity is key in cardiovascular prevention. Patients should be helped to move more, sit less, interrupt prolonged sitting, and maintain realistic activity patterns over time.

Key words: physical activity; exercise; cardiovascular disease prevention; sedentary behavior; daily steps; hypertension; dyslipidemia; insulin sensitivity; cardiorespiratory fitness; cardiac rehabilitation; telerehabilitation

1. Introduction

Cardiovascular diseases remain the leading cause of death worldwide. They are a major contributor to disability and healthcare burden. Contemporary global analyses continue to show that ischemic heart disease, stroke, heart failure and other cardiovascular conditions account for a large share of preventable morbidity and mortality [1,2]. Despite significant advances in pharmacotherapy, revascularization and risk-factor control residual risk continues to be high. Many cardiovascular events are still driven by modifiable factors.

Among these exposures, physical inactivity deserves particular attention because its effects are broad and clinically relevant. Physical activity influences blood pressure, insulin sensitivity, body composition, inflammation, endothelial function, autonomic regulation, and cardiorespiratory fitness at the same time [3-6]. In practice, this should not be reduced to formal exercise alone. Meaningful movement also includes walking, active commuting, household tasks, occupational movement, stair climbing, and other small activities accumulated during the day [3-6]. This broader perspective is useful in daily care because many patients are more willing to change routine movement habits than to begin structured training immediately.

Modern cardiovascular prevention should also address sedentary behavior, not only insufficient exercise. Individuals may be insufficiently active, highly sedentary, or a combination of the two. These are related, but they are not the same exposure. Evidence increasingly suggests that prolonged sitting has adverse metabolic and cardiovascular consequences of its own, especially in people with otherwise low activity levels [8,9]. The practical takeaway is simple: formal exercise matters, total daily movement matters, and prolonged sitting matters as well.

The aim of this narrative review is to summarize the role of physical activity as a non-pharmacological intervention in the primary and secondary prevention of cardiovascular disease, using the uploaded outline as the main narrative scaffold. The review focuses on dose-response associations, daily steps and incidental movement, biological mechanisms, the role of sedentary behavior, effects on major cardiovascular risk factors, exercise-based cardiac rehabilitation, and digital rehabilitation models, while also considering implementation barriers and clinically realistic counseling strategies.

2. Materials and Methods / Literature Search Strategy

This article was prepared as a narrative review rather than a formal systematic review. The uploaded outline served as the main structural baseline, while the seed PDF was used as supporting source material for continuity of topic selection and emphasis. To update and strengthen the evidence base, PubMed and major professional society sources were searched for English-language publications from January 2018 to March 2026 using combinations of the terms *physical activity*, *exercise*, *cardiovascular disease prevention*, *sedentary behavior*, *daily steps*, *blood pressure*, *hypertension*, *lipids*, *obesity*, *visceral adipose tissue*, *insulin sensitivity*, *glycemic control*, *cardiorespiratory fitness*, *cardiac rehabilitation*, and *telerehabilitation*.

Evidence was prioritized in a predefined hierarchy consistent with the aims of a clinically oriented review: first, international guidelines and major scientific society statements; second, systematic reviews, meta-analyses, and umbrella reviews; third, selected large cohort studies or randomized trials when they offered clinically useful detail not captured adequately in higher-order syntheses. Preference was given to literature from 2018 onward, although earlier landmark guidance or foundational reviews were retained where they improved conceptual continuity or explanatory value. Because the objective was synthesis rather than pooled re-estimation, the selected evidence was organized thematically around prevention stage, movement behavior, biological mechanisms, risk-factor modification, and rehabilitation.

3. Physical Activity and Cardiovascular Disease Risk

Physical activity includes any motion produced by skeletal muscles that increases energy use above resting levels. In practical and clinical terms, this includes planned exercise sessions, recreational activity, active commuting, walking during daily tasks, occupational movement and brief episodes of everyday or incidental movement [4-6]. This broad framing is important in prevention because the cardiovascular effect of movement is not limited to athletic training. Many patients derive meaningful benefit from increasing ordinary movement rather than following highly structured exercise programs.

The link between physical activity and cardiovascular outcomes is now well established. Large prospective syntheses consistently show inverse, nonlinear associations between non-occupational physical activity and all-cause mortality, cardiovascular mortality, incident CVD, coronary heart disease, stroke, and heart failure [7]. The pattern is clinically important. The largest relative gains usually occur when people move from very low levels of activity to modest levels. Additional benefit continues at higher volumes with diminishing marginal returns. This supports a simple counseling principle that some activity is better than none and early gains matter.

This nonlinear association fits well with guideline-based recommendations. The World Health Organization and U.S. and European guidance consistently recommend at least 150–300 minutes per week of moderate-intensity aerobic activity, 75–150 minutes per week of vigorous activity or an equivalent combination, alongside muscle-strengthening exercise on at least two days per week [3-6]. However, the epidemiological data also make clear that meaningful benefit begins below these thresholds. This matters in practice because inactive patients may disengage when recommendations are presented as all-or-nothing targets rather than progressive ranges.

Daily-step evidence has made the dose-response message easier to use in patient counseling. In a meta-analysis of 15 international cohorts, higher daily step counts were associated with progressively lower mortality, with the apparent plateau depending partly on age: approximately 6,000–8,000 steps per day in older adults and 8,000–10,000 steps per day in younger adults [10]. A later meta-analysis of more than 111,000 individuals also supported nonlinear associations between objectively measured step counts and both all-cause mortality and incident cardiovascular disease, with health gains beginning at relatively low step volumes and continuing upward toward an estimated optimal range [11]. Device-based cohort data further suggest that, compared with very low daily step counts, around 4,000–4,500 steps per day already captures roughly half of the maximal observed benefit, while 9,000–10,500 steps per day is associated with the lowest mortality risk in many populations [12].

These data should nevertheless be interpreted with practical restraint. Steps are an appealing metric because they are understandable, measurable, and adaptable to wearable technologies. Yet step count is not a universal physiological truth. It varies by age, baseline health status, measurement device, wear protocol, cadence and the endpoint being considered. For example, the step count associated with lower mortality risk is not identical to the count associated with lower incident CVD risk and optimal targets may not transfer directly between younger and older adults [10-12]. Thus, step-based counseling works best when it is framed as a range or progression rather than as a rigid daily quota.

Another important practical point is that movement pattern matters in addition to total volume. A patient with moderate total step count may accumulate those steps through dispersed everyday activity or through a single concentrated period surrounded by prolonged sitting. These patterns are not necessarily equivalent from a cardiometabolic standpoint. Accordingly, the most clinically useful interpretation of the dose-response literature is broader than “exercise more”. Patients should increase total movement, reduce very low-activity days and aim for movement that is sustained across the week and embedded into daily routine.

4. Biological Mechanisms Linking Physical Activity With Cardiovascular Protection

The cardiovascular effects of physical activity are mediated through multiple convergent pathways rather than a single mechanism. Repeated bouts of aerobic and resistance exercise produce hemodynamic, endothelial, metabolic, autonomic and inflammatory adaptations that collectively reduce atherothrombotic risk and improve cardiometabolic resilience [15]. This mechanistic breadth helps explain why physical activity is associated with benefit across diverse cardiovascular phenotypes and why it remains relevant even in patients already receiving optimal medical therapy.

At the vascular level, exercise increases shear stress on the endothelium, which supports nitric oxide bioavailability and improves endothelial function. Over time, this favors better vasomotor responsiveness, reduced arterial stiffness and improved blood pressure regulation. Regular physical activity is also associated with improved coronary perfusion, enhanced microvascular function and favorable effects on vascular remodeling [5,15]. These changes are particularly relevant because endothelial dysfunction and increased arterial stiffness are not merely biomarkers but integral components of the pathophysiology linking inactivity to hypertension, atherosclerosis and heart failure.

Metabolic adaptations are equally important. Contracting skeletal muscle increases glucose uptake through insulin-independent and insulin-sensitizing pathways, while regular training improves mitochondrial function, capillary density and substrate utilization. In parallel, exercise reduces visceral adiposity, alters adipokine signaling and tends to lessen chronic low-grade inflammation [15,20]. These effects contribute to better glycemic control, improved insulin sensitivity and attenuation of metabolic syndrome features. Because visceral fat and insulin resistance are closely linked to dyslipidemia, hypertension and systemic inflammation, even modest improvements in activity may influence several interconnected cardiovascular risk pathways at once.

Exercise also affects autonomic regulation. Habitual activity lowers resting heart rate, improves parasympathetic tone and may reduce maladaptive sympathetic overactivity [15]. This has implications for arrhythmic risk, myocardial oxygen demand, exercise tolerance and blood pressure control. Furthermore, physical activity improves skeletal muscle oxidative capacity and peripheral oxygen extraction, which may partly explain why patients often experience functional benefits and symptom relief even before dramatic changes in body weight occur.

Cardiorespiratory fitness (CRF) represents an especially important integrative pathway. Although influenced by genetics and comorbidity as well as habitual activity, CRF is one of the strongest and most consistent predictors of morbidity and mortality in adults. An overview of meta-analyses published in 2024, representing more than 20.9 million observations from 199 cohort studies, confirmed CRF as a powerful and consistent predictor of both all-cause and cardiovascular outcomes [13]. A dose-response meta-analysis of cohort studies likewise showed graded inverse associations between CRF and mortality from all causes, cardiovascular disease, and cancer [14]. For clinicians, this means that improved fitness should be seen not merely as an athletic achievement but as a meaningful therapeutic target.

This CRF perspective helps correct an overly narrow focus on body weight alone. Some patients experience only modest weight change despite sustained improvements in activity, yet they still gain substantial prognostic benefit through improved fitness, lower blood pressure, better glucose regulation, improved body composition and reduced sedentary time. In high-risk patients with obesity or metabolic syndrome, CRF may therefore be a more informative intermediate target than weight reduction alone, provided that body composition and metabolic markers are also considered.

5. Physical Activity in Primary Prevention

In primary prevention, physical activity should be treated as a routine medical recommendation rather than as optional lifestyle advice. Contemporary ACC/AHA, ESC, WHO and U.S. physical activity guidelines converge on the view that regular aerobic and muscle-strengthening activity is a core component of cardiovascular prevention in adults without established disease, especially when other risk factors are present [3-6]. This includes people with elevated blood pressure, overweight or obesity, impaired glucose regulation, dyslipidemia, a family history of premature CVD, or a predominantly sedentary lifestyle.

The rationale is straightforward. Primary prevention depends on reducing lifetime exposure to cumulative risk. Physical activity works upstream by influencing several determinants of cardiovascular risk before clinical disease develops. This is particularly important because risk-factor clustering is common: the same patient may simultaneously have central adiposity, borderline hypertension, reduced fitness, rising glucose, poor sleep, and high occupational sitting time. Few interventions besides physical activity can address this cluster so broadly and with relatively low cost.

Guideline recommendations are typically expressed in weekly totals, but patients do not live their lives in weekly blocks. Counseling should therefore translate those targets into achievable patterns: brisk walking on most days, cycling for transport, mixed aerobic and resistance activity during the week and deliberate interruption of long sitting periods. It is helpful to emphasize that activity can be accumulated in shorter bouts and does not require sporting identity or gym access [3-6]. This is especially relevant for patients who are older, deconditioned, self-conscious about exercise, time-constrained or living with musculoskeletal limitations.

For clinicians, the most effective advice is usually simple and individualized. Many patients benefit from a starting prescription based on current behavior rather than ideal targets for example an additional 10–15 minutes of walking on most days, replacing short car trips with walking where feasible, or adding two brief home-based resistance sessions per week. Walking is often the best initial modality because it is familiar, inexpensive, scalable and easy to fit into routine life. Cycling, swimming, resistance training, chair-based exercise, or interval walking may be preferable in selected patients depending on joint symptoms, balance, local environment and preference. The tone of counseling also matters. Recommendations framed around perfection or "proper exercise" can be counterproductive in sedentary adults. Patients are more likely to adhere when the emphasis is on regularity, progression and sustainability rather than athletic performance. A plan that is modest but maintainable is usually more valuable than an ambitious prescription abandoned after two weeks. In this sense, the most useful exercise prescription is often the one the patient can realistically absorb into everyday life.

6. Sedentary Behavior as an Independent Cardiovascular Risk Factor

Sedentary behavior refers to waking behavior characterized by very low energy expenditure while sitting, reclining, or lying. It is conceptually different from insufficient moderate-to-vigorous physical activity. A person can meet exercise recommendations and still spend much of the day sedentary. In contrast, another person may perform little structured exercise but remain relatively active through nonexercise movement. This distinction is clinically relevant because prolonged sedentary time has been associated with higher mortality and adverse cardiometabolic outcomes independent of total activity in many analyses [8,9].

Device-based evidence has strengthened this interpretation. In the harmonized meta-analysis by Ekelund and colleagues, greater accelerometer-measured sedentary time was associated with progressively higher all-cause mortality, whereas greater total physical activity at any intensity was associated with lower mortality [8]. Importantly, the relationship was nonlinear, and high amounts of moderate-to-vigorous activity attenuated the risk associated with sitting. This supports the view that sedentary time should not be ignored simply because a patient reports some exercise.

The practical implications extend into occupational health. A 2024 cohort study linked predominantly occupational sitting to higher all-cause and cardiovascular mortality compared with predominantly non-sitting work, while also showing that higher leisure-time physical activity could partially offset this excess risk [31]. This is highly relevant in modern clinical practice, where many adults spend long periods at desks, in vehicles, or in screen-based work even if they do not consider themselves sedentary.

Experimental studies provide a plausible physiological basis for these associations. Systematic reviews of sitting-interruption studies suggest that breaking up prolonged sitting with brief bouts of light- or moderate-intensity activity lowers postprandial glucose and insulin responses compared with uninterrupted sitting [30]. Although these studies are often short-term and use surrogate endpoints, they strengthen the biological argument for advising brief movement breaks during the day, especially in adults with overweight, insulin resistance, or dysglycemia.

In practice, reducing sedentary behavior should be discussed as its own target. Advice can be concrete: stand during part of phone calls, walk for a few minutes each hour, use stairs for short trips within buildings, break long driving periods when feasible and add brief post-meal walks when possible. This kind of counseling is particularly useful for patients who are not yet ready for broader exercise prescriptions. Becoming less sedentary is often the first successful step toward becoming more active.

7. Effect of Physical Activity on Major Cardiovascular Risk Factors

7.1. Blood pressure and hypertension

Exercise is one of the best-supported non-pharmacological interventions for blood pressure reduction. A large pairwise and network meta-analysis of 270 randomized controlled trials found significant reductions in resting systolic and diastolic blood pressure across aerobic, dynamic resistance, combined training, high-intensity interval training, and isometric exercise interventions [16]. The pooled effects were clinically meaningful, particularly given that even modest blood pressure reductions at the population level translate into fewer strokes, myocardial infarctions, and heart failure events.

These findings support describing exercise as an antihypertensive therapy rather than only a general wellness measure. The specific exercise modality may matter. Some analyses suggest relatively strong effects for isometric training or combined approaches but the broader practical message is that multiple forms of regular exercise lower blood pressure [16]. This is important in patients who cannot or will not engage in a single "ideal" exercise mode. It also reinforces the need to tailor prescriptions to comorbidity, orthopedic tolerance and adherence potential.

Exercise should not be framed as a substitute for indicated antihypertensive medication in higher-risk patients. Rather, it should be positioned as a complementary therapy that improves blood pressure control, lowers overall cardiovascular risk and may reduce long-term treatment burden when embedded sustainably in care.

7.2. Lipid profile

The effects of exercise on lipids are generally favorable but more modest and heterogeneous than the effects on blood pressure. A 2025 systematic review and meta-analysis found that exercise training improved several lipid measures on average, including total cholesterol, LDL cholesterol, triglycerides and HDL cholesterol, although between-study heterogeneity was substantial and not all studies showed benefit [17]. This variability likely reflects differences in baseline dyslipidemia severity, body composition, diet, intervention dose, and exercise modality.

Clinically, the lipid literature should be interpreted carefully. Exercise can support improved lipid management and should be recommended as part of global cardiovascular risk reduction, but it should not be oversold as sufficient monotherapy for patients with marked dyslipidemia or clear statin indications. The most balanced message is that exercise improves the lipid profile modestly on average while also contributing to weight control, insulin sensitivity, inflammation, and fitness.

7.3. Body weight, adiposity and visceral fat

Weight loss is often the outcome patients expect most, but focusing on body mass alone can understate the cardiovascular benefit of exercise. A 2024 dose-response meta-analysis showed that aerobic exercise is associated with reductions in body weight and waist circumference, with greater exercise volumes producing larger average effects [18]. These changes are clinically relevant, especially because waist circumference and central adiposity more closely reflect cardiometabolic risk than body weight alone. Visceral adipose tissue is of particular importance because it is metabolically active and strongly linked to insulin resistance, dyslipidemia, inflammation and cardiovascular risk. In a 2024 network meta-analysis of 84 randomized trials, aerobic exercise, resistance training, combined training and high-intensity interval training all reduced visceral adipose tissue to varying degrees, with vigorous aerobic exercise and HIIT ranking highly in some analyses [19]. This is useful clinically because it supports the idea that body composition and fat distribution can improve even when scale weight changes are modest.

Accordingly, clinicians should avoid presenting exercise as successful only when body weight falls dramatically. Improvements in waist circumference, visceral fat, functional capacity and metabolic markers are also meaningful. This is especially important for patients who become discouraged when early weight loss is limited despite better movement habits.

7.4. Insulin sensitivity, glycemic control, and metabolic syndrome

Exercise improves insulin sensitivity through both acute and chronic mechanisms. Acute muscle contraction increases glucose uptake independently of insulin, while repeated training improves mitochondrial density, capillarization, muscle oxidative capacity and body composition. The 2022 ACSM consensus statement on exercise in type 2 diabetes emphasized not only increasing physical activity but also reducing and breaking up sedentary time [20]. This combined focus is especially relevant in adults with obesity, prediabetes or metabolic syndrome features.

In patients with metabolic syndrome, exercise improves several components simultaneously, including waist circumference, blood pressure, triglycerides, HDL cholesterol, fasting glucose and peak oxygen uptake [21]. This reinforces the view that movement-based interventions should be introduced early, before overt diabetes or clinical cardiovascular disease develops. It also supports a broader clinical narrative: exercise helps re-shape cardiometabolic risk even without dramatic weight loss.

At the same time, heterogeneity remains important. Glycemic and insulin-sensitivity responses vary with adherence, diet, sleep, medication use, baseline obesity, and social context. Therefore, physical activity should be treated as essential but not isolated. It works best when supported by broader risk-factor management and realistic long-term behavior change strategies.

8. Secondary Prevention and Cardiac Rehabilitation

Once cardiovascular disease is established, physical activity remains central, but it should be reframed from generic advice into structured therapy. In patients after myocardial infarction, coronary revascularization, chronic coronary syndrome diagnosis, or heart failure diagnosis, exercise becomes part of comprehensive disease management rather than an optional adjunct. The ESC sports cardiology and exercise guidance emphasizes that most individuals with cardiovascular disease benefit from regular, appropriately prescribed activity, with more vigorous exercise individualized according to diagnosis, symptoms, ischemic burden, arrhythmic risk, ventricular function, and shared decision-making [22].

Exercise-based cardiac rehabilitation is the clearest clinical embodiment of this principle. In coronary heart disease, an updated 2023 meta-analysis of 85 randomized trials involving more than 23,000 participants found that exercise-based rehabilitation improves health-related quality of life and supports favorable cardiovascular outcomes in the context of contemporary care [23]. Although effect sizes differ across outcomes and settings, the overall evidence base continues to support cardiac rehabilitation as a key component of secondary prevention. The evidence is also strong for heart failure. The 2024 Cochrane review on exercise-based cardiac rehabilitation in adults with heart failure concluded that rehabilitation improves health-related quality of life and reduces hospital admission burden, while mortality effects remain less certain in some contexts [25]. The closely related 2023 contemporary Cochrane synthesis published in the *European Journal of Heart Failure* similarly supported rehabilitation as a valuable intervention for symptoms, function, and quality of life [24]. For clinicians, this means that exercise should be understood not as a luxury after stabilization, but as part of the treatment plan itself.

Several mechanisms explain these secondary-prevention benefits. Beyond traditional risk-factor modification, rehabilitation improves exercise tolerance, confidence in movement, autonomic balance, symptoms of deconditioning, and self-management behavior. Participation also creates opportunities for medication optimization, smoking cessation, dietary counseling, psychosocial support, and reinforcement of long-term movement habits. For this reason, rehabilitation is not merely an exercise prescription in isolation. It is a structured platform for multidisciplinary risk reduction.

Yet the gap between evidence and uptake remains substantial. Referral, enrollment, completion, and maintenance rates for cardiac rehabilitation are often disappointing, particularly among women, older adults, rural populations, socioeconomically disadvantaged patients and those with competing work or caregiving responsibilities. This implementation gap is one of the major reasons why contemporary rehabilitation models increasingly incorporate home-based and digital approaches.

9. Digital and Telerehabilitation Approaches

Digital and home-based rehabilitation strategies have expanded rapidly, initially as a way to extend access and later as a durable component of rehabilitation delivery. A systematic review and meta analysis of home-based cardiac telerehabilitation in coronary heart disease found that, compared with usual care, telerehabilitation improved functional capacity, daily step count, exercise behavior, and selected quality-of-life outcomes, while appearing comparable to center-based rehabilitation for several outcomes [26].

A 2024 systematic review and meta-analysis of different telerehabilitation models in coronary artery disease refined this picture further. It suggested that both fully home-based telerehabilitation and hybrid models are feasible, safe, and broadly non-inferior to conventional interventions for selected outcomes, including exercise capacity and risk-factor control, while adherence in many studies was high [27]. Another meta-analysis focusing on post-percutaneous coronary intervention populations also found beneficial effects of home-based telerehabilitation programs on rehabilitation-related outcomes [28].

These findings are clinically important because access barriers remain one of the biggest limitations of conventional cardiac rehabilitation. Patients may live far from centers, face transport difficulties, work irregular hours, have caregiving obligations, or feel uncomfortable in group settings. Telerehabilitation can lower some of these barriers and may also support continuity once a formal center-based phase ends.

Nevertheless, digital delivery should not be presented as a universal replacement for center-based care. Patient selection matters. Some individuals require closer in-person monitoring, supervised progression, or more intensive psychosocial support. Digital literacy, device access, language barriers, and reimbursement frameworks also influence feasibility. Economic evidence is encouraging. A 2023 systematic review found that most included studies supported the cost-effectiveness of exercise-based cardiac telerehabilitation but the best design and financing model remain context-dependent [29].

The most balanced conclusion is therefore pragmatic: telerehabilitation is a valuable complement and for selected patients, a reasonable alternative to conventional delivery. Its greatest promise lies in expanding reach rather than simply replacing existing programs.

10. Discussion

The evidence reviewed here supports physical activity as a broad-spectrum cardiovascular intervention rather than as a narrow lifestyle preference. Across guidelines, cohort studies and trial syntheses, the same themes recur - movement lowers risk, the greatest relative gains often appear when inactive individuals become modestly active, sedentary behavior deserves attention in its own right, and exercise remains clinically meaningful even after disease is established [3-12,22-29]. This convergence is striking given the diversity of study designs and populations.

One of the most important practical lessons from the literature is that activity should be prescribed progressively, not idealistically. Inactive patients often derive large relative benefits from small, sustainable increases in movement. This is both scientifically supported and clinically useful. It shifts the focus from a binary distinction between “meeting guidelines” and “failing guidelines” toward a more constructive model in which each increase in movement is meaningful. Daily-step framing, incidental activity, active transport, post-meal walking, and brief sitting interruptions all make the message more accessible for patients who are far from formal exercise targets [10-12,30].

The literature also supports treating sedentary behavior as more than a secondary concern. Long sitting time is not simply the mirror image of low exercise. Patients who spend most of the day seated, especially in desk-based work or screen-heavy routines, may retain a meaningful risk exposure even if they complete some purposeful activity. This matters particularly in contemporary practice, where many adults perceive themselves as “reasonably active” while still accumulating highly sedentary days. Recommendation to interrupt sitting is therefore not trivial. It is a practical translation of a growing evidence base [8,9,30,31].

From a therapeutic point, physical activity should be integrated with pharmacotherapy rather than set against it. Lifestyle and medication address different aspects of the same risk profile.

For example, antihypertensive therapy may lower blood pressure more predictably in some patients, but exercise improves blood pressure while also influencing insulin sensitivity, body composition, inflammation, endothelial function, and fitness [15-21]. Likewise, exercise is unlikely to replace statins in a patient with clear dyslipidemia-related risk, yet it contributes to lipid improvement and addresses multiple parallel pathways. The value of physical activity lies partly in this multi-target effect.

This multi-target quality is especially important in family medicine, internal medicine, cardiology, and rehabilitation settings. Physical activity is low cost compared with many downstream interventions. Can usually be prescribed safely with appropriate tailoring and is adaptable to a wide range of clinical circumstances. It also gives patients an active role. Unlike some medical interventions that occur episodically, movement behavior is practiced daily and can reshape risk cumulatively over time. The most important clinical success is not transforming sedentary adults into athletes, but helping them become consistently less sedentary and modestly more active. Several limitations of the evidence base should temper interpretation. First, a substantial portion of the epidemiological literature remains observational, leaving room for residual confounding and reverse causation despite sophisticated adjustment. Second, exposure measurement is heterogeneous. Self-reported physical activity tends to overestimate activity and misclassify intensity, while device based measures vary according to device type, placement, algorithms, and wear-time criteria. Third, exercise interventions differ in modality, dose, supervision, and adherence, which complicates direct comparison and simple universal prescription. Fourth, women, frail older adults, socioeconomically disadvantaged populations, and some racial or ethnic groups remain underrepresented in parts of the rehabilitation literature. Finally, digital interventions may reduce access barriers for some while increasing them for others if technology and support are unequally available.

These limitations do not weaken the core conclusion, but they do shape how it should be communicated. The evidence is strong enough to support routine promotion of physical activity in cardiovascular prevention, yet not so precise that one exact step count, one best exercise modality, or one sedentary-time threshold can be prescribed for all patients. This is a field in which the overall direction is robust, even if the exact optimum remains uncertain.

Future research should therefore focus less on proving again that activity is beneficial and more on refining implementation. Priorities include better integration of step count, intensity distribution, and sedentary patterning in device-based studies. More individualized prescriptions by age, sex, baseline fitness, and disease phenotype and implementation research addressing adherence, equity, and sustainable hybrid rehabilitation models. These questions are especially relevant if physical activity is to be embedded more fully into routine cardiovascular care rather than remaining a well-supported but inconsistently delivered recommendation.

11. Conclusions

Regular physical activity is one of the most important non-pharmacological interventions in cardiovascular prevention. It is associated with lower all-cause and cardiovascular mortality, improves blood pressure, body composition, insulin sensitivity, lipid metabolism, and cardiorespiratory fitness. Remains a core component of secondary prevention and cardiac rehabilitation. Sedentary behavior should be addressed explicitly alongside exercise promotion, because prolonged sitting is itself a clinically relevant exposure.

The most useful clinical message is practical and non-dogmatic. Patients should be encouraged to move more than they do now, sit less than they do now, interrupt prolonged sitting, and build sustainable activity patterns suited to their health status and daily life. In preventive cardiology, progress matters more than perfection.

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