Review

Digital interventions in sport psychology and psychiatry

A bibliometric analysis

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Abstract: *Introduction:* The increasing prevalence of mental health challenges among athletes and the general population has catalyzed a growing demand for digital interventions in sport psychology and psychiatry. This study aims to map the research landscape of digital interventions in sport psychology and psychiatry, highlighting key trends, influential contributions, and areas for future exploration. *Methods:* Bibliometric analysis of digital interventions in sport psychology and psychiatry was conducted to provide insights into the global research landscape, collaboration patterns, and thematic evolution. Using data from 2005 to 2024 indexed in the Scopus database, the analysis highlights key metrics, including publication growth, citation impact, and emerging trends. *Results:* A significant increase in research activity, with mental health, sport, and digital health identified as core themes, while topics like social media and virtual reality emerge as expanding areas of interest. Leading contributors include the United Kingdom, the United States, Australia, and China, with notable institutional and author-level collaborations driving innovation in the field. *Discussion:* The findings underscore the interdisciplinary and global nature of this domain, emphasizing the integration of digital technologies to address mental health and optimize performance in sport contexts. This study provides a foundation for future research, highlighting opportunities in underexplored areas such as virtual reality applications, algorithm-driven interventions, and culturally specific approaches to digital mental health care.

Keywords: digital interventions, sport psychology, mental health, social media, virtual reality

Introduction

Digital interventions in sport psychology and psychiatry have emerged as a transformative approach to enhancing mental health and performance outcomes. These interventions utilize technologies such as digital platforms, mobile applications, and other technological tools to deliver evidence-based psychological treatments, performance optimization strategies, and mental health support. The increasing prevalence of mental health challenges among athletes and the general population has catalyzed a growing demand for innovative, accessible, and scalable solutions. Digital interventions address these needs by providing flexible and personalized care that transcends geographical and temporal boundaries [1, 2].

The integration of digital technologies in sport psychology and psychiatry aligns with broader trends in healthcare, where technology is redefining the delivery of mental health services. These interventions encompass a range of methodologies, from cognitive-behavioral therapy delivered via mobile apps to biofeedback systems and virtual reality environments designed to enhance performance and resilience [3, 4]. Research in this domain has highlighted the potential of digital tools to overcome traditional barriers to mental health care, including stigma, accessibility, and affordability, making them particularly relevant for athletes who often face unique stressors and high-performance demands [5].

Despite their promise, the implementation of digital interventions in sport psychology and psychiatry poses challenges, such as ensuring user engagement, maintaining data security, and demonstrating long-term efficacy. Nevertheless, the rapid advancements in technology and the increasing emphasis on mental health in sports suggest that digital interventions will continue to play a pivotal role in shaping the future of this field. This bibliometric

analysis aims to map the research landscape of digital interventions in sport psychology and psychiatry, highlighting key trends, influential contributions, and areas for future exploration.

Methodology

Study design

This study employs a bibliometric analysis approach to systematically examine scientific literature on digital interventions in sport psychology and psychiatry. Bibliometric analysis is a quantitative method used to evaluate the characteristics, patterns, and trends within a body of academic literature [6]. This approach offers insights into the intellectual structure, emerging trends, and influential contributions within the research domain.

The analysis focuses on publications indexed in the Scopus database, recognized for its extensive and reliable coverage of peer-reviewed journals, conference papers, and other scholarly outputs [7]. The study spans the period from 2005 to 2024, capturing two decades of research activity in this rapidly evolving field. Inclusion criteria were limited to publications in English and document types such as journal articles, book chapters, and conference proceedings. Otherwise, non-English publications and non-research-focused content were excluded.

The study design incorporates a data-driven framework to ensure robustness and replicability. Biblioshiny, a tool for bibliometric analysis, was employed to visualize collaboration networks, thematic clusters, and research trajectories [8]. This study contributes to the literature by offering a holistic overview of the scholarly landscape, identifying gaps, and suggesting future research directions to advance the development and application of digital interventions in sport psychology and psychiatry.

Search strategy

The search strategy for this study was conducted using the Scopus database, employing a focused query to identify relevant literature on digital interventions in sport psychology and psychiatry. The search string used was: TITLE-ABS-KEY (“sport” AND “psychology” OR “psychiatry” AND “digital”) AND (LIMIT-TO (LANGUAGE, “English”) AND (LIMIT-TO (DOCTYPE, “ar”). This query targeted documents with the specified keywords appearing in the title, abstract, or keyword fields, ensuring the inclusion of research specifically relevant to the topic. Filters were applied to limit the results to English-language publications and document types categorized as journal articles. This precise approach allowed for the identification of high-quality, peer-reviewed studies, providing a robust dataset for the bibliometric analysis. Although terms like telepsychiatry and eHealth are relevant to digital interventions, they were not included in the search strategy to maintain a focused and sport-specific scope. These broader terms often yield a wide range of articles unrelated to sport psychology or psychiatry, potentially diluting the relevance of the search results. By using the term digital in combination with sport, psychology, and psychiatry, the search strategy ensured the inclusion of interventions leveraging digital technologies while keeping the results specific to the context of sport and mental health. This helped maximize both the specificity and relevance of the bibliometric dataset.

Data analysis

The data analysis for this bibliometric study was conducted using a combination of bibliometric and network analysis techniques to comprehensively explore the scholarly landscape of the digital interventions in sport psychology and psychiatry. The analysis was structured to address key aspects such as research productivity, collaboration patterns, thematic evolution, and influential contributions.

i. Descriptive bibliometric analysis: Basic metrics were calculated to assess the overall characteristics of the dataset, including the total number of publications, annual growth rate, average citations per document, and the distribution of document types (articles, book chapters, conference papers). Key contributing journals, institutions, countries, and authors were identified, and their productivity and citation impact were analyzed. The H-index and related metrics were then calculated to evaluate the impact of leading authors and sources.
ii. Temporal trends: The publication data was analyzed to track annual scientific production trends, exploring growth patterns in research activity over time. Citation trends were examined to identify impactful years and influential works, considering both total citations and citations per annum.
iii. Collaboration analysis: Collaboration networks were visualized and analyzed using co-authorship data to examine the partnerships between authors, institutions, and countries. Relevant metrics such as international collaboration percentages, co-authors per document, and centrality measures (e.g., betweenness, closeness, and PageRank) were calculated to identify notable contributors and key hubs in the research network.
iv. Keyword and thematic analysis: Keyword co-occurrence analysis was conducted to identify prevalent topics and emerging themes in the field. Thematic mapping was performed using bibliometric tools to

categorize research themes into four quadrants: motor, niche, basic, and emerging/declining quadrants. This analysis highlighted the conceptual structure and thematic evolution of the field.

v. Thematic evolution: A Sankey diagram and timeline analysis were used to trace the progression of themes across distinct time periods (2005 – 2019, 2020 – 2022, 2023 – 2024). Changes in thematic focus were examined to capture shifts in research priorities and emerging areas of interest, such as sport, mental health, social media, and digital health.

vi. Citation and impact analysis: Highly cited papers and influential works were identified to highlight key contributions to the field. To rank impactful publications, metrics such as total citations, normalized citation scores, and citation per year were assessed.

vii. Network visualization: Network visualizations were generated for co-authorship, keyword co-occurrence, and country collaboration using bibliometric software. These visualizations provided insights into the structural dynamics of the research community, including the most connected entities and rather isolated clusters.

The results from these analyses offered a comprehensive understanding of the research landscape, including patterns of growth, collaboration, and thematic focus. The findings also informed further discussions on gaps and opportunities for future research in the digital interventions in sport psychology and psychiatry domain.

Results and discussion

Overview of research trends and impact

A total of 88 documents were sourced from 63 publications, including peer-reviewed journals and other academic outputs published between 2005 to 2024 (see Table E1 in the electronic supplementary material ESM1). The field has demonstrated robust growth with an annual growth rate of 11.57% and the average citation rate per document is 15.35, reflecting an increasing academic interest in integrating digital technologies into sport psychology and psychiatry.

The dataset comprises 809 keywords plus and 303 author keywords, reflecting a quite diverse and rich thematic focus across the studies. Contributions from 313 authors were recorded, with an average of 3.73 co-authors per document, highlighting the collaborative nature of the field. International co-authorship accounts for 23.86% of the documents, underscoring the global relevance and interconnectedness of research on digital interventions. Single-authored documents, while fewer in number, account for 12 contributions (13.6%). The dataset is entirely composed of journal articles (88 documents), showing that the field is maturing and has a reliance on peer-reviewed publications rather than grey literature to disseminate research findings.

Figure 1 illustrates the annual scientific production on digital interventions in sport psychology and psychiatry from 2005 to 2024. The research output has grown over the years and the growth is especially evident particularly after 2018, marking a period of accelerated growth. In the early years (from 2005 to 2017), there was a relatively low and sporadic production, with only occasional peaks (e.g., 3 articles in 2012 and 4 in 2014 and 2015). This suggests that the field was still in its nascent stage of maturity, that there were still lower levels of research interest in this particular area.

However, starting in 2019, there is a sharp and sustained increase, with a notable jump to 9 articles in 2019, followed by a consistent growth, culminating in 16 articles in 2024. Hence, we can see that there is a growing interest and emphasis on integrating digital technologies in sport psychology and psychiatry, as the field gains global recognition and momentum. This also can be explained by the growth in digital technology and generative artificial intelligence that happened post 2019.

The mean total citation per article shows significant fluctuations, with notable peaks in 2010 (110 citations) and 2020 (37.17 citations) (see Figure E1 in ESM1). This indicates that a few highly cited articles contributed significantly to the overall impact during these years. In contrast, the mean total citation per year shows a more consistent but gradually increasing trend, with peaks in 2020 (7.43) and 2021 (4.18), reflecting the growing relevance and academic attention toward recent publications. The overall trend suggests increasing engagement and impact in this research area, with a sharp decline for the most recent years due to limited time for citations to accumulate.

Figure 2 shows a three-field plot connecting authors' countries (AU_CO), affiliated institutions or universities (AU_UN), and key research topics (DE - descriptors) in the field of digital interventions in sport psychology and psychiatry. The plot highlights the strong contributions of countries like the USA, Australia, and the Netherlands, which are linked to prominent institutions such as the University of Queensland, Ghent University, and the University of Groningen. These institutions are associated with thematic areas like "social media," "sport psychology," and "mental health," showcasing their focus on diverse and impactful research topics. The dense interconnections underscore the international and interdisciplinary collaboration driving the research, with institutions and countries acting as important hubs for advancing the field.

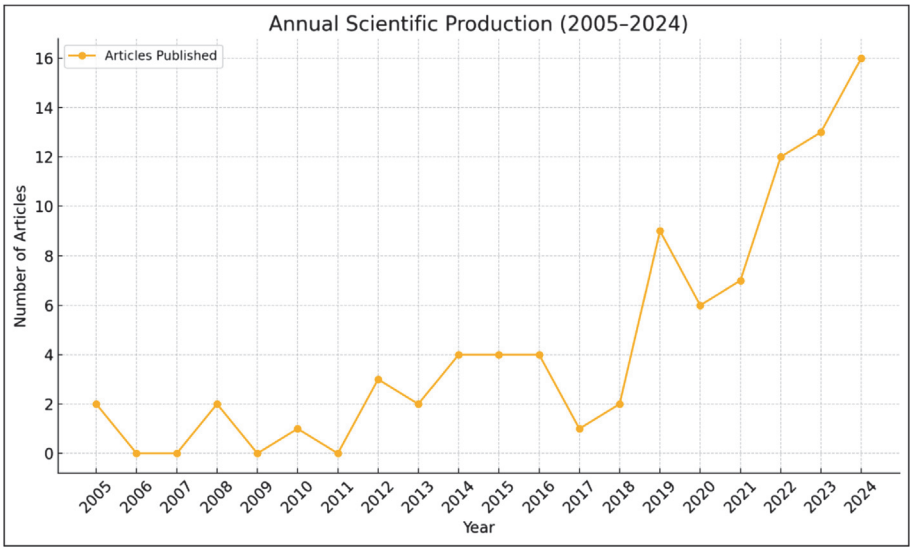

Figure 1. Annual scientific production.

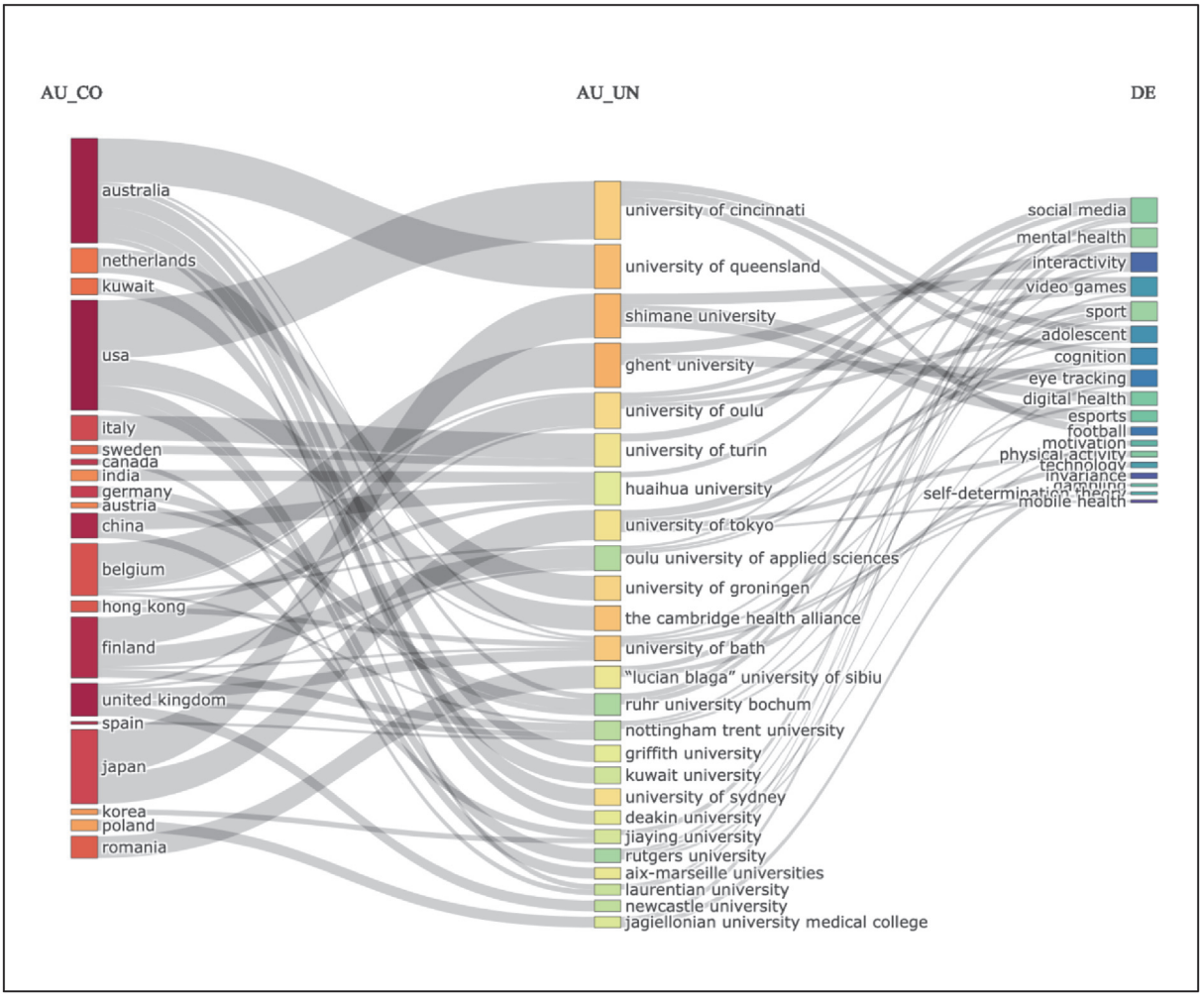

Figure 2. Three-field plot. AU_UN: Authors universities/affiliations; AU_CO: Authors countries; DE: Descriptors or keywords.

Prominent and impactful publication sources

The International Journal of Environmental Research and Public Health ranks highest with a H-index of 5, a G-index of 6, and the most publications (6 articles) since 2019, accumulating 72 total citations (see Table E2 in ESM1). Meanwhile, PLOS ONE has the highest total citations at 121, alongside a H-index of 3 and 5 publications since 2020. Other sources, such as Heliyon and International Journal of Sport and Exercise Psychology, demonstrate moderate impact with H-indices of 2 and total citations of 37 and 39, respectively. The Journal of Applied Sport Psychology and Sustainability (Switzerland) have contributed consistently, with H-indices of 3 and citation counts of 25 and 20, respectively. Journals in psychology, sport science, public health, and sustainability all contribute and host digital interventions in sports psychology and psychiatry research, showing that multiple parties contribute to this unique research area. These metrics illustrate the growing academic focus on digital interventions in this domain, with significant contributions from both established and emerging journals.

Key authors and their contributions

All included authors in this analysis exhibit identical H-index and G-index values of 2, reflecting similar productivity and citation performance across their works. Notable differences emerge in total citations, with Kääriäinen, Miettunen, and Männikkö achieving the highest citation counts (51), underscoring the greater impact of their publications since their earliest contributions in 2018 (see Table E3 in ESM1). Conversely, authors such as Franquelo, Hernández-Mendo, and Pérez-Romero have lower citation counts (6) despite their recent contributions starting in 2022, indicating that their work may require more time to accrue citations. The M-index, which normalizes productivity over time, highlights consistent annual contributions, with most authors achieving a value of 0.667, except for those with longer publication histories (e.g., Kääriäinen, Miettunen, Männikkö), whose M-index values are slightly lower at 0.286. This analysis demonstrates the diversity of contributions and the varying levels of influence among authors in this emerging research domain.

Institutional and geographical contributions

Ghent University, Shimane University, and the University of Queensland, each with 4 articles, lead the list for affiliations contributing to research on digital interventions in sport psychology and psychiatry. Following closely are institutions such as the Cambridge Health Alliance, University of Bath, University of Cincinnati, University of Groningen, University of Oulu, University of Sydney, and University of Tokyo, with each institution contributing 3 articles. This distribution underscores the global participation and collaborative efforts of various institutions in advancing this research domain.

Table 1 highlights key contributing countries producing high impact research in digital interventions in sport psychology and psychiatry, along with their collaboration patterns. The United Kingdom leads with 9 articles (10.2%), of which 8 are single-country publications (SCP) and 1 is a multi-country publication (MCP). Hence, MCPs account for 11.1% of the country's total output. Australia and China follow with 8 articles (9.1% each), with Australia having a total MCP share of 12.5% and China having a total MCP share of 25% respectively of each country's total output, indicating these two countries exhibit higher levels of international collaboration. The United States contributes 7 articles (8%), with a relatively lower MCP share of 14.3%.

Germany, Canada, and Spain also demonstrate noteworthy contributions, with Germany producing 6 articles (6.8%) and an MCP share of 16.7%. Canada and Spain contribute 4 articles each (4.5%), with Canada achieving a high MCP share of 50% and Spain at 75%, underscoring their reliance on international partnerships. Finland and France, with 3 articles each (3.4%), exhibit moderate MCP shares of 33.3%, while Japan contributes 3 articles entirely as SCPs, reflecting no international collaboration. The data underscores the diverse contributions of countries, with varying degrees of collaboration influencing the research landscape.

Figure E3 in ESM1 illustrates the country-wise contributions to research on digital interventions in sport psychology and psychiatry. The United States leads with the highest frequency of 35 contributions, followed by Australia (27) and the United Kingdom (25). China comes next with 19 contributions, while Finland and Spain each contribute 12. Canada (11), Germany (10), Japan (10), and Italy (8) follow closely. This distribution highlights the prominent role of the United States and other major contributors in shaping the research landscape, emphasizing a global effort with diverse geographical participation in advancing this field.

Figure 3 visualizes total citations (blue bars) and average article citations (orange line) for countries contributing to digital interventions in sport psychology and psychiatry research. The United Kingdom leads in total citations (230), while interestingly, Georgia and Portugal exhibit the highest average article citations (38.0 and 34.0, respectively), reflecting significant impact despite fewer contributions. The United States, Australia, and Germany show a balance of high total and average citations, indicating consistent influence in the field. China has notable total

Table 1. Key contributing countries in digital interventions in sport psychology and psychiatry research and their collaboration patterns

Country	Articles	Articles %	SCP	MCP	MCP %
United Kingdom	9	10.2	8	1	11.1
Australia	8	9.1	7	1	12.5
China	8	9.1	6	2	25
United States	7	8	6	1	14.3
Germany	6	6.8	5	1	16.7
Canada	4	4.5	2	2	50
Spain	4	4.5	1	3	75
Finland	3	3.4	2	1	33.3
France	3	3.4	2	1	33.3
Japan	3	3.4	3	0	0

Notes: *SCP = single country publication, MCP = multiple country publication.

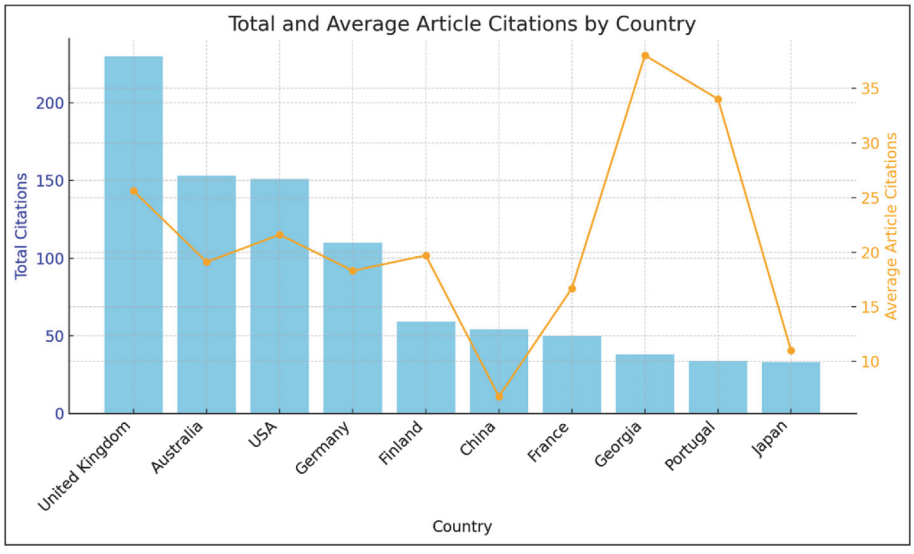

Figure 3. Most cited countries and their research impact in digital interventions in sport psychology and psychiatry.

citations (54) but a lower average (6.8), suggesting its research output is less cited on average. This dual-axis plot effectively highlights both volume and impact of contributions by country.

Most cited papers and their impact metrics

The paper by Roberts (2010) leads with 110 total citations and a steady annual citation rate (7.33), reflecting long-term influence. Recent papers, such as Delfabbro (2021) and Nagorsky (2020), exhibit exceptional impact with high citations per year (18.25 and 17.40, respectively) and standout normalized citation metrics (4.37 and 2.34). Mills (2019) also shows significant influence with 12.50 citations per year and a normalized total citations (TC) of 3.48. Foundational studies like Hinton-Bayre (2005) maintain relevance with 73 total citations and a normalized TC of 2.00. These metrics highlight a balance between foundational and recent contributions, showcasing the evolving and impactful nature of research in this field.

Key themes and evolving trends

Terms like "male" (63 occurrences), "female" (53), and "human" (48) dominate, reflecting the emphasis on participant demographics and human-centered studies (see Figure E4 in ESM1). Words like "psychology" (42), "mental health" (21), and "exercise" (14) signify the thematic relevance of psychological and physical health in this research. Other frequent terms such as "adolescent" (26), "young adult" (24), and "aged" (19) indicate the focus on diverse age groups. Keywords like "social media" (11), "gambling" (13), and "mobile application" (6) highlight the technological aspects, while terms like "questionnaire" (15) and "self report" (9) suggest a reliance on survey-based methodologies.

The temporal trends of key topics highlight the frequency and chronological spread of topics using first quartile (Q1), median, and third quartile (Q3) publication years. As such, common themes like "male" (63 occurrences), "female" (53), "human" (48), and "adult" (44) have their focus intensify after 2019, as indicated by the Q1 and median years (see Figure E5 in ESM1). Emerging terms such as "social media," "mental health," and "questionnaire" have more recent median years (2022-2023), signaling their growing importance. Specific focus on "China," "social participation," and "surveys and questionnaires" peaks in 2024, indicating nascent areas of interest. Early recurring terms like "learning" (Q1: 2008) and "human experiment" (Q1: 2012) illustrate foundational topics, while newer ones like "adolescent" and "mental health" demonstrate a recent shift towards inclusive age groups and psychological aspects. This temporal analysis reflects evolving priorities in research, driven by technological advancements and societal needs.

Thematic landscape and evolution

Figure 4 presents a strategic overview of thematic areas in digital interventions in sport psychology and psychiatry research, categorizing topics based on their centrality and development. Core motor themes, such as "human," "psychology," "athlete," and "learning," dominate the field, highlighting their importance in driving research. Niche themes like "cognition," "students," and "depression" represent specialized yet impactful areas that support broader inquiries. Emerging or declining themes, including "sports training," "sociology," and "medical education," suggest areas with fluctuating relevance or potential for future growth. Basic themes such as "sports," "virtual reality," and "curricula" serve as foundational topics that are central but less developed, indicating opportunities for further research. This mapping underscores the field's dynamic nature, balancing well-established areas with emerging topics for future exploration.

Zooming in thematic evolution of digital interventions in sport psychology and psychiatry research, early themes (2005–2019) focused primarily on "sport" and "mental health," reflecting foundational research areas (see Figure E6 in ESM1). In the 2020–2022 period, the emergence of "social media" and "digital health" highlights a shift toward integrating technology and its role in mental health and sport contexts. By 2023–2024, themes such as "physical activity," "social media," and "sport" gained prominence, showing an expanding focus on the broader applications of digital interventions in physical health and online platforms. The consistent presence of "mental health" throughout all periods underscores its centrality to this field, while the growing influence of "social media" and "digital health" signals the increasing importance of technology-driven approaches. This thematic evolution reflects the dynamic and interdisciplinary growth of the research area.

The interplay between core themes and niche areas fosters an avenue for cross-disciplinary collaboration, enabling researchers to tackle complex questions from multiple perspectives. For instance, integrating insights from "psychology" and "sports training" can lead to breakthroughs in optimizing athletic performance and mental well-being. Similarly, the convergence of "virtual reality" and "medical education" opens new frontiers in immersive learning and simulation-based training, enhancing both pedagogical approaches and practical skills acquisition.

Global collaboration network

Figure 5 illustrates the global collaboration network in digital interventions in sport psychology and psychiatry research. The network highlights strong collaborative ties between countries, with major hubs such as the United Kingdom, the United States, and Australia playing central roles, as indicated by their larger node sizes and more extensive connections. Interestingly, China also emerges as a key player, with notable links to countries like Hong Kong and Lebanon, suggesting possible regional research strength. European nations, including Germany, Spain, and Switzerland, show active participation and connections, fostering interdisciplinary and international collaboration. Smaller clusters, such as those involving Italy, Sweden, and Argentina, represent localized or specialized research efforts. This network underscores the global nature of the research, with prominent collaboration between North America, Europe, Asia, and Oceania, driving advancements in the field.

Despite the global distribution of research in digital interventions within sport psychology and psychiatry, certain regions such as North America, Western Europe, and Australia dominate the landscape. This imbalance may be attributed to several sociocultural and structural factors. Countries like the United States, United Kingdom, and Australia benefit from robust academic infrastructures, greater research funding, and well-established traditions of interdisciplinary collaboration. Public and private investments in digital health and sport sciences are more common in these regions, facilitating both innovation and implementation. Furthermore, societal openness to mental health discourse and the widespread adoption of digital technologies enhance both the relevance and feasibility of digital intervention studies. These regions often have policies that support mental health promotion and the integration of digital tools into healthcare systems, creating a conducive environment for research and application.

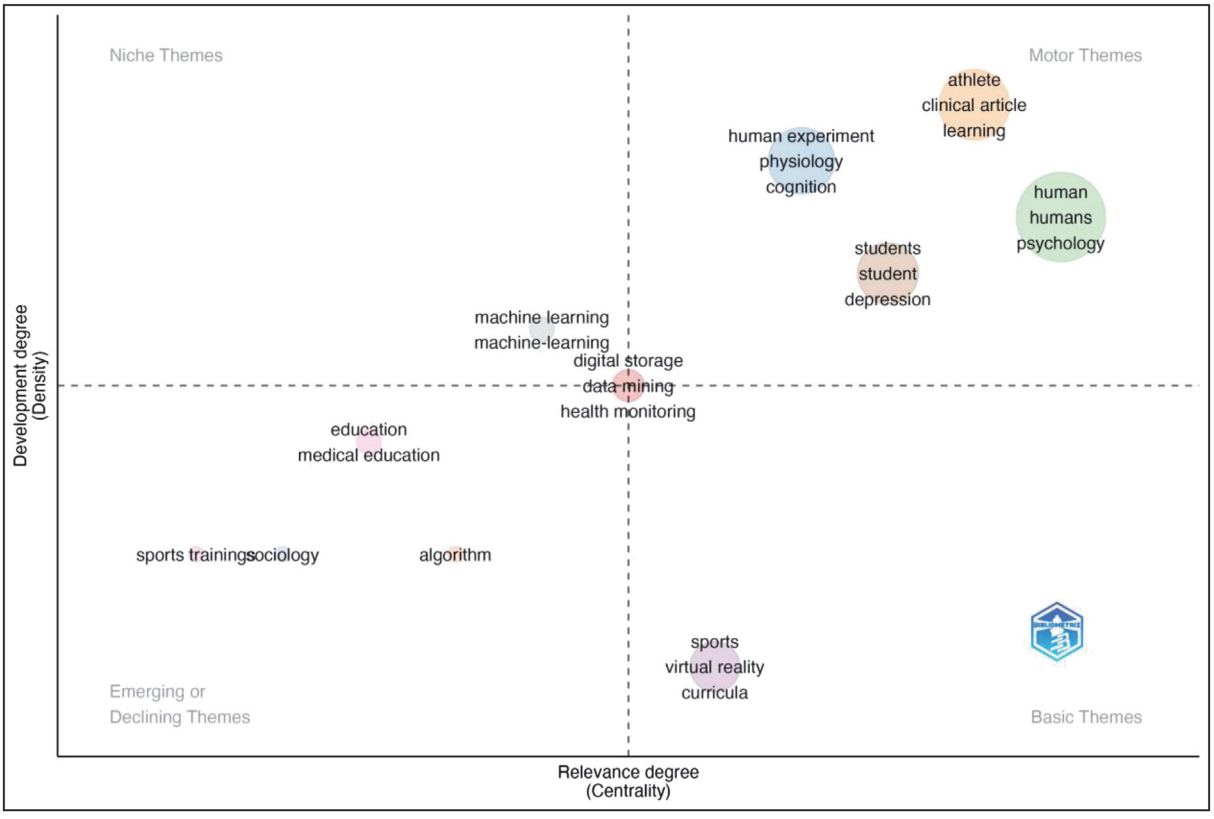

Figure 4. Strategic overview of thematic areas in digital interventions in sport psychology and psychiatry research.

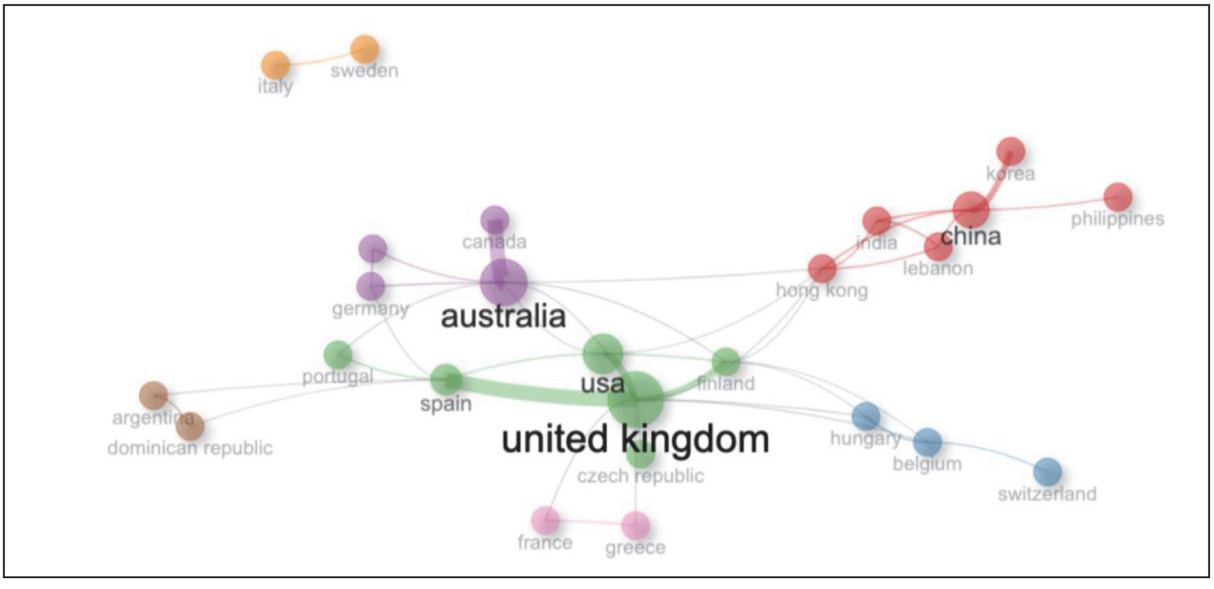

Figure 5. Global collaboration network in digital interventions in sport psychology and psychiatry research.

In contrast, regions such as parts of Africa, South Asia, and Latin America are underrepresented, potentially due to limited research funding, fewer specialized academic programs, and infrastructural barriers such as lower digital connectivity and limited access to sport psychology services. Sports psychology and psychiatry is still seen as an optional bonus rather than as an integral component of a comprehensive sports national programme. Moreover in

these more collectivist and closeknit countries, the double whammy of cultural stigma surrounding mental health, particularly in a field as contentious as high performance sports, may also inhibit research participation and innovation in digital mental health interventions. Additionally, language barriers and the prioritization of other health or economic challenges may divert focus away from digital mental health research in sport. This is highlighted as well by the low numbers of membership in the International Society of Sports Psychiatry from these underserved regions These disparities highlight the need for targeted international collaborations, equitable research funding mechanisms, and localized capacity-building initiatives to ensure that digital interventions are developed and tested across diverse sociocultural contexts, enhancing both their global applicability and inclusivity.

Clinical implications

The findings from this bibliometric analysis offer valuable insights for practitioners in sport psychology and psychiatry by highlighting emerging digital tools, key research trends, and areas of high impact. Understanding which interventions are most frequently studied and cited can help clinicians and sport mental health professionals prioritize evidence-based digital strategies, such as mobile applications, teletherapy platforms, or virtual reality programs, that are gaining empirical support. Additionally, awareness of the evolving thematic focus - such as increased attention to social media, mental health, and youth populations - can guide professionals in tailoring interventions to current needs and technological habits of athletes. Recognizing global collaboration patterns and geographic gaps in research can also inform culturally sensitive practice and encourage professionals to adapt or co-develop tools for underserved populations. Ultimately, integrating this knowledge into clinical and performance settings can help bridge the gap between research and practice, fostering more responsive, innovative, and accessible mental health care in sport contexts.

Conclusion and further directions

The bibliometric analysis of digital interventions in sport psychology and psychiatry highlights a rapidly evolving research landscape characterized by growing global collaboration, diverse thematic areas, and significant academic impact. The analysis reveals the prominence of core themes such as mental health, sport, and digital health, while emerging topics like social media and virtual reality suggest expanding applications of digital technologies in this field. Countries such as the United Kingdom, the United States, Australia, and China serve as central hubs of research activity, fostering international partnerships that enhance the multidisciplinary nature of the domain.

Highly cited publications underscore the field's reliance on both foundational studies and recent innovative contributions. Key contributing institutions and authors demonstrate a balanced mix of individual and collaborative efforts, driving impactful research. Thematic evolution over time highlights a shift from foundational topics to technologically integrated approaches, addressing societal and psychological needs in increasingly digital environments.

This study underscores the critical role of digital interventions in addressing mental health challenges and optimizing psychological well-being in sport contexts. Future research should continue exploring underdeveloped areas, such as virtual reality and algorithm-driven interventions, while fostering collaborations across regions and disciplines. By building on these findings, the field is well-positioned to advance innovative, evidence-based interventions that can meet the demands of a digital-first world.

Electronic supplementary materials

The following electronic supplementary material is available with this article at https://doi.org/10.1024/2674-0052/a000119.

ESM1. Tables E1-E4 and Figures E1-E6.

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