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Exploring the Intersection of Personalized Recommendation Systems and Surfing Injuries: A Bibliometric Perspective (2020–2025)

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Abstract. This study employed bibliometric methods to systematically retrieve academic literature on personalized recommendation systems and surfing-related injuries from the Web of Science Core Collection database between 2020 and 2025. After screening and analysis, 189 relevant papers were identified and analyzed using Citespace and VOS viewer software. The research explored five dimensions—core authors, journals, national distribution, keyword co-occurrence, and clustering relationships—to reveal the knowledge structure and development trends in this field.

Keywords: Bibliometrics, Personalized Recommendation System, Surfing, injury

1 INTRODUCTION

In recent years, with the rapid development of information technology, personalized recommendation systems have been widely applied in multiple fields, especially in sports science (Zhao, Arya, Orji, & Chan, 2020), where they provide athletes with more accurate training suggestions and health management plans. Meanwhile, Surfing, as an extremely challenging extreme sport (Robinson, 2013). The potential injury problems it brings have gradually attracted widespread attention from scholars (Warren & Gibson, 2014). In order to better understand the current research status and future development direction of this interdisciplinary field, this study adopted the method of bibliometrics and focused on the relevant literature published during the period from 2020 to 2025.

The research selected the Web of Science Core collection database as the data source. The Rayyan tool was used to remove duplicates and eliminate irrelevant literature from the 189 literatures obtained through the initial retrieval, ensuring the accuracy and scientific nature of the data. On this basis, with the help of Citespace and VOSviewer software, we conducted systematic mining and analysis from five perspectives: core author analysis, core journal analysis, national publication distribution, keyword co-occurrence analysis, and keyword clustering analysis.

Through these analyses, we not only identified the important research forces and academic centers in this field, but also discovered several key research directions. For example, at the author

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level, kisala, pamela a. and tulsky, david s. Such people have a relatively high influence in this field; At the journal level, "Archives of Physical Medicine and Rehabilitation" and "Sports Medicine" are the most influential publications (Fredericson, 2016). Furthermore, the keyword co-occurrence network reveals the close connections among themes such as "surfing", "injury", "risk", and "rehabilitation", reflecting the trend of multidisciplinary cross-disciplinary research.

It is worth noting that this study also explored multiple thematic directions such as social media and information dissemination, federated learning and data privacy, injury prevention and risk management, demonstrating the trend of evolution from specialized technologies to comprehensive health concepts. These findings are of great significance for promoting the application of personalized recommendation systems in the prevention and control of surfing injuries, and point out the direction for future research, emphasizing the importance of international cooperation and multidisciplinary integration (Leatherman, Leatherman, & Rangel-Buitrago, 2024). With the advancement of technology, especially the development of artificial intelligence and wearable devices, it has become possible to build a more intelligent and personalized sports risk management system, which will help enhance the safety guarantee level and overall sports performance of athletes (Gurgis & Kerr, 2021).

2 METHOD

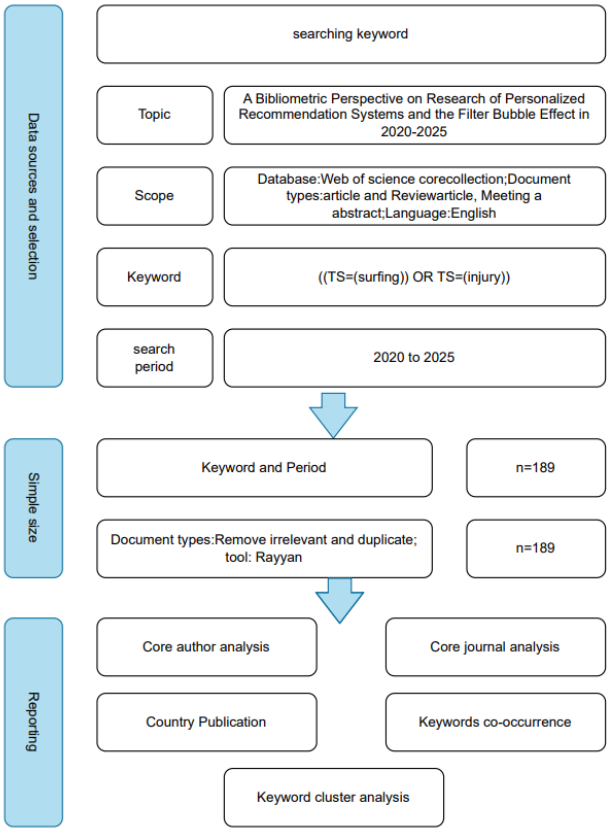
Data Sources

This study takes the Web of Science Core Collection database as the data source. This database widely collects globally influential academic resources and is authoritative and representative in bibliometrics and academic analysis (Donthu, Pandey, & Lim, 2021). The research focuses on the period from 2020 to 2025, conducting a search and analysis of the research literature on "surfing personalized recommendation systems" and "injuru information cocoon effects" in the field of surfing sports injuries. By setting the search formula "((TS=(surfing)) OR TS=(injury))", and limiting the literature types to journal articles, reviews and conference abstracts, with the language being English, 189 relevant literatures were initially obtained.

To ensure the accuracy and scientific nature of the data, the study used the Rayyan tool to de-duplicate and eliminate irrelevant literature from the retrieval results. Furthermore, the key words are standardized to categorize the terms with similar semantics or different expressions but consistent meanings uniformly, thereby enhancing the effectiveness and stability of keyword co-occurrence and cluster analysis (Al-Natsheh, 2019). During the literature screening stage, the literature that did not directly explore the personalized recommendation related to surfing and the injury prevention mechanism was excluded to ensure that the data were highly relevant and of theoretical value.

As shown in Figure 1, the research conducts systematic mining based on five dimensions: "Core author analysis", "Core Journal Analysis", "National publication distribution", "Keyword co-occurrence analysis", and "keyword cluster analysis", aiming to comprehensively present the knowledge evolution context and research hotspots in this research field. This process not only helps to identify the important research forces and academic centers in this field but also provides solid data support and theoretical inspiration for the subsequent research on personalized recommendation systems for the injury prevention mechanism in surfing.

Fig. 1 Workflow of Bibliometric Analysis on Personalized Recommendation Systems and Filter Bubble Efect.



Analysis Methods

This study adopted the bibliometric method and analyzed the preprocessed literature data using Citespace and VOSviewer viewing software. Citespace is a commonly used tool for scientific literature analysis and visualization, which can reveal the knowledge structure and development trends in the research field (Chen, C.,2006). VOSviewer is particularly suitable for analyzing relationships such as keyword co-occurrence, author collaboration networks, and literature co citation, helping researchers intuitively understand the structure and development trends of the academic field (Klarin, 2024).

3 RESULTS

Descriptive Statistics

A total of 189 papers were collected in this study. These papers were written by 795 authors from 40 countries and published in 66 journals. These papers cited 4,017 articles, covering 75 different journals.

Core Author Analysis

Table 1 Quantitative Analysis Table of Core Authors in the Field of Personalized Recommendation System and Surfing Injury Research

Rank	Author	Documents	Citations	Average Citation/Publication
1	kisala, pamela a.	5	24	4.8
2	tulsky, david s.	5	24	4.8
3	boulton, aaron j.	4	19	4.75
4	heinemann, allen w.	4	26	6.5
5	kerr, zachary y.	4	38	9.5
6	register-mihalik, johna k.	4	92	23
7	byun, jinsu	3	3	1
8	chandran, avinash	3	92	30.6
9	choi, kyu ha	3	3	1
10	fekete, christine	3	40	13.3
11	gildner, paula	3	37	12.3
12	kay, melissa c.	3	37	12.3
13	nedimyer, aliza k.	3	92	30.6
14	olive, rebecca	3	58	19.3
15	sherer, mark	3	45	15

Table 1 presents the situation of core authors with certain influence in this field. kisala, pamela a. and tulsky, david s. It ranked first with the publication volume of 5 papers, and each of its papers was cited an average of 4.8 times, which indicates that kisala, pamela a. The achievements in the field of personalized recommendation systems and surf injury research have received relatively high attention. The research results may have certain pioneering or important reference value in this field, providing a key theoretical basis or empirical evidence for subsequent research and leading some research directions. Another author, nedimyer, aliza k. And chandran, avinash, published three papers, but each paper was cited an average of 30.6 times. This indicates that more authors pay more attention to the research directions of these two authors, which might be the future trend of surf injury research. Future research should pay more attention to the scientific research achievements of these two authors. It will provide directional guidance and suggestions for the subsequent research.

In the research of this field, although Guskiewicz, Kevin M., Cantu, Robert C., Covassin, Tracey and Giza, Christopher C. Each of them has only published two papers, but their research achievements have also demonstrated a certain academic influence. For instance, the papers of Guskiewicz and Cantu have been cited 4 times and 3 times respectively. Although the citation volume is not outstanding yet, it shows that their research has attracted the attention of relevant scholars. The papers of byun, jinsu, choi and kyu ha are currently cited less frequently, but their continuous research investment cannot be ignored either. It is worth noting that publishing three papers also indicates that these scholars have a certain level of research activity in this field, and their research has played a positive role in enriching academic discussions and broadening research perspectives. As time goes by, their work is expected to gain more academic recognition. Overall, these authors, together with high-impact researchers, have jointly promoted the development of this field in sports medicine and concussion research, which is of great significance for grasping the research evolution path and hot issues in this field. Future research can continue to focus on the subsequent achievements of these scholars and their research teams, thereby delving deeper into the potential value and cutting-edge trends in this field.

Core Journal Analysis

Table 2 Ranking of the Influence of Personalized Recommendation Systems and Core Journals on Surfing Injury Research.

Rank	Source	Documents	Citations	Average Citation/Publication
1	archives of physical medicine and rehabilitation	19	260	13.6
2	sport in society	13	35	2.7
3	international journal of sports science & coaching	12	42	3.5
4	journal of sport and health science	11	205	18.6
5	journal of the philosophy of sport	8	4	0.5
6	sports medicine	7	330	47.1
7	journal of sport & social issues	7	128	18.3
8	leisure studies	6	27	4.5
9	pm&r	5	79	15.8
10	human movement science	4	44	11

In the core journal analysis of Table 2, different journals demonstrated their respective academic influence and research characteristics in terms of the number of documents, citation frequency and average citation frequency. In terms of the number of published papers, "Archives of Physical Medicine and Rehabilitation" ranked first with 19 published papers, demonstrating the high activity of this journal in the field of sports medicine and rehabilitation, and providing a stable

publication platform for researchers. It reflects its extensive coverage and influence in the research of rehabilitation and sports injury prevention.

Immediately following are "Sport in Society" and "International Journal of Sports Science & Coaching", which have published 13 and 12 papers respectively. It indicates that the continuous attention and active communication of these two journals in the fields of sports sociology and sports training science also play an important role in promoting the knowledge development in this field.

In terms of the average citation count of each paper, "Sports Medicine" leads by a wide range with an average citation volume of 47.1 times, highlighting its high-quality and highly influential academic status. This indicates that the research results it publishes have extremely high reference value and dissemination power in the academic circle, and often serve as the basis or theoretical basis for subsequent research. The subsequent "Journal of Sport & Social Issues" and "Journal of Sport and Health Science", with average citations of 18.3 and 18.6 times respectively, also demonstrated strong academic influence. Especially in the intersection field of social sports and health exercise science, it shows a high citation rate, reflecting the theoretical depth or practical application value of its articles.

Furthermore, publications such as "PM&R" (with an average of 15.8 times) and "Human Movement Science" (with an average of 11 times) also exhibit good citation performances, indicating that they have a certain influence in related studies such as movement behavior and rehabilitation medicine. While some journals such as "Journal of the Philosophy of Sport" have published 8 papers, the average citation is only 0.5 times, indicating that the content they publish may be more focused on theoretical exploration or have a smaller audience, and the citation rate is relatively low in the short term.

Overall, these core journals have played an irreplaceable role in promoting the development of research related to "prevention and rehabilitation intervention of sports injuries". The performance differences among various journals in terms of the number of published articles and citation indicators not only reveal the differences among them in terms of academic quality, research focus and reader positioning, but also provide valuable reference basis for researchers when choosing submission targets and understanding the frontiers of the field. Especially the research achievements represented by high-citation journals may have more practical guiding value and research depth, and deserve continuous attention from the academic community.

Core Country Analys

Table 3 Ranking Table of Publications and Influence of Core Countries in Personalized Recommendation Systems and Surfing Injury Research.

Rank	Source	Documents	Citations	Average Citation/Publication
1	usa	75	843	11.24
2	australia	36	401	11.13
3	england	25	420	16.8
4	canada	15	242	16.13
5	spain	12	233	19.41
6	france	10	133	13.3
7	germany	10	151	15.1
8	ireland	10	114	11.4

As shown in Table 3, the United States ranked first with 75 published articles, demonstrating its strong scientific research capabilities and continuous investment in the fields of personalized recommendation systems and surf injury research. Australia and the United Kingdom ranked second and third respectively with 36 and 25 published papers, which also indicates that these two countries have maintained a relatively high level of activity in research in this field. Although the number of published papers by countries such as Canada, Spain, France, Germany and Ireland is not as large as the top three, their participation indicates that this field has attracted widespread attention worldwide and has established an international research pattern featuring multi-national participation and cross-integration.

In terms of the average citation count, Spain tops the list with 19.41 times, indicating that its research achievements have extremely high influence in the academic circle and may make outstanding contributions in theoretical construction or practical application. The United Kingdom and Canada, which followed closely behind, had average citation counts of 16.8 and 16.13 respectively, also demonstrating strong academic recognition and research depth. Germany ranked fourth with 15.1 times. Although the number of published papers was not large, the quality of the achievements was relatively high, and they had strong research accuracy and citation value.

In contrast, although the United States and Australia have a relatively high number of published papers, their average citation counts are 11.24 and 11.13 respectively, slightly lower than those of some European countries, indicating that their research influence maintains a relative balance between quantity and quality. The average citation counts of France and Ireland were 13.3 and 11.4 respectively, which also demonstrated certain research influence and quality guarantee.

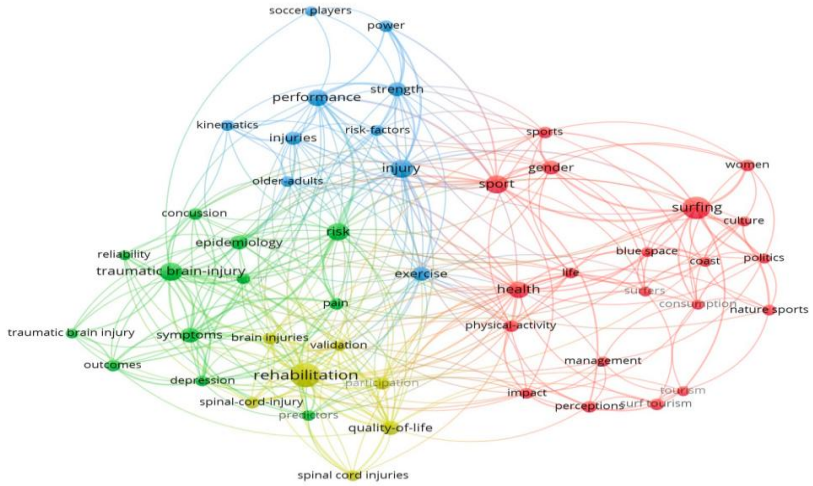
Overall, this field shows an international distribution trend of "equal emphasis on high output and high quality". Some European countries stand out in terms of research depth and influence, while English-speaking countries have advantages in the quantity and continuity of research. Future research can further strengthen international cooperation, promote academic exchanges and resource integration among different countries, so as to drive the continuous development and breakthroughs in this field.

Keyword Analysis

Keyword Co-occurrence Analysis

Figure 2 Through the analysis of the keyword co-occurrence network by CiteSpace, the merged network is composed of 52A node and 217. The composition of these links indicates that there are relatively extensive academic discussions and close thematic connections within the research field. This reflects a strong co-occurrence relationship between key words and the diversity and concentration of research content in this field.

Fig. 2 Keywords co-occurrences



	Node characteristics	Academic role
Surfing	It is closely connected with key words such as "sport", "gender", "culture" and "tourism", reflecting its core position in multi-dimensional contexts such as social culture, gender, ecology and leisure	Reflecting that surfing is not only a sports activity but also an important subject of cultural, gender and natural space studies, promoting interdisciplinary research
Injury	As an intermediary node among multiple groups (such as performance, risk, rehabilitation), it is associated with concepts such as "risk-factors", "injuries", and "concussion"	It is the intersection of research in sports medicine, rehabilitation, risk assessment, etc., revealing the mechanism of sports injuries and intervention pathways
Risk	It is widely related to "injury", "rehabilitation", "epidemiology", "pain", etc., and is at a pivotal position between health and disease	It is used to construct a health risk assessment model, supporting the design of intervention strategies and public health management
Rehabilitation	It is connected with terms such as "quality-of-life", "spinal cord injury" and "depression", reflecting its core role in the recovery after injury	Emphasize the role of rehabilitation in improving the quality of life and promote the integration of medical, psychological and social support systems

continued

Sport	It is closely connected with the key words of social and humanities disciplines such as "gender", "health", "life" and "culture", and the nodes present the characteristics of cross-disciplinary integration	Sports are not only physical activities, but also tools for social construction and the expression of cultural identity
Performance	Closely related to sports science concepts such as "strength", "power" and "kinematics", more inclined towards sports performance and training science	Provide a theoretical basis for the optimization of sports training and promote the exploration of human sports potential and scientific guidance
Traumatic Brain Injury	Clusters with words such as "concussion", "symptoms", "reliability", and "outcomes" represent the types of severe consequences in sports injuries	It is a key point in the research of brain injuries, promoting the coordinated development of fields such as brain science, rehabilitation medicine, and risk assessment

Overall, the key words in Figure 1 are interrelated and developed in a coordinated manner, jointly constructing a cross-disciplinary research network where multiple directions such as sports injury and rehabilitation, sports performance, and social culture converge. Among them, injury, as the core concept, is located at the hub of the network structure and connects multiple important fields such as performance, risk, rehabilitation, sport and health. It reflects its key position in academic research and practical application.

The research on Injury relies on the continuous identification and intervention of factors such as epidemiology, risk factors, concussion and pain. It is also supported by elements of sports science such as performance and exercise to achieve more effective injury prevention and management functions（Leddy, Hinds, Sirica, & Willer, 2016）.

In practical applications, with rehabilitation and quality-of-life as the goal orientations, through in-depth analysis of factors such as symptom manifestations, psychological influences (such as depression), and participation, the personalization and scientification of sports rehabilitation services are promoted (Reza, 2024). Thereby enhancing the overall recovery efficiency and life happiness of the sports population. This rehabilitation pathway is widely applied in complex sports injury situations including spinal cord injury and traumatic brain injury and has significant social value and medical significance in sports medicine and public health management.

Furthermore, research related to surfing reflects the extension of sports culture to a broader social context. The high aggregation with key words such as "sport", "gender", "culture", "tourism" and "blue space" reflects that surfing is not only a form of physical activity, but also a lifestyle with deep social, spatial and cultural attributes. This research approach focuses on the interactive relationship between sports and social structures, emphasizes the comprehensive influence of sports in shaping identity, political ecology and natural perception, and promotes the in-depth integration and development of fields such as sports sociology, human geography and tourism studies.

Overall, this keyword network graph sketches out a multi-dimensional knowledge map covering medicine, sports science, social culture and tourism research, providing a structured perspective and theoretical support for related research, and guiding scholars to seek new

directions for collaborative innovation and interdisciplinary integration in the "injury - rehabilitation - sports - society" chain.

Keyword Clustering Relationships

Fig. 3 the visual representation of the keyword clustering.

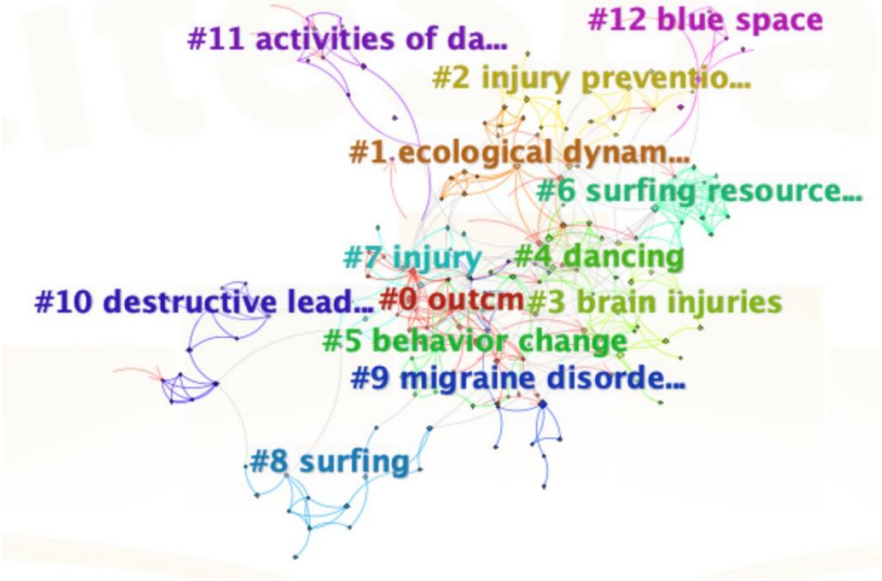


Table 5 Keyword Clustering Analysis and Research Directions

Cluster Number	Topic Name	Keywords	Research Direction
#0	Social Media and Information Diffusion	social media, echo chambers, filter bubbles, news, personalized recommendation	Investigate the phenomenon of information dissemination and user behavior in social media platforms. Analyze how echo chambers and filter bubbles form and their impact on the spread of news and diverse opinions. Explore strategies to improve personalized recommendation algorithms.
#1	Federated Learning and Data Privacy	federated learning, data privacy, machine learning, algorithm	Research techniques and applications of federated learning where data privacy is critical. Develop algorithms for joint model training without sharing raw data, exploring trade-offs between performance and privacy.

continued

#2	Injury Prevention and Risk Management	injury prevention, risk factors, injury mechanism, athlete safety	Explore strategies for preventing sports injuries by analyzing injury mechanisms and risk factors. Emphasize safety protocols, training modifications, and technology-based monitoring to reduce injury rates and enhance athlete well-being.
#3	Brain Injuries and Cognitive Function	brain injuries, concussion, neurocognitive function, recovery	Focus on the short- and long-term effects of brain injuries in athletes, especially concussions. Research cognitive assessment tools and rehabilitation methods to support safe return-to-play decisions and long-term brain health.
#4	Dance and Movement Studies	dance, movement analysis, motor control, physical performance	Investigate the biomechanical and neurological basis of dance and movement. Use motion capture and performance metrics to analyze movement efficiency, injury risk, and creative expression.
#5	Behavior Change in Health Contexts	behavior change, intervention, motivation, adherence	Study behavior change theories and interventions to promote healthy lifestyles. Examine factors that influence motivation and adherence to physical activity or rehabilitation programs.
#6	Surfing Resources and Environmental Impact	surfing, environmental sustainability, coastal management	Explore the interaction between surfing activities and coastal environments. Focus on sustainable management of surfing resources, environmental impact assessments, and policy recommendations to preserve surf zones.
#7	Injury Mechanisms and Biomechanics	injury, biomechanics, impact forces, musculoskeletal analysis	Research the biomechanics of sports injuries, particularly the forces involved during activities. Identify movement patterns and physical stressors that lead to injury, providing a scientific basis for injury prevention programs.
#8	Surfing Culture and Athlete Development	surfing, performance, athlete development, extreme sports	Investigate the culture and performance development of surfers. Analyze training approaches, psychological aspects, and athlete identity within extreme sports.
#9	Migraine Disorders and Neurological Health	migraine, neurological disorders, triggers, quality of life	Study the causes and impacts of migraine and other neurological conditions on athletes and the general population. Explore treatment strategies and preventive measures to improve quality of life.
#10	Destructive Leadership in Sports	destructive leadership, coaching behavior, team dynamics	Explore the effects of harmful leadership behaviors on athlete performance and team cohesion. Identify strategies for promoting positive coaching practices and leadership development.
#11	Activities of Daily Living and Aging	daily activities, aging, physical activity, rehabilitation	Studying how aging affects the ability to perform daily activities. Investigate interventions to maintain independence, mobility, and health in older populations through tailored physical activity programs.

continued

#12	Blue Space and Mental Health	blue space, mental health, nature therapy, emotional well-being	Explore how exposure to aquatic environments (blue spaces) contributes to mental health and emotional restoration. Study nature-based interventions and their effectiveness in promoting psychological well-being.

Based on the 12 themes shown in the clustering graph, it can be summarized from the macro level that the current academic research shows a trend of high diversification and cross-integration. Although these themes belong to different fields, they jointly reflect in-depth discussions on core issues such as technological progress, human health, social structure and environmental sustainability.

Firstly, social media and information dissemination (#0) focus on the flow of information and the formation mechanism of public opinion in the digital age. This research direction not only involves the ways individuals receive and interact with information on social platforms, but also has a profound impact on the cognitive structure and value orientation of the entire society, especially having significant practical significance in the governance of false information and public opinion guidance (Alvarez & Brehm, 2020).

Corresponding to this is federated learning and data privacy (#1) clustering, which reflects the technological exploration of the balance between "privacy protection" and "shared intelligence" in the context of big data. With the continuous increase in the demand for cross-institutional and cross-platform data applications, how to conduct model training without disclosing users' original data has become a key breakthrough for achieving data security and collaborative innovation.

Starting from the user experience, clustering such as recommendation system optimization and behavior change intervention (such as #5 behavior change, #4 dance movement research) shows the in-depth research in the academic circle on the prediction and influence paths of individual behaviors. This type of research has extensive application value in fields such as health management, content push, and sports training (Chelladurai, 2014).

In the clusters related to health and sports science (such as #2 injury prevention, #3 Brain injury, #7 sports injury mechanism, #8 Surfing, #9 migraine and neurological health), more emphasis is placed on the association between human health, sports safety and functional rehabilitation. Researchers are committed to providing evidence-based evidence and practical strategies for improving the motor performance and health level of the population through methods such as motor mechanism analysis, neurological function assessment, and rehabilitation behavior modeling.

Meanwhile, clusters such as #6 Surf Resources and Environmental Management and #12 Blue Space reflect the dynamic relationship between human activities and the natural environment. The former focuses on how to protect the ecological environment while ensuring the sustainable utilization of sports resources, while the latter links the water environment with mental health, providing scientific support for green health care.

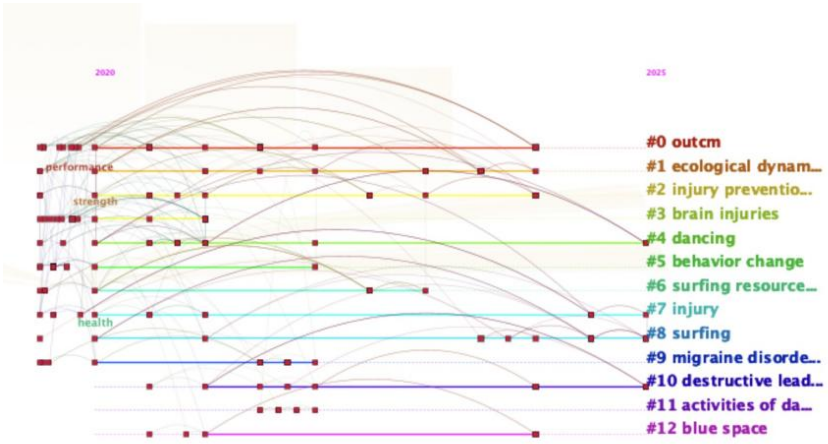
Furthermore, the research on #10 destructive leadership and #11 daily activities and aging has further extended to the issues of social psychology and population structure changes, demonstrating the integrated development of humanities and social sciences and health research.

Overall, these clustering themes not only play a key role in their respective fields, but also achieve the collaborative advancement of multiple disciplines through cross-disciplinary paths such as artificial intelligence, behavioral science, sports medicine, and environmental psychology (Shahid, 2024). For instance, applying artificial intelligence technology to predict the recovery

cycle of concussions, using federated learning methods to construct cross-regional sports health data models, or incorporating blue Spaces into urban health intervention strategies are all highly forward-looking cross-border innovation directions.

This research model of "problem-oriented + technology-driven + interdisciplinary integration" is becoming an important path to promote contemporary scientific research to a deeper level, and also provides more diverse, precise and sustainable solutions to complex problems in real society (Klein, 2001).

Fig. 3 Timeline chart of keyword clustering



Clusters such as #0 outcome, #1 ecological dynamics, and #2 injury prevention have shown stable research enthusiasm throughout the entire period, indicating that these directions have long received attention in the academic community and have a high research foundation and continuity. Among them, the #2 injury prevention cluster has many connections with both the two keywords "performance" and "health", indicating that it has research value in both the improvement of sports performance and the maintenance of health. It is a core field with strong intersections and wide applications.

#12 blue space began to show an increasing trend of activity near 2025, indicating the growing concern of the public and the academic community about the relationship between the natural environment and mental health.

Similarly, the research enthusiasm for #9 migraine disorders and #11 activities of daily living has also increased in recent years, indicating an emerging focus on the management of daily functional disorders and chronic diseases.

#5 behavior change and #4 dancing have prominent research activities in some years, but the overall situation shows a fluctuating state, which may be related to specific policies, social events or technological breakthroughs (for example, public health events may drive a research boom in behavior change).

performance: Highly concentrated on themes such as #0, #1, #2, and #5, it is particularly closely related to clusters such as injury prevention, ecological dynamics, and behavioral changes, indicating that sports performance is not only a competitive indicator but also closely linked to safety, cognitive strategies, and behavioral decisions. strength: It is mainly associated with #3 brain injuries, #7 injury and #8 surfing, indicating that in the research of neurological injuries and specialized sports such as surfing, "body strength" is a key dimension, involving rehabilitation

assessment and injury mechanism analysis. health: It is the most widely connected keyword, running through almost all clusters, especially occupying a central position in directions such as #2 injury prevention, #6 surfing Resources, #9 migraine disorders, and #12 blue space. It reflects the universality and integration of "health" as the main research axis.

The research clustering and keyword connections shown in this chart reveal a clear trend: the evolution from "specialized technologies" to "comprehensive health". Initially, the research focus was concentrated on the analysis of performance improvement and injury mechanisms. However, in recent years, more and more studies have begun to pay attention to issues such as the natural environment, chronic disease management, mental health and the recovery of daily functions. This change reflects the transformation of the academic community from the concept of "maximizing sports performance" to that of "healthy and all-round development". Especially in fields such as sports science, rehabilitation medicine, and environmental psychology, integrated research will become an important direction for future development.

4 DISCUSSIONS

This study, through the bibliometric analysis of personalized recommendation systems and the research field of surfing sports injuries, reveals the characteristics of this interdisciplinary field such as research hotspots, core authors, representative journals and national distribution. On the part of the authors, although the number of published papers by some authors is not high, the high citation frequency of their research results indicates that they have a strong influence in specific subfields, especially in the direction of concussion and sports rehabilitation. Highly cited authors often focus on fields such as sports injury assessment and rehabilitation tool development, which also reflects the high attention paid to "practical tools" and "quantitative indicators" in current research.

From the perspective of journal distribution, there are not only high-impact medical journals such as Sports Medicine, but also journals focusing on the social and cultural perspective such as Sport in Society (Tsigilis, Grouios, Tsorbatzoudis, & Koidou, 2010). This indicates that the research in this field has a high degree of multidisciplinary intersections, involving not only biomedicine, but also the dimensions of sociology and anthropology (Hahn & Kleinman, 1983). Furthermore, although the United States and Australia dominate in terms of the number of papers, European countries such as Spain and Canada stand out in terms of research quality and influence, indicating that different countries have formed a complementary and collaborative pattern in this research field.

The analysis of keyword clustering and co-occurrence further indicates that the research topics mainly focus on directions such as "personalized intervention", "sports injury assessment", "athlete recovery", and "concussion management". Moreover, in recent years, keywords such as AI technology, wearable devices, and risk prediction have frequently emerged, reflecting that this field is developing towards "intelligence" and "precision".

Implications

The results of this study provide multiple inspirations for the future integration research of injury prevention and control in surfing and personalized recommendation systems. Firstly, core authors and highly cited literature often focus on rehabilitation assessment and concussion research, suggesting that there is still a gap in standardized tools for surfing in terms of injury types, post-

injury assessment and intervention methods. In the future, personalized risk prediction models can be developed by combining AI algorithms and wearable devices. Secondly, in terms of the distribution of journals and countries, the integration of multiple disciplines and international cooperation have become a trend, which provides a cooperation path and reference for journal selection for related research in our country (Terjesen, Hessels, & Li, 2016).

Furthermore, the evolution of keywords indicates that this field is transforming from traditional descriptive research to data-driven and technology-integrated research. This suggests that researchers should fully consider individual differences of users, characteristics of the sports environment and technology adaptability when designing intervention strategies or recommendation systems. For example, in surfing, conducting dynamic risk assessment by combining real-time data such as weather, tides, and water temperature will help enhance the practicality and forward-looking nature of personalized recommendation systems (Male, 2020).

5 CONCLUSIONS

Research findings indicate that this field has shown a continuous growth trend in recent years, with authors, journals, and research countries all demonstrating distinct clustering and interdisciplinary characteristics. The United States and Australia lead in the number of studies, while countries such as Spain and Canada have an advantage in academic influence. The co-occurrence and cluster analysis of key words show that "concussion assessment", "rehabilitation tools", "wearable devices" and "AI-assisted diagnosis" are the main research directions at present, and present a trend of the integration of intelligence and personalization. Future research should further strengthen the application and promotion in niche sports such as surfing, especially in aspects like pre-injury early warning, post-injury intervention and rehabilitation path recommendation, to construct a more accurate and efficient personalized sports risk management system.

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