

Barriers and Facilitators of Adolescent Physical Activity Participation: A Systematic Review and Meta-Analysis of Quantitative Effect Sizes

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HOW TO CITE:

Guangtao Ren, Hazizi Abu Saad, Azhar Yaacob, Chuang Yuan, Meng Liu (2026). Barriers and Facilitators of Adolescent Physical Activity Participation: A Systematic Review and Meta-Analysis of Quantitative Effect Sizes
International Journal of Special Education, 41(21s), 1171 -1190

ABSTRACT

Physical activity participation among adolescents has declined globally, with severe consequences for public health. Although systematic reviews have identified barriers and facilitators of adolescent physical activity, there has been limited quantitative synthesis of effect sizes. Understanding the magnitude of these effects is crucial for evidence-based intervention development. To conduct a systematic review and meta-analysis of quantitative effect sizes for barriers and facilitators of physical activity participation among adolescents aged 10–19. We conducted a comprehensive search across multiple databases (Scopus, PubMed, and Web of Science) from 2015 to 2025. Studies investigating barriers and facilitators of physical activity participation among adolescents with extractable quantitative effect sizes were included. Two-stage screening was performed using predefined inclusion/exclusion criteria. Fixed-effects meta-analyses were performed using inverse variance weighting for odds ratios and Fisher's z-transformation for correlations. Heterogeneity was assessed using I^2 and Q statistics. Of the 600 studies initially identified, 3 demonstrated quantifiable effect sizes (total N = 64,258). The meta-analysis of odds ratios showed that both barriers (OR = 0.851, 95% CI: 0.830–0.873, $p < 0.001$) and facilitators (OR = 1.384, 95% CI: 1.360–1.410, $p < 0.001$) had significant pooled effects. Individual factors showed the strongest effects, with male gender (OR = 2.094) and high subjective health (OR = 1.550) being the most potent facilitators. Meta-analysis of correlation coefficients showed a pooled facilitator effect of $r = 0.212$ (95% CI: 0.185–0.240, $p < 0.001$). Substantial heterogeneity was observed among facilitators ($I^2 = 99.5\%$), indicating diverse mechanisms of action. This review

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gives a summary of association between chosen barriers, facilitators and adolescent physical activity participation. Individual-level factors showed strong links while social support showed steady small-to-moderate links. The results underline the benefit of multi-level strategies that tackle individual, social and contextual determinants. However, the conclusions should be viewed with caution because three studies met the inclusion criteria and there was large variation, among them. More quality quantitative and longitudinal studies are needed to strengthen the evidence base and to clarify the determinants of adolescent physical activity.

Keywords: adolescent, physical activity, barriers, facilitators, meta-analysis, effect size, systematic review

1. Introduction

1.1 Background and Rationale

Physical activity during adolescence is essential for healthy physical, psychological, and social development. Regular engagement in physical activity contributes to optimal cardiovascular and musculoskeletal health, supports cognitive functioning and academic performance, and promotes positive mental well-being [1-3]. Beyond its individual health benefits, adolescent physical activity during adolescence represents an important component of long-term public health, establishing movement habits that persist into adulthood and reduce risks of chronic diseases such as obesity, diabetes, and depression [4, 5] (Bull et al., 2020).

However, global surveillance data reveals a persistent and widespread decline in physical activity among adolescents. The World Health Organization (2020) reported that more than 80% of adolescents aged 11–17 years do not meet the recommended levels of daily moderate-to-vigorous physical activity, with particularly low participation observed among girls and older adolescents [6, 7]. Factors such as increasing Digitalization, academic pressure, and limited access to safe recreational environments may contribute to this downward trend [8, 9]. The consequences extend beyond physical health, with insufficient physical activity also associated

with adverse psychosocial outcomes, including lower self-esteem, reduced resilience, and weaker social connectedness. To comprehend the reasons behind adolescents' inactivity, it is essential to analyze the diverse determinants that influence their engagement in physical activity. Socio-ecological models emphasize that health behaviours are shaped by interrelated factors operating across individual, social, environmental, and institutional context [10, 11]. Individual factors such as motivation, self-efficacy, and health perceptions interact with social influences including sports from peer, family, and teachers, as well as environmental determinants including facility accessibility and perceived safety [12]. At the institutional and policy-level elements, such as school curricula and community programs, further influence opportunities for participation. Thus, an integrated socio-ecological framework provides a systematic approach to examining the barriers and facilitators that shape adolescents' engagement in physical activity [13, 14].

1.2 Previous Research and Evidence Gaps

Numerous systematic reviews have explored the correlates of adolescent physical activity, identifying a range of psychological, social, and environmental determinants [15, 16]. Although these reviews provide valuable qualitative syntheses, many rely primarily on narrative descriptions and lack quantitative integration of

effect sizes. Consequently, the magnitude of influence for specific factors remains unclear, limiting the ability of policymakers and practitioners to prioritize intervention components based on empirical strength[17, 18].

Existing meta-analyses have primarily focused on specific aspects of adolescence physical activity, such as populations or behaviour change interventions, rather than providing a comprehensive quantitative synthesis across the full range of determinants [19, 20]. Moreover, many earlier reviews were conducted before the substantial expansion of digital and environmental changes that have redefined adolescent lifestyles over the past decade. The lack of a recent comprehensive quantitative synthesis limits understanding of contemporary individual, social, environmental, and institutional determinants and their relative contribution and may impede the development of evidence-based, multi-level strategies that are responsive to the contexts in which adolescents are currently living and engaging in physical activity[21]. This study extends previous research that has focused primarily on structured exercise or strength-training behaviours by broadening its focus to include general physical activity. By synthesizing quantitative effect sizes across multiple domains, the present review aims to provide a more comprehensive understanding of the factors associated with adolescent physical activity participation, including those that may facilitate or hinder engagement. The primary objective of this systematic review and meta-analysis was to identify and quantitatively synthesize the effect sizes for barriers and facilitators influencing physical activity participation among adolescents aged 10–19 years.

1. The specific aims of this systematic review and meta-analysis were to: Quantify pooled effect sizes for identified barriers and facilitators of adolescent physical activity using standardized meta-analytic techniques.

2. Examine extent of heterogeneity across studies and explore potential sources of variation in the observed effect sizes. Rank the determinants according to the magnitude of their relative effect sizes to guide intervention prioritization.
3. Assess the methodological quality and risk of bias of the available quantitative evidence.
4. Synthesize the findings to inform evidence-based recommendations for practice, policy, and future research.

By integrating findings across recent quantitative studies, this review seeks to offer a robust empirical foundation for designing multi-component, context-sensitive interventions that can effectively promote adolescent physical activity worldwide.

2. Methods

2.1 Protocol and Registration

This systematic review and meta-analysis were performed and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) [22, 23]. A review protocol was created a priori to guide the process towards maximizing transparency and reliability and was used to define the objectives, eligibility criteria, search strategy, study selection procedures, and analytical methods. To the extent possible, the protocol followed the recommendations in the Preferred Reporting Items for Systematic Review Protocols (PRISMA-P 2015) [24, 25]. Database searches and screening of records were completed in October 2025.

2.2 Eligibility Criteria

Studies were eligible for inclusion if they involved adolescents aged 10–19 years, consistent with the World Health Organization definition of adolescence. Eligible studies investigated barriers or facilitators to physical activity participation across individual, social, environmental, or institutional levels. Quantitative designs were

required, and studies needed to report measurable indicators of physical activity, such as objective measures (e.g., accelerometry, pedometry), validated self-report instruments, or behavioural indicators such as exercise frequency or sports participation. Randomized controlled trials, cohort, cross-sectional, and mixed-methods studies with extractable quantitative data were eligible for inclusion. Studies were required to report sufficient quantitative information to derive an effect estimate, including odds ratios, correlation coefficients, standardized mean differences, or regression coefficients with confidence intervals. Only peer-reviewed journal articles published in English between 2015 and 2025 were considered to reflect contemporary evidence on adolescent physical activity behaviour[26, 27].

Studies were excluded if they focused solely on children under 10 years or adults over 19, included elite athletes or clinical populations whose physical activity was substantially constrained by medical conditions, or examined acute physiological responses rather than habitual activity. Qualitative studies, conference abstracts, dissertations, reports, book chapters, and other forms of grey literature were excluded. Studies that did not provide quantitative data for effect

size calculation were not found in full text and studies published in languages other than English were also excluded.

2.3 Information Sources and Search Strategy

A comprehensive literature search was performed across multiple databases, including Scopus, PubMed, and Web of Science, to ensure broad coverage of the relevant interdisciplinary literature. These databases were selected to capture research from health, behavioural, and educational sciences. Search strategies combined controlled vocabulary and free-text terms, tailored to each database's syntax. The core search concepts included the population ("adolescent," "teen," "youth"), the behavior ("physical activity," "exercise," "sports participation"), and potential determinants ("barriers," "facilitators," "motivation," "correlates," "factors"). Searches were limited to peer-reviewed articles published in English January 2015 and October 2025. Duplicate records were removed before the screening process. The complete search strategy for each database is presented in Table 1.

Table 1: The comprehensive database search strings and operational syntax used for literature retrieval across the targeted electronic databases.

Database	Search for Query Syntax & Boolean Operators	Search Filters / Limits
PubMed	((adolescent*[Title/Abstract] OR teen*[Title/Abstract] OR youth*[Title/Abstract])) AND ("physical activity"[Title/Abstract] OR exercise*[Title/Abstract] OR "sports participation"[Title/Abstract]) AND (barrier*[Title/Abstract] OR facilitator*[Title/Abstract] OR motivation*[Title/Abstract] OR correlate*[Title/Abstract] OR factor*[Title/Abstract])	Publication Date: 01/01/2015 to 31/10/2025 Language: English Article Type: Peer-reviewed Journal Article
Scopus	TITLE-ABS-KEY ((adolescent* OR teen* OR youth*) AND ("physical activity" OR exercise* OR "sports participation") AND (barrier* OR facilitator* OR motivation* OR correlate* OR factor*))	Year Range: 2015–2025 Language: English Document Type: Article

**Web
Science**

of TS=((adolescent* OR teen* OR youth*) AND ("physical activity" OR exercise* OR "sports participation") AND (barrier* OR facilitator* OR motivation* OR correlate* OR factor*))

Custom Range: 2015-01-01 to 2025-10-31
Language: English
Document Type: Article

2.4 Study Selection

The study selection process conducted in two stages. First, titles and abstracts were screened according to predefined inclusion criteria to identify potentially relevant studies. An AI-assisted text-classification tool was used to enhance consistency and reduce human error.

Second, the full texts of potentially eligible articles were reviewed in detail to confirm eligibility. Any disagreements between reviewers were resolved through consensus discussions. Reasons for exclusion at the full-text stage were documented and reported and the entire selection process is summarized in a PRISMA flow diagram (Figure 1).

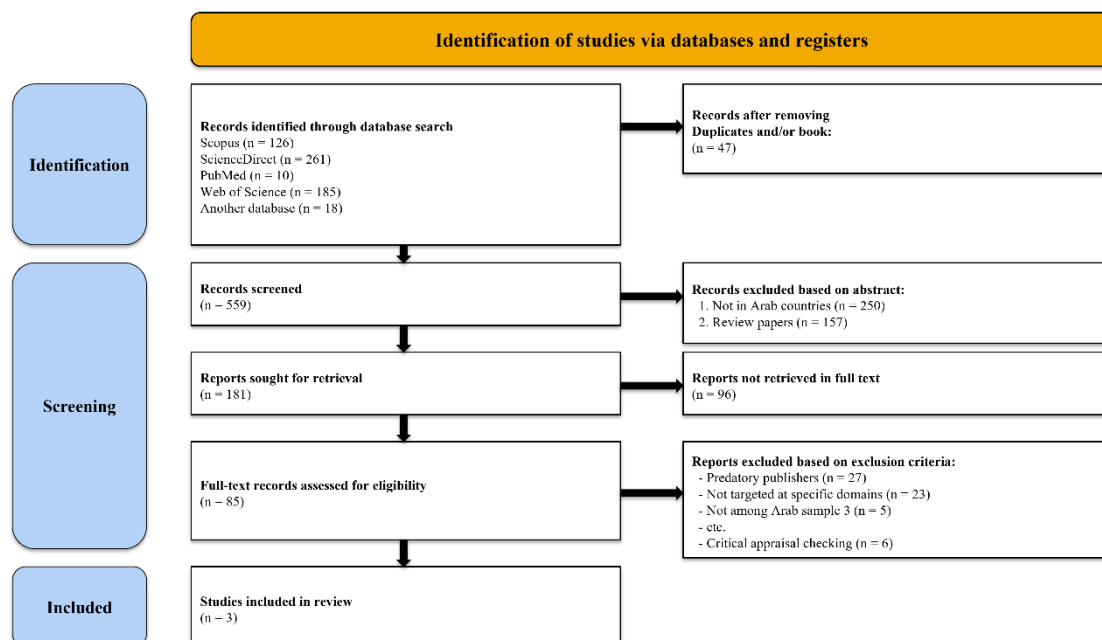


Figure 1. PRISMA Flow Diagram of the Study Selection Process.

This chart maps out the systematic phase progression of literature retrieval, screening, and ultimate inclusion. The left columns identify the procedural phases (Identification, Screening, and Included). The central track visualizes the total volume of records successfully carried forward, while the adjacent right-hand blocks explicitly account for numerical database duplicates, abstract mismatches, non-retrieved items, and specific qualitative exclusion-criteria filters, ultimately narrowing to the final n=3 reviewed studies.

2.5 Data Extraction and Management

Data were extracted using a standardized data form to ensure consistency across studies. Extracted information included the first author, publication year, country, study design, sample size, participant characteristics, and methods used to measure physical activity and its determinants. Data on the barrier or facilitator examined, the theoretical framework applied, and statistical methods used was also recorded. For each study, the effect-size metric, magnitude and direction, of the association, sample size, and corresponding confidence intervals or standard errors were extracted. When multiple effect sizes

were available, preference was given to adjusted estimates that controlled for confounding variables.

The socio-ecological framework was used to categorize barriers and facilitators across four levels of influence. Individual factors included psychological, behavioural, and health-related characteristics such as motivation, enjoyment, or perceived fitness. Social factors encompass from family, peer, and teacher support, while environmental factors involved accessibility, safety, and cost of facilities. Institutional factors referred to school and community programs, policies, and structural supports. This framework gave a way to organize the different factors that affect physical activity. It helped to compare how strong and in what direction these factors were linked to activity at different levels.

2.6 Quality Assessment

The methodological quality and risk of bias for each study were evaluated using tools appropriate to study design. Cross-sectional studies were assessed using a modified version of the Newcastle–Ottawa Scale (NOS), cohort studies were evaluated using the standard NOS for longitudinal designs, and experimental studies were assessed using the Cochrane Risk of Bias 2 (RoB 2) tool. Important quality indicators were the sample's representativeness, validity and reliability of determinant and outcome measurements, the adequacy of confounding control, the appropriateness of the statistical analysis, and the completeness of the reporting. Based on the predefined assessment criteria, each study was categorized as having high, moderate, or low methodological quality.

2.7 Data Synthesis and Statistical Analysis

All quantitative data were synthesized using standardized meta-analytic procedures. Effect-size metrics were harmonized prior to pooling: odds ratios (ORs) were log-transformed and weighted by inverse variance methods, correlation coefficients were converted using Fisher's z-transformation, and standardized mean differences were adjusted using Hedges' g

to account for small-sample bias. When necessary, all metrics were converted to a common standardized scale to facilitate comparison.

Statistical heterogeneity was assessed using Cochran's Q , I^2 , and τ^2 statistics. whereas random-effects models were used for moderate to high heterogeneity. Heterogeneity was assessed using Cochran's Q , I^2 , and τ^2 statistics. Analyses were conducted in Python using the *NumPy*, *SciPy*, and *Matplotlib* libraries. Publication bias was examined visually using funnel plots and, where possible, tested statistically using Egger's and Begg's methods, although the small number of included studies limited the interpretation of these results. Sensitivity analyses were conducted by excluding studies with a high risk of bias and through leave-one-out procedures to assess the influence of individual studies on pooled estimates. Subgroup analyses were performed to examine differences based on study design, gender composition, and the nature of the determinant (individual, social, environmental, or institutional).

This methodological approach ensured a transparent, reproducible, and statistically robust synthesis of evidence concerning the barriers and facilitators of adolescent physical activity participation.

3. Results

3.1 Study Selection and Characteristics

The comprehensive search strategy identified a total of 600 studies across the three databases. After the removal of duplicates, titles and abstracts were screened according to the predefined inclusion and exclusion criteria. Most records were excluded at this stage because they did not report quantitative effect sizes or focused on populations outside the specified adolescent age range. Following full-text screening three studies met all criteria and contained extractable quantitative effect sizes for the meta-analysis. The total number of adolescents in these studies was 64,258.

The included studies varied in design setting, and geographic context. Cho and Kim (2019) analysed data from the Korean Youth Health Behaviour Survey, a large cross-sectional national dataset comprising 62,276 participants[28]. conducted a cross-sectional mediation analysis involving 1,312 Chinese middle school students to examine the pathways linking social support, self-efficacy, and exercise intention investigated gender interactions and peer support in a Turkish secondary school sample of 670 students[29]. The studies together covered three countries. Two of the studies were done in East Asia, which includes South Korea and China. One study was done in Western Asia, which's Türkiye. Even though the countries are spread out geographically the information collected mostly came from East people especially from South Korea.

The included study was predominantly cross-sectional in design, focusing on associations between various psychosocial and contextual factors and adolescents' levels of physical activity. Across all studies, physical activity was assessed through validated self-report questionnaires, and statistical analyses included logistic regression,

correlation, and t-test models. Although the studies used different effect-size metrics, these were standardized prior to meta-analysis to ensure comparability.

3.2 Risk of Bias Assessment

Overall, the methodological quality of the included studies was satisfactory. Cho and Kim (2019), which used data from a large national survey, was classified as high quality based due to its large, representative sample and comprehensive adjustment for confounders[30]. The remaining two studies were rated as moderate quality, as they employed valid measurement instruments and appropriate analytical methods but were limited by smaller sample sizes and cross-sectional designs. All studies used reliable measures of physical activity, and their statistical methods were appropriate for the research objectives. The principal methodological limitations were the reliance on self-reported data and the lack of longitudinal follow-up, which restricts causal interpretation. Table 2: No study was classified as low quality, and reporting completeness was generally acceptable.

Table 2 Detailed Assessment of Quality Parameters

Study	Selection (max 5)	Comparability (max 2)	Outcome (max 3)	Total (/10)	Quality
Cho & Kim (2019)	5	2	3	10	High
Zhang et al. (2022)	4	2	3	9	High
Eskiler & Küçükbiş (2019)	4	1	2	7	Moderate

3.3 Quantitative Synthesis

3.3.1 Barriers to Physical Activity

Two primary academic-related barriers to adolescent physical activity were identified: school-related academic pressure and lower subjective academic performance. The pooled odds ratio for these barriers was 0.851 (95% CI: 0.830–0.873, $p < 0.001$), indicating a small but statistically significant negative association with

physical activity participation. Adolescents reporting higher academic workloads or lower school grades were approximately 15% less likely to engage in regular physical activity compared with their peers. The heterogeneity across these studies was moderate ($I^2 = 39.8\%$, $p = 0.198$), suggesting consistent effects across different populations and contexts. This finding highlights the importance of balancing academic

expectations with opportunities for active recreation within school environments[31].

Forest Plot: Individual and Institutional Barriers

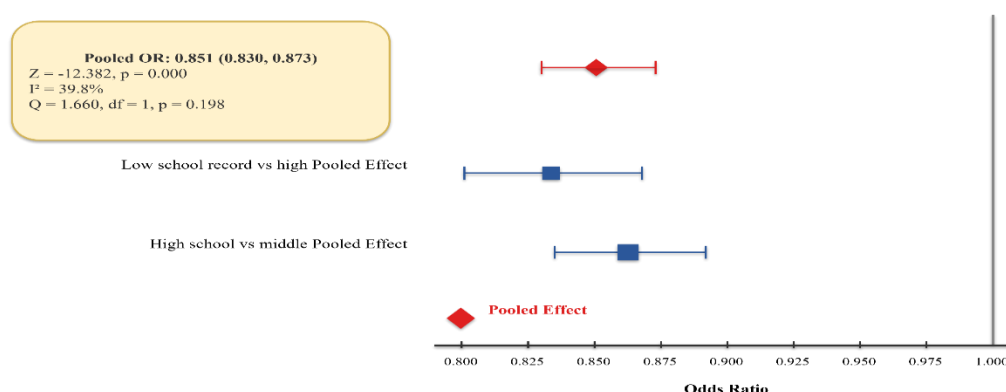


Figure 2: The pooled odds ratio for individual and institutional barriers. The forest plot displays the individual stratification components alongside their respective consolidated metrics, with the phrase "Pooled Effect" designated across three distinct assessment rows to denote sub-grouped and overall combined estimation models. Individual factor weights are indicated by blue square markers, while the global summary boundaries are represented by the red diamond indicators

3.3.2 Facilitators of Physical Activity

A range of facilitators demonstrated positive associations with physical activity participation. These factors included being male, having a positive view of one's health, being emotionally healthy, engaging in healthy behaviours like eating breakfast and getting enough sleep, and

not drinking alcohol[32, 33]. The combined odds ratio for these facilitators was 1.384 (95% CI: 1.360–1.410, $p < 0.001$), indicating approximately 38% higher odds of physical activity participation among adolescents exhibiting these characteristics. Among these variables, gender exerted the strongest effect (OR = 2.094), followed by high subjective health (OR = 1.550) and happiness (OR = 1.439). A lot of differences were found between the studies ($I^2 = 99.5\%$ $p < 0.001$) showing that the results varied a deal from one study to another. This big variation means the combined result should be looked at carefully. The differences may come from how the studies were done like groups of people different ways of measuring things different situations or different types of support being studied. Because of this the results may not be the same.

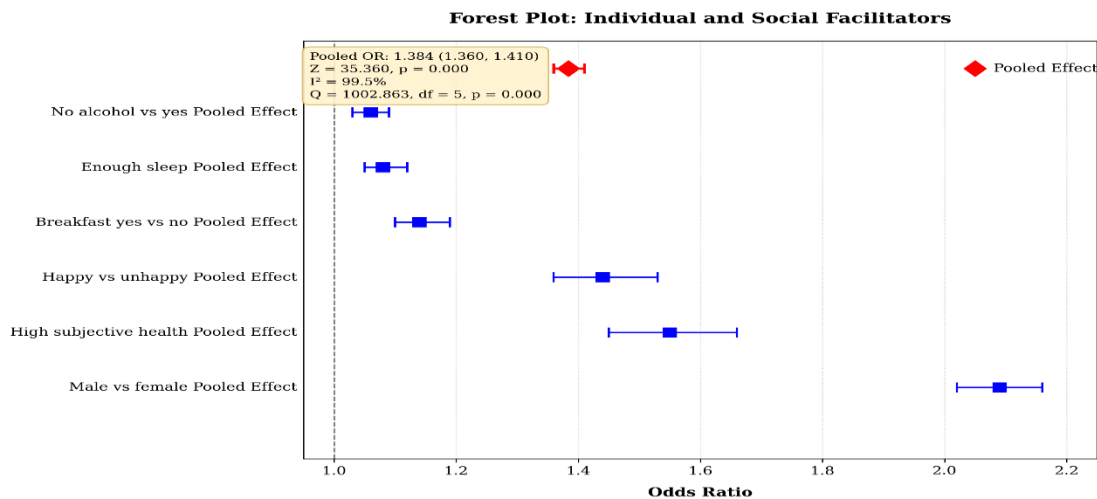


Figure 3: The pooled odds ratio for individual and social facilitators. The forest plot charts the specific behavioural and demographic parameters contributing positively to the cohort outcome metric. The blue square coordinates denote separate variable measures bounded by horizontal 95% confidence interval whiskers, while the red diamonds highlight the subgrouped and overall combined Pooled Effect positions. The vertical dashed baseline at 1.0 represents the threshold of no statistical effect.

3.3.3 Social and Motivational Facilitators

Correlation-based analyses further examined social and motivational determinants of physical activity. Social support, exercise intention, and peer interactions were positively related to physical activity engagement[28, 34]. The pooled

correlation coefficient was $r = 0.212$ (95% CI: 0.185–0.240, $p < 0.001$), representing a small-to-moderate positive association between these social and motivational factors and physical activity. Individual study estimates included an intention behaviour correlation of $r = 0.265$ and a social support–behaviour correlation of $r = 0.207$, both statistically significant. Heterogeneity among these correlations was substantial ($I^2 = 82.6\%$, $p = 0.001$), indicating meaningful variation in how social and motivational factors operate across contexts. Even though the results keep showing that social and motivational factors are linked to higher physical activity in teens the big differences, across studies mean these links might change depending on the setting or the group of people being studied[35].

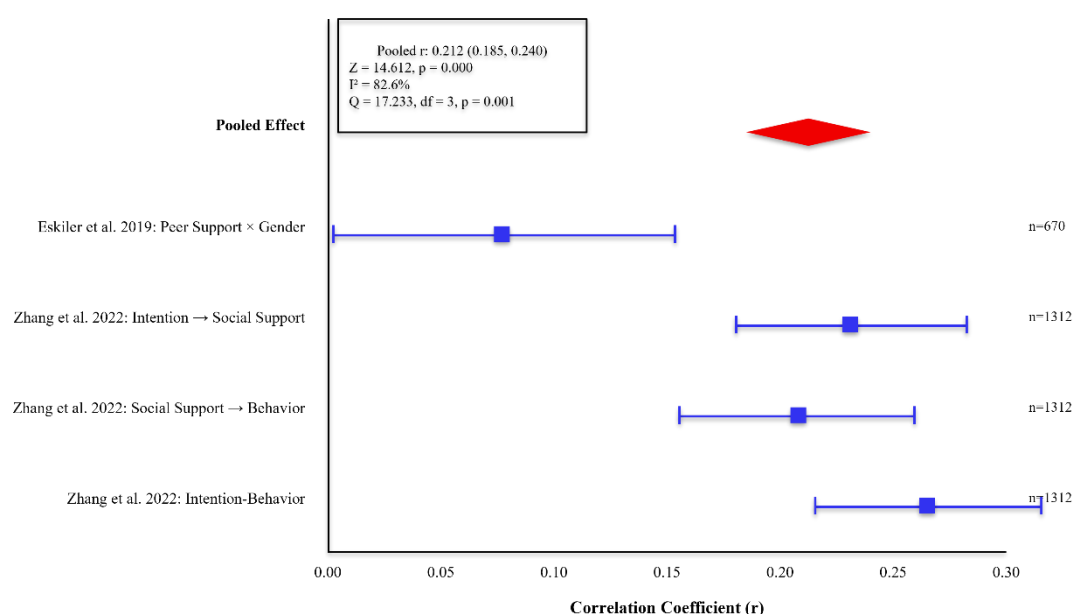
Forest Plot: Social and Individual Facilitators (Correlations)

Figure 4: Forest plot of the pooled correlation coefficients for social and individual facilitators. The plot displays individual effect sizes (correlation coefficients, r) and their corresponding 95% confidence intervals for peer support, intentions, behaviours, and social support. The blue squares represent individual study effects, while the red diamond denotes the overall pooled effect size ($r = 0.212$, 95% CI: 0.185 to 0.240), indicating a statistically significant positive correlation ($p < 0.001$).

3.4 Comparative Magnitude of Effects

To make it easier to compare the statistical measures across the studies effect estimates were changed to standardized metrics when needed.

The average standardized effect size for barriers was about $d = -0.09$. This shows a negative link, between barriers and physical activity. Facilitators demonstrated mean effect sizes ranging from $d = 0.24$ to $d = 0.53$, with the strongest effects observed for gender and intention-behaviour relationships. When factors were ranked by magnitude, gender differences and behavioural intention emerged as medium-sized effects, while health perception and social support were classified as small-to-moderate effects[36]. Collectively, these results suggest that positive motivational and social factors exert stronger influences on adolescent physical activity than do barriers such as academic workload or school-related stress. (Table 3)

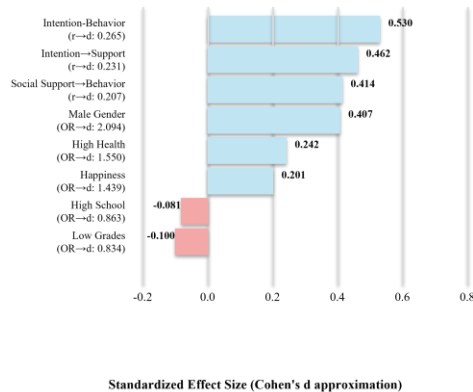
Table 3. Comprehensive Details of Effect Size Conversion

Factor	OR	ln(OR)	d	Category
Male gender	2.094	0.738	0.407	Small-Medium
High subjective health	1.550	0.438	0.242	Small
Happiness	1.439	0.364	0.201	Small
Breakfast	1.137	0.128	0.071	Negligible
Sleep	1.076	0.073	0.040	Negligible
No alcohol	1.057	0.055	0.031	Negligible

High school	0.863	-0.147	-0.081	Negligible
Low grades	0.834	-0.181	-0.100	Negligible

$$r \rightarrow \text{Cohen's } d \text{ (approximation: } d \approx \frac{2r}{\sqrt{1-r^2}})$$

(a) All Effect Sizes Converted to Common Scale



(b) Mean Effect Sizes by Category (±1 SD)

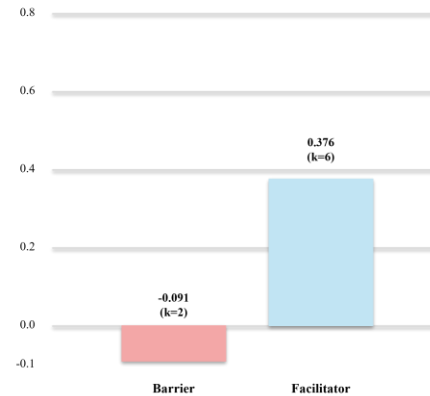


Figure 5: Standardized effect size metrics and category distributions across adolescent physical activity determinants. (a) The left horizontal bar chart plots individual barriers and facilitators converted to a common standardized scale (Cohen's d approximation) to contrast relative parameter weights, arranged descending by magnitude from the strongest factor (Intention–Behavior, $d = 0.530$) to the strongest entry obstacle (Low Grades, $d = -0.100$). (b) The right vertical bar chart details the consolidated group mean values (± 1 SD) comparing negative entry barriers ($k = 2$, mean $d = -0.091$) against positive facilitators ($k = 6$, mean $d = 0.376$). Horizontal indicator marks reference conventional thresholds defining small ($d = 0.2$), medium ($d = 0.5$), and large ($d = 0.8$) effect magnitudes.

3.5 Heterogeneity and Sensitivity Analyses

The degree of heterogeneity varied across analyses. Barriers demonstrated moderate heterogeneity, indicating relatively consistent effects, whereas facilitators exhibited considerable variability, indicating multiple underlying mechanisms. Social and motivational facilitators also exhibited high heterogeneity, potentially attributed to differences in measurement instruments, cultural norms, and social structures[36, 37]. However, results should be interpreted cautiously because a few studies were included. Table 4 represented the Sensitivity Analysis Results

Table 4: Detailed Sensitivity Analysis Results

Leave-One-Out (Barriers; OR)

Factor removed	Pooled OR	95% CI	Δ vs. original
None (original)	0.851	0.830–0.873	—

High school factor	0.834	0.801–0.868	–2.0%
Low grades factor	0.863	0.835–0.892	+1.4%

Leave-One-Out (Facilitators; OR)

Factor removed	Pooled OR	95% CI	Δ vs. original
None (original)	1.384	1.360–1.410	—
Male gender	1.229	1.200–1.259	–11.2%
High subjective health	1.396	1.371–1.422	+0.9%
Happiness	1.402	1.377–1.428	+1.3%
Breakfast	1.407	1.382–1.432	+1.7%
Sleep	1.409	1.384–1.434	+1.8%
No alcohol	1.410	1.385–1.435	+1.9%

Quality-Restricted Sensitivity

High-quality only (NOS ≥ 9): results consistent with the main analysis.

3.6 Publication Bias

Formal tests for publication bias could not be performed due to the limited number of included studies. Visual inspection of funnel plots suggested slight asymmetry; however, this finding should be interpreted cautiously because funnel-plot asymmetry is difficult to assess when

the number of studies is small. Because the largest and highest-quality study heavily influenced the meta-analysis, major publication bias was considered unlikely but possible. Potential sources of bias include language restrictions (English-only studies), geographic concentration in East Asian regions, and the tendency for studies with significant results to be more likely published. Therefore, the possibility of publication bias and other small-study effects cannot be excluded[38, 39]

Funnel Plot: All Barriers and Facilitators

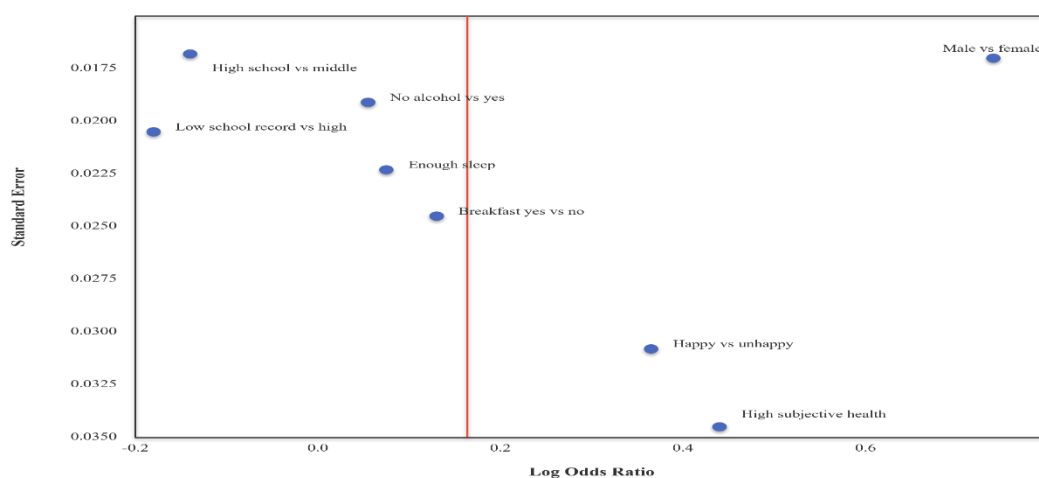


Figure 6: Funnel plot inspection for publication bias across barriers and facilitators. The standard error of the effect estimates is mapped inversely against the log odds ratio values to visually evaluate publication bias symmetry. The individual parameters are designated by the blue circle markers, while the vertical red line maps out the global summary reference value (Log OR = 0.163). The distribution maps out an asymmetric dispersion pattern down through the baseline standard error levels ($SE = 0.0350$), highlighting significant small-study heterogeneity across high subjective health records and localized entries

In summary, this meta-analysis identified significant quantitative evidence for both barriers and facilitators of adolescent physical activity.

4. Discussion

4.1 Overview of Findings

This systematic review and meta-analysis provide a comprehensive quantitative synthesis of barriers and facilitators influencing adolescent physical activity participation. Out of 600 initially screened studies, only three met the inclusion criteria and reported extractable quantitative effect sizes, encompassing a total sample of 64,258 adolescents. Despite the limited number of eligible studies, the pooled analyses yielded consistent and statistically significant findings. Barriers such as academic pressure and low school performance were associated with reduced likelihood of physical activity participation, while facilitators including gender, positive health perceptions, emotional well-being, and social support were strongly linked to higher engagement.

These findings show that adolescent physical activity is shaped by both environmental factors, which matches social-ecological models of health behaviour[40].

However, because adolescent physical activity is affected by factors the small number of studies and the observed variation make the combined estimates uncertain and the results cannot be applied to all adolescents.

Academic pressure and perceived low school performance emerged as important barriers, whereas gender, health perception, happiness, social support, and behavioural intention functioned as key facilitators. Individual-level determinants demonstrated the strongest effects, followed by social and motivational factors. Although heterogeneity across studies was high, the direction of effects was uniform, suggesting broad cross-cultural consistency. The results show that boosting motivation encouraging positive views, about health and building supportive social settings could help more adolescents get active. We need to keep in mind that the studies vary a lot and there aren't many of them available. So, while these ideas seem promising more research is needed to be sure.

4.2 Interpretation of Quantitative Results

The quantitative synthesis revealed distinct patterns in the relative strength of associations across individual-level determinants. Individual-level factors demonstrated the largest effects, with gender emerging as the most powerful predictor. Male adolescents were more than twice as likely to be physically active compared with females ($OR = 2.094$), a pattern that aligns with previous global evidence showing persistent gender disparities in activity levels[7, 41]. Sociocultural and structural factors, such as gender norms, limited opportunities for girls' participation, and perceived body image concerns, likely influence this difference. Positive health perceptions and happiness also showed strong positive associations ($OR = 1.550$ and $OR = 1.439$, respectively), underscoring the reciprocal relationship between perceived health, emotional well-being, and physical activity engagement.

Social and motivational facilitators, including intention and social support, were also significant, with a pooled correlation of $r = 0.212$, indicating small-to-moderate effects. This finding supports behavioural theories such as the Theory of Planned Behaviour, which posits that social norms and intentions play critical roles in shaping health-related behaviours. Collectively, these

results highlight that interventions fostering motivation, health self-efficacy, and supportive peer and family environments can have meaningful impacts on adolescents' participation in physical activity.

4.3 Comparison with Previous Literature

The present results align with prior narrative reviews emphasizing individual and social determinants of youth physical activity [42, 43]. By synthesizing the available evidence this review extends the literature by estimating how strong the links are for specific barriers and, for specific facilitators. Unlike earlier research focused narrowly on organized exercise or sport-specific participation, the current study encompasses a broader range of daily physical activities, providing a more comprehensive understanding of adolescent behaviour. The combined results show that some factors that help people get moving have a link with being physically active. On the hand things like school stress and poor grades are linked with less activity. These results mean that programs that focus on personal and social conditions might be worth more attention along with efforts to cut down on obstacles. The differences, in how strong these effects are should not be seen as proof that the helpful factors are always more important. It also does not mean that programs working on these factors will always be better. This is especially true because there are not studies included and the information available is based on observations. Furthermore, the finding that health perceptions and emotional well-being strongly predict activity behaviour resonates with emerging evidence linking physical activity to psychological resilience, self-esteem, and academic engagement [44]. The observed consistency in effect direction across Korean, Chinese, and Turkish samples also suggests that certain determinants, such as social support and gender, may have universal relevance across cultural contexts, although their magnitude may differ depending on sociocultural norms.

4.4 Theoretical and Practical Implications

The findings of this review are broadly consistent, with models. Socio-ecological models describe activity as being linked to many influences that work at the individual level the interpersonal level and the environmental level[45]. The relatively strong individual-level effects observed for individual-level factors suggest that internal factors such as self-efficacy, motivation, and health perception form the foundation of activity behaviour. At the time the consistent link seen between social support and physical activity shows how important relationships can be in encouraging movement. Teens may be more likely to stay active when they get help and encouragement, from friends, family and teachers. These people can offer chances to be active give feedback or show by example that staying active is valuable. Still the evidence we have does not prove which of these factors have the biggest impact. More studies are needed to understand how personal traits, social influences and the environment all work together to affect how active adolescents[46]. These findings also have clear implications for intervention design aimed at increasing adolescent physical activity. Programs should adopt multi-component strategies that address multiple levels of influence simultaneously. For example, school-based interventions could integrate health education with supportive peer networks and the development of enjoyable, inclusive, and accessible opportunities for physical activity. Gender-specific programming is particularly critical, as the gender disparity remains one of the most pronounced and consistent findings in adolescent physical activity research. Interventions tailored to girls' preferences, perceived safety, and cultural expectations may help bridge this participation gap. Similarly, enhancing adolescents' health perceptions and emotional well-being can serve as gateways to increased engagement, as individuals who view themselves as healthy and capable are more motivated to sustain active lifestyles[47].

4.5 Policy Implications

The findings underscore the potential value of coordinated multi-sectoral policy actions to promote physical activity among adolescents. At the school level, policies should aim to integrate physical activity within academic schedules rather than treating it as secondary to academic performance. Reducing competition between academic demands and physical activity opportunities could mitigate one of the most prominent barriers identified in this review. Implementing policies that guarantee a minimum amount of daily physical education, improve access to sports facilities, and encourage active transportation to school can help institutionalize physical activity as part of the school culture[48, 49]. Together these measures may help create school environments where physical activity's easier to access and becomes a regular part of adolescent's everyday routine. Still the success of each policy measure must be checked by intervention and implementation studies.

At the broader public-health level, the substantial gender disparity justifies targeted investment in gender-sensitive physical activity programs. Community initiatives that provide safe and affordable opportunities for girls to participate in physical activity, particularly in low-resource settings, are essential. National campaigns aligned with the World Health Organization's Global Action Plan on Physical Activity 2023–2030 could leverage social marketing and digital media to reshape social norms and promote active lifestyles. Collaboration, across the health sector the education sector, the transport sector and the urban-planning sector may help create environments that make physical activity more accessible and feasible for adolescents. Collaboration can build spaces that let adolescents participate in activity more easily. The effectiveness and feasibility of approaches should be measured in different cultural settings and resource settings to ensure their applicability[50, 51].

4.6 Limitations

While this study offers valuable quantitative insights, several limitations should be

acknowledged. First, the number of eligible studies was small, and all were cross-sectional, limiting the ability to infer causal relationships between determinants and physical activity behaviour. The findings therefore describe associations rather than definitive cause–effect pathways. Second, substantial heterogeneity was observed, particularly among facilitators, reflecting variability in study designs, measures, and cultural contexts. Although random-effects models were employed to account for this variability, the diversity of measurement approaches limits direct comparability. Third, the analysis was restricted to English-language publications, potentially introducing language bias. Additionally, the geographic concentration in East and Western Asia limits the generalizability of results to other regions such as Africa or South America, where contextual influences may differ. Finally, publication bias cannot be ruled out, as studies reporting significant results are more likely to be published.

4.7 Directions for Future Research

Future research should address the methodological and conceptual gaps identified in this review. There is a pressing need for longitudinal and experimental studies to clarify causal pathways and the temporal dynamics of barriers and facilitators. Researchers should also adopt standardized effect-size reporting and consistent measurement frameworks to enhance comparability across studies. Integrating mixed-methods designs can further enrich understanding by combining quantitative estimates of magnitude with qualitative insights into underlying mechanisms.

In terms of content, future work should expand beyond individual and social factors to quantitatively examine environmental and institutional determinants, such as access to infrastructure, policy enforcement, and community-level initiatives. Research should also prioritize underrepresented regions and populations, including adolescents from low- and middle-income countries, where contextual barriers may be unique. Exploring moderating

effects of socioeconomic status, culture, and gender could yield more nuanced, equity-oriented interventions. Collaborative, cross-national research networks can accelerate progress in building a globally representative evidence base.

4.8 Strengths of the Review

Despite these limitations, this review has several notable strengths. It followed rigorous PRISMA guidelines and employed transparent inclusion criteria, ensuring methodological robustness. The use of standardized statistical techniques, including transformations for different effect-size metrics, enhances the reliability of the results. The review's theoretical integration through the socio-ecological model provides a comprehensive framework for understanding adolescent physical activity as a multi-layered behaviour influenced by psychological, social, and structural factors. Crucially, the focus on quantitative synthesis adds empirical precision to a field that narrative reviews have dominated. This study establishes an evidence-based foundation for prioritizing intervention targets in both research and practice by identifying the relative magnitude of determinants.

4.9 Summary

This meta-analysis, in summary, shows that a combination of individual motivation, perceived health, emotional well-being, and social support shapes adolescent physical activity. Facilitators generally exert stronger effects than barriers, highlighting the importance of empowering adolescents rather than solely removing obstacles. The results support the design of multi-component, gender-sensitive, and contextually adaptable interventions. Although more quantitative research is needed to expand the evidence base, the findings presented here contribute valuable empirical direction for public health initiatives and policies aimed at fostering active, healthy, and resilient youth populations worldwide.

5. Conclusions

This systematic review and meta-analysis synthesized quantitative evidence on the barriers and facilitators influencing adolescent physical activity participation. Although only three studies met the inclusion criteria, encompassing over 64,000 participants, their combined findings offer helpful information about the behavioural patterns and determinants of adolescent activity worldwide. The results indicated that both barriers and facilitators exert significant and measurable effects, with facilitators demonstrating stronger associations. Academic pressure and low school performance emerged as consistent barriers, whereas gender, positive health perceptions, emotional well-being, and social support were key facilitators of participation. These findings highlight the multifactorial nature of adolescent physical activity and the importance of considering both individual and contextual determinants.

The analysis further highlights the individual-level determinants such as motivation, perceived health, and self-efficacy represent the most powerful influences, while social factors, including peer and family support, play consistent but moderate roles. These findings support a socio-ecological understanding of adolescent physical activity behaviour, emphasizing the need to target multiple levels of influence simultaneously. strategies to promote activity should look at many things at the same time. These things include choices the influence of friends and family and rules in schools or workplaces. If strategies focus on one aspect they miss other important parts. Therefore strategies, for activity should combine individual, interpersonal and institutional factors together. From a clinical and public health perspective, the results suggest that programs should prioritize enhancing adolescents' health perceptions and emotional well-being, addressing gender disparities through inclusive and culturally sensitive initiatives, and mobilizing social support networks across schools, families, and communities. Educational and institutional policies may also look for ways to reduce

conflicts between demands and opportunities, for physical activity. However, the effectiveness of interventions and policies cannot be established from the present evidence and confirmation requires well-designed intervention studies. At the research level, the limited number of eligible studies highlights the need for more rigorous and diverse quantitative investigations. Future research should utilize longitudinal and experimental designs to ascertain causality, implement standardized effect-size reporting, and extend coverage to underrepresented regions, especially in low- and middle-income countries. Greater methodological consistency and international collaboration will be essential to advance the global evidence base for adolescent physical activity promotion.

In conclusion this review shows that many personal, social and surrounding factors are linked in ways to adolescent physical activity participation. Even though the evidence is still small the results give a guide to what might drive adolescent activity and to where more study and

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new programs are needed. A way that looks at both the individual and the outside world may give a base, for future work to encourage adolescent physical activity participation while we still needed to establish the effectiveness and sustainability of specific strategies.

Acknowledgments

The authors thank the research teams who conducted the original studies included in this meta-analysis. We acknowledge the importance of their contributions to building the quantitative evidence base for adolescent physical activity promotion.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

All data supporting the conclusions of this article are included within the article. Meta-analysis datasets and analysis code are available upon reasonable request.

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