



Challenges and Opportunities of Outdoor Play Activities on Early Childhood Motor Competence: A Bibliometric Analysis

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ABSTRACT

Research on outdoor play activities (OPA) and early childhood motor skills has received considerable attention due to its significant role in supporting children's physical, cognitive, and social development. However, the global literature has not been comprehensively mapped over a long period. This study aims to analyze the trends, structure, and dynamics of OPA research during the period 2006–2026. The study uses a bibliometric approach. Data were obtained from the Scopus database, consisting of 211 systematically selected publications, and then analyzed using VOSviewer software through visualization of collaboration networks, co-citations, and keyword co-occurrences. The study findings indicate that the highest number of publications in 2021 was 25, with a significant increasing trend since 2018. Dominant keywords include children, motor skills, physical activity, and outdoor play, reflecting the multidisciplinary nature of health, education, and the environment. Influential authors and publications have largely focused on the importance of social and environmental factors on children's physical activity (Brown et al., 2009, Xue et al., 2007, and Boldemann et al., 2006). Research collaboration is strongest in developed countries such as the United States, Australia, and Canada, while contributions from developing countries remain limited. This study demonstrates that OPA has evolved into a multidisciplinary field that supports holistic child development. In practice, stronger global collaboration can be achieved through international research partnerships and shared data platforms, while local exploration should involve culturally relevant play programs and community-based interventions, particularly in developing countries, to generate context-specific evidence and inform education and health policy.

Keywords: Play Activities, children, motor skills, outdoor, Trends.



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INTRODUCTION

Outdoor Play Activities (OPA) are play activities carried out in an outdoor environment, which support children by providing a wider, more diverse, and challenging space for movement in early childhood (Deng et al., 2024; Ramsden et al., 2022, 2025). Outdoor environments provide a playground for children to perform basic movements such as running, jumping, climbing, and throwing freely and naturally (Craig et al., 2024; Pawlowski et al., 2023). Outdoor Play Activities have the principle of experience-based learning, where children acquire knowledge and skills through direct interaction with the physical and social environment (T. Gray et al., 2025; Ramsden et al., 2025). Outdoor play activities are unstructured but directed in nature, thus providing opportunities for children to explore movement, develop creativity, and practice decision-making skills (R. L. T. Lee et al., 2020; Loebach et al., 2021). In addition, OPA is also multisensory because it involves various stimuli such as the condition of the playing field, weather, and various natural objects (Spencer et al., 2021). This directly contributes to the improvement of motor skills, such as coordination, balance, agility, and muscle strength (Sutapa et al., 2021; Zhou et al., 2025). OPA also tends to have a higher physical intensity than indoor activities, thus playing an important role in improving children's physical fitness (Rohde et al., 2023).

In addition, OPA research has significantly contributed to the development of early childhood motor skills by providing an environment rich in movement stimulation (Sutapa et al., 2021). Outdoor play activities provide opportunities for early childhood to explore and practice motor skills, so OPA becomes the foundation for improving coordination, balance, agility, and muscle strength (Zhou et al., 2025). Furthermore, participation in OPA also has a positive impact on social and cognitive development, including increased concentration, self-confidence, and communication skills (Biernat & Piątkowska, 2025; Drapeau et al., 2025). Therefore, OPA is a valuable tool for optimizing children's overall motor development.

Several previous studies have shown that spending time in outdoor spaces is positively correlated with better health outcomes, not only in adults

and older adults, but also in children (Beyer et al., 2018; Christensen et al., 2013; Ryu & Heo, 2018), and provides multidimensional benefits for children in terms of improved sleep quality, social interactions, fitness, and cognitive scores (Söderström et al., 2013; Wu et al., 2014). Outdoor play activities are recognized as an important component in enhancing early childhood development, particularly in improving motor skills and health (Tremblay et al., 2015). This suggests that dynamic and stimulating environments enable children to develop motor skills, and outdoor play activities are an important part in supporting early childhood health and development.

This study aims to explore and analyze the development and trends of global research published in the Scopus database between 2006 and 2026. Specifically, this study aims to determine which keywords are most frequently used in scientific publications and to utilize bibliometric mapping based on keyword co-occurrence to analyze the relationship between topics and countries, as well as to compare the current research overview and opportunities for future development.

Research Questions

- (1) RQ1: What are the trends in scientific publications related to Outdoor Play Activities (OPA) and early childhood motor skills during the period 2006–2026?
- (2) RQ2: What are the structure and patterns of research collaborations, including contributions from authors, countries, and collaborative networks in the field of OPA and early childhood motor skills?
- (3) RQ3: How are research themes and study directions evolving, based on keyword analysis, situational patterns, and future research opportunities and challenges?

METHODOLOGY

Research Design

This study uses a bibliometric analysis approach with quantitative evaluative and descriptive techniques to identify patterns in the development of scientific publications related to outdoor play activities and motor skills. This approach allows the formation of knowledge structures through the visualization of relationships between data (Garfield, 2009). Data were

obtained from the Scopus database with a total of 226 initial documents. After filtering based on a two-decade time span (2006–2026) and English language criteria, 211 relevant documents were obtained for analysis. The data were then analyzed using VOSviewer to produce three types of visualizations: collaboration networks, keyword co-occurrence, and citation analysis. Indicators used include the number of publications, citation frequency, and the strength of links between elements in the network. This approach provides a comprehensive overview of research trends, scientific contributions, and development dynamics in the field of OPA and early childhood motor skills.

Procedure

The analysis period of 2006–2026 was set to capture the dynamics of research development over two decades based on data from Scopus. Bibliometric analysis was conducted using VOSviewer to map various important aspects, including author collaborations, keyword co-occurrence, country distribution, and annual publication trends. VOSviewer is software designed to systematically visualize bibliometric networks, displaying relationships between research elements in informative and easy-to-interpret maps (Orduña-Malea & Costas, 2021; Oyewola & Dada, 2022; Sovacool et al., 2022; van Eck & Waltman, 2017). Furthermore, VOSviewer allows the identification of the most frequently used terms in a field of study, thus helping to understand the conceptual structure and direction of research development (Guleria & Kaur, 2021; Huang et al., 2022). Therefore, VOSviewer serves not only as a visualization tool but also as an analytical instrument to comprehensively evaluate trends, collaboration patterns, and thematic focuses in the scientific literature. The stages in the VOSviewer analysis are five steps (Dewi et al., 2021):

- (1). **Determining Research Keywords:** The initial stage of the research was carried out by identifying and defining keywords relevant to the research topic, namely Outdoor Play Activities and Motor Skills. This process aimed to ensure that the collected data was directly related to the research focus and reflected a representative scope of the literature.

- (2). Data Delimitation and Collection: Data collection was conducted through the Scopus database, applying certain limitations, such as publication period, document type, and language. These limitations aimed to increase the relevance and quality of the data described.
- (3). Data Selection and Filtering Process: All search results were then systematically searched and selected to eliminate irrelevant documents. This process was carried out using VOSviewer to direct and focus the data according to the analysis needs.
- (4). Preparing Initial Statistical Descriptions: The selected data were then processed to produce initial statistical descriptions, including the distribution of publications by country, institution, journal, author, and analysis of bibliographic and keyword pairs.
- (5). Data Analysis and Interpretation: The final stage involved analyzing and interpreting the data using VOSviewer through network visualization. The visualization results are used to identify patterns of relationships between variables, research trends, and opportunities for future study development.

Data synthesis

Data synthesis in this study was conducted using a deductive approach, starting with general findings and then moving to more specific and detailed findings. The initial stage of analysis involved gathering an overview, such as publication trends, country distribution, and author contributions. Further analysis was deepened by reviewing author bibliographies, country bibliographies, publication distribution, and keyword co-occurrences to uncover the structure and relationships between elements within the study. This approach allows for a systematic and structured presentation of information, making it easier for readers to understand the development of the research from a macro perspective to a more in-depth and comprehensive analysis (Ersozlu & Karakus, 2019; C. I. S. G. Lee et al., 2014).

RESULTS

Based on the search results in the Scopus database using a combination of keywords ("outdoor play activities" and "motor skills"), the data obtained were then visualized using VOSviewer to produce a systematic bibliometric analysis (Donthu et al., 2021). The initial search results revealed 226 relevant documents. However, through a filtering process based on inclusion criteria such as publication period, document type, and language, the number of documents that met the inclusion criteria was 211 publications that met the analysis requirements. This final dataset was then used as a basis for the research landscape and pace, as presented in Table 1.

Figure 1 shows the fluctuating publication trend related to the research topic during the period 2006–2026. In the initial phase (2006–2011), the number of papers was relatively low and stable, ranging from 2 to 5 publications per year, indicating limited academic attention to the topic. Entering the period 2012–2015, there was a significant increase with a temporary peak in 2015 (around 20 papers), indicating the beginning of increased research interest. However, in 2016–2017, there was a drastic decline, possibly reflecting a shift in focus or limited scholarly output. Thereafter, the trend continued to increase consistently from 2018 until reaching its highest peak in 2021 (around 25 papers), indicating a phase of expansion and strengthening of the topic in the global scientific literature. Despite a slight decline after 2021, the number of publications remained relatively high until 2025. The sharp decline in 2026 is likely due to incomplete data. Overall, this trend reflects dynamic growth with a strong acceleration phase over the past two decades.

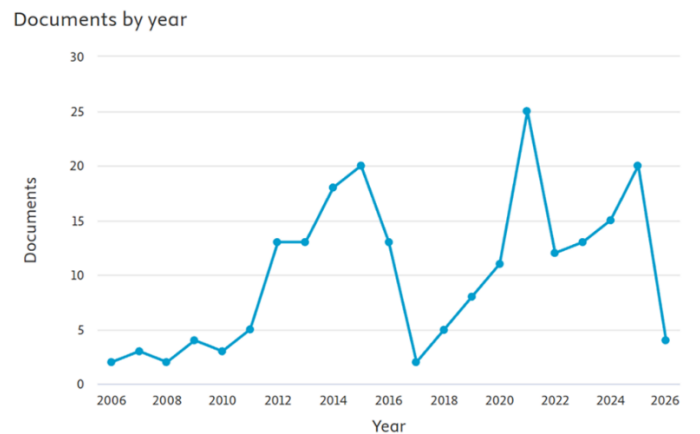


Figure 1. Year of publication

Table 1. Number of publications and citation trends.

Year	TP	NCP	TC	H	G	C/P
2026	4	0	0	0	0	0
2025	20	10	22	3	3	1,10
2024	15	13	64	4	7	4,27
2023	13	13	132	7	11	10,15
2022	12	11	106	6	10	8,83
2021	25	25	307	12	16	12,28
2020	11	11	218	7	11	19,82
2019	7	7	201	6	7	28,71
2018	5	4	144	4	5	28,80
2017	2	2	61	2	2	30,50
2016	13	13	660	12	13	50,77
2015	20	20	890	14	20	44,50
2014	18	18	628	14	18	34,89
2013	13	12	360	10	13	27,69
2012	13	13	583	12	13	44,85
2011	5	5	438	5	5	87,60
2010	3	2	183	2	3	61,00

2009	4	4	556	4	4	139,00
2008	2	2	192	2	2	96,00
2007	3	3	447	3	3	159,00
2006	2	2	310	2	2	155,00

Table 1 shows the dynamics of publications and citations in research during the period 2006–2026, which fluctuated but tended to increase. In the early period (2006–2011), the number of publications (TP) was relatively low, but the citations per publication (C/P) ratio was high, indicating that the articles had a significant impact. The peak of citation impact was observed in 2015–2016, with the highest total citations (TC) reaching 890 and 660, respectively, and high H and G indices. Entering the period 2018–2021, there was a significant increase in the number of publications, peaking in 2021 (25 publications), followed by an increase in citation contribution. In 2022, the number of publications remained relatively high, but the citations per publication (C/P) ratio tended to decrease, indicating a possible topic expansion but with a more diffuse citation impact. The low value in 2026 is likely due to incomplete data.

Table 2. Publications with the highest number of citations.

Year	Author	Title	Journal name	Quote	Quotes per year
2009	(Brown et al., 2009)	Social and Environmental Factors Associated With Preschoolers' Nonsedentary Physical Activity	Child Development	303	17,82
2007	(Xue et al., 2007)	A Meta-Analysis of Children's Hand-to-Mouth Frequency Data for Estimating Nondietary Ingestion Exposure	Risk Analysis	228	12,00
2006	(Boldemann et al., 2006)	Impact of preschool environment upon children's physical	Preventive Medicine	204	10,20

		activity and sun exposure			
2011	(Kimbrow et al., 2011)	Young children in urban areas: Links among neighborhood characteristics, weight status, outdoor play, and television watching	Social Science and Medicine	188	12,53
2016	(Pesce et al., 2016)	Deliberate Play and Preparation Jointly Benefit Motor and Cognitive Development: Mediated and Moderated Effects	Frontiers in Psychology	184	18,40
2015	(Bassett et al., 2015)	Trends in Physical Activity and Sedentary Behaviors of United States Youth	Journal of Physical Activity and Health	172	15,64
2009	(Binns et al., 2009)	The Built Environment: Designing Communities to Promote Physical Activity in Children	Pediatrics	171	10,06
2008	(Hannon & Brown, 2008)	Increasing preschoolers' physical activity intensities: An activity-friendly preschool playground intervention	Preventive Medicine	151	8,39
2007	(Alhassan et al., 2007)	The effects of increasing outdoor play time on physical activity in Latino preschool children	International Journal of Pediatric Obesity	125	6,58
2007	(Poulsen et al., 2007)	Boys With Developmental Coordination Disorder: Loneliness and Team Sports Participation	American Journal of Occupational Therapy	124	6,53

Table 2 displays the publications with the highest number of citations, indicating a significant contribution to the development of children's physical and motor activity studies. Manuscript [32] ranks first with 303 citations, highlighting the importance of social and environmental factors on children's physical activity. Other studies, such as [33] and [34], also have a strong influence, particularly regarding children's environment and exposure to activity. In general, the most cited publications occurred between 2006 and 2011, indicating that early research has had a significant impact and provided a theoretical foundation for further studies. Furthermore, the dominant topics related to physical activity, environment, and child development reflect the main focus of this field.

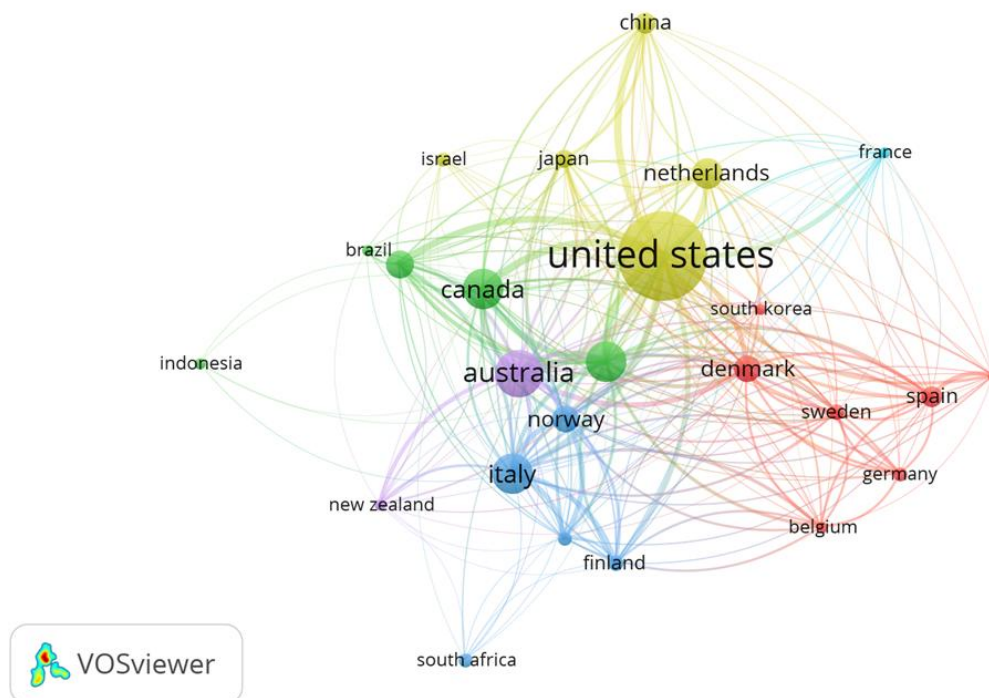


Figure 2. Collaboration between Countries

The visualization of the collaboration network between countries shows a complex structure with the United States as the main hub, indicating its dominance in scientific production and collaboration. Countries such as Australia, Canada, and the Netherlands serve as important hubs between clusters. European clusters such as Spain, Germany, and Sweden exhibit strong

internal linkages, while Asian countries such as China and Japan are connected through global collaboration. Indonesia sits on the periphery with limited connectivity. Overall, this map reflects an imbalance in global collaboration, with developed countries dominating research networks.

Documents by country or territory

Compare the document counts for up to 15 countries/territories.

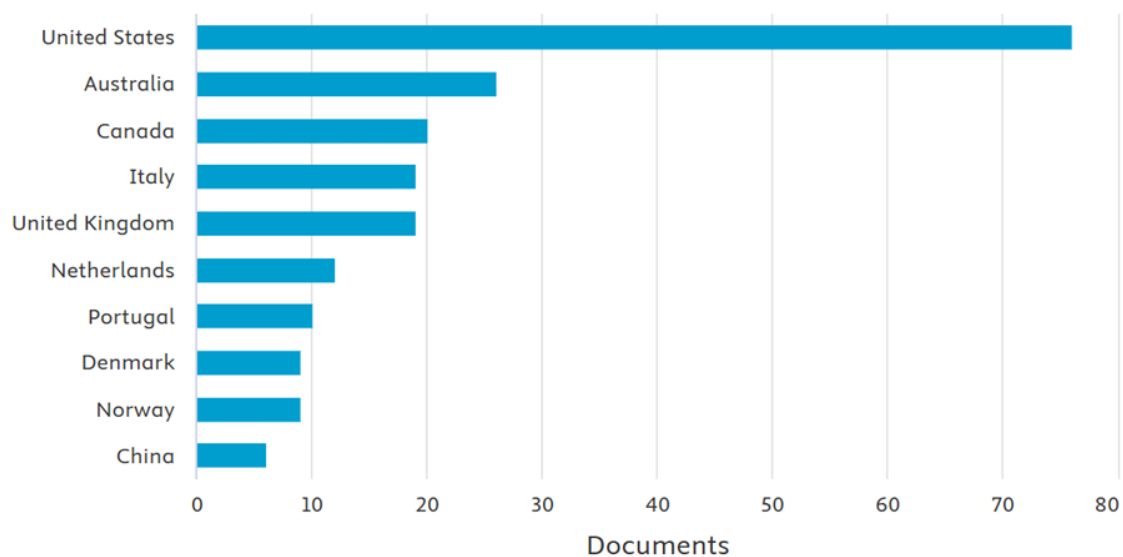


Figure 3. Documents by Region

Figure 3 shows the United States' strong dominance in the number of publications, far surpassing other countries. Australia and Canada follow, followed by Italy and the United Kingdom, with relatively similar contributions. European countries such as the Netherlands and Portugal show intermediate contributions, while China remains relatively low. This pattern highlights the imbalance in global scientific production, with developed Western countries dominating research.

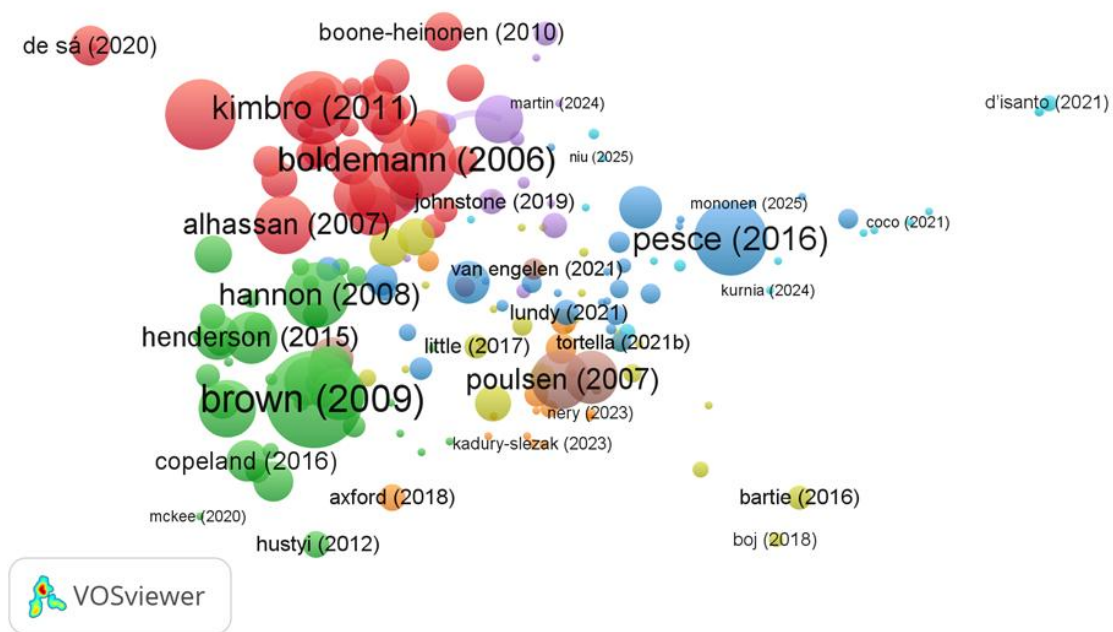


Figure 4. Study area structure

Figure 4 shows a co-citation network map using VOSviewer that illustrates the intellectual structure of a field. Node size represents citation intensity, while color indicates thematic clusters. Red clusters (e.g., Kimber, 2011; Boldemann, 2006; Alhassan, 2007) reflect key conceptual foundations. Green clusters, dominated by Brown (2009), Hannon (2008), and Henderson (2015), represent empirical developments and implementations. Blue clusters, centered on Pesce (2016), indicate contemporary research directions connected to recent studies. Yellow and orange clusters (e.g., Poulsen, 2007; Tortella, 2021) serve as links between themes. Peripheral nodes represent new research with limited connections. Overall, this map demonstrates the field's evolution from foundational theory to increasingly integrated modern applications and innovations.

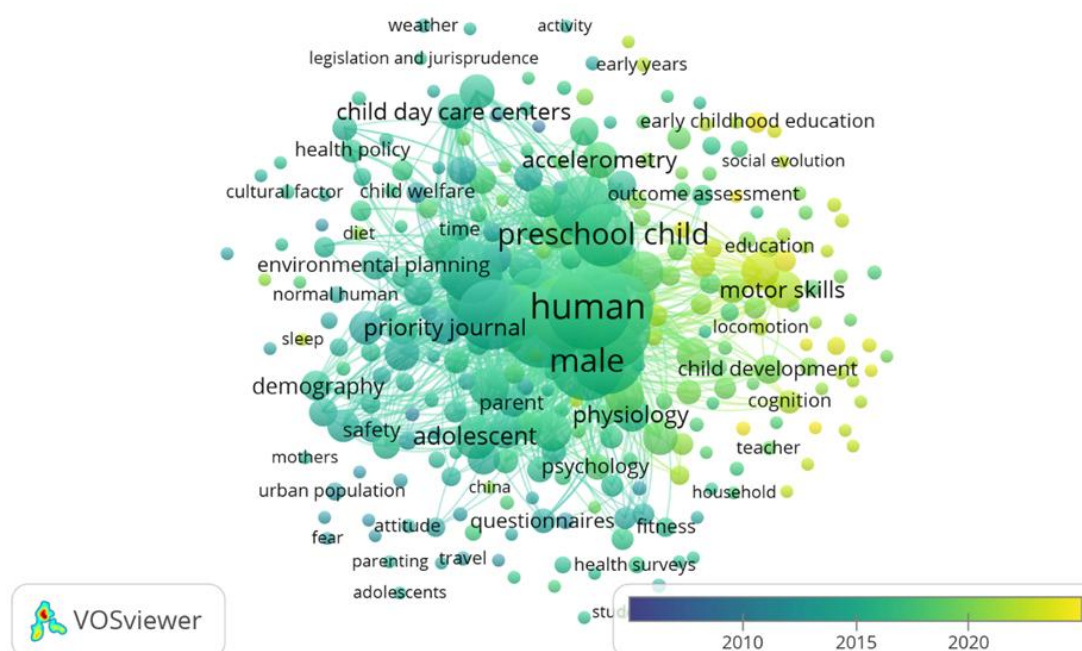


Figure 6. Research novelty

This VOSviewer visualization shows a map of keyword co-occurrence over time (blue = old, yellow = new). Dominant keywords such as human, male, and preschooler are in the center, indicating a primary focus on early childhood population studies and physiological-psychological aspects. Links to terms such as child well-being, environmental planning, and health policy suggest a multidisciplinary approach. Newness (contemporary) is evident in yellow keywords such as motor skills, education, child development, cognition, and teachers, reflecting a recent research shift toward integrating education, motor development, and cognitive development in children. This indicates a new trend emphasizing education-based interventions and holistic development over traditional medical approaches.

DISCUSSION

Research findings indicate that there has been a significant increase in research on outdoor physical activity (OPA) and motor skills, particularly after 2018. The number of publications peaked between 2022 and 2024. This suggests that the role of outdoor physical activity in enhancing children's motor development is receiving increasing academic attention (Deng et al., 2024). Keyword analysis indicates that the relationship with health, environment, and

education is multidisciplinary, with themes such as motor skills, physical exercise, and child development being the main focus of research. However, wealthy countries continue to dominate the distribution of publications, indicating a lack of global contribution.

Several leading health organizations have emphasized the importance of outdoor play in supporting children's health. For example, the Council of Chief Medical Officers of Health of Canada and the Canadian Paediatric Society emphasize that outdoor play is a critical component in maintaining children's physical health and development (Beaulieu & Beno, 2024; Yogman et al., 2018). Furthermore, modern clinical practice is beginning to prescribe outdoor play as a therapeutic strategy to improve overall health (Rariden & Kuhn, 2024; Sundermann et al., 2023).

In line with this, outdoor play significantly contributes to increased physical activity and reduced sedentary behavior in children aged 3–12 years (C. Gray et al., 2015). Furthermore, this approach has great potential for future global health policy implementation (Kondo et al., 2020). Thus, outdoor play serves not only as a recreational activity but also as a promotive and preventive intervention for children's health.

Although this study was conducted with great care, researchers should highlight limitations that should be considered when interpreting the findings. The bibliometric analysis did not fully capture papers indexed in other databases, such as Web of Science, PubMed, or Google Scholar, as it only used the Scopus database. Furthermore, the survey was limited to English-language publications, which may have uncovered significant scientific contributions from developing countries. The bibliometric approach does not adequately reflect the methodological quality or empirical efficacy of implementing Outdoor Play Activity (OPA) for early childhood motor development, as it focuses more on publication patterns, citations, and network connections.

It is recommended that future studies utilize multiple databases worldwide to provide a more comprehensive and representative body of knowledge. To further clarify the effectiveness of OPA therapy, future studies should also employ systematic review or meta-analysis techniques.

Furthermore, longitudinal research on how outdoor play activities affect children's motor, social, emotional, and cognitive development is essential. Potential new research directions include the integration of sensors, the Internet of Things, and digital analytics in tracking children's motor activity. To create locally tailored and sustainable OPA models that consider cultural characteristics, environments, and early childhood educational needs, research in developing countries is also crucial.

CONCLUSION

Outdoor Play Activity and early childhood motor skills expanded substantially between 2006 and 2026, particularly after 2018. This bibliometric analysis shows that OPA supports not only motor skill development but also cognitive, social, health, and overall well-being outcomes. The field has become increasingly multidisciplinary, with growing emphasis on physical activity, preventive health, and early childhood education. Although high-income countries dominate research collaborations, greater contributions from developing countries are needed to provide more inclusive and context-specific evidence. These findings offer a scientific foundation for designing play environments, educational policies, and outdoor activity programs that promote optimal child development. Despite limitations related to the use of a single database and bibliometric methods, this study highlights future research directions, emphasizing broader international collaboration, longitudinal studies, and technology-based approaches to support sustainable early childhood development.

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