Peripheral Artery Disease and Life Style Changes: Systematic Review with ☸SAIMSARA.

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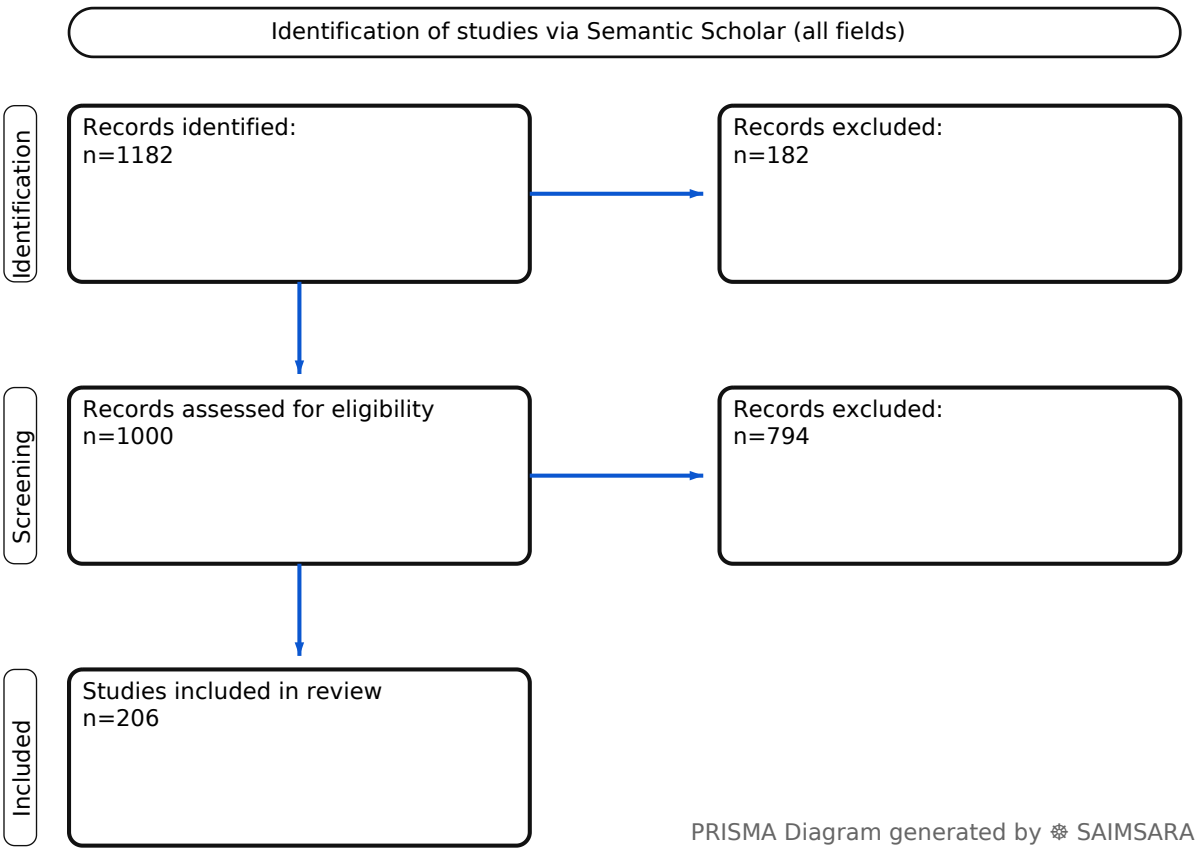
Abstract: This paper aims to systematically review and synthesize the current evidence regarding the role and efficacy of lifestyle changes in the management of peripheral artery disease, focusing on their impact on disease severity, functional outcomes, and quality of life. The review utilises 206 studies with 99706 total participants (naïve ΣN). Lifestyle interventions, particularly supervised exercise training, consistently improve functional capacity and health-related quality of life in patients with peripheral artery disease, despite observed variability in individual responses. These benefits are observed across various populations, including those with comorbidities like type 2 diabetes, highlighting the broad applicability of such interventions. However, the heterogeneity of outcome measures and study designs limits direct quantitative comparisons, and the significant prevalence of non-responders to exercise remains a key challenge. Clinicians should prioritize comprehensive lifestyle modifications and exercise therapy, while future research should focus on developing personalized interventions and long-term adherence strategies to improve outcomes for all PAD patients.

Keywords: Peripheral Artery Disease; Lifestyle Modifications; Exercise Therapy; Cardiovascular Risk Factors; Disease Management; Quality of Life; Supervised Exercise; Physical Activity; Prevention; Diabetes Mellitus

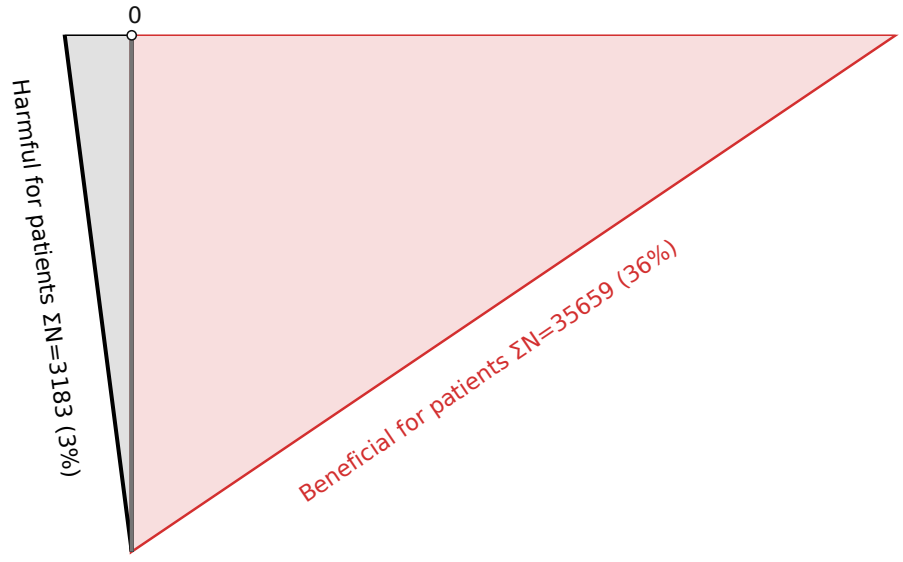
Review Stats

- Generated: 2026-01-29 07:23:29 CET
- Plan: Pro (expanded craft tokens; source: Semantic Scholar)
- Source: Semantic Scholar
- Scope: All fields
- Keyword Gate: Fuzzy (≥60% of required terms, minimum 2 terms matched in title/abstract)
- Total Abstracts/Papers: 1182
- Downloaded Abstracts/Papers: 1000
- Included original Abstracts/Papers: 206
- Total study participants (naïve ΣN): 99706



PRISMA Diagram generated by ☸ SAIMSARA

△OSMA Triangle
Effect-of Predictor → Outcome
life style changes → peripheral artery disease



Neutral ΣN=60864 (61%)

△OSMA Triangle generated by ☸SAIMSARA

Outcome-Sentiment Meta-Analysis (OSMA): *(LLM-only)*

Frame: Effect-of Predictor → Outcome • *Source*: Semantic Scholar

Outcome: peripheral artery disease Typical timepoints: 1-y, 12-mo. Reported metrics: %, CI, p.

Common endpoints: Common endpoints: qol, mortality, functional.

Predictor: life style changes — exposure/predictor. Doses/units seen: 80 mg, 40 mg, 4 kg.

Routes seen: sc. Typical comparator: men, control, those with aaa alone or, heart failure….

- **1) Beneficial for patients** — peripheral artery disease with life style changes — [2], [3], [12], [19], [21], [25], [30], [36], [37], [38], [40], [42], [45], [46], [48], [50], [54], [55], [56], [57], [62], [63], [65], [67], [69], [70], [71], [73], [74], [75], [93], [94], [96], [136], [150], [160], [161], [166], [168], [169], [174], [176], [179], [185], [189], [190], [192], [194], [195], [196], [197], [202], [204], [206] — ΣN=35659
- **2) Harmful for patients** — peripheral artery disease with life style changes — [35], [49], [51], [59], [60], [64], [68], [72], [175] — ΣN=3183
- **3) No clear effect** — peripheral artery disease with life style changes — [1], [4], [5], [6], [7], [8], [9], [10], [11], [13], [14], [15], [16], [17], [18], [20], [22], [23], [24], [26], [27], [28], [29], [31], [32], [33], [34], [39], [41], [43], [44], [47], [52], [53], [58], [61], [66], [76], [77], [78], [79], [80], [81], [82], [83], [84], [85], [86], [87], [88], [89], [90], [91], [92], [95], [97], [98], [99], [100], [101], [102], [103], [104], [105], [106], [107], [108], [109], [110], [111], [112], [113], [114], [115], [116], [117], [118], [119], [120], [121], [122], [123], [124], [125], [126], [127], [128], [129], [130], [131], [132], [133], [134], [135], [137], [138], [139], [140], [141], [142], [143], [144], [145], [146], [147], [148], [149], [151], [152], [153], [154], [155], [156], [157], [158], [159], [162], [163], [164], [165], [167], [170], [171], [172], [173], [177], [178], [180], [181], [182], [183], [184], [186], [187], [188], [191], [193], [198], [199], [200], [201], [203], [205] — ΣN=60864

1) Introduction

Peripheral artery disease (PAD) represents a significant global health challenge, characterized by reduced blood flow to the limbs, primarily the lower extremities [68, 129]. It is a manifestation of systemic atherosclerosis and is associated with substantial morbidity, including functional impairment, reduced quality of life, and increased risk of major cardiovascular events such as heart attack and stroke [72, 121, 172, 176]. The global burden of PAD continues to grow, driven by demographic changes and rising metabolic risk factors, particularly in low socio-demographic index (SDI) regions and among the elderly [5, 6, 15, 26, 64, 76, 91, 130]. Modifiable lifestyle factors,

including high fasting plasma glucose, high systolic blood pressure, tobacco use, sedentary behavior, and unhealthy dietary patterns, are major contributors to PAD incidence and mortality [14, 15, 20, 53, 59, 68, 70, 81, 90, 113, 139, 143, 175, 189, 195]. Consequently, lifestyle modifications are recognized as fundamental to both the prevention and management of PAD, aiming to reduce disease severity, improve functional status, and enhance patients' health-related quality of life (HRQoL) [1, 11, 30, 54, 56, 73, 79, 89, 136, 179, 196, 197]. This paper synthesizes current evidence on the efficacy and impact of lifestyle changes in patients with PAD.

2) Aim

This paper aims to systematically review and synthesize the current evidence regarding the role and efficacy of lifestyle changes in the management of peripheral artery disease, focusing on their impact on disease severity, functional outcomes, and quality of life.

3) Methods

Systematic review with multilayer AI research agent: keyword normalization, retrieval & structuring, and paper synthesis (see SAIMSARA About section for details).

- **Bias:** The included studies exhibit a range of designs, from randomized controlled trials (RCTs) and cohort studies to cross-sectional analyses and mixed-method approaches. While RCTs and prospective cohort studies offer higher levels of evidence for intervention efficacy, the presence of non-specified study types and reliance on observational data in some instances introduce potential for selection and confounding biases. Furthermore, the variability in sample sizes, follow-up durations, and outcome measures across studies may limit direct comparability and introduce heterogeneity.

4) Results

4.1 Study characteristics:

The included studies comprise a diverse range of designs, with a notable presence of randomized controlled trials (RCTs) [3, 8, 9, 13, 23, 25, 31, 37, 39, 40, 41, 42, 44, 45, 47, 48, 50, 51, 52, 55, 63, 74, 82, 87, 89, 92, 93, 96, 116, 118, 120, 134, 135, 146, 157, 161, 166, 199, 201], cohort studies [2, 4, 12, 29, 35, 36, 57, 58, 69, 73, 76, 85, 90, 91, 95, 97, 102, 118, 123, 124, 138, 144, 149, 156, 158, 164, 167, 175, 178, 183, 188, 190, 196, 205], and cross-sectional studies [4, 53, 81, 100, 133, 147, 174, 185, 189, 202]. Populations primarily include patients with symptomatic peripheral artery disease (PAD) at various Fontaine or Rutherford stages, often with comorbidities such as type 2 diabetes (T2D) or other lifestyle-related diseases [2, 3, 8, 9, 23, 38, 46, 60, 82, 84, 92, 99, 119, 128, 136, 153, 161, 162, 174, 175, 196]. Follow-up periods range from short-term interventions of weeks (e.g., 8 weeks [40, 50], 10 weeks [39], 12 weeks [3, 25, 33, 41, 44, 47, 63, 93, 146]) to several

months (e.g., 3 months [2, 21, 34, 42, 51, 71, 88, 117, 199], 4 months [37], 6 months [23, 45, 55, 62, 116, 185, 206]) and longer durations up to multiple years (e.g., 1 year [35, 75, 86, 89, 144, 166, 178], 5 years [85, 95], 10 years [188], 30 years [7]).

4.2 Main numerical result aligned to the query:

Lifestyle interventions, particularly supervised exercise training (SET) and home-based physical activity, consistently demonstrate improvements in functional capacity and health-related quality of life (HRQoL) in patients with peripheral artery disease (PAD). For instance, SET significantly improved peak walking distance (PFWD) by +102% and maximal walking distance (MWD) by +87%, alongside a +14% increase in 6-minute walking distance (6MWD) in symptomatic PAD patients [2]. Other studies reported clinically meaningful increases in 6MWD by 34.1 meters [33], or by 1211 total daily steps and 11 minutes in moderate-to-vigorous physical activity (MVPA) associated with large HRQoL improvements [25]. Despite these benefits, a significant prevalence of nonresponse (24.6% [33], 31.8% [47]) and poor response (32.3% [33], 43.2% [47]) to SET has been observed, indicating substantial inter-individual variability in outcomes.

4.3 Topic synthesis:

- **Efficacy of Exercise Training:** Supervised exercise training (SET) significantly improves treadmill performance, 6-minute walking distance (e.g., +14% [2]), and physical functioning in symptomatic PAD patients [2, 3, 38, 45, 46, 73, 93, 120, 132, 196]. Home-based leg heat therapy also shows promise, improving 6-minute walk distance ($p=0.029$) [40, 50].
- **Impact on Health-Related Quality of Life (HRQoL):** Lifestyle modifications, particularly exercise, consistently improve HRQoL in PAD patients [2, 3, 9, 19, 25, 30, 37, 38, 46, 96, 136]. Patients with PAD and comorbidities like abdominal aortic aneurysm (AAA) or type 2 diabetes (T2D) often report moderate-to-severe impact on physical functioning and HRQoL at baseline [9, 23, 99].
- **Role of Risk Factor Management:** Comprehensive management of modifiable risk factors (e.g., smoking cessation, dietary changes, blood pressure, diabetes, cholesterol control, physical activity) is crucial for preventing and managing PAD [5, 7, 11, 14, 15, 18, 20, 29, 54, 56, 70, 72, 79, 81, 85, 89, 90, 98, 101, 113, 117, 130, 136, 174, 176, 177, 178, 185, 189, 196, 197]. High fasting blood glucose is a leading risk factor for PAD burden, especially in the elderly [15].
- **Growing Burden and Disparities:** The global burden of PAD is increasing, particularly in low socio-demographic index (SDI) regions and among the elderly, with significant regional and demographic disparities [5, 6, 15, 20, 26, 64, 76, 90, 91, 130]. PAD is underrecognized and undertreated in women, leading to poorer outcomes compared to men [10, 26, 67, 76].

- **Challenges and Adherence:** Despite the known benefits, challenges exist in PAD management, including low use of guideline-directed medical therapy, patient non-compliance with lifestyle changes, and a significant prevalence of nonresponse to exercise therapy (e.g., 24.6% nonresponse to 6MWT improvement [33]) [16, 28, 33, 47, 57, 85, 162, 163, 178, 181, 182]. Sustained adherence to lifestyle modifications remains a key challenge [150, 178].
- **Novel and Digital Interventions:** Emerging strategies include semaglutide for walking outcomes in PAD with T2D [8, 13], technology-assisted home exercise [21], digital therapeutic programs for lifestyle factors and medication adherence [32], motivational interviewing for walking and weight loss [42, 51], and noninvasive therapeutic ultrasound (TUS) [94].
- **Comorbidity and Systemic Impact:** PAD is frequently associated with other lifestyle-related diseases and systemic conditions, such as sarcopenia (43.3% prevalence in PAD vs. 9.6% without PAD, $p < 0.001$) [4], type 2 diabetes, hypertension, and coronary artery disease [8, 9, 11, 14, 18, 23, 60, 84, 92, 99, 121, 128, 153, 158, 174, 175, 183]. Sedentary behavior can induce atheropromoting hemodynamic changes [59].

5) Discussion

5.1 Principal finding:

Lifestyle interventions, particularly supervised exercise training, consistently improve functional capacity and health-related quality of life in patients with peripheral artery disease, despite observed variability in individual responses [2, 3, 25, 33].

5.2 Clinical implications:

- **Prioritize Exercise Therapy:** Supervised exercise training (SET) should be a cornerstone of PAD management to improve walking performance and HRQoL, even in the presence of comorbidities [2, 3, 30, 38, 46].
- **Holistic Risk Factor Control:** Clinicians must emphasize comprehensive lifestyle modifications, including smoking cessation, dietary changes, and aggressive management of diabetes and hypertension, which are critical for preventing disease progression and complications [11, 14, 79, 176].
- **Address Treatment Non-Response:** Given the significant prevalence of non-responders to SET (up to 43.2% [47]), clinicians should identify these patients early and explore alternative or adjunctive therapies like home-based heat therapy or digital interventions [33, 40, 50].

- **Tailored Interventions for Women:** Recognizing the underrecognition and undertreatment of PAD in women, leading to poorer outcomes, necessitates sex-specific screening, diagnosis, and management strategies [10, 67].
- **Integrate Digital Health Solutions:** Digital therapeutic programs and technology-assisted home exercise may enhance medication adherence, exercise engagement, and quality of life, particularly for elderly PAD patients [21, 32, 63].

5.3 Research implications / key gaps:

- **Mechanisms of Non-Response:** Further research is needed to elucidate the underlying physiological and behavioral mechanisms contributing to non-response to supervised exercise therapy in PAD patients [33, 47].
- **Long-Term Adherence Strategies:** Studies are required to develop and evaluate innovative, sustainable interventions that promote long-term adherence to lifestyle modifications beyond the initial intervention period [150, 178].
- **Comparative Effectiveness of Exercise Modalities:** Head-to-head trials are needed to compare the long-term effectiveness of different exercise modalities (e.g., treadmill, arm-ergometry, home-based, technology-assisted) on functional outcomes and HRQoL in diverse PAD populations [3, 21].
- **Impact of Early-Stage Interventions:** Research should investigate the efficacy of lifestyle interventions in very early-stage or asymptomatic PAD to determine if they can alter disease progression or prevent symptom onset [64].
- **Sex-Specific Outcomes and Interventions:** More studies are needed to understand sex-specific responses to lifestyle interventions and to develop tailored programs that address the unique challenges faced by women with PAD [10, 12, 67, 76].

5.4 Limitations:

- **Heterogeneity of Outcomes** — The variety of outcome measures (e.g., different walking distance metrics, HRQoL scales) limits direct quantitative comparisons and meta-analysis across studies.
- **Variability in Study Designs** — The inclusion of diverse study designs, from RCTs to cross-sectional studies, introduces variability in the strength of evidence and potential for bias.
- **Limited Long-Term Follow-up** — Many intervention studies have relatively short follow-up periods, making it challenging to assess the sustained impact of lifestyle changes on long-

term PAD progression and outcomes.

- **Generalizability to Diverse Populations** — While some studies address global burden, specific intervention studies may not be fully generalizable to all demographic groups, particularly those in low SDI regions or with multiple complex comorbidities.
- **Reporting of Adherence Data** — The structured summary often lacks detailed reporting on patient adherence rates to lifestyle interventions, which is crucial for interpreting intervention effectiveness.

5.5 Future directions:

- **Standardized Outcome Measures** — Develop and implement standardized outcome measures for functional capacity and quality of life in PAD research.
- **Personalized Exercise Prescriptions** — Investigate personalized exercise prescriptions to optimize response rates and overcome non-response to supervised exercise therapy.
- **Community-Based Lifestyle Programs** — Design and test community-based lifestyle intervention programs, especially in low SDI regions, to address global PAD burden.
- **Digital Health Integration** — Further explore the integration of digital health tools and telemedicine for remote monitoring and support of lifestyle changes in PAD patients.
- **Cost-Effectiveness Analyses** — Conduct comprehensive cost-effectiveness analyses of long-term lifestyle interventions for PAD management.

6) Conclusion

Lifestyle interventions, particularly supervised exercise training, consistently improve functional capacity and health-related quality of life in patients with peripheral artery disease, despite observed variability in individual responses [2, 3, 25, 33]. These benefits are observed across various populations, including those with comorbidities like type 2 diabetes, highlighting the broad applicability of such interventions. However, the heterogeneity of outcome measures and study designs limits direct quantitative comparisons, and the significant prevalence of non-responders to exercise remains a key challenge. Clinicians should prioritize comprehensive lifestyle modifications and exercise therapy, while future research should focus on developing personalized interventions and long-term adherence strategies to improve outcomes for all PAD patients.

References

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Figure 1. Publication-year distribution of included originals

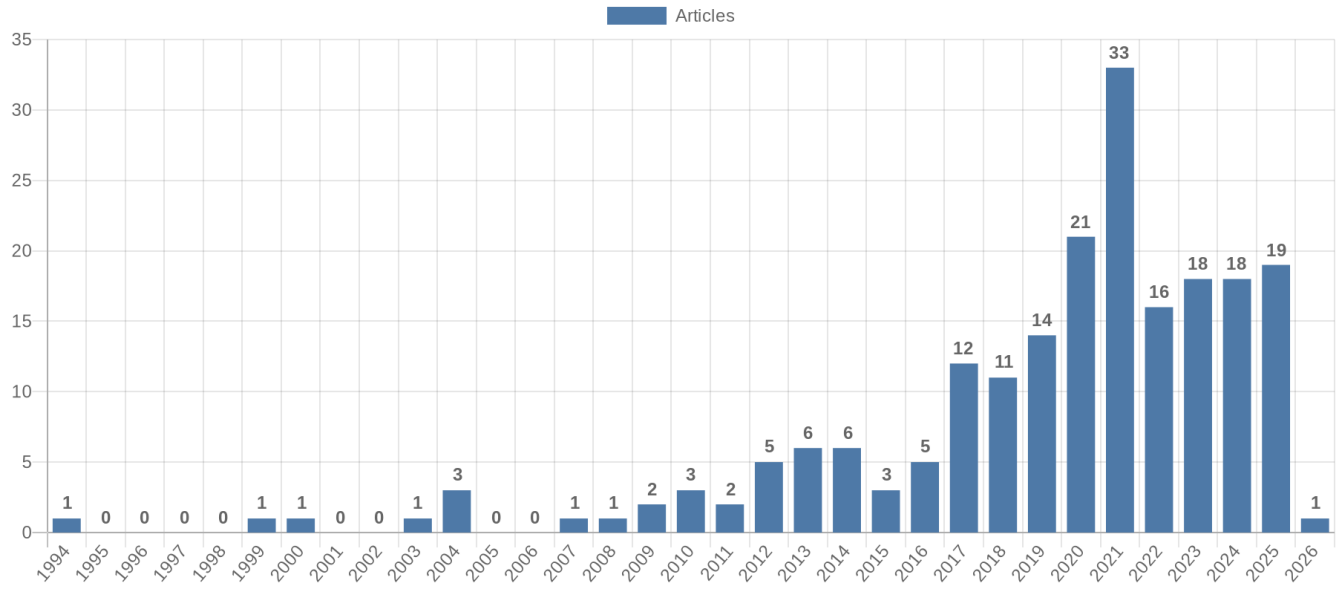

Figure 2. Study-design distribution of included originals

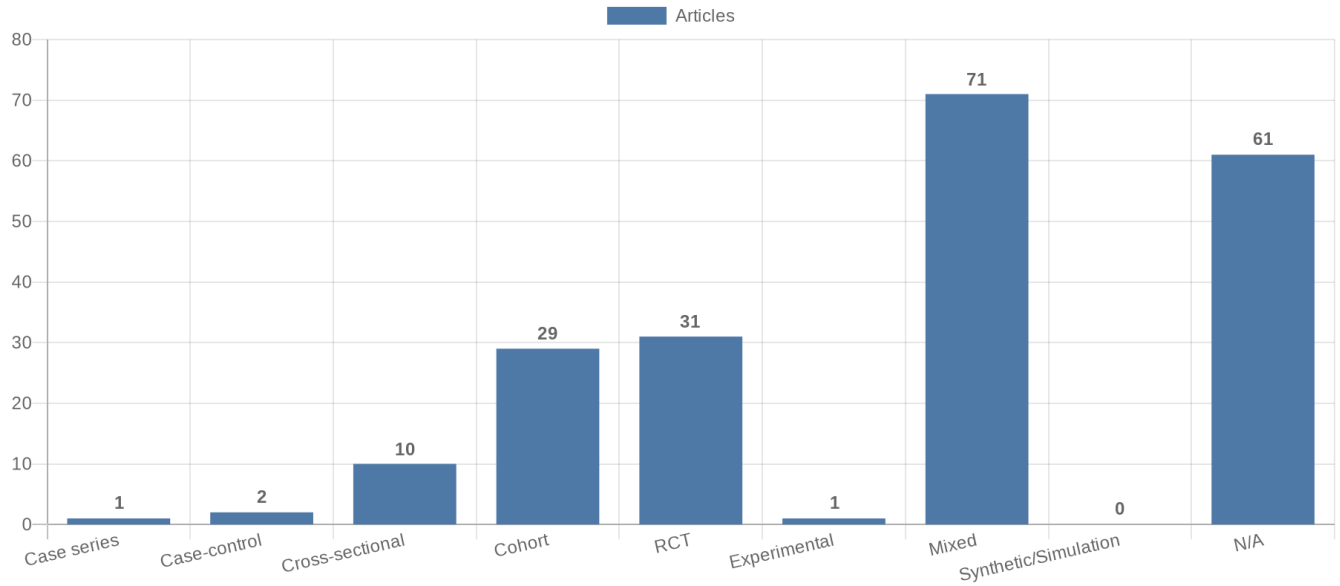

Figure 3. Study-type (directionality) distribution of included originals

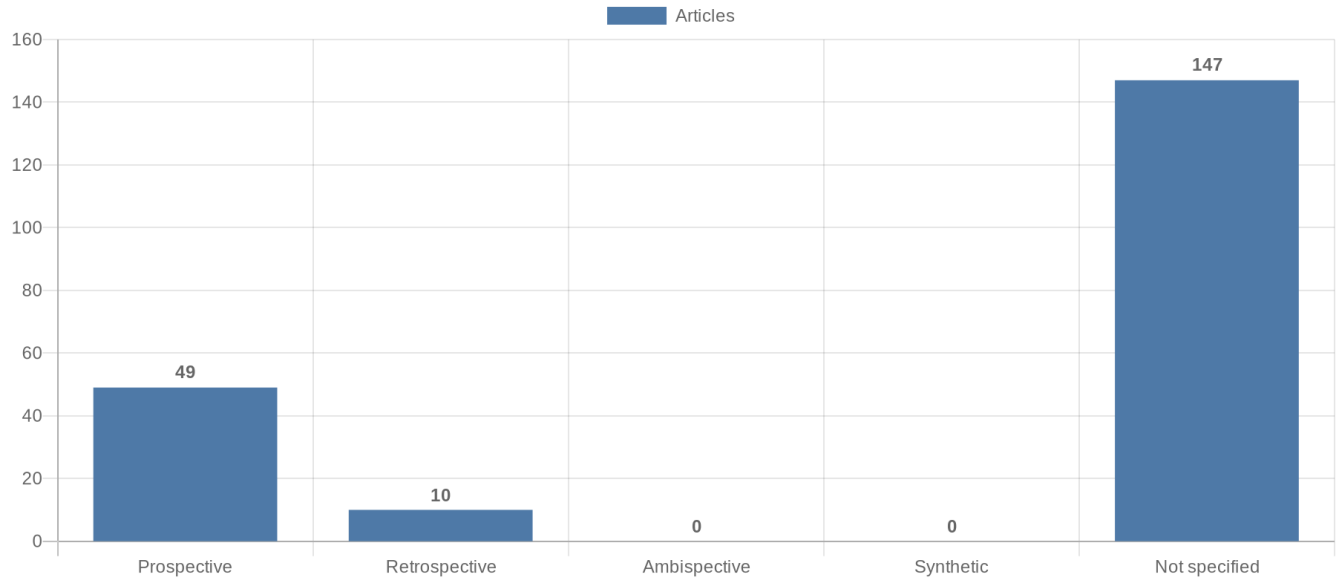

Figure 4. Main extracted research topics

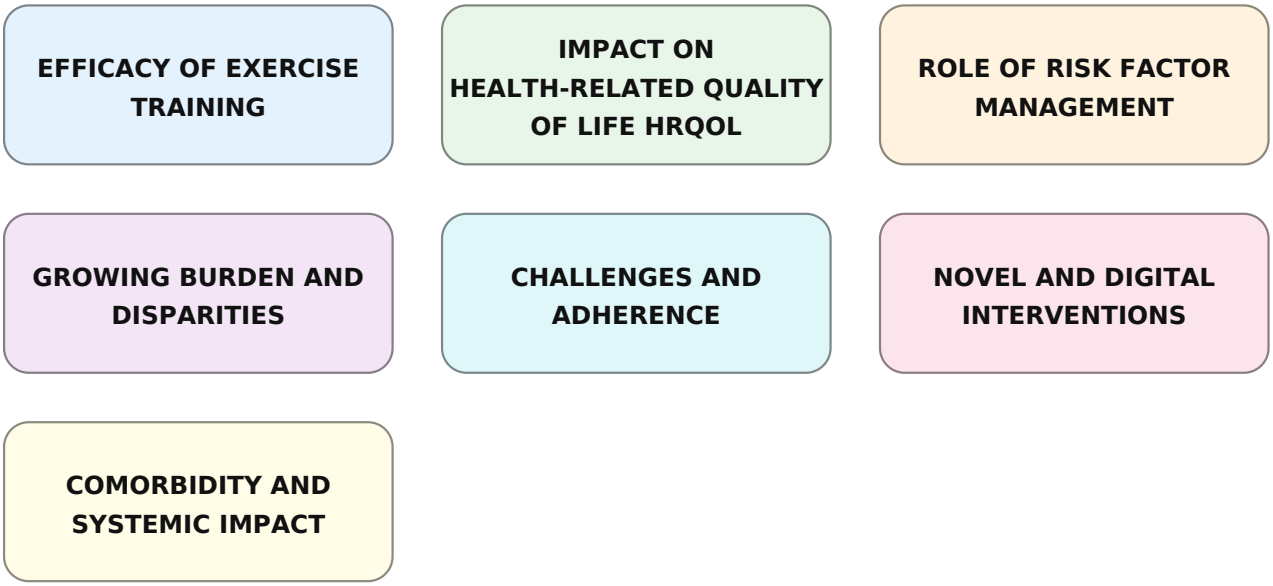

Figure 5. Limitations of current studies (topics)

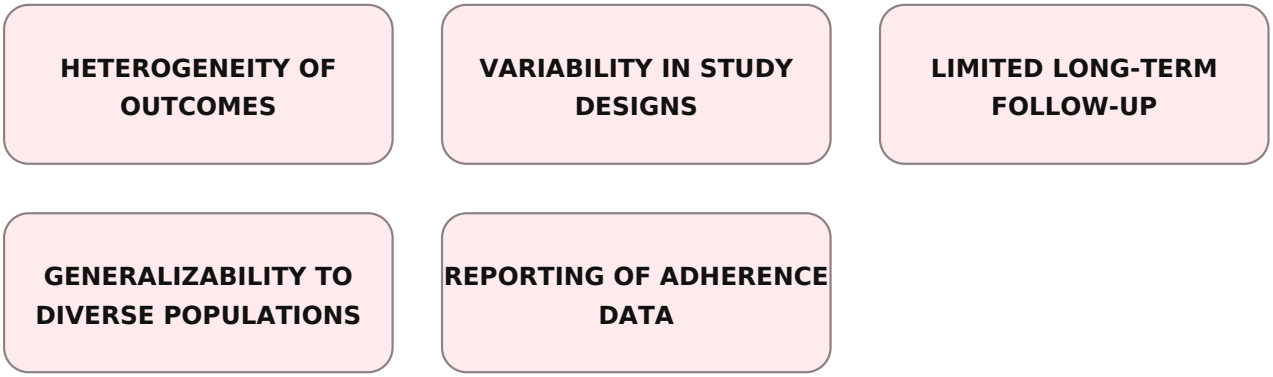

Figure 6. Future research directions (topics)