

**Bibliometric Analysis of Intellectual and Social Structures in Physical Activity and Mental Health**Jingyan Cui¹, Md Safwan Samsir², Mansor Abu Talib³, Ce Ren⁴**ARTICLE INFO****ABSTRACT****Article History:**

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Adolescents; Health education; Sport; Well-being

Purpose: Adolescence is characterised by a marked decline in physical activity alongside a rising prevalence of mental health disorders. As a result, scholarly interest in the relationship between physical activity and adolescent mental health has grown rapidly. This study aims to systematically map the intellectual and social structure of this research domain, providing a comprehensive overview of its development, key themes, and collaborative patterns. **Methods:** A bibliometric approach was employed to analyse publications indexed in the Scopus database from 2022 to 2026. Data were extracted and analysed using VOSviewer software, focusing on keyword co-occurrence to identify thematic structures and co-authorship networks to examine patterns of scholarly collaboration. **Findings:** The keyword co-occurrence

analysis revealed a well-developed and interconnected intellectual structure, organised into distinct yet related thematic clusters, including clinical mental health (e.g., depression, anxiety), positive psychology (e.g., well-being, self-esteem), and lifestyle behaviours (e.g., sedentary behaviour). Co-authorship analysis demonstrated the presence of several strong and centralised research networks that significantly contribute to knowledge production. However, collaboration across these networks remains relatively limited, indicating fragmentation within the field. **Implications for Research and Practice:** The findings suggest that while the field has reached a level of maturity, future progress depends on strengthening interdisciplinary and cross-network collaborations. Bridging existing thematic and social clusters may foster more integrative research and support the development of comprehensive, evidence-based interventions aimed at improving adolescent mental health through physical activity.

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Introduction

Adolescence represents a critical developmental period for the establishment of lifelong health behaviours, yet it is also characterised by a marked decline in physical activity. Historically, physical activity formed an integral part of adolescents' daily routines through active transport, outdoor play, and school-based physical education. However, over recent decades, rapid urbanisation, technological advancement, and changing social norms have contributed to increasingly sedentary lifestyles among young people. Contemporary adolescents are now more likely to engage in screen-based activities than in organised sports or unstructured physical play, reflecting a global behavioural shift that has raised significant public health concerns (Guthold et al., 2020). This trend is particularly alarming given international guidelines recommending at least 60 minutes of moderate-to-vigorous physical activity daily to support optimal physical development, including cardiorespiratory fitness, bone health, and metabolic functioning (Bull et al., 2020). Despite these established norms, approximately 80% of adolescents worldwide fail to meet recommended activity levels (World Health Organization, 2024b), indicating a substantial gap between public health expectations and actual behaviour.

From a theoretical perspective, this decline can be understood through ecological models of health behaviour, which emphasise the interaction between individual, social, and environmental factors in shaping physical activity patterns (Sallis et al., 2012). These models highlight how modern environmental constraints, such as reduced access to safe recreational spaces and increased digital engagement, systematically limit opportunities for active behaviour among adolescents.

Parallel to the decline in physical activity, adolescent mental health has emerged as a major global health priority. Mental disorders among young people have gained increasing recognition since the early 21st century, with growing epidemiological evidence highlighting their prevalence and long-term consequences. Currently, one in seven adolescents aged 10–19 experiences a mental disorder, accounting for 13% of the global burden of disease within this age group (World Health Organization, 2024a). Conditions such as depression, anxiety, and behavioural disorders are among the leading causes of illness and disability. These challenges are compounded by the unique developmental characteristics of adolescence, including rapid neurological changes, identity formation, and heightened sensitivity to social and academic pressures. In recent years, additional contextual factors, such as the widespread use of social media, academic competition, and the psychosocial disruptions associated with the COVID-19 pandemic, have further intensified psychological distress, loneliness, and reduced well-being among adolescents (Loades et al., 2020). Together, these conditions highlight an urgent need for scalable and accessible strategies to support adolescent mental health.

Theoretically, adolescent mental health can be interpreted through the biopsychosocial model, which posits that psychological well-being is influenced by the dynamic interaction of biological, psychological, and social determinants (Lehman et al., 2017). This perspective underscores the importance of multifaceted interventions, including behavioural strategies such as physical activity, in addressing complex mental health challenges.

Within this context, physical activity has been increasingly recognised as a promising, non-stigmatising, and cost-effective approach to enhancing mental well-being. Early

research primarily focused on the physiological benefits of physical activity; however, since the 2000s, there has been a notable expansion of studies examining its psychological and psychosocial effects, including improvements in mood, self-esteem, and cognitive functioning. Empirical evidence consistently supports this relationship. For instance, a systematic review by [Biddle and Asare \(2011\)](#) found that physical activity is associated with reduced symptoms of depression and anxiety among children and adolescents. Similarly, [Rodriguez-Ayllon et al. \(2019\)](#) conducted a meta-analysis demonstrating that higher levels of physical activity are linked to improved psychological well-being and lower levels of emotional distress. More recent studies have further confirmed that maintaining regular physical activity during periods of disruption, such as the COVID-19 pandemic, is associated with better mental health outcomes among adolescents ([Panchal et al., 2021](#); [Wunsch et al., 2022](#)). In addition, Self-Determination Theory provides a theoretical explanation for these findings, suggesting that physical activity enhances mental health by fulfilling basic psychological needs for autonomy, competence, and relatedness ([Ryan & Deci, 2023](#)).

Consequently, the intersection between physical activity and mental health has evolved into a multidisciplinary research field spanning public health, psychology, education, and sports science. Despite this growth, the literature remains highly fragmented, with studies varying in methodological approaches, populations, and outcome measures. Traditional narrative reviews have attempted to synthesise this evidence but are often limited by subjectivity and a lack of transparency in study selection, making it difficult to capture the full intellectual development and structural dynamics of the field. Furthermore, existing empirical studies often focus on specific outcomes or populations, resulting in a fragmented evidence base that limits the ability to identify overarching research trends and collaborative patterns across disciplines. This fragmentation highlights the need for a more systematic and quantitative synthesis of the field.

To address these limitations, bibliometric analysis has emerged as a robust methodological approach for systematically mapping large bodies of scientific literature. By applying quantitative techniques to bibliographic data, bibliometric analysis enables researchers to identify key publication trends, influential authors, collaborative networks, and thematic structures within a research domain ([Donthu et al., 2021](#)). This approach provides a comprehensive overview of both the intellectual structure, such as knowledge domains and thematic clusters, and the social structure, such as patterns of collaboration among researchers and institutions, offering insights that are not readily accessible through conventional review methods. Therefore, the present study aims to explore the dominant thematic foci, influential contributors, and collaborative networks in research on physical activity and mental health among adolescents, thereby advancing understanding of the field's development and informing future research directions.

Literature Review

The relationship between physical activity and mental health among adolescents has been widely explained through several theoretical frameworks. One of the most prominent is the biopsychosocial model, which posits that health outcomes are shaped by the interaction of biological, psychological, and social factors. Within this framework, physical activity contributes to mental well-being through neurobiological mechanisms,

psychological processes, and social interactions, such as endorphin release and improved brain function, enhanced self-efficacy and self-esteem, peer support and social connectedness (Biddle & Asare, 2011). Complementing this perspective, Self-Determination Theory suggests that participation in physical activity can satisfy basic psychological needs for autonomy, competence, and relatedness, thereby promoting intrinsic motivation and psychological well-being (Ryan & Deci, 2023). These theoretical perspectives highlight that physical activity is not merely a physiological behaviour but a multidimensional experience that can influence adolescents' mental health across different domains. However, the extent to which these mechanisms operate consistently across diverse contexts and populations remains an area requiring further synthesis, particularly given the expanding and fragmented nature of the literature.

Moreover, a substantial body of empirical research has demonstrated a positive association between physical activity and mental health outcomes among adolescents. Systematic reviews and meta-analyses have consistently reported that higher levels of physical activity are associated with lower levels of depression, anxiety, and psychological distress, as well as improved self-esteem and overall well-being (Biddle & Asare, 2011; Rodriguez-Ayllon et al., 2019). These findings suggest that physical activity serves as a protective factor against mental health problems during adolescence. In addition, more recent studies have further highlighted the role of physical activity in mitigating the negative psychological effects of contemporary challenges. For instance, reduced physical activity levels were associated with increased mental health problems among adolescents during the COVID-19 pandemic, whereas maintaining active lifestyles was linked to better emotional well-being (Panchal et al., 2021; Wunsch et al., 2022). Similarly, research has shown that sedentary behaviours, particularly excessive screen time, are positively associated with symptoms of depression and anxiety, reinforcing the importance of promoting active lifestyles in modern digital environments (Guthold et al., 2020). Despite these consistent findings, the literature also reveals variability in effect sizes and outcomes depending on factors such as age, gender, cultural context, and type of physical activity. This heterogeneity indicates that while the overall relationship is well established, a more comprehensive understanding of research patterns and thematic developments is needed.

Although the field of physical activity and adolescent mental health has grown rapidly, it remains conceptually and methodologically fragmented. Studies are distributed across multiple disciplines, including public health, psychology, education, and sports science, each employing different theoretical frameworks, research designs, and outcome measures. Previous reviews have primarily focused on specific outcomes or intervention effects, often adopting narrative or systematic approaches. While these methods provide valuable insights, they are limited in their ability to capture the broader intellectual structure, research trends, and collaborative patterns within the field (Donthu et al., 2021). Furthermore, there is limited research examining how knowledge production is organised socially, such as through co-authorship networks and institutional collaborations, which are critical for understanding how scientific knowledge evolves. This fragmentation directly relates to the problem identified in this study: despite the increasing volume of research, there is a lack of comprehensive mapping of the field's development, making it challenging for researchers and practitioners to identify key themes, influential contributors, and emerging directions.

To address these gaps, bibliometric analysis has emerged as an effective approach for synthesising large and complex bodies of literature. Unlike traditional reviews, bibliometric methods apply quantitative techniques to analyse publication patterns, citation structures, and collaborative networks, enabling a more objective and systematic overview of a research field (Donthu et al., 2021). Specifically, keyword co-occurrence analysis can reveal dominant thematic clusters, while co-authorship analysis can identify patterns of collaboration and knowledge exchange. In the context of physical activity and adolescent mental health, bibliometric analysis is particularly valuable given the interdisciplinary and rapidly expanding nature of the field. By mapping both the intellectual structure and the social structure, such as key research themes and collaboration networks, this approach provides a comprehensive understanding of how the field has evolved and where future research efforts should be directed.

Building on the theoretical foundations and empirical evidence discussed above, as well as the identified fragmentation in the literature, the present study aims to systematically map the intellectual and social structures of research on physical activity and adolescent mental health. Specifically, it seeks to identify dominant thematic foci, influential authors, and patterns of collaboration within the field. By doing so, this study addresses the existing gap in comprehensive evidence synthesis and provides a clearer understanding of the field's development, thereby supporting future research and policy-making efforts.

Methodology

Research Design

This study adopted a quantitative bibliometric research design to systematically map the intellectual and social structures of research on physical activity and adolescent mental health. Bibliometric analysis is a well-established methodological approach that applies statistical and mathematical techniques to analyse large volumes of scientific publications, enabling the identification of research trends, thematic structures, and patterns of scholarly collaboration (Donthu et al., 2021).

Specifically, this study employed a science mapping approach, which focuses on visualising relationships among research elements such as keywords, authors, institutions, and countries. Science mapping is particularly suitable for examining the development of interdisciplinary fields, as it allows for the identification of both intellectual structures and social structures, such as thematic clusters and collaboration networks (van Eck & Waltman, 2014). The research design followed a structured and reproducible workflow, including database selection, search strategy development, data extraction, and network analysis, ensuring methodological rigour and transparency.

Data Collection

Data Source and Search Strategy

The bibliographic data for this study were retrieved from the Scopus database, which is widely recognised for its extensive coverage of peer-reviewed literature and robust citation indexing, making it suitable for bibliometric research (Zhu & Liu, 2020). A comprehensive search strategy was developed to capture relevant publications based on

three core concepts: (1) adolescent populations, (2) physical activity, and (3) mental health. Boolean operators and truncation symbols were used to enhance search sensitivity and inclusiveness. The search was limited to titles, abstracts, and author keywords to ensure relevance and precision. The search query was defined as follows: TS= [(adolescen* OR teen* OR youth OR "young people" OR child* OR "school-aged" OR student*) AND ("physical activity" OR exercise OR sport* OR "physical fitness" OR "aerobic exercise") AND ("mental health" OR depress* OR anxiet* OR stress OR "psychological distress" OR well-being OR wellbeing OR mood OR "self-esteem")]

To ensure consistency and relevance, the following inclusion criteria were applied: (1) publications focused on adolescents or young populations; (2) studies addressing physical activity and mental health; (3) review articles published in peer-reviewed journals; (4) articles written in English; and (5) publications between 2022 and 2026.

The restriction to review articles was intended to capture high-level evidence and synthesised knowledge within the field, which is particularly relevant for identifying overarching research trends. A total of 1638 articles met these criteria and were included in the final dataset. All records were retrieved at the final stage of publication to ensure completeness. The search was conducted on 23 January 2026 to avoid bias due to ongoing database updates. All identified records were exported in plain text format, including key bibliographic information such as titles, authors, affiliations, abstracts, keywords, publication years, source journals, and citation data. The dataset was initially processed using Microsoft Excel for data cleaning, screening, and deduplication, ensuring accuracy and consistency prior to analysis.

Data Analysis

Science Mapping and Visualisation.

The cleaned dataset was imported into VOSviewer for bibliometric analysis and visualisation. VOSviewer is a widely used tool for constructing and visualising bibliometric networks, particularly in science mapping studies ([van Eck & Waltman, 2014](#)). It enables the graphical representation of relationships among research elements, where node size indicates frequency or impact, and link strength reflects the degree of association between items.

Keyword Co-occurrence Analysis.

Keyword co-occurrence analysis was conducted to identify the dominant research themes and conceptual structure of the field. This method examines how frequently keywords appear together across publications, allowing for the detection of thematic clusters and research hotspots ([Narong & Hallinger, 2023](#)). A minimum occurrence threshold of 15 keywords was applied to focus on the most significant and frequently studied topics. The resulting network visualisation grouped related keywords into clusters, representing the intellectual structure of the research domain.

Co-authorship Analysis.

To examine patterns of scholarly collaboration, a co-authorship analysis was performed at multiple levels, including authors, organisations, and countries. Co-authorship analysis

Interpretation of keywords Co-occurrence

Physical activity occupies a central and dominant position within the network, confirming its role as the primary organising construct of the field. Its strong co-occurrence with keywords such as anxiety, stress, mental health, and physical health indicates that the literature is heavily oriented towards examining physical activity as a multidimensional determinant of both psychological and physiological outcomes. This central positioning not only reflects its high research frequency but also suggests that physical activity functions as an integrative variable that bridges traditionally separate domains, reinforcing its theoretical and practical significance.

The identified thematic clusters reveal distinct but interconnected research directions. The cluster comprising obesity, nutrition, body mass index, hypertension, and metabolic health reflects a biomedical orientation, indicating that a substantial proportion of studies continue to frame physical activity within disease prevention and physiological health paradigms. In contrast, the cluster centred on anxiety, stress, sleep disorders, and negative emotions represents a psychological and behavioural orientation, highlighting increasing scholarly attention to mental health outcomes. The coexistence of these clusters suggests a gradual shift towards a more holistic understanding of health, where physical and mental dimensions are increasingly examined in tandem rather than in isolation.

The presence of a cluster related to educational and population-specific contexts, including students, schools, and health promotion, indicates that research is progressively extending into applied and intervention-based settings. This suggests a translational trend in the field, where knowledge is being operationalised within educational environments to promote behavioural change among adolescents. Additionally, the emergence of keywords such as COVID-19, pandemic, and digital mental health reflects the field's responsiveness to contemporary global challenges, demonstrating how external events can rapidly reshape research priorities and introduce new thematic directions.

Furthermore, the distribution of peripheral keywords, including public health, epidemiology, athletes, and sport, indicates the presence of specialised subfields that, while less central, contribute to the diversification of the research landscape. The linkage of these peripheral nodes to the central cluster suggests that even niche areas remain conceptually connected to the broader discourse on physical activity and mental health. This pattern reflects a mature research field characterised by both thematic consolidation and contextual diversification.

Overall, the network structure indicates that the field has evolved beyond fragmented research towards a more integrated and interdisciplinary knowledge system. The strong interconnections among clusters suggest increasing convergence across disciplines, while the presence of emerging themes highlights ongoing innovation and adaptation. These findings demonstrate not only the current state of the research landscape but also its developmental trajectory towards greater conceptual integration and practical applicability.

Co-authorship - authors

Figure 2 illustrates the co-authorship network at the author level, depicting patterns of

scholarly collaboration within the field of physical activity and adolescent mental health. The network was generated using VOSviewer, applying threshold criteria of a minimum of two publications and two citations per author. The resulting visualisation reveals a structured yet moderately interconnected research community, characterised by multiple well-defined clusters of authors. These colour-coded clusters represent groups of researchers who frequently collaborate, suggesting the existence of distinct research teams or thematic concentrations within the broader field (Gonzalez-Alcaide et al., 2021).

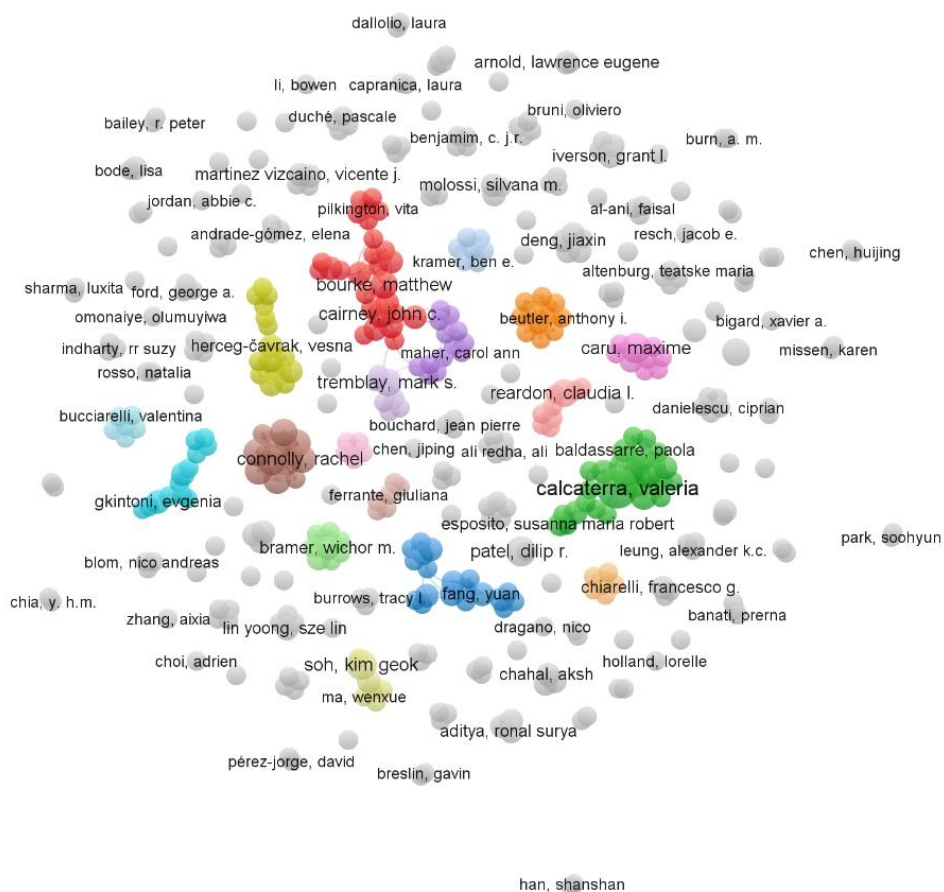


Figure 2: Co-authorship - author

Interpretation of author Co-authorship

A closer examination of the network structure provides important insights into the organisation of knowledge production in this field. The presence of clearly delineated clusters indicates that research is largely conducted within relatively cohesive groups, reflecting the development of specialised research domains or “research fronts.” This suggests that scholars tend to collaborate within established intellectual communities,

often sharing similar theoretical frameworks, research interests, or methodological approaches. The variation in node size within clusters further indicates an unequal distribution of scholarly influence, with a small number of highly productive and frequently cited authors occupying central positions. These central actors likely function as knowledge leaders, shaping research directions and facilitating collaboration within their respective networks.

At the same time, the comparatively lower density of connections between clusters highlights a degree of fragmentation within the research community. While some inter-cluster links are present, indicating instances of cross-group collaboration and interdisciplinary exchange, these connections remain limited. This pattern suggests that knowledge integration across subfields is still developing and may be constrained by disciplinary boundaries or differences in research focus. Consequently, although the field demonstrates internal cohesion within clusters, it lacks a fully integrated collaborative structure at the broader level.

Furthermore, the presence of peripheral authors with fewer connections reflects the dynamic and evolving nature of the field. These authors may represent early-career researchers, emerging research areas, or geographically isolated contributors who are not yet fully integrated into established collaboration networks. Their position within the network indicates potential areas for future growth and diversification of the research community.

Overall, the co-authorship network reveals a field characterised by strong intra-group collaboration alongside moderate inter-group fragmentation. This structure reflects a mature but still evolving research landscape, where established research teams dominate knowledge production while opportunities remain for strengthening interdisciplinary and cross-network collaboration. Enhancing such connections may facilitate greater theoretical integration, methodological innovation, and global knowledge exchange within the field.

Co-authorship - organization.

Figure 3 presents the organisational co-authorship network constructed using thresholds of a minimum of two documents and two citations per organisation. The resulting network depicts a highly interdisciplinary and internationally collaborative research landscape. Nodes represent a wide range of academic departments and research centres, with a strong concentration in paediatrics, sports science, kinesiology, mental health, and physical education. This distribution reflects the cross-sectoral nature of the research domain, integrating perspectives from clinical medicine, public health, and human performance sciences to address complex health-related issues (Humboldt-Dachroeden et al., 2020). The prominence of several highly connected nodes, including institutions such as Johns Hopkins University and Universidade de São Paulo, indicates that these organisations function as central hubs within the network, playing a key role in coordinating large-scale collaborations and shaping research agendas.

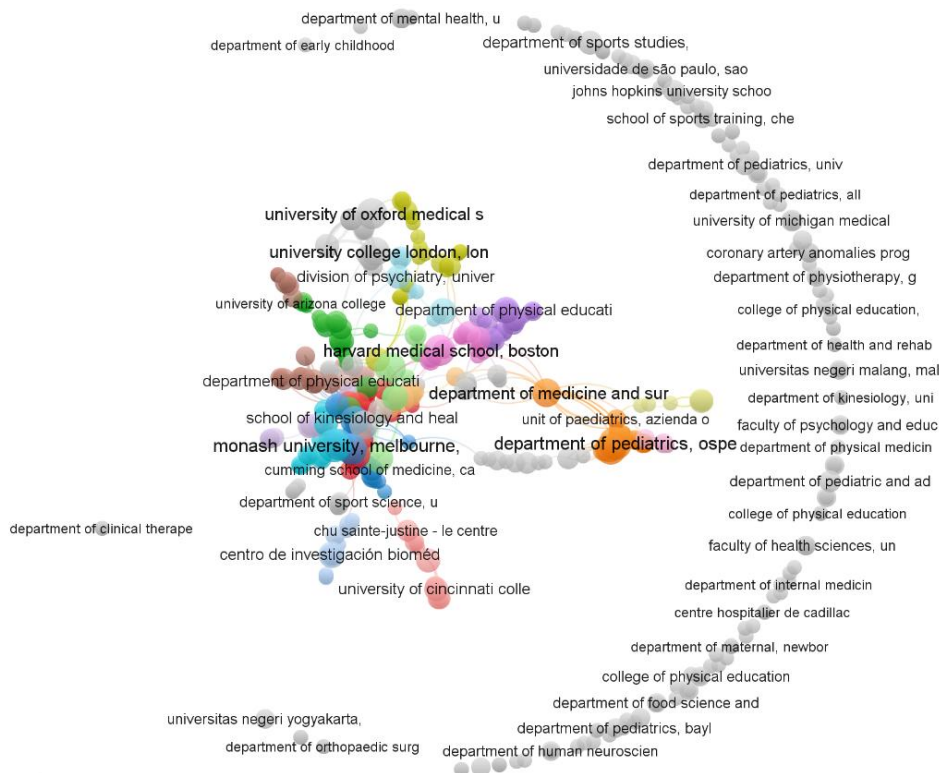


Figure 3: Co-authorship – organisation

Interpretation of organisation Co-authorship.

A deeper analysis of the network structure reveals important patterns in institutional knowledge production. The presence of dense clusters suggests that organisations tend to collaborate within established institutional or disciplinary networks, forming stable partnerships centred around specific research themes. For example, clusters dominated by paediatric departments reflect a strong clinical and developmental health orientation, whereas clusters associated with faculties of physical education and sport science indicate a focus on behavioural, performance, and intervention-based research. This clustering pattern demonstrates that institutional collaboration is often structured along disciplinary lines, reinforcing specialised knowledge domains within the broader field.

At the same time, the existence of inter-cluster connections highlights the increasing importance of interdisciplinary collaboration in addressing complex issues related to adolescent mental health. These cross-cluster linkages suggest that organisations are engaging in integrative, problem-oriented research that bridges traditionally distinct domains, such as medicine, education, and sport sciences. Such integration is particularly important in this field, where effective interventions require the combination of physiological, psychological, and social perspectives. However, the variation in link

density across clusters indicates that this interdisciplinary collaboration is uneven, with some institutional groups more strongly interconnected than others.

Furthermore, the central positioning of a limited number of highly connected institutions suggests a concentration of research capacity and influence within a small group of globally recognised universities and research centres. These organisations likely act as knowledge brokers, facilitating international collaboration and driving the dissemination of research findings. In contrast, less connected institutions located at the periphery of the network may have more limited access to collaborative opportunities, reflecting disparities in research resources, visibility, and global engagement.

Overall, the organisational co-authorship network demonstrates a research system characterised by both consolidation and integration. While strong intra-cluster collaboration indicates the presence of well-established institutional partnerships, the relatively uneven inter-cluster connectivity suggests that opportunities remain for strengthening cross-institutional and interdisciplinary collaboration. Enhancing such connections may contribute to more comprehensive and innovative approaches to understanding and promoting adolescent mental health through physical activity.

Co-authorship - country

Figure 4 reveals distinct patterns of international research collaboration among countries that met the minimum thresholds of at least two documents and two citations. The network is moderately dense, indicating an established level of cross-national cooperation rather than isolated national research activity. Node size reflects publication output, while link thickness represents the strength of collaborative ties between countries, thereby illustrating both research productivity and the intensity of international partnerships.

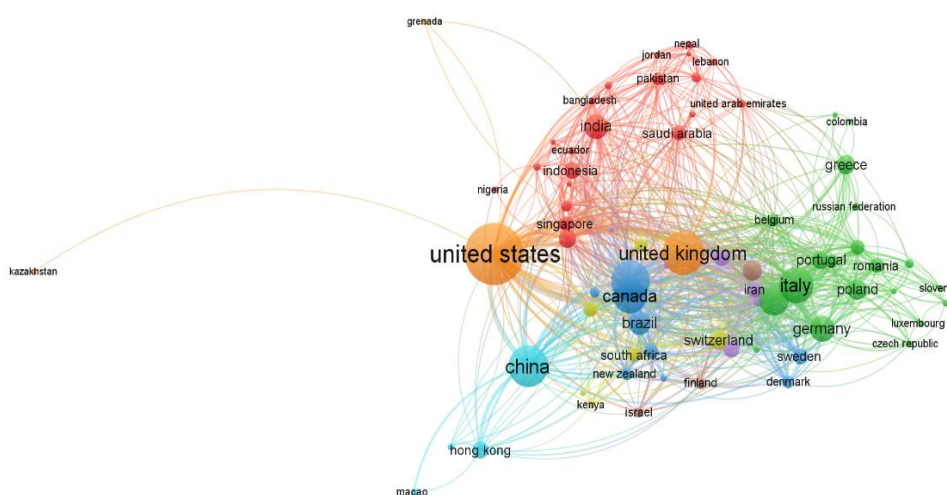


Figure 4: *Co-authorship – country*

Interpretation of country Co-authorship.

A closer examination of the network highlights a hierarchical and centralised collaboration structure. The United States emerges as the most influential and central actor, characterised by the largest node size and extensive collaborative links spanning multiple regions. This central positioning indicates that the United States functions as a global hub and knowledge broker, facilitating the flow of research collaboration and contributing significantly to agenda-setting within the field. Closely connected countries, including the United Kingdom, China, Canada, and Italy, also demonstrate high publication output and strong connectivity, suggesting that they serve as secondary hubs that reinforce and extend the global collaboration network.

The formation of regional clusters provides further insight into the geographic organisation of research collaboration. The European cluster, led by countries such as Italy, Germany, and the United Kingdom, exhibits dense internal linkages, reflecting well-established regional research frameworks and funding mechanisms that promote intra-European collaboration. In contrast, the cluster comprising Asian and Middle Eastern countries, including China, India, Saudi Arabia, Pakistan, and the United Arab Emirates, indicates a growing but comparatively less dense collaboration network. This suggests that while research capacity in these regions is expanding, collaborative structures are still in the process of consolidation and international integration.

Importantly, certain countries, such as Singapore, occupy intermediary positions within the network, acting as bridging nodes that connect geographically and culturally distinct regions. These bridging roles are critical for facilitating knowledge exchange between Western and non-Western research communities, thereby enhancing the global diffusion of scientific knowledge. However, the network also reveals structural inequalities, as countries such as Kenya, Macao, Kazakhstan, and Grenada are located at the periphery, indicating lower research output and limited integration into global collaboration networks. This peripheral positioning reflects disparities in research infrastructure, funding, and international visibility.

Overall, the country-level co-authorship network demonstrates a globally interconnected, yet uneven research landscape characterised by centralised hubs and peripheral contributors. While strong international linkages indicate a high level of global engagement, the concentration of influence within a small number of high-income countries suggests the need for more inclusive and equitable collaboration strategies. Strengthening partnerships involving underrepresented regions may enhance the diversity, contextual relevance, and global applicability of research on physical activity and adolescent mental health.

High Cited Articles

Table 1 presents the top ten most highly cited articles published between 2022 and 2026, highlighting influential research themes, dominant evidence types, and leading publication outlets within the field. Citation counts range from 220 to 811, indicating a significant variation in scholarly impact and suggesting differing levels of influence across research topics and publication types. A closer analysis of the table reveals that the most highly cited works are predominantly systematic reviews, meta-analyses, and clinical

guidelines rather than primary empirical studies. For example, highly cited publications by Samji et al. (2021), Panchal et al. (2021), and Viner et al. (2022) focus on synthesising evidence related to the mental health impacts of the COVID-19 pandemic. This pattern indicates that the field places strong emphasis on evidence consolidation, particularly during periods of global uncertainty, where policymakers and practitioners require comprehensive and reliable summaries of existing knowledge. The prominence of these studies suggests that citation influence is closely linked to the practical applicability and policy relevance of research outputs.

Table 1

The Top Ten Highly Cited Articles Between 2022-2026

Author and Year	Title	Cited Count	Source Title
Ahmad et al. (2022)	Type 2 diabetes	811	The Lancet
Samji et al. (2021)	Mental health impacts of the COVID-19 pandemic on children and youth - a systematic review	743	Child and Adolescent Mental Health
Panchal et al. (2021)	The impact of COVID-19 lockdown on child and adolescent mental health: systematic review	716	European Child and Adolescent Psychiatry
Rock et al. (2022)	American Cancer Society nutrition and physical activity guideline for cancer survivors	621	Ca-A Cancer Journal for Clinicians
Viner et al. (2022)	School Closures during Social Lockdown and Mental Health, Health Behaviors, and Well-being among Children and Adolescents during the First COVID-19 Wave: A Systematic Review	535	JAMA Pediatrics
Joham et al. (2022)	Polycystic ovary syndrome	527	The Lancet Diabetes and Endocrinology
Sadeghi et al. (2022)	Polycystic Ovary Syndrome: A Comprehensive Review of Pathogenesis, Management, and Drug Repurposing	314	International Journal of Molecular Sciences
Zhu et al. (2022)	Ketogenic diet for human diseases: the underlying mechanisms and potential for clinical implementations	285	Signal Transduction and Targeted Therapy
Wunsch et al. (2022)	Changes in Physical Activity Patterns Due to the COVID-19 Pandemic: A Systematic Review and Meta-Analysis	246	International Journal of Environmental Research and Public Health
Barakat et al. (2023)	Risk factors for eating disorders: findings from a rapid review	220	Journal of Eating Disorders

In addition, the thematic distribution of highly cited articles reflects a convergence between physical activity, mental health, and broader public health concerns. While some top-cited works directly address adolescent mental health, others focus on related domains

such as chronic diseases (such as type 2 diabetes, polycystic ovary syndrome) and lifestyle interventions (such as nutrition and physical activity guidelines). This indicates that the research field extends beyond a narrow focus on mental health to encompass a wider health context, reinforcing its interdisciplinary nature. The inclusion of studies on non-communicable diseases further suggests that physical activity is conceptualised as a shared determinant across multiple health outcomes.

Furthermore, the dominance of publications in high-impact journals, such as *The Lancet*, *JAMA Pediatrics*, and *CA: A Cancer Journal for Clinicians*, highlights the role of prestigious outlets in amplifying research visibility and citation impact. This suggests that citation patterns are not solely determined by research content but are also influenced by journal reputation and dissemination reach. Consequently, highly cited articles may shape research agendas by directing attention towards specific topics, methodologies, and health priorities.

Another notable pattern is the strong influence of COVID-19 related research within the citation landscape. The high citation counts of pandemic-focused studies indicate that global health crises act as catalysts for rapid knowledge production and dissemination. This reflects the field's responsiveness to emerging societal challenges and its alignment with urgent public health needs. However, it also suggests that citation trends may be temporally influenced, with certain topics gaining prominence due to contextual relevance rather than long-term theoretical contribution.

Overall, the analysis of highly cited articles reveals that the field is driven by evidence synthesis, interdisciplinary health perspectives, and responsiveness to global health priorities. The concentration of citation influence within systematic reviews and high-impact journals underscores the importance of producing integrative and policy-relevant research. At the same time, it highlights the need for future studies to balance evidence synthesis with original empirical research to further advance theoretical development and contextual understanding within the field.

Discussion

This bibliometric analysis provides a comprehensive overview of the intellectual and collaborative landscape of research on physical activity and adolescent mental health between 2022 and 2026. The keyword co-occurrence, co-authorship, and citation analyses collectively demonstrate that this is a mature yet rapidly evolving field characterised by strong interdisciplinary integration and increasing international collaboration.

The keyword co-occurrence analysis reveals that physical activity functions as the central conceptual anchor of the literature, closely linked with mental health outcomes such as anxiety, stress, and emotional wellbeing. This finding reflects a well-established consensus that physical activity plays a critical role in promoting both psychological and physical health, particularly among young populations. The prominence of mental health-related keywords alongside physical health indicators such as obesity, body mass index, and metabolic health suggests that contemporary research increasingly adopts a holistic health perspective rather than treating physical and mental health as separate domains. The identification of distinct yet interconnected thematic clusters indicates that while the

field has diversified into specialised subtopics, these areas remain conceptually integrated through the overarching construct of physical activity.

The presence of keywords related to educational settings and student populations highlights the growing scholarly attention to schools and universities as important intervention contexts. This trend aligns with broader public health and educational priorities that emphasise early prevention and health promotion among adolescents and young adults. Furthermore, the emergence of COVID-19-related terms reflects the field's responsiveness to global public health crises. The integration of pandemic-related research within the broader keyword network suggests that COVID-19 has not formed an isolated research strand but has instead reshaped existing research agendas concerning physical activity behaviours and mental health outcomes.

From a pedagogical perspective, these findings extend beyond descriptive mapping by illustrating how the conceptual integration of physical activity and mental health can inform educational practice. The central positioning of physical activity across thematic clusters suggests that it operates not only as a health-related behaviour but also as a pedagogical mechanism for fostering holistic student development. In particular, the strong linkage between physical activity, emotional wellbeing, and educational contexts underscores the potential for schools to function as critical sites for integrated health promotion. This implies a need to reorient physical education from a predominantly performance-based model towards a more holistic, student-centred approach that explicitly incorporates mental health outcomes. Moreover, the observed fragmentation in collaboration networks indicates a disconnect between knowledge production and pedagogical application, highlighting the need for stronger alignment between research, curriculum design, and instructional practice. Consequently, the analytical insights generated in this study provide a foundation for developing interdisciplinary pedagogical frameworks that integrate physical, psychological, and social dimensions of learning.

The co-authorship analysis at the author level indicates that knowledge production in this field is organised around well-defined collaborative clusters, typically representing stable research teams or research fronts. Strong intra-cluster collaboration suggests sustained partnerships built around shared theoretical frameworks, populations, or methodologies. However, the relatively lower density of inter-cluster connections implies that opportunities remain for broader cross-team collaboration, which could facilitate greater theoretical integration and methodological innovation. Peripheral authors with fewer collaborative ties may represent emerging scholars or niche specialisations, indicating ongoing renewal within the research community.

At the organisational level, the findings highlight a highly interdisciplinary research ecosystem involving institutions from paediatrics, sports science, physical education, and mental health disciplines. The prominence of major research-intensive universities as central hubs underscores their role in driving large-scale, multi-institutional projects and shaping research agendas. Importantly, the observed cross-cluster connections between medical and sport-related institutions suggest that complex health challenges related to adolescent mental health are increasingly being addressed through integrative, problem-oriented research approaches.

The country-level co-authorship network further demonstrates that research in this field is globally interconnected but unevenly distributed. The dominance of the United States, alongside strong contributions from the United Kingdom, China, Canada, and several European countries, indicates that high-income nations continue to function as key collaboration hubs. While the participation of countries from Asia, the Middle East, and Africa reflects a gradual broadening of the global research base, their peripheral positioning suggests disparities in research capacity and international visibility. Strengthening South-South and South-North collaborations may therefore be crucial for ensuring that research findings are culturally diverse and globally relevant.

Finally, the analysis of highly cited articles shows that citation influence during the study period is largely driven by systematic reviews, clinical guidelines, and pandemic-related research published in high-impact journals. This pattern suggests a strong demand for synthesised evidence to inform policy and practice, particularly in response to global health emergencies and chronic non-communicable diseases. The prominence of lifestyle-related reviews further reinforces the centrality of physical activity as a modifiable factor in both mental and physical health research.

Conclusion

This study provides a systematic and evidence-based bibliometric mapping of research on physical activity and adolescent mental health between 2022 and 2026. The findings demonstrate that the field has developed into a conceptually cohesive and interdisciplinary domain, with physical activity serving as a central construct linking mental health, physical health, education, and public health perspectives. The identification of well-defined thematic clusters and structured collaboration networks indicates that the field has reached a level of maturity, while still exhibiting opportunities for greater integration across disciplines and regions. Importantly, the consistency of findings across multiple analytical techniques, including keyword co-occurrence, co-authorship, and citation analyses, strengthens the robustness of this study. These converging results consistently highlight physical activity as the central organising concept and confirm the stability of major thematic clusters and collaboration patterns within the field, suggesting a high degree of coherence and reliability in the existing body of research. By revealing dominant research themes, influential contributors, and patterns of collaboration, this study contributes to a clearer understanding of the intellectual and social structures shaping this research area.

Despite these contributions, several limitations should be acknowledged. First, the analysis was restricted to a single bibliographic database and English-language publications, which may have resulted in the exclusion of relevant studies from other databases or non-English contexts. Second, reliance on citation counts as a measure of impact may favour older publications and high-impact journals, potentially underrepresenting emerging or context-specific research. Third, the application of threshold criteria in the visualisation process, while necessary for clarity, may have excluded smaller or emerging research groups and countries with lower publication output.

Based on these limitations, several recommendations for future research are proposed. Future bibliometric studies should incorporate multiple databases (such as Web of Science

and PubMed) and include non-English literature to provide a more comprehensive and globally representative analysis. Longitudinal studies covering extended timeframes are also recommended to capture the evolution of research themes and collaboration patterns over time. In addition, integrating bibliometric analysis with qualitative approaches could provide deeper insights into theoretical frameworks, intervention strategies, and methodological developments within the field, such as content or thematic analysis. Further research should also prioritise underrepresented regions and culturally diverse populations to enhance the global relevance and inclusivity of findings.

The findings of this study have several important implications for research and practice. For researchers, the identification of fragmented collaboration networks highlights the need for stronger interdisciplinary and international partnerships to advance knowledge integration and innovation. For policymakers and educators, the central role of physical activity in promoting adolescent mental health underscores the importance of implementing evidence-based physical activity programmes within schools and community settings. For practitioners, including physical education teachers and health professionals, the results support the development of holistic interventions that integrate physical, psychological, and social dimensions of health. In conclusion, this study not only maps the current landscape of research on physical activity and adolescent mental health but also provides strategic directions for future research, policy development, and practice. By addressing existing gaps and promoting greater collaboration and inclusivity, it contributes to the advancement of a more integrated and impactful research field.

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