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REVIEW

Sports Therapy in Focus: a Systematic Bibliometric Analysis of Research Development and Impact

Terapia deportiva en el punto de mira: un análisis bibliométrico sistemático del desarrollo y el impacto de la investigación

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ABSTRACT

Introduction: this bibliometric analysis explores the research landscape of sports therapy, a specialized field focused on injury prevention, assessment, rehabilitation, and performance enhancement. The study aims to analyze key trends, contributors, and thematic evolution in sports therapy research, providing insights into its development and emerging focus areas.
Method: the study utilizes Biblioshiny, VOSviewer, and CiteSpace to analyze publication trends, citation networks, and thematic evolution. Data was retrieved from Scopus, covering the period 1965–2025. The study examines annual scientific production, the most relevant authors, and co-citation networks to uncover key contributors and collaborative research. Additionally, the most relevant sources and timezone maps of citing journals determine core publication outlets in the discipline.
Results: the study examines global scientific production by country and analyzes the most globally cited articles, providing insight into seminal studies. Trend and thematic mapping identify shifts in research focus, with greater emphasis on rehabilitation, chronic disease management, and AI-driven interventions. Co-occurrence analysis of author keywords further categorizes dominant and emerging research themes.
Conclusions: identified research gaps include limited studies on female athletes, adaptive sports therapy, and mental health integration. The study offers practical insights for researchers, clinicians, and policymakers, with a call for greater interdisciplinary collaboration and technology-driven innovations in sports therapy.

Keywords: Sports Therapy; Bibliometric Analysis; VOSviewer; Citespace; Biblioshiny.

RESUMEN

Introducción: este análisis bibliométrico explora el panorama de la investigación en terapia deportiva, un campo especializado centrado en la prevención, evaluación, rehabilitación y mejora del rendimiento de lesiones. El estudio busca analizar las tendencias clave, los contribuyentes y la evolución temática en la investigación en terapia deportiva, aportando información sobre su desarrollo y las áreas de enfoque emergentes.
Método: el estudio utiliza Biblioshiny, VOSviewer y CiteSpace para analizar las tendencias de publicación, las redes de citas y la evolución temática. Los datos se obtuvieron de Scopus, abarcando el período 1965-2025. El estudio examina la producción científica anual, los autores más relevantes y las redes de cocitación para identificar contribuyentes clave e investigación colaborativa. Además, las fuentes más relevantes y los mapas de zonas horarias de las revistas que citan determinan los principales medios de publicación en la disciplina.

Resultados: el estudio examina la producción científica global por país y analiza los artículos más citados a nivel mundial, aportando información sobre estudios seminales. El mapeo de tendencias y temas identifica cambios en el enfoque de la investigación, con mayor énfasis en la rehabilitación, el manejo de enfermedades crónicas y las intervenciones basadas en IA. El análisis de coocurrencia de palabras clave de autor categoriza con mayor precisión los temas de investigación dominantes y emergentes.
Conclusiones: las lagunas de investigación identificadas incluyen estudios limitados sobre atletas femeninas, terapia deportiva adaptativa e integración de la salud mental. El estudio ofrece perspectivas prácticas para investigadores, profesionales clínicos y legisladores, y aboga por una mayor colaboración interdisciplinaria e innovaciones tecnológicas en la terapia deportiva.

Palabras clave: Terapia Deportiva; Análisis Bibliométrico; Vosviewer; Citespace; Biblioshiny.

INTRODUCTION

Sports therapy is a specialized discipline dedicated to preventing, assessing, rehabilitating, and managing injuries related to physical activity and sports.[1,2] It integrates principles from physiotherapy, exercise science, biomechanics, and sports medicine to optimize athletic performance and ensure safe participation in sports.[3,4] The field has evolved significantly over the past few decades, driven by advancements in medical technologies, a deeper understanding of human physiology, and the growing emphasis on evidence-based practice.[2,5,6] Sports therapists work with athletes across all levels—from amateurs to elite professionals—to address acute injuries, chronic conditions, and psychological barriers to recovery.[1,7] Their role extends beyond treatment to include education on injury prevention, biomechanical analysis, and the design of tailored rehabilitation programs.[2,7] As global participation in sports and fitness activities continues to rise, the demand for skilled sports therapists and innovative therapeutic interventions has surged, positioning the field as a cornerstone of modern athletic healthcare.[8,9]

The historical roots of sports therapy trace back to ancient civilizations, where physical exercise and manual therapies were used to treat injuries.[8] However, the formalization of the discipline began in the mid-20th century, paralleling the rise of organized sports and the need for specialized care.[2] Early practices focused on reactive measures, such as treating sprains or fractures, but contemporary sports therapy emphasizes proactive strategies, including injury risk assessment, load management, and performance optimization.[10] Innovations like cryotherapy, neuromuscular training, and regenerative medicine (e.g., stem cell therapy) have revolutionized treatment protocols, enabling faster recovery and reducing long-term complications.[11] Moreover, the integration of psychological support—addressing anxiety, motivation, and mental resilience—has broadened the scope of sports therapy, reflecting its holistic approach to athlete well-being.[12,13]

In recent years, the field has faced new challenges and opportunities. The increasing intensity of competitive sports, coupled with the commercialization of athletics, has heightened athletes' physical and mental demands.[14] This has led to a rise in overuse injuries, burnout, and mental health issues, necessitating more sophisticated therapeutic interventions.[15] Simultaneously, technological advancements, such as wearable sensors, motion capture systems, and artificial intelligence (AI)-driven diagnostics, have transformed how injuries are monitored and managed.[16] These tools enable real-time data collection on biomechanics, workload, and recovery patterns, allowing therapists to personalize interventions with unprecedented precision.[17] However, the rapid pace of innovation also raises questions about accessibility, ethical considerations, and the need for standardized guidelines to ensure equitable application across diverse populations.[18]

Despite its growth, sports therapy remains a fragmented field, with research often siloed into sub-disciplines such as orthopaedics, neurology, or sports psychology.[14] This fragmentation complicates efforts to synthesize knowledge, identify overarching trends, and address interdisciplinary challenges. Furthermore, the exponential growth of scholarly literature—spanning journals, conferences, and clinical trials—creates barriers for practitioners and researchers aiming to stay abreast of developments. A systematic analysis of the field's intellectual structure, key contributors, and thematic evolution is thus critical to consolidating knowledge, fostering collaboration, and guiding future research priorities.

Bibliometric analysis provides a quantitative, fact-based mapping of the research field of sports therapy. By examining publication trends, citation networks, and co-occurring keywords, such an analysis reveals trends in productivity, collaboration, and theme domains regarding research output.[19,20] Unlike traditional literature review, bibliometric analysis assigns a numerical value to the contribution of single authors, institutes, and journals and reveals emerging trends and gaps in knowledge.[21,22] In a rapidly developing field like sports therapy with shifting discursive spaces, such an analysis helps map its evolution, current trends, and directions of future work.[23] Previous research in sports therapy has applied bibliometric analysis in examining given areas, including concussion rehabilitation and tendinopathy, but a review of the discipline is understudied. In filling such a gap, in this study, advanced tools of bibliometric analysis have been employed to examine the entirety of work in sports therapy, offering information about its evolution over time, current trends, and future direction.[24,25]

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This study employs three high-quality bibliometric tools—Biblioshiny, VOSviewer, and Citespace—to conduct a multi-dimensional analysis of literature in sports therapy.[26,27] Biblioshiny, an accessible, R-based software, constitutes a backbone for the extraction, cleaning, and preliminary analysis of information.[28,29,30] Biblioshiny processes metadata in databases, including Scopus and Web of Science, and generates publication trends, productivity of authors, and impact of journals in graphs, a valuable tool for discerning annual growth rates, geographical distributions of studies, and most productive institutions.[31] Interactive dashboards in Biblioshiny even allow filtering information in terms of keywords, publication years, or types of documents, allowing focused examination of sub-themes in sports therapy.[32,33]

VOSviewer and Citespace complement Biblioshiny in their function for network analysis and trends over a period of years.[34] VOSviewer is particularly skilled at generating and mapping networks of co-author collaborations, networks of citations, and keyword clusters of co-occurrence.[35,36] Mapping networks, VOSviewer reveals collaboration between researchers, between institutions, between countries, and between dominant conceptual frameworks in a field.[37,38] For instance, keyword clusters could reveal such subjects as "injury prevention in youth sports" or "the biomechanics of ACL rehabilitation," providing a macro view of focal areas of investigation activity. Citespace, on the other hand, is best at discovering emerging trends and "burst" keywords—keywords with sharp spikes in use—showing a shift in direction in terms of foci of investigation.[39,40,41] It generates timeline maps to visualize trends in investigation over a period of several decades, distinguishing between early and persistent subjects (e.g., techniques in manual therapy) and new and emerging ones (e.g., AI rehabilitation). Together, these tools provide a rich lens through which to view social and intellectual structures of studies in sports therapy, offering both breadth and depth in the analysis of its publication output.

This study aims to explore five key research questions to provide a comprehensive understanding of the field of sports therapy. First, it investigates the core research themes and emerging trends (RQ1) to identify the primary areas of focus and potential future directions. Second, it examines the key contributors and their collaborative networks (RQ2), shedding light on influential researchers and institutional partnerships that drive advancements in the field. Additionally, the study analyzes the evolution of publication output over time (RQ3) to understand how research activity has developed and expanded. Furthermore, it identifies the most influential publications and their impact on shaping sports therapy research (RQ4). Lastly, the study seeks to uncover existing research gaps and underserved areas (RQ5), highlighting opportunities for future studies and practical applications within the discipline.

The findings of this bibliometric analysis have important implications for a range of stakeholders. For researchers, the establishment of key themes (RQ1) and emerging trends will inform areas of future prioritization for investigation, for instance, the application of telehealth in rural groups of athletes or ethics in genetic profiling for preventing injuries. Cross-disciplinary collaborations (RQ2) can drive cross-disciplinary collaborations, closing gaps between sports therapy and, for instance, data science and public health. Trends in publication output over time (RQ3) can reveal shifts in worldwide research leadership, opening doors for underrepresented nations to contribute to the discussion.

For practitioners, the most effective publications (RQ4) can inform evidence-based practice, maintaining current research in harmony with practice. For example, studies in eccentric training for tendinopathies or cognitive-behavioural interventions for anxiety in relation to an injury can inform rehabilitation protocols. Meanwhile, gaps in research (RQ5)—e.g., fewer studies in female athletes or in adaptive sports—can stimulate inclusive research agendas that can respond to inequality in sports therapy.

Policymakers and funding agencies can leverage these findings to allocate resources strategically, prioritizing high-impact areas like concussion protocols or mental health interventions. Educational institutions may also update curricula to reflect emerging tools (e.g., wearable technology) and methodologies, preparing the next generation of sports therapists for evolving challenges. Ultimately, this analysis not only maps the current state of sports therapy but also charts a roadmap for advancing the field, ensuring it remains responsive to the needs of athletes in an increasingly complex and dynamic sporting landscape.

METHOD

The main source of bibliographic data for this study is Scopus, selected for its inclusion of a wider range of high-quality journals compared to other databases.[42,43,44] We retrieved publications using the query TITLE-ABS-KEY ("sports therapy"). The search was not restricted to any particular language, and the data included articles from peer-reviewed journals, book chapters, and conference papers. We collected 277 articles from 170 different sources, spanning 1967 to 2025. To ensure accuracy, we screened the Scopus records to remove any duplicates. Figure 1 illustrates the PRISMA approach for selecting papers for bibliometric analysis through a three-phase procedure.[45] In the first phase, we identify and extract the necessary data for analysis from the databases. We excluded Reviews, Editorials, Books, Short Notes, Retractions, Errata, Letters, and Short Surveys in the second phase. The documents included are Articles, Conference Papers, and Book Chapters. The findings were saved as CSV and RIS files and bibliometric analysis was conducted on the data using CiteSpace version 6.2.R3 (Advanced), VOSviewer, and Bibloshiny software.

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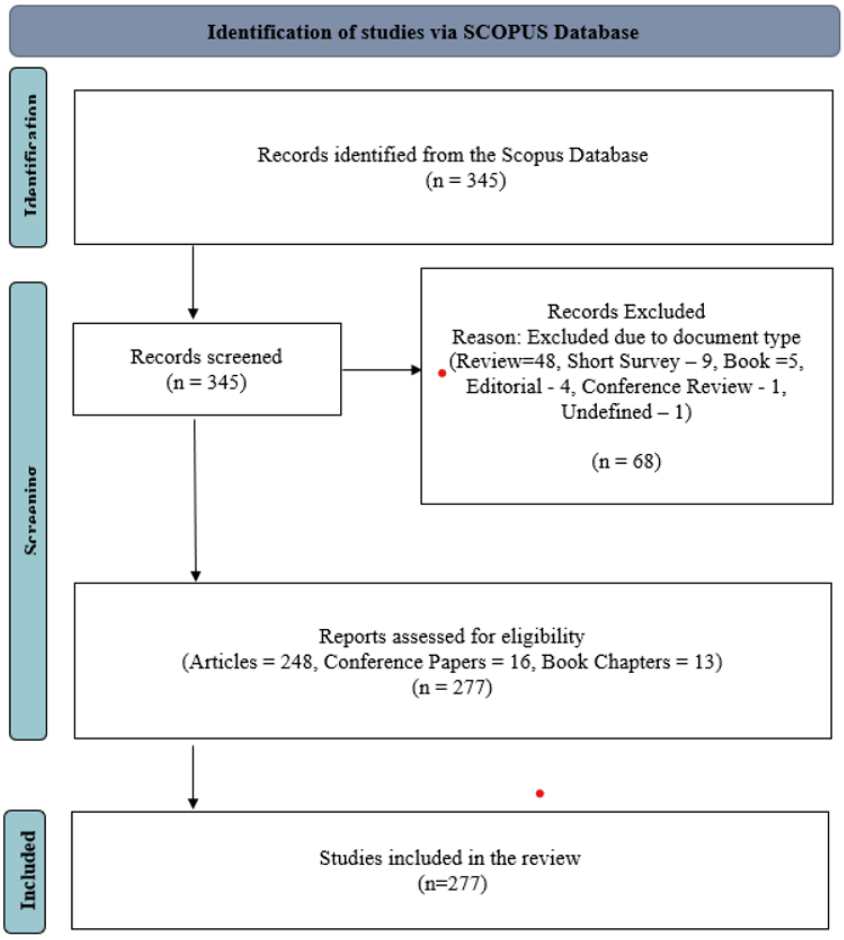

Figure 1. PRISMA flow diagram used to identify, screen, and include papers in the bibliometric analysis

RESULTS

Main information of the investigation

Table 1. Primary information of the investigation

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	1965:2025
Sources (Journals, Books, etc)	170
Documents	277
Annual Growth Rate %	-1,15
Document Average Age	17,4
Average citations per doc	6,755
References	6784
DOCUMENT CONTENTS	
Keywords Plus (ID)	1537
Author's Keywords (DE)	637
AUTHORS	
Authors	860
Authors of single-authored docs	60
AUTHORS COLLABORATION	
Single-authored docs	71
Co-Authors per Doc	3,71
International co-authorships %	7,942
DOCUMENT TYPES	
article	248
book chapter	13
conference paper	16

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The bibliometric analysis on Sports Therapy covers a timespan from 1965 to 2025, with 2025 likely representing a prospective endpoint, and draws from 170 sources, including journals, books, and other publications. 277 documents were analyzed, revealing a slight decline in annual scholarly output with a growth rate of -1,15 %. The field exhibits maturity, reflected in an average document age of 17,4 years and moderate citation influence, averaging 6,76 citations per document, supported by 6784 referenced works. Collaboration is a key feature, with 860 authors contributing to the literature, averaging 3,71 co-authors per document, though international collaboration remains limited at 7,94 %. Solo research persists, evidenced by 71 single-authored documents. Most publications are journal articles, totaling 248, complemented by 13 book chapters and 16 conference papers. Keyword analysis underscores a broad thematic range, with 1,537 terms identified through Keywords Plus compared to 637 author-defined keywords, suggesting diverse interdisciplinary connections. Overall, the field demonstrates stability with a gradual decline in output, strong foundational knowledge, and localized collaborative networks.

Annual Scientific Productions

Figure 2 presents annual scientific production between 1965 and 2024, with a field having phases of variable expansion, with technological, historical, and global factors having an impact. In its early years (1965–1980s), publication output was negligible, with 0–4 articles per annum, a reflection of infancy in the field. Short-term fluctuations, such as 1973–1976 and a short-term spurt in 1983, most likely arose from increased interest in sports rehabilitation and early investigations in its base. Long-term gaps, such as those between 1984 and 1986, with no publication, point towards obstacles such as a lack of institutional support or shifts in the foci of investigation. In the 1990s and early 2000s, a slow build-up ensued, with 1–6 articles produced per annum, with increased rehabilitation and sports science methodologies driving improvements. There was a spurt in 2008 to 12 articles, in coordination with the Beijing Olympics, a reflection of reactivity in the field towards global games with a strong focus on avoidance of injury and maximization of performance.

The modern era (2010s–2024) is marked by fluctuations with strong growth phases. Production rose from 8 articles in 2013 to 13 in 2015, facilitated through multidisciplinarity and breakthroughs in terms of wearable sensors and biomechanical modeling. The rapid climb to 26 articles in 2024, an all-time high, most likely mirrors post-pandemic care for bodily wellbeing, AI-facilitated rehabilitation technology, and preparation for events including the Paris Olympics. Short-term drops, such as in 2016, when output plunged to 8 articles, may represent funding gaps or integration phases in studies. The sole article in 2025 mirrors incomplete reporting and not a dip. Overall, trends follow technological breakthroughs, global sporting events, and investments in policies, and dips follow financial constraints or short-term saturation. Trends illustrate Sports Therapy's establishment as a thriving, practice-oriented field with growing academic and pragmatic value.

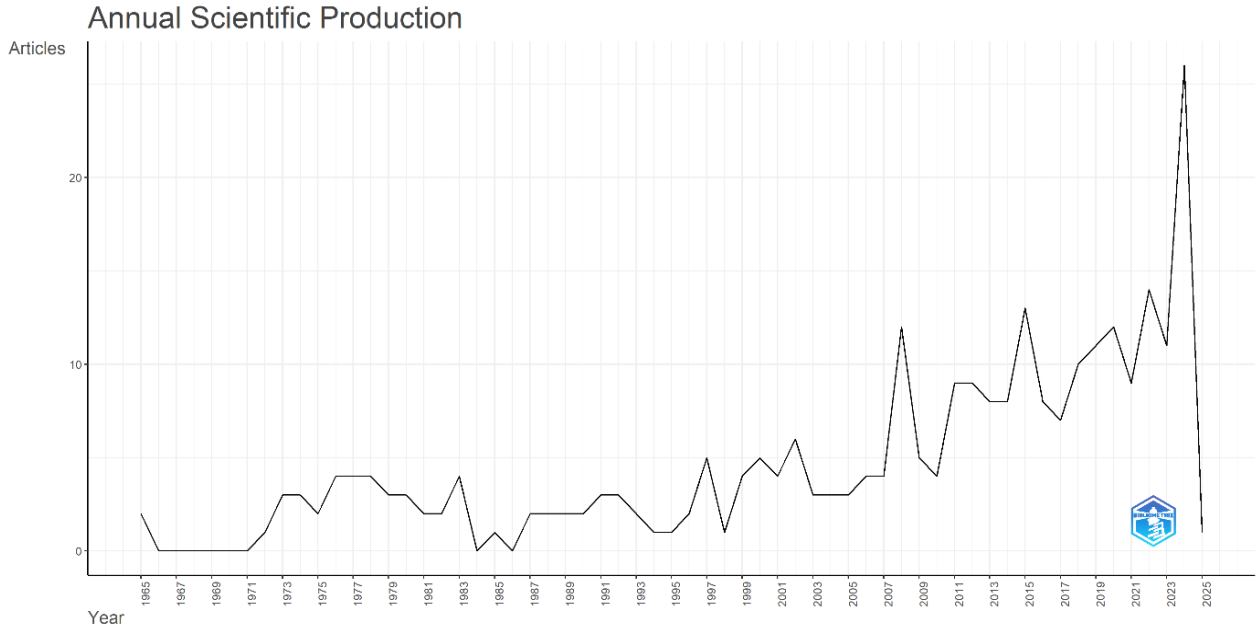

Figure 2. Significant growth trajectory from 1965 to 2025

Most Relevant Authors

Figure 3 highlights key contributors, measured by both total and fractionalized articles—a metric that distributes authorship credit proportionally among co-authors. Hilberg, T. emerges as the most prolific author with 12 articles, but their fractionalized score of 3,13 suggests extensive collaboration, as their individual

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contribution per paper is diluted across multiple co-authors. In contrast, Deimel, H., with 5 articles, has the highest fractionalized score (4,00), indicating a dominant role in their work, likely as a lead or sole author. This distinction underscores differing research approaches: Hilberg's high output reflects broad collaborative networks, while Deimel's fractionalized score signals focused, independent contributions.

Other notable authors include Ambrosini, Emilia (6 articles, 1,02 fractionalized) and Pedrocchi, Alessandra (5 articles, 0,86 fractionalized), whose low fractionalized scores imply frequent participation in large teams. Geidl, Wolfgang and Pfeifer, Klaus (5 articles each, 1,19 fractionalized) strike a balance between collaboration and individual input. The disparity between total articles and fractionalized scores highlights the interdisciplinary and team-driven nature of Sports Therapy research. Authors with lower fractionalized values may prioritize collaborative projects, while those with higher scores focus on leading studies. This pattern aligns with the field's emphasis on multidisciplinary approaches to rehabilitation, performance optimization, and injury prevention, where diverse expertise is often essential. Overall, the data reflects a blend of collaborative and independent research styles, with Hilberg and Deimel representing two distinct paradigms of scholarly contribution.

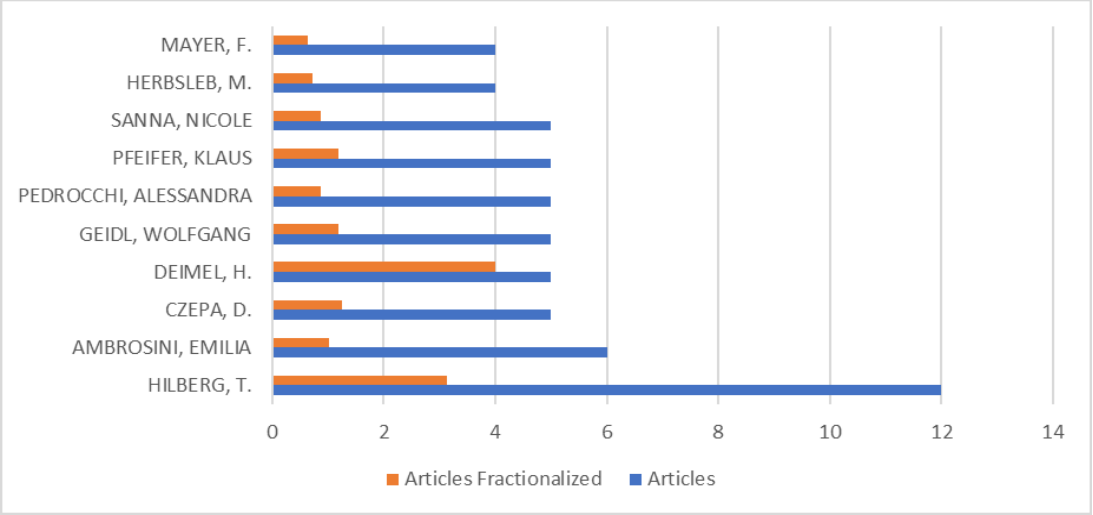

Figure 3. Most relevant authors

Network visualization of co-citation of cited authors

Figure 4 illustrates the co-citation network of citing authors in sports therapy research and recognizes six dominant clusters, each with a theme in the discipline. Cluster #0 (Psychiatric In-Patient) is comprised of 42 members and a silhouette value of 0,965, indicating high cohesion. Exercise and sports therapy in psychiatric rehabilitation are prominent in this cluster, with seminal works of authors like Baumann FT and Dimeo F. Cited literature argues that exercising psychiatric patients induces overall and mental well-being in them. Similarly, Cluster #4 (Schizophrenia) is concerned with exercise in managing symptoms of schizophrenia, with seminal works of researchers like VanCampfort D and Stubbs B. Studies in this cluster examine the effect of training in endurance and structured exercise programs in psychiatric patients.

Another significant theme in long-term disease rehabilitation and improvement in physical performance in studies of sports therapy is its use in enhancing long-term rehabilitation and improvement in physical performance. Cluster #1 (Physical Training Increases), with 41 samples and a silhouette value of 0,958, puts a high value on organized training in terms of strengthening and proprioception, particularly in cases of hemophiliac patients. Most studies in this cluster, including studies by Hilberg T, reveal positive improvements in long-term sports therapy interventions in terms of enhancing motor function and overall well-being. Likewise, Cluster #7 (Hip) puts a high value on interventions in osteoarthritis and rehabilitation in cases of hip replacement operations. Authors such as Bohannon RW and Appell HJ have shed new light on improvement in gait behavior, muscle force, and life quality in hip surgical cases through exercise.

The bibliometric network highlights methodological advancements and policy discussions in sports therapy research. Cluster #6 (DNVF Memorandum), with 20 members, explores the integration of sports therapy into broader healthcare frameworks. Cited works by Borg G and Damschroder LJ examine how sports therapy interventions are assessed and implemented in rehabilitation programs. Additionally, Cluster #9 (AMPA System) introduces personalized sports therapy interventions, particularly for metabolic disorders. Studies in this cluster, led by researchers like Blair SN and Ades PA, propose adaptive and customized exercise regimens that align with individual patient needs.

Overall, the network visualization of co-citation underscores the multidimensional nature of sports therapy research, spanning mental health applications, rehabilitation strategies, and methodological advancements. The field is rapidly evolving with contributions from interdisciplinary collaborations, including physiotherapists,

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sports scientists, psychologists, and healthcare policymakers. Future research may focus on expanding the role of AI-driven rehabilitation programs, wearable technology, and personalized therapy approaches, ensuring more effective and patient-centered sports therapy interventions.

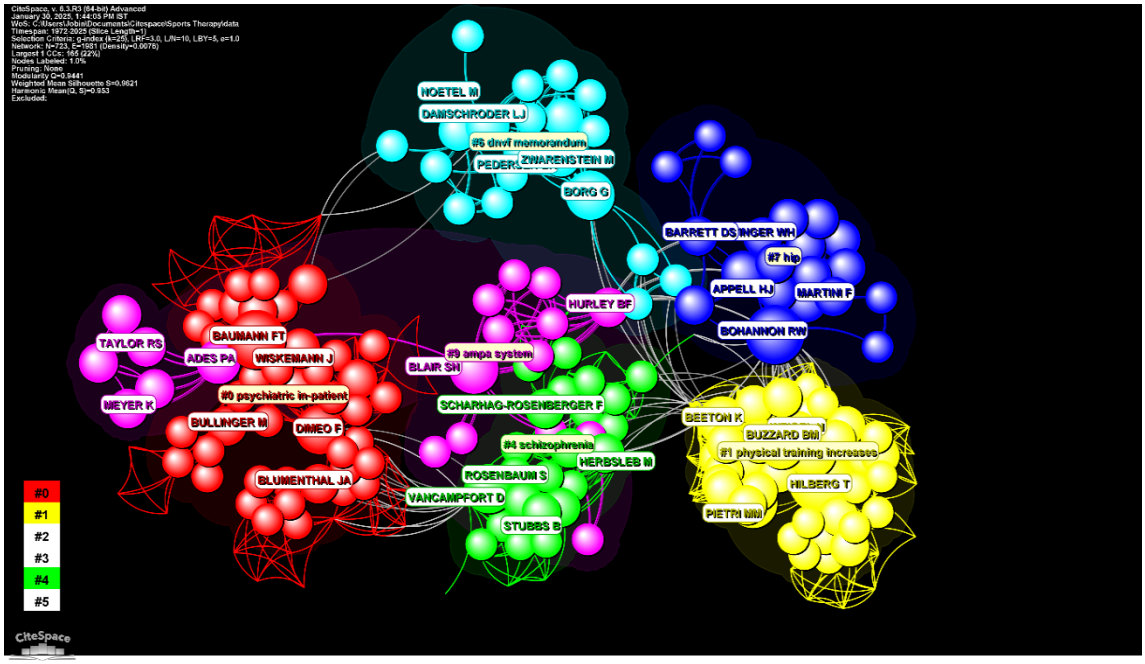

Figure 4. Network visualization of co-citation of cited authors

Most Relevant Sources

Table 2 reveals that the most relevant sources are predominantly German-language medical and rehabilitation journals, with Deutsche Zeitschrift Fur Sportmedizin, Medizin Und Sport, and Rehabilitation leading the list with eight articles each, indicating a strong European research presence. Aktuelle Rheumatologie, with seven articles, and Haemophilia, with six articles, emphasize the role of sports therapy in managing joint conditions and rehabilitation for blood disorders. Including Revista Brasileira De Medicina Do Esporte, which has five articles, and the Chinese Journal of Clinical Rehabilitation, which has four articles, which reflect a growing global interest in sports therapy research. Meanwhile, The Handbook of Sports Medicine and Science, with four articles, highlights structured approaches to sports therapy services, and the International Journal of Therapy and Rehabilitation, also with four articles, reinforces the clinical rehabilitation perspective. Overall, the table underscores the interdisciplinary and international nature of sports therapy research, integrating medical, rehabilitation, and organizational frameworks.

Table 2. Most relevant sources

Sources	Articles
Deutsche Zeitschrift Fur Sportmedizin	8
Medizin Und Sport	8
Rehabilitation	8
Aktuelle Rheumatologie	7
Haemophilia	6
Physikalische Medizin Rehabilitationsmedizin Kurortmedizin	6
Revista Brasileira De Medicina Do Esporte	5
Chinese Journal of Clinical Rehabilitation	4
Handbook of Sports Medicine and Science: Sports Therapy Services: Organization and Operations	4
International Journal of Therapy and Rehabilitation	4

Timezone network visualization of Co-citation of Cited Journals

Figure 5 presents a timezone network visualization of co-cited journals in sports therapy research consisting of 12 major clusters, each representing a thematic focus within the field. The largest cluster (#0, Exercise

Project), with 77 members and a silhouette value of 0,839, emphasizes the role of exercise in managing musculoskeletal conditions such as fibromyalgia, osteoarthritis, and haemophilia. Highly cited journals in this cluster include Archives of Physical Medicine and Rehabilitation (18 citations), Physical Therapy (16 citations), and Haemophilia (8 citations), reflecting the multidisciplinary nature of exercise-based rehabilitation. The key citing articles investigate physical therapy's impact on gait, strength, and quality of life, particularly in orthopaedic and rheumatologic conditions.

The second-largest cluster (#1, Bewegungsbezogener), with 62 members and a silhouette value of 0,771, explores methodological approaches in sports therapy and behavioral interventions in rehabilitation. PLOS ONE (16 citations) and the British Journal of Sports Medicine (10 citations) dominate this cluster, indicating a strong focus on empirical research and evidence-based sports therapy interventions. Studies within this cluster assess psychological training for sports therapists, rehabilitation in chronic inflammatory conditions, and the role of exercise in cardiovascular disease prevention. Meanwhile, Cluster #3 (Physical Activity) highlights the role of sports therapy in promoting physical activity for health benefits, with highly cited journals such as BMJ (15 citations) and JAMA (11 citations). Research in this area investigates osteoporosis prevention, motor function in cerebral palsy, and the effects of structured exercise programs on rehabilitation.

A significant direction in studies in sports therapy is its application in cognitive and neurological rehabilitation. Cluster #4 (Attention Cognition), with 46 members and a silhouette value of 0,949, examines the role of sports therapy in terms of neuroplasticity, cognitive function, and attention. Medicine and Science in Sports and Exercise (26 citations) is most significant in this cluster, supplemented with studies of exercise impact in pediatric stem cell transplantation and neurorehabilitation for hematopoietic disease. Similarly, Cluster #5 (Spinal Cord Injury Rehabilitation) identifies the role of sports therapy in regaining care and mobility in spinal injured patients, with Sports Medicine most cited in this group. This cluster identifies long-term gain and classification of sports therapy interventions in neurological rehabilitation.

Finally, sports therapy's technological and specialized applications are emerging research areas. Cluster #13 (Sports Rehabilitation Therapy) and Cluster #15 (Obese Children) indicate a growing interest in using functional electrical stimulation, neuro-engineering, and personalized sports therapy for rehabilitation. Journals like The Lancet and the Journal of Neuroengineering and Rehabilitation are key contributors, emphasizing the integration of biomedical engineering with sports therapy. Additionally, Cluster #10 (Asthma Bronchiale) focuses on exercise interventions for respiratory conditions, with Chest being the most cited journal. These findings suggest that sports therapy is expanding beyond musculoskeletal disorders to include cognitive, cardiovascular, and respiratory rehabilitation, supported by interdisciplinary research collaborations.

Figure 5. Timezone Network visualization of co-citation of cited journals

Countries Scientific Productions

Table 3 highlights the global scientific contributions, showcasing the countries with the highest number of research outputs. Germany leads in scientific production with 127 documents, significantly surpassing other countries, indicating strong research focus and funding in the field. The United Kingdom and China are key contributors, with 28 and 25 documents reflecting their well-established research ecosystems. Italy, Switzerland, and the United States show moderate contributions with 17, 13, and 11 documents, respectively,

with the United States relatively lower count suggesting that the topic may be more specialized or regionally significant in Europe. Meanwhile, Indonesia, Spain, and Australia contribute smaller numbers with six, six, and five documents, highlighting emerging research interests from Southeast Asia and the Asia-Pacific region. Overall, the data suggests a European dominance in scientific output, with some engagement from other global players.

Table 3. Countries Scientific Productions

Country/Territory	Documents
Germany	127
United Kingdom	28
China	25
Italy	17
Switzerland	13
United States	11
Indonesia	6
Spain	6
Australia	5
Canada	5

Most Globally Cited Documents

Table 4. Most globally cited documents

Authors	Title	Year	Source title	Cited by
Sterba J.A.; Rogers B.T.; France A.P.; Vokes D.A.	Horseback riding in children with cerebral palsy: Effect on gross motor function	2002	Developmental Medicine and Child Neurology	162
Weis J.	Cancer-related fatigue: Prevalence, assessment and treatment strategies	2011	Expert Review of Pharmacoeconomics and Outcomes Research	146
Hilberg T.; Hersbsleb M.; Puta C.; Gabriel H.H.W.; Schramm W.	Physical training increases isometric muscular strength and proprioceptive performance in haemophilic subjects	2003	Haemophilia	107
Bedbrook G.M.	Spinal injuries with tetraplegia and paraplegia	1979	Journal of Bone and Joint Surgery - Series B	100
Ströhle A.	Sports psychiatry: mental health and mental disorders in athletes and exercise treatment of mental disorders	2019	European Archives of Psychiatry and Clinical Neuroscience	96
Kang K.D.; Choi J.W.; Kang S.G.; Han D.H.	Sports therapy for attention, cognitions and sociality	2011	International Journal of Sports Medicine	88
Van Der Ploeg H.P.; Streppel K.R.M.; Van Der Beek A.J.; Van Der Woude L.H.V.; Vollenbroek-Hutten M.M.R.; Van Harten W.H.; Van Mechelen W.	Successfully improving physical activity behavior after rehabilitation	2007	American Journal of Health Promotion	79
Crone D.; Guy H.	'I know it is only exercise, but to me it is something that keeps me going': A qualitative approach to understanding mental health service users' experiences of sports therapy: Feature Article	2008	International Journal of Mental Health Nursing	70
Rosenhagen A.; Bernhörster M.; Vogt L.; Weiss B.; Senn A.; Arndt S.; Siegler K.; Jung M.; Bader P.; Banzer W.	Implementation of structured physical activity in the pediatric stem cell transplantation	2011	Klinische Padiatrie	63
Moritz S.; Berna F.; Jaeger S.; Westermann S.; Nagel M.	The customer is always right? Subjective target symptoms and treatment preferences in patients with psychosis	2017	European Archives of Psychiatry and Clinical Neuroscience	60

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Table 4 presents the most globally cited documents in the field of sports therapy, covering various aspects of rehabilitation, mental health, cognitive development, and specialized physical activity programs. These studies highlight the effectiveness of sports therapy interventions in improving physical performance, mental well-being, and long-term rehabilitation outcomes. The citations reflect the significance of these research contributions and their impact on advancing sports therapy as a critical element in healthcare and rehabilitation.

The most cited work in this domain, Horseback Riding in Children with Cerebral Palsy: Effect on Gross Motor Function[46] has received 162 citations. This study underscores the therapeutic benefits of equine-assisted therapy in improving motor function in children with cerebral palsy. The popularity of this work highlights the increasing recognition of alternative therapies in pediatric rehabilitation. Similarly, Cancer-related Fatigue: Prevalence, assessment and Treatment Strategies,[47] cited 146 times, delves into the debilitating effects of fatigue in cancer patients, proposing targeted treatment strategies. Given the rising global incidence of cancer, this research remains crucial in shaping interventions that enhance quality of life for affected individuals.

The application of sports therapy in managing chronic conditions and disabilities is evident in multiple highly cited studies. Physical training increases isometric muscular strength and proprioceptive performance in haemophilic subjects,[48] demonstrating how structured physical training enhances muscle strength and proprioception in haemophilia patients, garnering 107 citations. Meanwhile, Spinal injuries with tetraplegia and paraplegia[49] remain influential in spinal cord injury rehabilitation with 100 citations, offering foundational insights into the long-term management of paraplegia. Furthermore, Sports Psychiatry: Mental Health and Mental Disorders in Athletes and Exercise Treatment of Mental Disorders[50] with 96 citations, emphasizes the dual role of sports therapy in both preventing and treating mental health disorders, reflecting a growing interdisciplinary approach to sports and mental health.

Several studies highlight the social and behavioral dimensions of sports therapy. Sports therapy for attention, cognitions and sociality[51] explores its impact on cognitive and social functioning, particularly in individuals with attention disorders, amassing 88 citations. Similarly, Successfully improving physical activity behavior after rehabilitation[52] (79 citations) and A qualitative approach to understanding mental health service users' experiences of sports therapy[53] (70 citations) examine behavioral adaptations following rehabilitation and the subjective experiences of therapy recipients. The inclusion of structured physical activity in pediatric stem cell transplantation[54] (63 citations) and patient-centric treatment preferences in psychosis[55] (60 citations) further illustrate the expanding scope of sports therapy. Collectively, these studies emphasize the holistic role of physical activity in medical rehabilitation, mental health, and long-term well-being.

Co-occurrence of all keywords

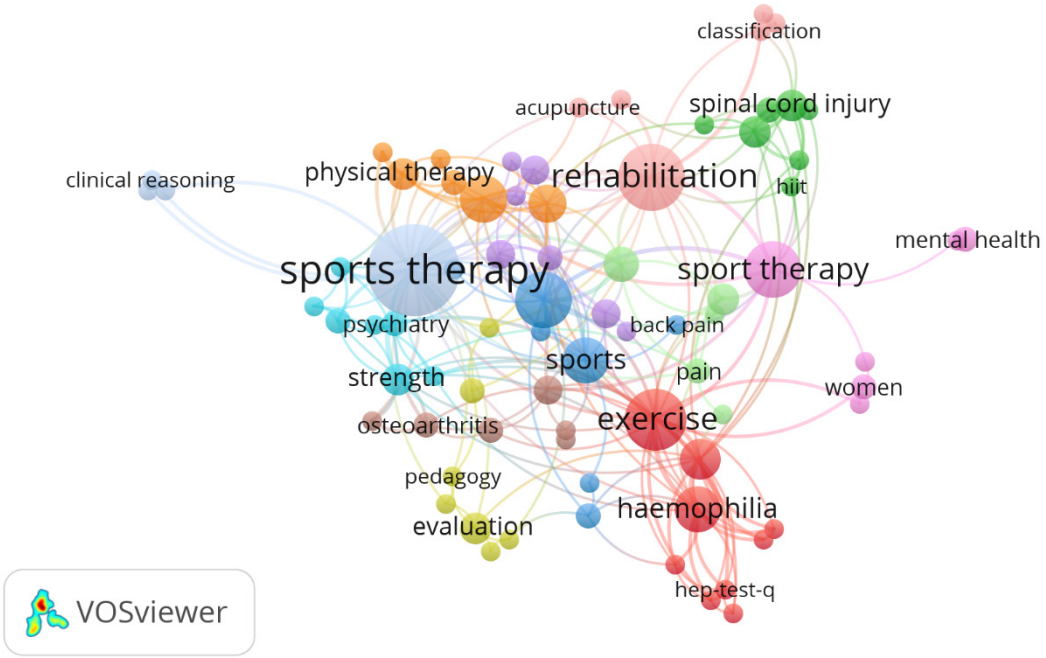

Figure 6. Co-occurrence of author keywords

Figure 6 is a visualization of a keyword co-occurrence network, representing its relationships in terms of co-occurrence frequency. With at least two occurrences, 78 out of 637 keywords with significant occurrences have been extracted and arranged in a hierarchical map with 12 clusters in terms of colors and sizes. VOSviewer

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software generated such a visualization, and it helps in identifying theme-related areas of studies and how such studies relate to one another in terms of the overall field of sports therapy.

The largest cluster, with nine keywords, is focused on sports therapy, with strong links to physical therapy, rehabilitation, prevention, and strength. This suggests the predominant research focus on the rehabilitative function of sports therapy in injury prevention and physical conditioning. The next largest cluster, with seven keywords, includes exercise, training, and haemophilia, reflecting the central position of exercise-based interventions in the treatment of disorders like haemophilia and in the improvement of general fitness. Similarly, a cluster with seven keywords is devoted to spinal cord injury and classification, revealing the necessity of rehabilitation interventions in neurological disorders.

Clusters with six to seven keywords cover diverse topics such as pain management, physical fitness, conservative treatment, pedagogy, and evaluation, reflecting the broad scope of sports therapy research, from injury recovery to educational frameworks in sports science. The smaller clusters represent more specialized or emerging themes like mental health, women's health, and acupuncture, highlighting growing research interest in psychological well-being and alternative therapies in sports rehabilitation. The network's structure and connectivity patterns indicate that sports therapy research is highly interdisciplinary, integrating medical, physical, and psychological aspects to enhance rehabilitation, performance, and quality of life.

Trend Topics

The trend analysis in figure 7 highlights the evolution of key research topics in sports therapy over time. The graph visualizes the emergence and frequency of specific terms, indicating shifts in research focus. Earlier topics, such as osteoporosis, strength, and prevention, gained attention between 1997 and 2010 but gradually declined in prominence. From 2010 onwards, there has been a noticeable shift towards more specific and applied topics such as rehabilitation, quality of life, exercise therapy, and spinal cord injury. The increasing frequency of terms like sports therapy, physical therapy, and training suggests a growing interest in structured rehabilitation approaches and their impact on patient outcomes. The term evaluation appears to have been consistently relevant over the years, signifying the importance of assessing the effectiveness of various sports therapy interventions.

More recent years, particularly post-2015, show a rise in interest in spinal cord injury and sports therapy, reflecting advancements in therapeutic interventions for neurological conditions. The presence of haemophilia as a recurring theme suggests an ongoing focus on using sports therapy for chronic conditions. The size of the bubbles represents the term frequency, with larger bubbles indicating higher research activity. The concentration of larger bubbles around sports therapy, training, and exercise therapy in recent years signals an increased emphasis on evidence-based rehabilitation practices. This trend suggests that sports therapy is not only evolving as a treatment method but also expanding into broader areas such as performance enhancement, injury prevention, and chronic disease management.

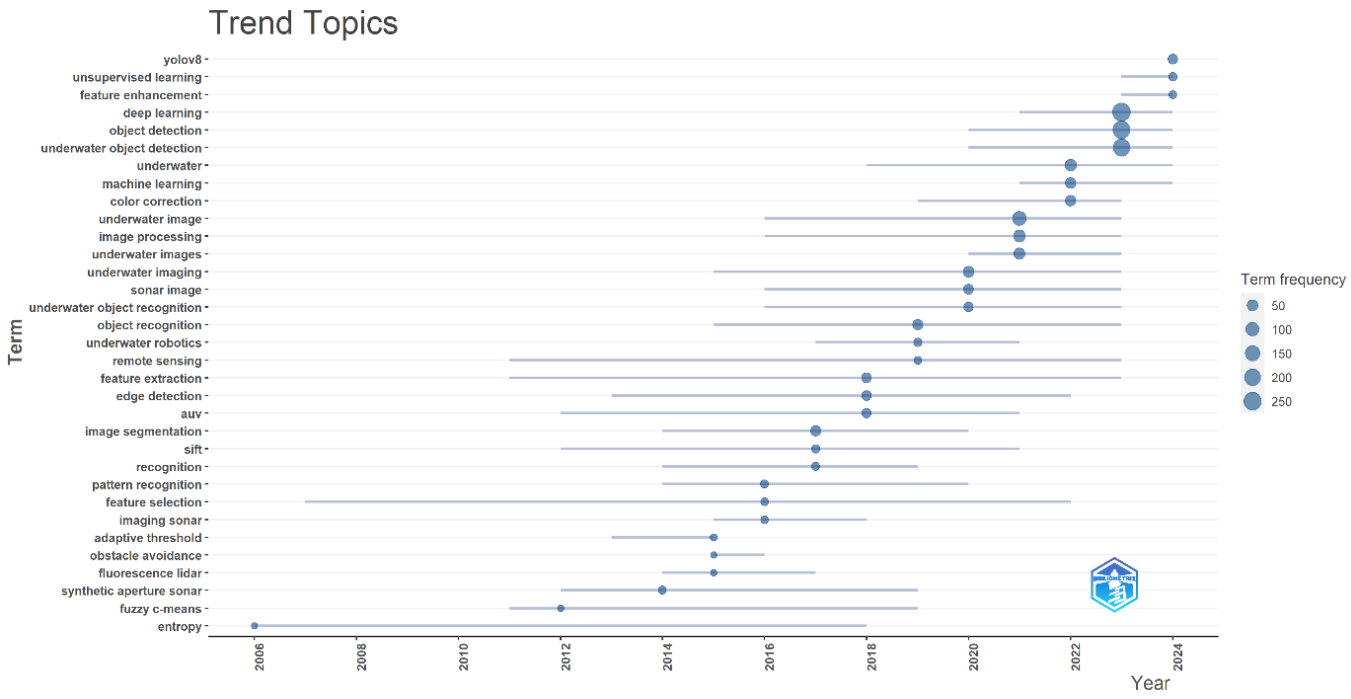

Figure 7. visualization of trending topics in the realm of research

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Thematic Map

The thematic map in figure 8 categorizes research themes in sports therapy based on their development (density) and relevance (centrality). The upper-right quadrant (Motor Themes) contains well-developed and highly relevant topics, including exercise, haemophilia, and training. These themes indicate established research areas that play a significant role in advancing sports therapy, particularly in rehabilitation and performance enhancement. Their high density suggests strong interconnections within the research domain, making them critical for further exploration and application in therapeutic interventions.

The upper-left quadrant (Niche Themes) contains less powerful but specialist subjects, including biologics, juvenile idiopathic arthritis, and oncologic rehabilitation and evaluation. All these subjects have high development density but lesser relevance in that they have been studied but perhaps not yet included in general discourses in sports therapy yet. Centrally positioned subjects, including rehabilitation, spinal cord injury, and sports therapy, act as a bridge between specialist and general studies and have high value in terms of being a bridge between specialist and general studies. All these subjects have high value in terms of creating new modalities and rehabilitation techniques, particularly for neurological impairment patients.

The lower-right quadrant (Basic Themes) comprises root subjects, including exercise, sports, prevention, physio, and conservative therapy. All of these have high utility but less development. Therefore, it can be argued that these represent the backbone of studies in sports therapy but have not yet been developed and researched in detail. In contrast, the lower-left quadrant (Declining or Emerging Themes) comprises subjects including fitness, composition, and anxiety, representing emerging subjects of concern or declining utility in the field. Overall, such a thematic map portrays development in studies in sports therapy, with significant areas for future development and recognition of firmly established areas.

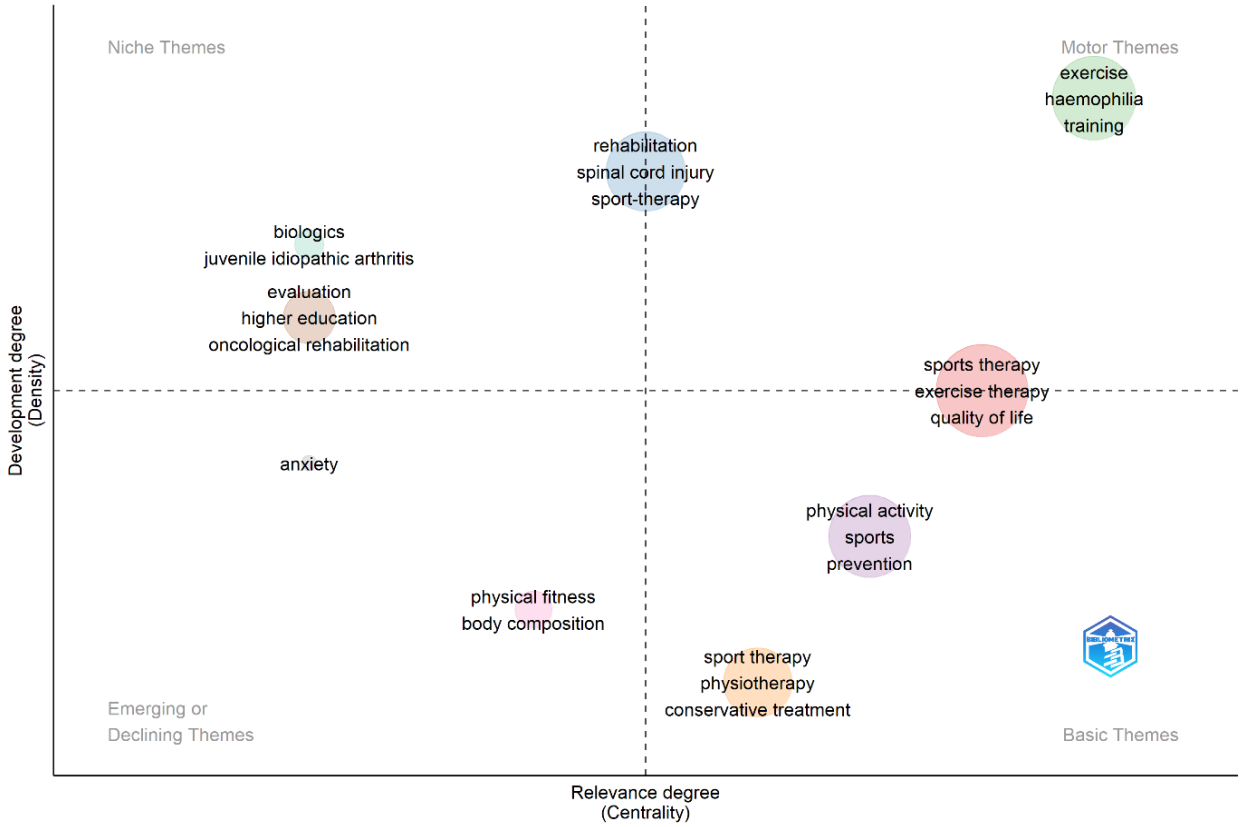

Figure 8. Thematic visualization of keywords

DISCUSSION

The bibliometric analysis of sports therapy reveals a dynamic and evolving research landscape characterized by interdisciplinary collaboration, emerging technologies, and increasing emphasis on evidence-based rehabilitation. Network visualizations of co-cited authors and journals indicate that sports therapy research spans diverse domains, including psychiatric rehabilitation, physical training, neurological recovery, and methodological advancements. Thematic maps and trend analyses highlight the growing focus on AI-driven rehabilitation, personalized therapy approaches, and the role of sports therapy in chronic disease management. The most relevant sources, including Archives of Physical Medicine and Rehabilitation, BMJ, and the British Journal of Sports Medicine, underscore the importance of sports therapy within medical and rehabilitation

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sciences. However, while the field demonstrates strong foundational knowledge and practical applications, limited international collaboration (7,94 %) and uneven global contributions suggest a need for more cross-border research initiatives.

Despite the expanding scope of sports therapy research, several research gaps remain. First, women's sports therapy and rehabilitation for female athletes remain underrepresented despite physiological and biomechanical differences that necessitate gender-specific interventions. Second, adaptive sports therapy for individuals with disabilities is emerging but still lacks standardized protocols and extensive empirical validation. Third, mental health integration in sports therapy, particularly in preventing burnout, stress-related injuries, and psychological recovery post-injury, requires more rigorous exploration. Additionally, the role of AI and wearable technologies in injury detection, real-time monitoring, and automated rehabilitation programs presents a promising yet underexplored research avenue. While AI-driven diagnostics and machine learning algorithms are gaining attention, concerns regarding data privacy, accessibility, and ethical considerations must be addressed.

Looking ahead, thematic maps and emerging research trends indicate that sports therapy will increasingly intersect with neuroscience, biomechanics, AI, and personalized medicine. The field's evolution suggests a shift from traditional rehabilitation models toward precision-based, technology-enhanced, and psychologically integrated approaches. To ensure sustained progress, future studies should expand cross-cultural investigations, develop standardized protocols for AI-driven rehabilitation, and explore the long-term impact of sports therapy beyond elite athletes, including ageing populations and individuals with chronic conditions. By addressing these gaps and leveraging new technological advancements, sports therapy can solidify its role as a holistic, patient-centred discipline at the intersection of healthcare, technology, and performance science.

Research Gaps and Practical Implications

The trend analysis and thematic mapping of sports therapy research reveal several research gaps that warrant further investigation. While rehabilitation, spinal cord injury, and exercise therapy have gained traction in recent years, specific populations remain understudied, such as female athletes, older adults, and individuals with rare neuromuscular disorders. Additionally, despite the increasing focus on haemophilia and chronic disease management, there is limited exploration of personalized rehabilitation protocols that integrate AI-driven diagnostics, wearable technology, and real-time biomechanical feedback. Another gap exists in the psychosocial dimensions of sports therapy, particularly in the long-term mental health outcomes of athletes undergoing rehabilitation. While some studies have addressed anxiety and motivation, a comprehensive framework that combines physical rehabilitation with psychological resilience-building interventions is still lacking. Similarly, evaluation methods for sports therapy interventions remain inconsistent, indicating a need for standardized metrics and assessment tools to ensure effective clinical application across diverse settings.

From a practical perspective, these findings suggest several implications for clinicians, researchers, and policymakers. For sports therapists and rehabilitation specialists, integrating data-driven rehabilitation models, incorporating AI-enhanced monitoring tools, and developing patient-specific therapy plans can enhance treatment efficacy. For researchers, expanding studies on underrepresented populations, alternative rehabilitation techniques, and the intersection of physical and mental health in sports therapy will ensure a more comprehensive and inclusive approach. For policymakers and funding bodies, prioritizing sports therapy research in underserved areas such as oncological rehabilitation, juvenile idiopathic arthritis, and adaptive sports therapy can help bridge gaps in accessibility and effectiveness. Furthermore, enhancing collaboration between physiotherapists, neurologists, psychologists, and data scientists will facilitate interdisciplinary advancements in sports therapy, ensuring that rehabilitation strategies are not only medically effective but also technologically innovative and patient-centred.

CONCLUSIONS

This bibliometric analysis provides a comprehensive overview of the evolving research profile in sports therapy, identifying key contributors, publication trends, and emerging themes. The findings demonstrate a shift in research focus away from generic injury prevention and towards individualized rehabilitation, AI-supported diagnostics, and chronic disease management. Despite significant progress, gaps remain in female athlete rehabilitation, adaptive sports therapy, and mental health integration. To advance the field, future research needs to prioritize interdisciplinarity, integrating physiotherapy, sports science, and data-driven rehabilitation designs. Standardized evaluation metrics are also necessary to quantify the effectiveness of sports therapy interventions across populations and conditions. Policymakers need to fund research activity in underrepresented areas, with a view to ensuring novel technologies are made accessible and ethically applied. Overall, this research identifies the need for evidence-based, patient-centred, and technologically enhanced sports therapy solutions to optimize both sporting performance and long-term well-being.

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CONFLICT OF INTERESTS

The authors declare no conflicts of interest.

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