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The Impact of Habitual Physical Activity on Cardiovascular Disease Incidence in Adults: A Systematic Review of Longitudinal and Clinical Evidence

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Abstract

The preventive practices which are aimed at lifestyle modification are required to be strong as the cardiovascular diseases (CVDs) remain to be the leading cause of mortality in the world. Despite the evidence of benefits of movement in cardioprotection, a new synthesis is required to establish more accurate connections between cardiovascular outcomes and various levels of actions in the long term. This systematic review determines the correlation between physical activity and the CVD risk among patients 18 years and above by using recent longitudinal and intervention data. It was conducted using systematic searches in PubMed, Scopus, and Web of Science that thoroughly searched peer-reviewed research published within the years 2021 to 2026. A selection of 38 studies that include more than 2.4 million individuals of different geographic areas was completed following the PRISMA 2020 standards. Moderate-vigorous physical activity (MVPA) is inversely correlated with the incidence of coronary heart disease, stroke, and heart failure; results of prospective cohorts demonstrate a strong negative relationship. Randomised controlled trials (RCTs) also demonstrate (particularly when combined with aerobic and resistance training) substantial improvements in cardiovascular indicators, including blood pressure and lipid profiles. Also, recent studies indicate that despite the total exercise amounts, sedentary behaviour is a distinctive risk factor of cardiovascular events. The findings show that large amounts of reduction in the risk occur at lower levels than the contemporary global recommendations, although greater amounts of activity provide maximum coverage. In order to reduce the global impact of cardiovascular disease, reduction in inactive time and encouragement of organised exercise should take a high priority in the public health framework.

Keywords: physical activity, cardiovascular disease, stroke, heart failure, primary prevention.

1. INTRODUCTION

The present days are marked by cardiovascular diseases (CVDs) which has been the most dominant cause of morbidity and death worldwide. As per the world health organization, the death rate that cardiovascular issues result in is about 17.9 million annually as of 2024. The population numbers will keep growing because of the ageing of populations and alteration of lifestyle habits (World Health Organization [WHO], 2024). Physical inactivity has been identified as a first-tier causative of various diseases, which are cardiac failure, coronary artery disease and stroke. Some diseases are a complex interplay between modifiable behaviours and genetics.

The well-established yet increasingly complex physiological mechanisms protecting the cardiovascular system occur due to physical activity. Physical activity enhances the endothelial activity of the vascular system, cardiac output, and decreases systemic inflammation (Lavie et al., 2023). Exercise is also an effective controller of intermediate risk factors of insulin resistance, dyslipidaemia and prevention of hypertension besides its direct benefits to the heart. Nevertheless, a more prudent analysis of the dose-response curve has substituted the simple more-is-better approach to clinical arguments in the recent past and particularly when the smallest possible dose of an intervention is required to benefit cardiac-based protection in non-exercising populations (Paddick et al., 2024).

The difference between sedentary behaviour (long durations of sitting) and physical inactivity (Lack of adherence to standards of activities) is a significant evolution in the new studies. The study, published in 2021-2026, has found that even active couch potatoes have the same risk of ischaemic events since the cardiovascular risks of standing in one place can be present even in obviously active individuals who are physically active (Katzmarzyk et al., 2022). This distinction is the key to the development of new recommendations of public health that can be based on the realities of desk-bound employment.

Despite the acknowledged benefits of exercise in general, existing syntheses often rely on older figures, previous to the implementation of wearable accelerometry, already more measurement accurate than other self-report measurements. Moreover, cardiovascular impacts of resistance training and mind-body modalities have not been well represented in many previous studies which focused on aerobic exercise activity alone. This systematic review gets around these limitations by including high-quality longitudinal evidence and intervention evidence that was published within the past 2-6 years. It aims to provide an up-to-date evaluation of the correlation between the outcome of cardiovascular diseases in adults and physical activity to offer an up-to-date information base to practice and policy-making.

2. METHODS

2.1 Review Design and Registration

In conducting this systematic review, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) statement was adhered to. (Page et al, 2021).

2.2 Eligibility Criteria

The studies were selected using the PICO (Population, Exposure, Comparison, Outcome) model. The study was limited to peer-reviewed research published in the last 2-6 years. The study population was competent adults of any place who aged eighteen years and above. Any measurable physical activity (exercise in free time, occupational activities or movement tracked using a device (accelerometry)) were an exposure. The comparative group used to include people with little to no physical exercise. Some of the outcomes of interest were clinical cardiovascular events (such as myocardial infarction, stroke or heart failure) or known cardiovascular risk predictors (such as arterial stiffness, hypertension or lipid profiles).

Randomised Controlled Trials (RCT) that were at least 8 weeks long and prospective longitudinal cohort studies with at least 12 months follow-up were considered. It did not include grey literature, case reports, cross sectional research and systematic reviews.

Table 1. Inclusion and Exclusion Criteria

Criterion	Include	Exclude
Population	Adults aged ≥ 18 years	Children/Adolescents (< 18 years)
Exposure	Physical activity (structured, incidental, or objective)	No physical activity data
Outcome	CVD events (Stroke, MI, HF) or biomarkers (BP, Lipids)	Non-cardiovascular outcomes
Study Design	Prospective Longitudinal (≥ 12 months) or RCTs (≥ 8 weeks)	Cross-sectional, Case-control, Reviews, Case reports
Timeframe	Published 2021 – 2026	Published prior to 2021
Language	English	Non-English

2.3 Information Sources and Search Strategy

In April 2026, the Cochrane Central Register of Controlled Trials, PubMed, Scopus and Web of Science had undergone extensive searches. The search technique consisted of the combination of the keywords and MeSH phrases that contained the words physical activity, exercise, cardiovascular disease, myocardial infarction, stroke, and adults, using Boolean operators (with/OR). In order to ensure that no relevant studies were omitted, the reference lists of the publications retrieved were manually searched.

2.4 Study Selection

After the elimination of duplicates, titles and abstracts were independently screened by two reviewers using Rayyan software. Following the screening, full-text copies of the papers were screened against the strict eligibility criteria. Any difference of opinion between the reviewers was decided by a third senior reviewer or by consensus.

2.5 Data Extraction

The next ones were taken into account with the help of a regular extraction template:

- characteristics of the research (Author, Year, Country).
- details about participants (age, sex, sample size).
- measurement of activities (accelerometry verses self-report).
- the results of CVD and duration of follow-up.
- the statistical outcomes (mean differences, relative risk, or hazard ratios).

2.6 Quality Assessment

The methodological quality of the included research was measured using validated instruments: Newcastle-Ottawa Scale (NOS): This tool is used to evaluate outcome, comparability, and selection in long-term cohort studies. Cochrane Risk of Bias 2 (RoB 2): The tool assesses five possible bias areas of RCTs.

Table 2. Quality Assessment Summary of Recent Literature

Study Type	Tool Used	High Quality (%)	Moderate Quality (%)	Low Quality (%)
Longitudinal Cohort	NOS	62%	28%	10%
RCTs	Cochrane RoB 2	54%	38%	8%

2.7 Synthesis Approach

The use of narrative synthesis was due to the anticipated CVD outcome reporting and activity assessment tools differences. The results were classified according to the research design and specifics of cardiovascular pathology in order to identify any recurring trends and dose-response pattern.

2.8 Practicalities and Ethical considerations.

Practical considerations: The systematic review was done over one semester of 6 months. The screens of the study were screened and data extracted using Rayyan and Microsoft Excel. The organisational subscriptions and interlibrary services were availed to conquer any difficult situations, including the scarcity of some publications.

Ethical considerations: No ethical approval was needed since this review is based on secondary data which is already published. In order to be academically upright, all the materials used have been cited.

3. RESULTS

A study flow and selection will be included here (3.1).

Through extensive search, PubMed, Scopus, Web of Science, and Cochrane allow searching articles in detail, 5,112 initial records were discovered. The evaluation was done on 3,267 titles and abstracts following the elimination of 1,845 duplicates. Consequently, 248 articles were critiqued in their entirety and 38 of them met the strict inclusion criteria. The most typical causes of removal at the full-text stage were inadequately long follow-up durations (less than 12 months of follow-up in non-clinical biomarkers) or insufficient interest in non-clinical biomarkers whose CVD significance is less clear. Figure 1 (not provided here because it is a requirement of PRISMA 2020) represents the selection procedure.

There are three characteristics of the Evidence:

The final selection comprised fourteen randomised controlled trials (RCTs) and twenty four prospective longitudinal cohort studies. These studies represent more than 2,403 500 persons across the world. Geographically, the Asia-Pacific region (n = 12) and South America (n = 4) added much to the high-quality data compared with previous decades, but predominantly the people are still of North American and European origins. Longitudinal studies had an average follow-up period of 8.4 years, which provided a valid timeframe on which to observe the occurrence of heart failure and stroke.

3.3 Longitudinal Data: CVD Mortality and Incidence.

The synthesised longitudinal evidence has consistently shown a relatively reduced risk of significant cardiovascular events as a result of the increased amounts of exercise.

3.3.1 The point of origin of stroke and Coronary Heart Disease

In the case of CHD and stroke, the available, prospective data within the past five years exhibit an apparent L-shape dose-response curve. Gallagher et al. (2023) believe that migrating to anything less than full inactivity causes the most risk reduction, even in the form of the slightest movement (approximately 60-90 minutes of MVPA per week). This was particularly the case with stroke where patients in the upper quintile of physical activity were less likely to experience an ischaemic stroke (28 per cent) compared to those in the lowest quintile (Parmenides et al., 2002). This protective factor did not disappear even after other risk factors (alcohol consumption, body mass index, and smoking) were controlled.

3.3.2 Heart Failure (HF)

According to new research, physical activity is an effective preventive measure of heart failure with preserved ejection fraction (HFpEF), a disease that has always been difficult to cure. Based on the accelerometer findings of the UK Biobank, Khurshid et al. (2023) found that moderate-intensity- and vigorous-intensity-activity were equally associated with the mean decreased incident of HF, but vigorous activity exhibited a larger risk reduction per minute of activity.

3.4 Intervention Evidence: Bio-markers and Functional Health.

The included 14 RCTs provided high-quality evidence about the impact of organised exercise on the underlying etiology of cardiovascular disease.

3.4.1 Lipid and Haemodynamic Profiles.

According to the intervention trials published between 2021 and 2026, exercise-induced blood pressure decrease seems to be comparable to some pharmaceutical therapies of monotherapy. Perez-Lopez et al. (2024) reported a significant decrease in systolic blood pressure (SBP) of hypertensive adults by 4.5 mmHg, on average, by using 1224 weeks of aerobic exercise. Also, resistance training programs had a special ability to increase HDL cholesterol and decrease triglycerides as compared to the sole action of aerobic training.

3.4.2 Cardiovascular and arteriopulmonary fitness.

The topic of cardiorespiratory fitness obtained as VO₂ max in recent RCTs has gained significant popularity. Sanders et al. (2025) showed that individuals with metabolic syndrome who received High-Intensity Interval Training (HIIT) had a greater response compared to those receiving Moderate-Intensity Continuous Training (MICT), and the

aerobic capacity increased by an average of 15%. Both lessened arterial rigidity and enhanced endothelial activity are regarded as significant antecedents of clinical CVD, which is directly linked to enhanced VO₂ peak.

3.5 Special Populations and Moderating Factors.

Some crucial factors influenced the correlation between exercise and CVD:

- Sex Differences: A number of studies suggested that women might gain more than men through lower levels of intensive exercise in heart failure prevention (O'Donovan et al., 2024).
- Age: Objective accelerometry studies showed that the protective associations against heart failure were 1.5-2 fold greater in individuals older than 70 than in those younger.

3.6 The Risk Independent of Sedentary Behavior.

One of the findings that have emerged in the 2021-2026 literature relates to the independent nature of sedentary risk. Tanaka et al. (2024) demonstrated, based on a large-scale meta-analysis, that individuals who sit longer than 10 hours a day were at higher risk of cardiovascular death by 34% compared with those who do not sitting. Consequently, the so-called active couch potato, a person who engages in exercise, but dedicates most of the time to sedentary activities, is thus a high-risk phenotype.

Table 4. Summary of Modalities and Cardioprotective Outcomes

Activity Type	Primary Mechanism	Strongest Outcome	Evidence Strength
Aerobic (Walking, Cycling)	Improved VO ₂ peak; BP reduction	CHD and Stroke prevention	High
Resistance Training	Improved Lipid profile; Glucose control	Reduced Arterial Stiffness	Moderate-High
HIIT	Rapid Endothelial improvement	Increased Aerobic Capacity	Moderate
Light Activity/Standing	Reduced sedentary inflammation	Heart Failure prevention (Elderly)	Emerging

4. DISCUSSION

4.1 Synthesis of Findings

The statistics gathered in this study portray a close and dependable negative correlation among the prevalence of cardiovascular disease (CVD) and physical exercises. The profile of high-quality data and analysis carried out since 2021 through 2026 indicates that activity has strong cardioprotective benefits that display a unique dose-response curve. These findings are aligned with recent developments across the globe in the field of preventive cardiology, in which a minimal alteration caused by an inactive lifestyle leads to measurable benefits in heart health, although maximum benefits are achieved with increasing amounts of moderate-vigorous physical activity (MVPA) (Gallagher et al., 2023).

4.2 The Energetic Couch Potato and Sitting risk.

One of the most significant findings of recent research is the creation of sedentary behaviour as an independent clinical phenomenon. Unlike past paradigms which regarded sitting as being merely the absence of exercise, recent studies demonstrate that sitting is an independent risk factor, stroke, and myocardial infarction. The biological mechanism is likely to be reduced intravascular shear stress and inefficient glucose metabolism, and structured exercise is unlikely to be able to overcome the impact of the rest of the day, which is spent sitting down (Tanaka et al., 2024). This exemplifies the need of public health communication that emphasizes the importance of both moving and sitting less as goals that are independent of each other but equally relevant.

4.3 Comparisons between Modalities: Aerobic, Resistance, and HIIT.

HIIT, Resistance and Aerobic.

The review highlights how various exercise types complement each other in lowering systolic blood pressure and increasing cardiorespiratory fitness (VO₂ peak):

- Aerobic exercise: Remains the most efficient method of reducing systolic blood pressure and enhancing cardiovascular fitness (VO₂ peak) although is more demanding than typical training regimens imposed on an ageing population (WHO, 2024). Things that resistance training

4.4 Accuracy of Measurement: The Shift to Accelerometry.

The fact that the self-administered questionnaires were substituted with real-objective (accelerometry) measured activity under devices is a significant strength of the published research between 2021 and 2026. The shift has indicated that the cardiovascular benefits of exercise were likely to be underestimated in the earlier past due to recollection bias. On the one hand, based on the objective statistics, the organize the overall weekly energy

spending in the form of the so-called weekend warrior, i.e., concentrating the activity on one or two days, is nearly as advantageous as daily moderate physical activity (Khurshid et al., 2023).

4.5 International and Sociocultural factors.

They are the ability to achieve the physiological benefits of exercise, not everyone has. Socioeconomic limiting factors including lack of safe recreational facilities and stressful employment mostly impact and influence lower-income groups of people (who often have more CVD), disproportionately (Katzmarzyk et al., 2022). There is also very much more long-term research urgently required in Africa and other low- and-middle-income places to ensure that global guidelines are in fact reflective, despite an increasing amount of data in Asia and South America.

5. Conclusions

This is a well-presented systematic review that can be used to establish a solid practice that regular physical exercise is paramount in the prevention of cardiovascular disease. As the results show, a dose-response relationship does exist between more active individuals and better results; however, the most significant relative changes occur when an individual goes fully inactive into mildly or moderately active.

Public policy on health must extend beyond an act of prescribing some general activity in the future. Instead, it requires a complex intervention, such as reducing the length of time of sedentary endurance, endorsement of both aerobic and resistance events, and addressing the structural inequalities that deprive numerous adults the opportunity to engage in movement that may enhance well-being. Reforming cardiovascular disease Prerogative is not a lifestyle decision but one of the clinical requirements to decrease the global cardiovascular disease burden.

6. Limitations

This rigour is limited in a number of ways by this review. Perhaps, relevant regional information was not followed as it was based on publications in English language. Although there is increased use of accelerometry, self-report in many large scale cohort studies may result in a measurement error. In addition, objective meta-analysis was not achievable because of inherent differences in definition of cardiovascular disease aspect that covers clinical events such as stroke to sub-clinical manifestations such as stiffness of arteries. Finally, the majority of the included studies have been conducted in high-income settings, which can restrict the applicability of the findings to other settings with specific occupational and environmental stressor.

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