Received: 03 FEB 2026 | Accepted: 02 JUNE 2026 | Published Online: 30 JUNE 2026
Recoletos Multidisciplinary Research Journal Vol. 14 no. 1 (June 2026)
DOI: https://doi.org/10.32871/rmrj2614.01.07

Original Article

Scientific Mapping of Exercise Integration in Chronic Disease Management: Systemic Pathways toward Equitable and Sustainable Population Health

Christie Lynne C. Codod

College of Teacher Education, Mountain Province State University, Bontoc Campus, Mountain Province, Philippines

Correspondence: christielynnecodod@gmail.com

Abstract

Background: *Most people recognize exercise as a central strategy in chronic disease management; however, the global structure and evolution of research in this field remain insufficiently understood. This study presents a scientometric analysis of 14,517 peer-reviewed articles indexed in Scopus from 1938 to 2024 to examine publication trends, intellectual structure, collaboration networks, and thematic evolution within the Exercise-is-Medicine paradigm and integrated care.*

Methods: *Bibliometric methods using Bibliometrix (R) and VOSviewer were applied to analyze citation patterns, co-authorship linkages, and keyword co-occurrence.*

Results: *Results demonstrate sustained growth in research output, with strong concentration in high-income countries, reflecting persistent global inequalities in knowledge production and influence. Citation structures are predominantly anchored in cardiovascular and respiratory clinical guidelines, indicating disciplinary dominance that shapes research priorities and standards. Core themes remain focused on pulmonary rehabilitation and cardiometabolic conditions. At the same time, emerging areas such as digital health, self-management, and primary care integration signal a shift toward implementation-oriented and population-health approaches. These trends indicate a transition from clinically bound rehabilitation models to more integrated care frameworks.*

Conclusion: *Strengthening global collaboration and advancing scalable, system-level implementation strategies are essential to ensure equitable integration of exercise into healthcare systems worldwide.*

Keywords

chronic disease management, public health, exercise-based interventions, Scientometric analysis, well-being, UN SDG 3

INTRODUCTION

Exercise is widely regarded as fundamental to human health, offering protective and therapeutic benefits across physiological, metabolic, cognitive, and psychosocial domains. Substantial evidence indicates that regular physical activity reduces the risk of major chronic diseases, including type 2 diabetes, cardiovascular disorders, obesity-related complications, and several cancers. Physical activity also strengthens the musculoskeletal system, enhances cognitive performance, improves mood, and supports restorative sleep

patterns (Booth et al., 2012; Warburton & Bredin, 2017). These findings have contributed to a global consensus that people should integrate exercise into routine clinical practice as a structured therapeutic modality, rather than recommended as a lifestyle behavior.

Multiple global initiatives and guideline frameworks have supported the integration of exercise into clinical practice. Among these, the Exercise is Medicine® (EIM) initiative, launched in 2007 by the American College of Sports Medicine, has played a significant role in promoting the assessment and prescription of physical activity within healthcare systems (ACSM, n.d.; Sallis, 2009). Since its inception, EIM has expanded to more than 40 countries, reinforcing the role of exercise as a legitimate and essential component of chronic disease management and preventive care.

The conceptual foundations of exercise as a therapeutic modality extend beyond any single initiative and encompass a broad body of research linking clinical evidence, guideline development, and healthcare implementation. Within this context, the Exercise-is-Medicine initiative can be understood as one component of a wider translational framework comprising three interrelated dimensions: empirical evidence establishing exercise as therapy for chronic disease, clinical guidelines and consensus statements that formalize exercise within standards of care, and implementation frameworks that integrate physical activity into healthcare pathways (Booth et al., 2012; Lobelo et al., 2014; Pedersen & Saltin, 2015). Highly cited cardiovascular, respiratory, metabolic, and rehabilitation guidelines, even when they do not explicitly reference the exercise-based chronic disease research initiative, contribute to the intellectual infrastructure that legitimizes and operationalizes exercise-based chronic disease management in contemporary medicine (Colberg et al., 2016; Warburton & Bredin, 2017).

A growing body of research demonstrates the therapeutic efficacy of structured exercise across diverse medical contexts. Exercise enhances endothelial function, modulates inflammatory processes, improves glycemic control, and increases insulin sensitivity in cardiometabolic conditions (Anderson & Durstine, 2019; Colberg et al., 2016). It is also critical in mental health management, mitigating symptoms of depression and anxiety while supporting cognitive vitality throughout the lifespan (Rebar et al., 2015). In oncology, exercise improves treatment tolerance, functional capacity, and quality of life among cancer survivors (Cormie et al., 2017). These findings are consolidated within guideline documents and position statements that translate research evidence into clinical recommendations, thereby reinforcing the institutionalization of exercise within disease management frameworks.

Despite the rapid expansion of scholarship on exercise as a therapeutic intervention, experts have not thoroughly examined the intellectual architecture of research on exercise in chronic disease management at a systems level. Most bibliometric studies have focused on isolated domains, such as physical activity promotion, sports medicine, or disease-specific rehabilitation (Ding et al., 2020; Hernández-Beltrán et al., 2023). Few analyses have investigated how these strands converge into a coherent translational paradigm that links clinical evidence, guideline authority, and integrated care implementation. As a result, the structural dynamics shaping knowledge production, including disciplinary concentration, citation hierarchies, collaboration networks, and geographic inequality, remain largely uncharted.

In the absence of comprehensive structural analysis, the field risks conflating citation dominance with conceptual centrality, potentially overlooking implementation-oriented and regionally grounded scholarship that is essential for equitable translation into practice (Donthu et al., 2021). Insufficient understanding of the distribution of influence among authors, institutions, and countries impedes assessment of whether exercise-based chronic disease management research is advancing toward integrated, globally inclusive healthcare systems or remains confined to specialized clinical silos. Moreover, given the global burden of chronic disease and disparities in research infrastructure, the lack of structural mapping obscures whether knowledge

production in this domain reflects equitable participation or perpetuates existing asymmetries between high-income and low- and middle-income regions (World Health Organization [WHO], 2022).

A comprehensive scientometric investigation is therefore necessary not only to quantify publication trends but also to clarify the epistemic structure, collaboration patterns, citation dynamics, and thematic evolution through which exercise has been institutionalized as medicine. This study presents a global scientometric analysis of research on exercise in chronic disease management, situating the exercise-based chronic disease research initiative as a key framework within this broader field. By examining publication growth, influential authors and institutions, collaboration networks, intellectual clusters, and emerging research trajectories, the study elucidates how the paradigm has diffused, consolidated authority, and intersected with integrated care and population health frameworks. These structural insights may inform more equitable, system-level integration of exercise prescription within healthcare systems worldwide.

METHODS

Study Design

A quantitative scientometric research design was employed to examine the global knowledge structure of research on exercise in chronic disease management. Scientometric analysis applies quantitative techniques to map the development, structure, and dynamics of scientific literature through bibliographic metadata such as citations, co-authorship relationships, and keyword co-occurrence patterns. These techniques enable the identification of publication growth trends, influential authors and institutions, collaboration networks, citation structures, and thematic evolution within a research domain (Aria & Cuccurullo, 2017; Donthu et al., 2021).

Most experts use scientometric approaches to analyze the intellectual structure of scientific fields and to reveal patterns of knowledge production that are not readily observable through conventional literature reviews. In this study, the researchers applied scientometric techniques to evaluate publication productivity, citation impact, collaborative networks, and the thematic development of exercise-based chronic disease management research.

Data Source

Bibliographic records were retrieved from the Scopus database (Elsevier) on 15 January 2025, with coverage limited to publications indexed up to 31 December 2024. This cutoff was applied to ensure data stability, as bibliographic databases continue to update records for the most recent publication year. The team selected Scopus for its comprehensive coverage of peer-reviewed literature and standardized citation indexing, both essential for reliable scientometric analysis.

Search Strategy

To enhance construct validity, the researcher restricted the search to the Title, Abstract, and Keywords (TITLE-ABS-KEY) fields. The strategy incorporated three conceptual blocks: exercise-related terms, chronic disease conditions, and management and integrated care terminology. Boolean operators and wildcard functions were applied to capture lexical variations while minimizing the retrieval of non-clinical exercise literature. The structured Boolean logic ensured that retrieved records simultaneously reflected exercise interventions, chronic disease contexts, and care-oriented frameworks. The researcher limited the search to the "Article" document type in Scopus to ensure consistency in publication type and comparability of bibliometric indicators. The complete reproducible search query, including all field tags and filters, is provided in Appendix A. The Exercise-is-Medicine paradigm was operationalized as the interdisciplinary body of

research that positions exercise as a structured therapeutic modality within chronic disease management and integrated care frameworks. This operationalization includes guideline-oriented and implementation-related research, but excludes studies focused solely on athletic performance or recreational fitness. The multi-block Boolean structure ensured alignment with therapeutic and clinical contexts.

Eligibility Criteria and Screening

Eligible documents included peer-reviewed journal articles indexed in Scopus between 1938 and 2024. Other document types, including reviews, conference papers, book chapters, editorials, letters, notes, errata, and retracted publications, were excluded to ensure consistency and comparability in bibliometric indicators. Records dated 2025 or later were also excluded because the study used a cutoff of 31 December 2024 to maintain temporal consistency in the analysis.

The team exported the bibliographic metadata from Scopus in CSV format, including titles, abstracts, keywords, authors, institutional affiliations, citation counts, and reference lists. They automatically removed duplicate records during the Scopus export process. Study selection followed a structured screening procedure consistent with PRISMA guidelines to ensure transparency and reproducibility.

Data Analysis

The researchers conducted bibliometric analyses using the Bibliometrix package in R (Aria & Cuccurullo, 2017) and VOSviewer software (version 1.6.20) (van Eck & Waltman, 2010). They used these tools to perform descriptive bibliometric analysis, citation analysis, and science mapping. They also performed network visualization in VOSviewer using the full-counting method with association-strength normalization. They applied the default layout and clustering resolution parameter (1.00) to generate collaboration and keyword networks.

The researchers established the threshold values to ensure meaningful network visualization. These thresholds included a minimum of 20 documents per author for co-authorship analysis, five documents per country for country collaboration networks, 20 keyword occurrences for co-occurrence analysis, and 50 citations per source for citation analysis. They provide detailed parameter specifications and search settings in Appendix B.

Methodological Considerations

The researchers acknowledged several limitations. First, they retrieved the data exclusively from Scopus; although comprehensive, database selection influences journal coverage patterns and may affect geographic representation. Second, restricting the search to English-language publications may introduce language bias and underrepresent scholarship from non-Anglophone regions, particularly given the emphasis of the study on global inequality in knowledge production. Third, citation metrics are affected by time-lag effects. Finally, guideline and consensus documents tend to accumulate disproportionately high citation counts due to their normative authority, which may influence observed patterns of intellectual centrality.

RESULTS

Main Information Overview

An initial retrieval from the Scopus database yielded 29,133 records. After applying language, document type, and temporal restrictions, 24,115 records remained for screening. Excluding an additional 9,598 records based on document type yielded a final dataset of 14,517 peer-reviewed journal articles for scientometric analysis.

The marked reduction in records reflects the strict eligibility criteria established to ensure methodological consistency and comparability of bibliometric indicators. The final dataset, encompassing publications from 1938 to 2024, illustrates both the historical depth and ongoing expansion of research on exercise in chronic disease management.

The substantial volume and temporal breadth of the dataset indicate that the field has progressed from fragmented clinical investigations to a mature and globally structured research domain. This phenomenon provides a robust empirical foundation for analyzing publication trends, collaboration networks, citation dynamics, and thematic development.

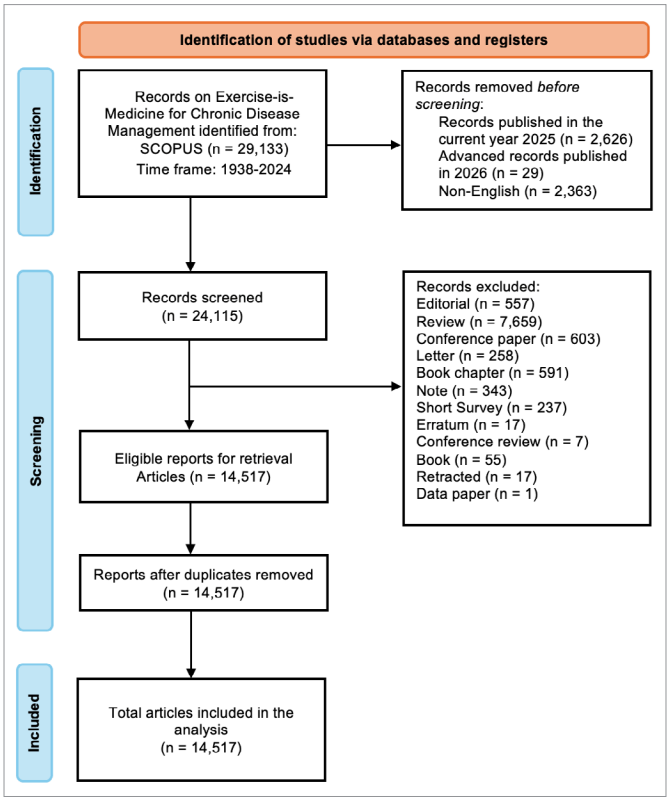

Figure 1. *PRISMA Flow Diagram*

Figure 1 presents the PRISMA flow diagram, which systematically outlines the phases of the study selection process: identification, screening, eligibility assessment, and final inclusion. An initial query of the Scopus database yielded 29,133 records. Targeted exclusion of 5,018 records - non-English publications and studies outside the defined temporal scope—reduced the dataset to 24,115 records for further screening. This attrition illustrates a deliberate effort to enhance dataset relevance and methodological stringency from the outset.

During the screening stage, the researchers excluded 9,598 records based on document type. This step, which omitted reviews, conference papers, editorials, and other non-article formats, was instrumental in maintaining consistency in bibliometric indicators. The resulting dataset, comprising 14,517 peer-reviewed journal articles, thus provides a robust and uniform basis for subsequent quantitative analyses.

The systematic filtering process underscores a commitment to data quality, comparability, and methodological rigor. By applying stringent selection criteria, the study enhances the validity of bibliometric analyses, ensuring that the resulting dataset accurately reflects research output in exercise-based chronic disease management.

Performance analysis

Most relevant contributors

Table 1. *Top 10 Most Productive Authors in the Field*

Rank	Author	NP	TC	h-index*	g-index	m-index
1	Spruit, M.A.	101	9,322	35	96	1.52
2	Zhang, Y.	86	1,374	21	34	0.95
3	Singh, S.J.	84	6,329	31	79	1.07
4	Wouters, E.F.M.	83	9,376	39	83	1.15
5	Wang, Y.	80	3,197	22	56	1.22
6	Li, Y.	77	5,033	20	70	1.33
7	Brooks, D.	75	6,144	32	75	1.19
8	Li, J.	65	3,827	18	61	1.50
9	Zhang, X.	61	2,302	18	47	1.20
10	Franssen, F.M.E.	60	5,023	23	60	1.15

Abbreviation: NP = number of publications; TC = total citations. h-index, g-index, and m-index were calculated within the dataset generated by Scopus.

Table 1 presents the most productive and influential authors in the field, based on publication counts and citation metrics. The results show that a small group of researchers contributes much more than others to both the amount and impact of scientific work. Although Spruit, M.A., has the most publications, citation counts indicate that influence is not based solely on productivity. For example, Wouters, E.F.M. has the highest total citations and h-index, showing the importance of lasting impact in guiding the field's ideas. This difference shows a research environment in which some authors exert a strong influence over how knowledge grows and spreads.

High g-index values also indicate that citations focus on a small group of highly influential papers, consistent with the idea that success builds on success in research. Also, m-index values above 1.0 suggest ongoing involvement in research over time, underscoring the importance of long-term projects in advancing the field.

Overall, these patterns show that well-known research leaders and steady collaboration groups play a key role in guiding research paths and maintaining consistency in the field.

However, this focus may also strengthen the control of established groups, making it harder for new contributors to gain recognition.

Most productive institutions

Table 2 clearly shows the top institutions leading research on exercise in managing chronic diseases by combining measures of how much they publish, how often researchers cite their work, and their international partnerships. This study shows that most research happens in top medical centers in wealthy countries, which are the main sources of new knowledge. This dominance reflects differences in available resources and

research support, and it keeps existing power structures in science and decision-making in place.

The University of Toronto – Faculty of Medicine has the most publications (NP = 112), followed by Istituti Clinici Scientifici Maugeri IRCCS and Monash University. The number of publications shows that research is focused in institutions with strong experience and good academic support. However, citation counts show that publishing a lot does not always translate into greater influence. Harvard Medical School, with fewer publications, has the highest total citations (TC = 9,983), suggesting that reputation, important connections, and long-standing prestige can increase research visibility. This difference between quantity and influence highlights the complex link between an institution's history, the visibility of its work, and the setting of global research standards.

Differences in international collaboration rates show how institutions choose to work with global research networks. High MCP values at institutions such as Maastricht University Medical Centre+ (40.0%) and Monash University (25.9%) indicate that these act as international centers of knowledge, leveraging partnerships across countries to expand their scientific influence and foster new ideas. On the other hand, institutions with low or no MCP values might be constrained by local research goals, funding, or policies, limiting their global visibility and ability to make a worldwide impact. These trends highlight the importance of international collaboration for building scientific strength and shaping global research plans.

In summary, this study shows that an institution's influence in exercise-based chronic disease management stems from the volume of its publications, its citation frequency, and its international partnerships. Institutions with strong resources set research priorities and support knowledge sharing across countries, but they also perpetuate ongoing global inequalities in the creation and dissemination of scientific knowledge. This institutional concentration of scientific knowledge reflects how institutions gain and maintain power and what this means for fair participation and the generation of new ideas in the field.

Table 2. *Leading Institutions / Universities by Publication Output, Citations, and International Collaboration*

Rank	Institution / Affiliation	NP	TC	International Collaboration Ratio (MCP %)
1	University of Toronto – Faculty of Medicine (Canada)	112	3,958	23.08%
2	Istituti Clinici Scientifici Maugeri IRCCS (Italy)	100	1,334	16.00%
3	Monash University (Australia)	97	5,022	25.93%
4	Maastricht University Medical Centre+ (Netherlands)	95	4,962	40.00%
5	Harvard Medical School (USA)	80	9,983	10.00%
6	University of Michigan Medical School (USA)	69	3,700	9.09%
7	VA Medical Center, North Chicago (USA)	67	3,297	0.00%
8	University of Toronto (Canada)	66	7,064	16.67%
9	National Heart and Lung Institute (UK)	66	5,008	16.67%
10	Cumming School of Medicine, University of Calgary (Canada)	64	8,151	0.00%

Abbreviation: NP = number of publications; TC = total citations.

Country-level Contributions

Figure 2 reveals a highly concentrated global knowledge production structure, with the United States serving as the dominant hub of scientific output and international collaboration. The overwhelming contribution of the United States suggests that the field's intellectual development has been largely shaped by research priorities, funding mechanisms, and institutional capacities concentrated within North American

academic and healthcare systems. Such dominance indicates not only productivity leadership but also substantial influence over research agendas, methodological approaches, and evidence generation.

The strong presence of the United Kingdom, Canada, Australia, and several Western European countries indicates a well-established transnational research network among high-income nations. These countries share comparable healthcare challenges, research infrastructures, and policy commitments toward chronic disease prevention and management, which likely facilitate collaborative knowledge production and dissemination. The prominence of multi-country publications among these nations further suggests that scientific advancement in the field increasingly relies on international partnerships rather than isolated national efforts.

China is becoming a major player in research, and this shift is driven by more countries getting involved in science. Even though Western countries still produce the most research, China is making a big impact and shows it is investing heavily in research on health and exercise. This means that the places where knowledge is being created are becoming more dispersed and are not limited to Western countries. As a result, we are seeing a more diverse range of ideas and perspectives, which is a good thing for the world of research. China's growth in this area signals that the global research landscape is shifting, and we can expect more countries like China to make significant contributions in the future.

Conversely, the limited representation of many countries in Africa, parts of Asia, and Latin America highlights persistent disparities in research capacity and visibility. These regions often carry a substantial burden of chronic diseases yet remain underrepresented in the scientific literature. The imbalance raises concerns regarding the generalizability of current evidence, as dominant perspectives may not fully capture the contextual realities, healthcare systems, and population needs of low- and middle-income countries. Consequently, important local experiences and culturally relevant intervention strategies may remain insufficiently documented.

The way research is distributed around the world shows that rich countries are still in charge, but emerging economies are starting to contribute more. However, there is still a significant gap in the number of countries involved in global research. This means we need to work more closely across borders, build capabilities in different areas, and ensure research partnerships include a wide range of voices. That way, the evidence we gather in the future will reflect the needs and situations of people all around the world, not just a few places. We need to make sure everyone is included, so we can make progress that helps everyone, no matter where they are from or what their healthcare system is like.

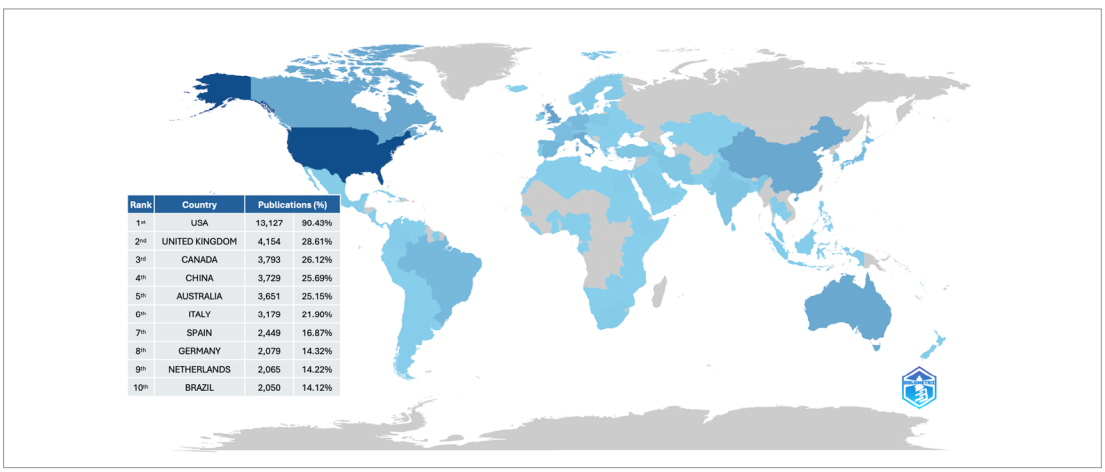

Figure 2. *Country-level contributions by single-country and multi-country publications*

Most Cited Documents

Table 3. *Most Cited Documents by Global and Local Citation Influence*

Rank	Document	Authors	Journal	Year	TC	TC per Year	Normalized TC
1st	Heart Disease and Stroke Statistics—2018 Update: A Report from the American Heart Association	Benjamin EJ et al.	Circulation	2018	6,046	755.75	140.39
2nd	2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure	Ponikowski P et al.	Eur J Heart Fail	2016	5,736	573.60	83.80
3rd	The Joint Task Force for the Diagnosis and Treatment of Pulmonary Hypertension of the European Society of Cardiology (ESC) and the European Respiratory Society (ERS)	Galiè N et al.	Eur Heart J	2016	5,336	533.60	77.96
4th	Heart Disease and Stroke Statistics—2012 Update: A Report from the American Heart Association	Roger VL et al.	Circulation	2012	4,699	335.64	64.13
5th	Heart Disease and Stroke Statistics—2011 Update: A Report from the American Heart Association	Roger VL et al.	Circulation	2011	4,603	306.87	73.52
6th	The Effect of Carvedilol on Morbidity and Mortality in Patients with Chronic Heart Failure	Packer M et al.	N Engl J Med	1996	4,425	147.50	29.00
7th	2013 ESH/ESC Guidelines for the management of arterial hypertension	Mancia G et al.	J Hypertens	2013	4,421	340.08	56.85
8th	Glucose Control and Vascular Complications in Veterans with Type 2 Diabetes	Duckworth W et al.	N Engl J Med	2009	4,328	254.59	58.81
9th	2013 ESC guidelines on the management of stable coronary artery disease: The Task Force on the management of stable coronary artery disease of the European Society of Cardiology	Montalescot G et al.	Eur Heart J	2013	4,260	327.69	54.78
10th	2013 ESH/ESC Guidelines for the management of arterial hypertension: The Task Force for the management of arterial hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC)	Mancia G et al.	Eur Heart J	2013	4,113	316.38	52.89

Abbreviation: NP = number of publications; TC = total citations; Local citation influence refers to the document's prominence within the retrieved dataset, inferred from repeated referencing and co-citation positioning.

Table 3 systematically identifies the most influential publications by employing both global citation counts and normalized citation metrics, thereby offering a multidimensional assessment of scholarly impact. This methodology demonstrates that the field is structurally anchored in guideline-oriented and consensus-driven literature, as indicated by the predominance of cardiovascular and respiratory clinical guidelines at the top of citation rankings. This pattern underscores the primacy of institutional authority and standard-setting documents in defining foundational knowledge.

The most highly cited documents, including the American Heart Association statistical updates and European Society of Cardiology guidelines, serve as authoritative reference frameworks that aggregate and codify extensive clinical evidence. Their exceptional citation counts reflect not only widespread adoption but also their central role in establishing research priorities, legitimizing methodologies, and setting standards for evaluating new findings. The dynamics highlight a knowledge ecosystem in which institutionalized consensus and credentialed authority exert greater influence than individual experimental studies.

Distinguishing between global and normalized citation metrics clarifies the temporal dynamics of influence within the field. Older publications maintain high aggregate citation counts due to extended visibility, while recently published guidelines demonstrate strong normalized citation impact, indicating rapid assimilation and immediate practical relevance. This trend reflects the field's responsiveness to evolving clinical standards and its tendency to reward timely, consensus-driven scholarship.

Analysis of local citation patterns further confirms the centrality of guideline publications, positioning them as critical nodes within the field's internal intellectual structure. The observation that documents with modest global citation counts can achieve high local prominence suggests that their influence is contextually concentrated, actively shaping discourse and methodological norms specific to exercise-based chronic disease management.

Collectively, these findings indicate a highly centralized intellectual structure anchored around clinically authoritative sources, privileging evidence synthesis, standardization, and application. Although this centralization enhances translational relevance and supports the dissemination of best practices, it may also reinforce disciplinary dominance, restrict methodological diversity, and limit the integration of novel or interdisciplinary perspectives. This structural orientation warrants critical reflection on how knowledge gatekeeping and consensus-driven paradigms shape the field's evolution and adaptability. This concentration of citation influence suggests that the field may be shaped by a relatively narrow set of clinical paradigms, potentially constraining innovation from emerging fields such as behavioral science, digital health, and implementation research.

Sources impact

Table 4 presents the most productive and influential journals in exercise-based chronic disease management research, ranked by the number of publications and citation frequency. The sources are mostly focused on respiratory and heart-lung medicine, indicating that clinical rehabilitation views guide the field's growth. This focus raises questions about how the limits of journal topics affect which research subjects are prioritized and what kinds of evidence are considered most important.

With 283 publications (NP = 283), the International Journal of COPD stands out as the most productive journal, underscoring the prominence of chronic respiratory diseases, especially COPD, as a major focus of research and knowledge development in the field. Likewise, the importance of Respiratory Medicine, CHEST, and the European Respiratory Journal—each with many publications and citations—shows a field built around well-known clinical approaches. This grouping can build expertise and depth, but may also limit the field's ideas and reduce interaction with related areas. This divergence between productivity and citation impact signals a stratified knowledge landscape, where a few high-impact journals set research agendas and

legitimize emerging evidence through selective dissemination. Such patterns may reflect editorial priorities that favor guideline-setting and consensus-generating work, amplifying certain topics and methodologies while marginalizing others.

The inclusion of multidisciplinary and public health journals—such as PLOS ONE, BMC Public Health, and the International Journal of Environmental Research and Public Health—indicates a gradual broadening of where research is published. This trend suggests the field is opening up to wider ways of understanding, allowing ideas from population health, prevention, and health systems research to mix. However, these multidisciplinary journals remain less prominent than specialized clinical journals, suggesting that interdisciplinary integration within the field is still developing. Overall, the journal landscape indicates a gradual shift toward broader dissemination across disciplines, reflecting growing interest in population health and health system perspectives. Nevertheless, the continued dominance of clinical journals highlights the enduring influence of clinical rehabilitation paradigms and may limit the visibility of contributions from behavioral science, social medicine, and implementation research. These patterns suggest that exercise-based chronic disease management remains largely grounded in clinical perspectives while gradually expanding toward a more interdisciplinary knowledge base.

Table 4. *Top 10 Most Productive Journals in Exercise-Based Chronic Disease Management Research (1938–2024)*

Rank	Journal	NP	TC
1	International Journal of COPD	283	7,439
2	PLOS ONE	236	5,706
3	Respiratory Medicine	227	8,826
4	CHEST	204	19,852
5	International Journal of Environmental Research and Public Health	195	3,683
6	BMJ Open	175	2,604
7	Respiratory Care	145	3,041
8	BMC Public Health	136	5,331
9	Trials	117	1,563
10	European Respiratory Journal	115	14,143

Abbreviation: NP = number of publications; TC = total citations.

Co-authorship networks

Figure 3 presents the author co-authorship network, using a minimum threshold of 20 publications per author to highlight the most active contributors. Analysis of this network reveals a highly clustered, modular structure in which knowledge production occurs through interconnected research teams rather than isolated individuals. This collective organization demonstrates the growing complexity and specialization within the field, while also prompting consideration of the inclusivity and permeability of collaborative boundaries.

Authors such as Singh, S.J., Spruit, M.A., Wouters, E.F.M., Brooks, D., and Goldstein, R.S. hold pivotal positions within the co-authorship network, as indicated by their large, highly connected nodes. These central figures act as gatekeepers of collaboration and conduits for knowledge transfer, facilitating the diffusion of expertise across otherwise separate research clusters. Their network centrality confers significant scientific influence, often exceeding that of publication volume alone, and enables them to shape research priorities, mobilize resources, and maintain epistemic cohesion. However, this centralization may reinforce hierarchical power dynamics and restrict the emergence of new leadership within the field.

The formation of multiple dense clusters within the network indicates the development of tightly knit, domain-specific research groups, often focused on subfields such as pulmonary rehabilitation or

cardiometabolic conditions. The presence of inter-cluster linkages demonstrates cross-disciplinary integration, which is essential for fostering methodological innovation and expanding the field's conceptual foundation. However, the varying density of connections between clusters suggests that, although collaboration enhances cohesion, structural barriers may remain and impede the free exchange of ideas across research silos.

In summary, the co-authorship network highlights the dominance of collaborative research communities with established leadership hierarchies. Highly connected authors direct research agendas and knowledge dissemination, yet the concentration of collaborations around these central figures suggests the potential for insular, semi-closed networks. While this structure may improve research continuity and efficiency, it also risks perpetuating exclusivity, restricting the introduction of new perspectives, and limiting broader, more democratic participation in the research enterprise.

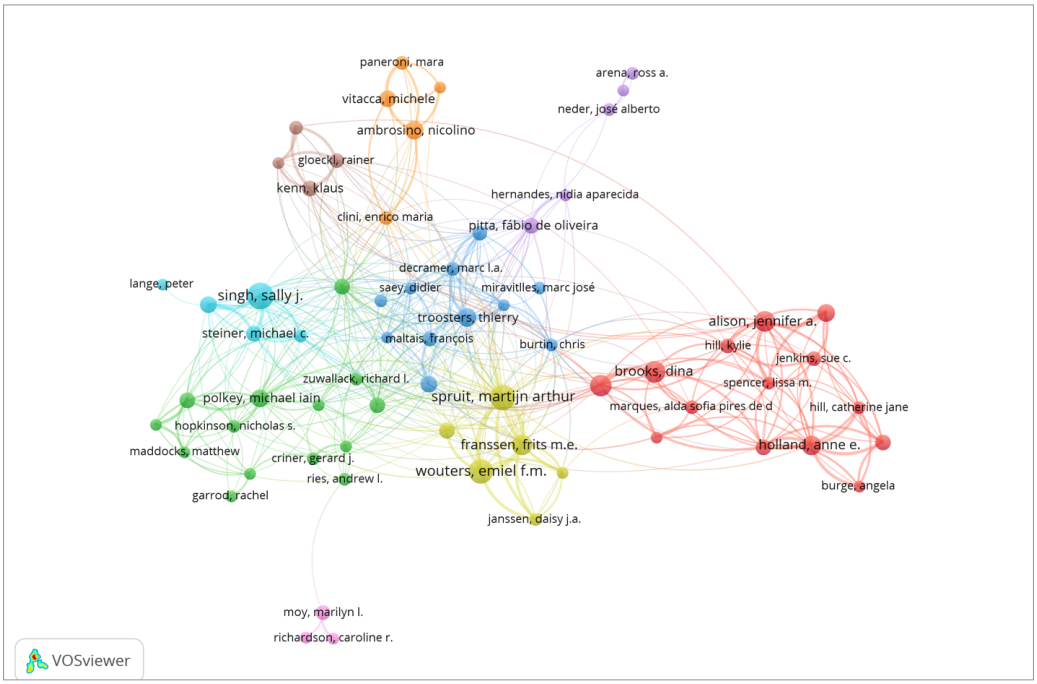

Figure 3. *Author co-authorship network analysis*

Figure 4 provides a systematic visualization of the country-level co-authorship network, illustrating international collaboration patterns based on a minimum threshold of five publications per country. Analysis of this network reveals a globally interconnected structure with pronounced asymmetries: a concentrated group of countries occupies central, highly influential positions, directing the flow and coordination of collaborative research. This structure highlights the strategic importance of national research ecosystems in shaping global scientific connectivity.

The United States serves as the principal hub within the network, distinguished by its large node size and extensive collaborative linkages. This centrality underscores the United States' leading role in directing international research activity. Dense bilateral and multilateral ties with the United Kingdom, Canada, and several European partners form a core cluster, exemplifying a transatlantic research complex that sets collaborative agendas, mobilizes resources, and enhances the global visibility of participating countries.

European countries, including Italy, Spain, France, the Netherlands, and Belgium, form a tightly interconnected regional cluster, reflecting strong intra-European collaboration and policy alignment. Within

this structure, the United Kingdom acts as a strategic bridge, facilitating knowledge exchange between North American and European research communities. This interconnectivity promotes the diffusion of innovations and best practices, but may also reinforce the dominance of established research centers, limiting broader global participation.

In contrast, countries with lower publication output occupy peripheral positions in the network, characterized by sparse and fragile collaborative ties. This marginalization reflects limited integration into global research systems, restricting these countries' ability to access resources, participate in agenda-setting, and contribute diverse perspectives to international research discourse. Such structural exclusion perpetuates global disparities in knowledge production and influence.

Overall, the network analysis demonstrates a persistent core–periphery model in global scientific collaboration. A select group of highly connected countries dominates the production, coordination, and dissemination of research, while less integrated nations remain at the margins of the international knowledge system. This structural asymmetry perpetuates and may exacerbate global inequalities by limiting opportunities for visibility, resource acquisition, and intellectual influence among peripheral countries. Addressing these imbalances is essential for fostering a more inclusive, equitable, and innovative global research landscape.

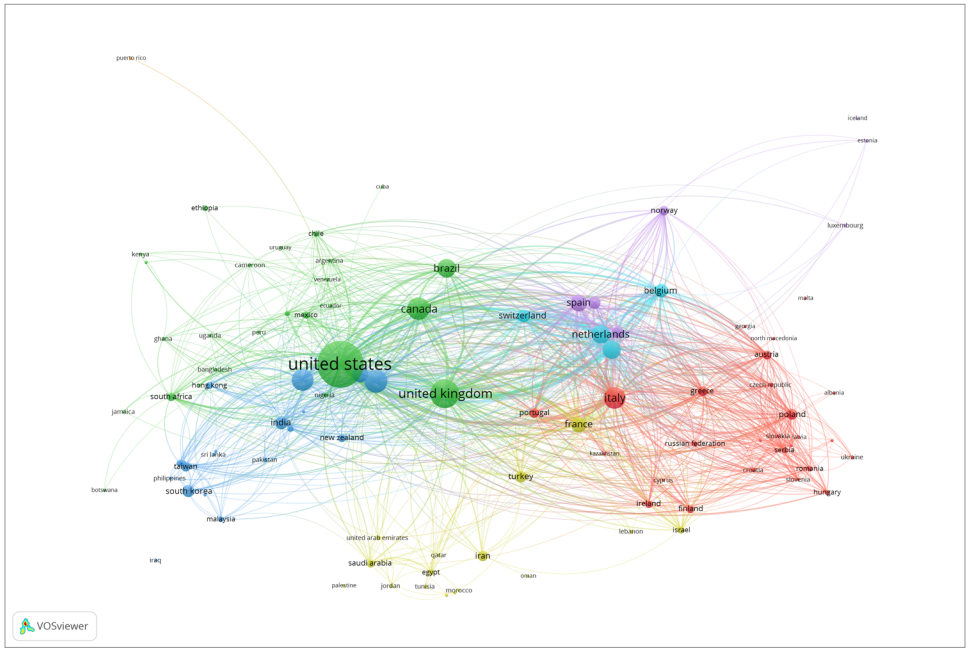

Figure 4. *Country-level Co-authorship Network*

Corresponding Author's Countries

Figure 5 presents the distribution of single-country publications (SCP) and multi-country publications (MCP) by the corresponding author's country, providing a detailed perspective on international research collaboration dynamics. Analysis indicates that while SCPs constitute the majority of total output, countries with high publication volumes also account for a substantial share of MCPs, reflecting strong participation in global research networks. This dual pattern highlights both research productivity and strategic international integration, which are critical for shaping knowledge exchange, resource allocation, and the global hierarchy of research influence.

Countries including the United States, the United Kingdom, Canada, and Australia exhibit a relatively

balanced SCP–MCP ratio, reflecting research systems that integrate domestic productivity with international collaboration. This balance enables these nations to assert intellectual leadership within their national contexts while actively shaping and participating in transnational exchanges of expertise. Such positioning enhances their capacity to influence research priorities, secure collaborative funding, and promote the global dissemination of scientific standards.

In contrast, countries with lower overall publication output tend to produce predominantly single-country publications, indicating a research orientation centered on localized agendas and limited international engagement. This insularity often results from structural barriers such as restricted access to global research networks, limited funding opportunities, and weaker institutional linkages. These factors collectively constrain participation in the broader scientific discourse and diminish the global visibility of their research contributions.

Variation in SCP–MCP ratios highlights substantial heterogeneity in collaboration intensity and exposes disparities in national research capacity and global integration. Countries with a higher proportion of MCPs are more deeply embedded in international networks, which systematically increases research visibility, citation rates, and the dissemination of innovations. In contrast, nations with limited international collaboration face persistent challenges in expanding their scientific impact. These dynamics can perpetuate and even widen global disparities in knowledge production, influence, and access to advanced research.

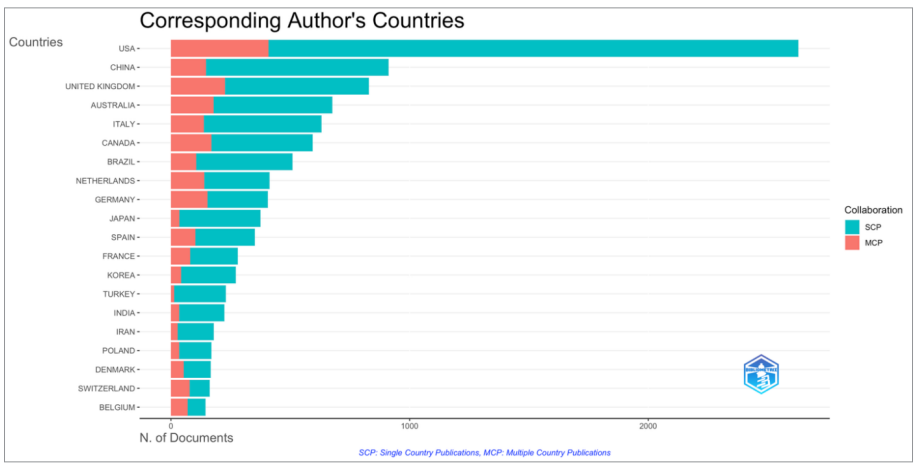

Figure 5. *Corresponding Author's Countries Distribution*

Source Co-Citation Analysis

Figure 6 shows a systematic mapping of the source co-citation network. It identifies the core journals forming the intellectual foundation of research on exercise in chronic disease management. The network is highly centralized, with a few high-impact journals holding dominant positions. This concentration highlights how specific outlets gain disproportionate influence. As a result, they shape the parameters of authoritative scholarship within the field.

Circulation, European Heart Journal, and The New England Journal of Medicine are the most influential sources. They form the network's central axis. Their prominence shows that the field depends on cardiovascular and general medical literature. This underscores the clinical focus of exercise-based interventions in chronic disease management.

Other journals, such as the European Journal of Heart Failure, the Journal of the American College of Cardiology, and the Journal of Hypertension, cluster near these central sources. This cluster reinforces the dominance of

cardiology and internal medicine. The clustering suggests a knowledge ecosystem with concentrated epistemic authority. In this system, established norms often shape or limit emerging research paths.

The strong clustering of these journals shows high intellectual cohesion. Research activity is grounded in unified clinical frameworks and authoritative guidelines. This cohesion can improve rigor and reliability. However, it may also encourage conformity, limiting openness to new methods and interdisciplinary ideas. The dominance of medical disciplines brings stability, but could also restrict research development.

Overall, the co-citation network reveals a concentrated, clinically focused knowledge system. A few authoritative journals lead the development, validation, and spread of scientific knowledge. Centralization helps build consensus and supports the use of evidence in clinical practice. However, it may exclude perspectives from fields like public health, behavioral science, and implementation research. Addressing this ensures intellectual diversity, flexible methods, and field advancement.

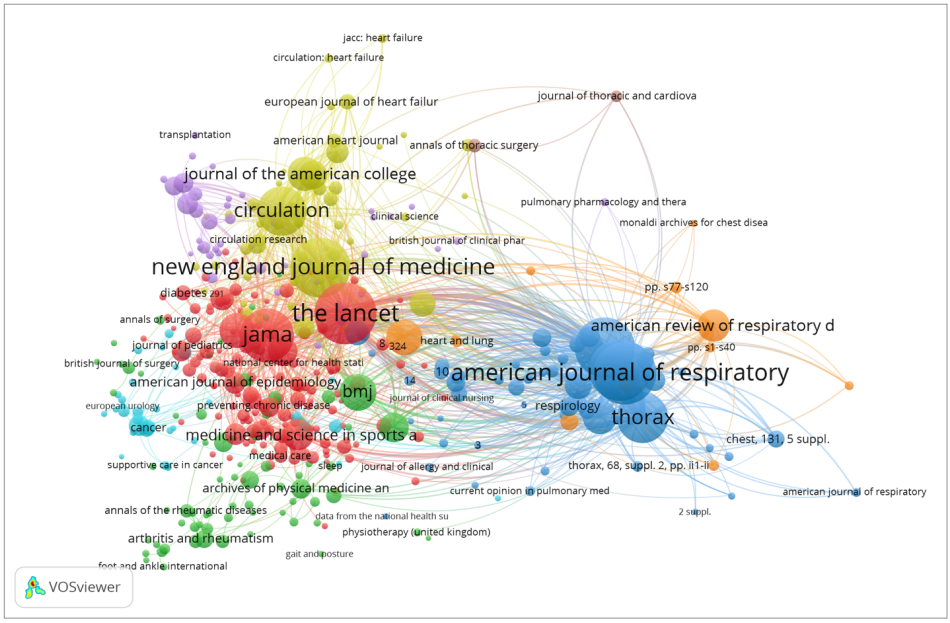

Figure 6. *Source Co-citation Analysis of Journals Shaping the Field*

Keyword analysis

To examine the conceptual structure and thematic evolution of research on exercise in chronic disease management, keyword frequency, treemap visualization (Figure 7), trending-topic analysis (Figure 8), and keyword co-occurrence networks (Figure 9) were employed to identify dominant themes, emerging research directions, and their underlying conceptual relationships.

Treemap

Figure 7 presents a treemap of the most frequent keywords in the literature on exercise in managing chronic diseases. The size of each block shows keyword frequency, highlighting the prominence and structure of research themes.

The visualization reveals a strong dominance of respiratory-related research, with chronic obstructive pulmonary disease (COPD) emerging as the most prominent theme. Closely associated terms, such as pulmonary rehabilitation and exercise, further reinforce the central role of structured exercise interventions in clinical rehabilitation settings, indicating that the field has historically been anchored in respiratory disease management.

In addition to respiratory conditions, lifestyle and behavioral factors—including physical activity and obesity—appear frequently among the identified keywords, highlighting the growing emphasis on preventive and lifestyle-based approaches. The presence of quality-of-life and rehabilitation-related terms further underscores the field's patient-centered orientation, focusing not only on clinical outcomes but also on functional recovery and overall well-being.

Cardiometabolic conditions like hypertension, diabetes, and cardiovascular disease occupy much of the conceptual space. This reflects the wider role of exercise-based interventions across chronic disease domains.

Emerging keywords include public health, health promotion, primary care, and prevention. This suggests a shift from disease-specific research to broader, population-level and health system approaches, and shows a move toward integrated care frameworks. Despite this diversification, the continued dominance of clinically oriented themes suggests that rehabilitation contexts may drive the field more strongly than fully integrated public health and preventive care models.

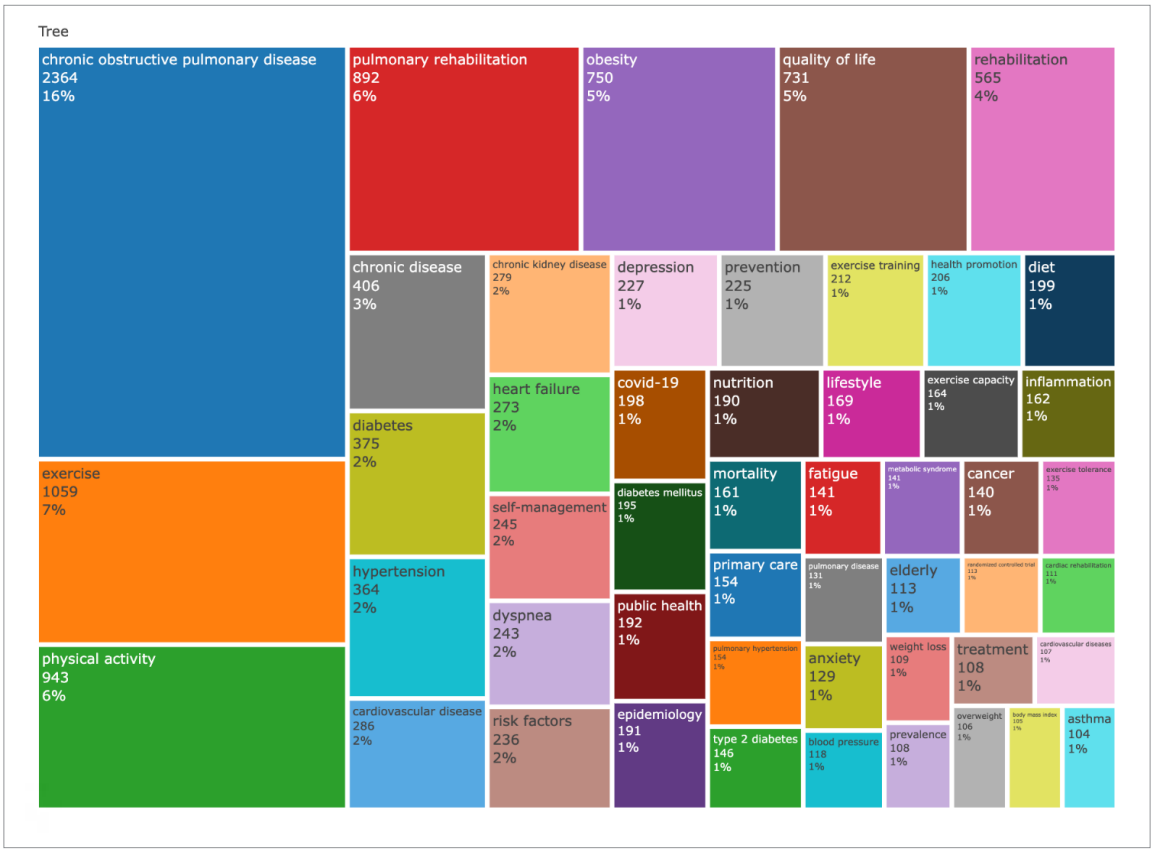

Figure 7. *Treemap Visualization*

Trend Topics

Figure 8 shows how research topics in exercise-based chronic disease management change over time. It emphasizes the emergence, persistence, and decline of major themes. The analysis reveals a shift from clinical investigations to broader, system-level, and technology-driven approaches.

Early research primarily focuses on clinical themes such as exercise training, rehabilitation, and disease-specific management. These topics reflect the field's origins in structured clinical interventions. Their continued

presence shows their lasting importance in building the evidence base for exercise as a therapy.

Recently, topics like digital health and telehealth have emerged. This shift shows a move to technology-driven delivery of exercise interventions. These advances aim to expand access, improve adherence, and address the limitations of traditional rehabilitation.

Simultaneously, greater emphasis on primary care and self-management signals a transition toward patient-centered, integrated care models, in which exercise is incorporated into routine healthcare practice rather than confined to specialized clinical settings. The emergence of COVID-19-related research further demonstrates the field's responsiveness to global health challenges and its capacity to support continuity of care. The increasing use of meta-analysis and network meta-analysis reflects a trend toward consolidating evidence and advancing methodological advancement. The field is synthesizing knowledge to inform clinical guidelines and policy development.

Overall, the field is transitioning from efficacy-focused clinical research to implementation-oriented, technology-supported, and system-integrated approaches. This shift aligns with broader trends in population health and healthcare transformation. Nevertheless, the recent emergence of implementation and technology-focused themes indicates that these areas are still evolving and may not yet be fully integrated into mainstream clinical practice.

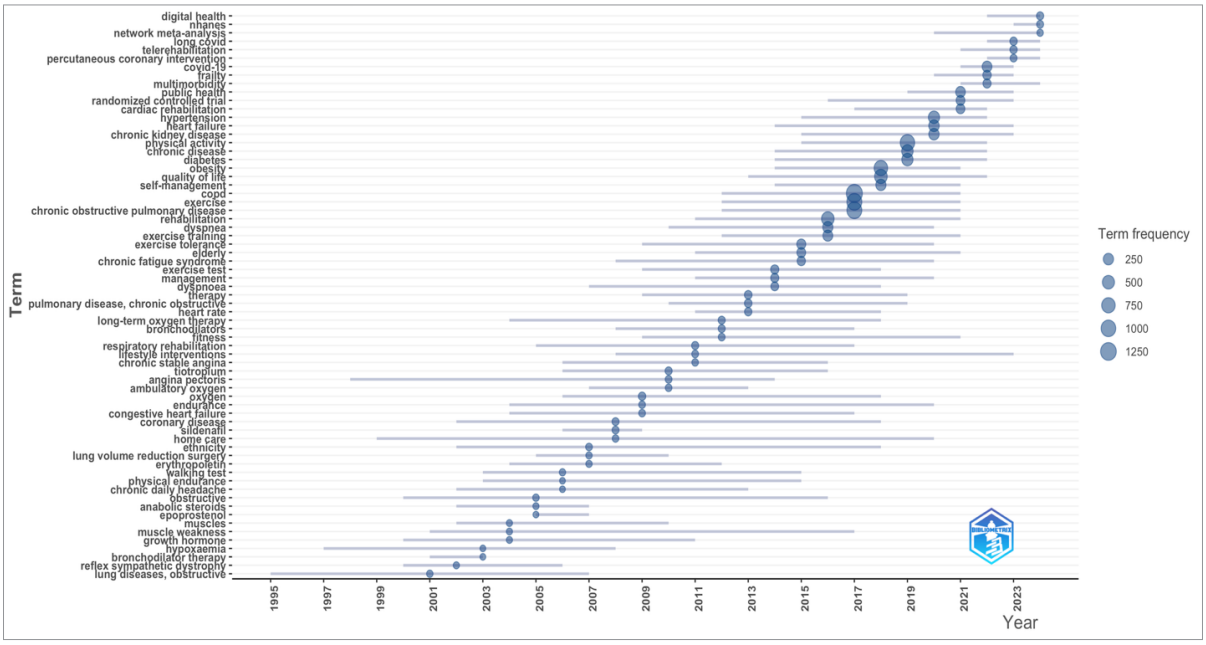

Figure 8. *Trend Topics in the Integration of Exercise into Chronic Disease Management literature (1938–2024)*

Thematic Evolution

Figure 9 synthesizes the conceptual structure and temporal evolution of research on exercise in chronic disease management through (a) a keyword co-occurrence network, (b) overlay visualization, and (c) thematic evolution analysis. Together, these visualizations provide a comprehensive look at how the field is structured, interconnected, and changing over time.

The co-occurrence network (Figure 9a) reveals a densely interconnected conceptual structure. Physical activity occupies a central position and links multiple chronic disease domains, including COPD, hypertension, and heart failure. This centrality shows that exercise acts as a unifying therapeutic concept across diverse

clinical conditions. It reinforces the role of exercise as a core component of chronic disease management.

The overlay visualization (Figure 9b) shows a temporal shift in research focus. Focus has moved from disease-specific, clinically oriented themes to prevention, self-management, mortality, and population-level outcomes. This change reflects a shift from specialized clinical interventions to public health and system-level perspectives.

The thematic evolution analysis (Figure 9c) further demonstrates a progression from early, disease-centered research toward more complex and integrated themes, including multimorbidity, public health, and emerging topics such as COVID-19. This evolution indicates a growing recognition of the need for holistic, adaptable approaches to chronic disease management.

Overall, the combined analyses illustrate that the field is transitioning from fragmented, disease-specific research toward a more integrated, interconnected knowledge system, in which exercise serves as a central linking concept across clinical, behavioral, and population health domains. Despite this increasing integration, the persistence of disease-specific clusters suggests that full conceptual convergence across disciplines has not yet been fully achieved.

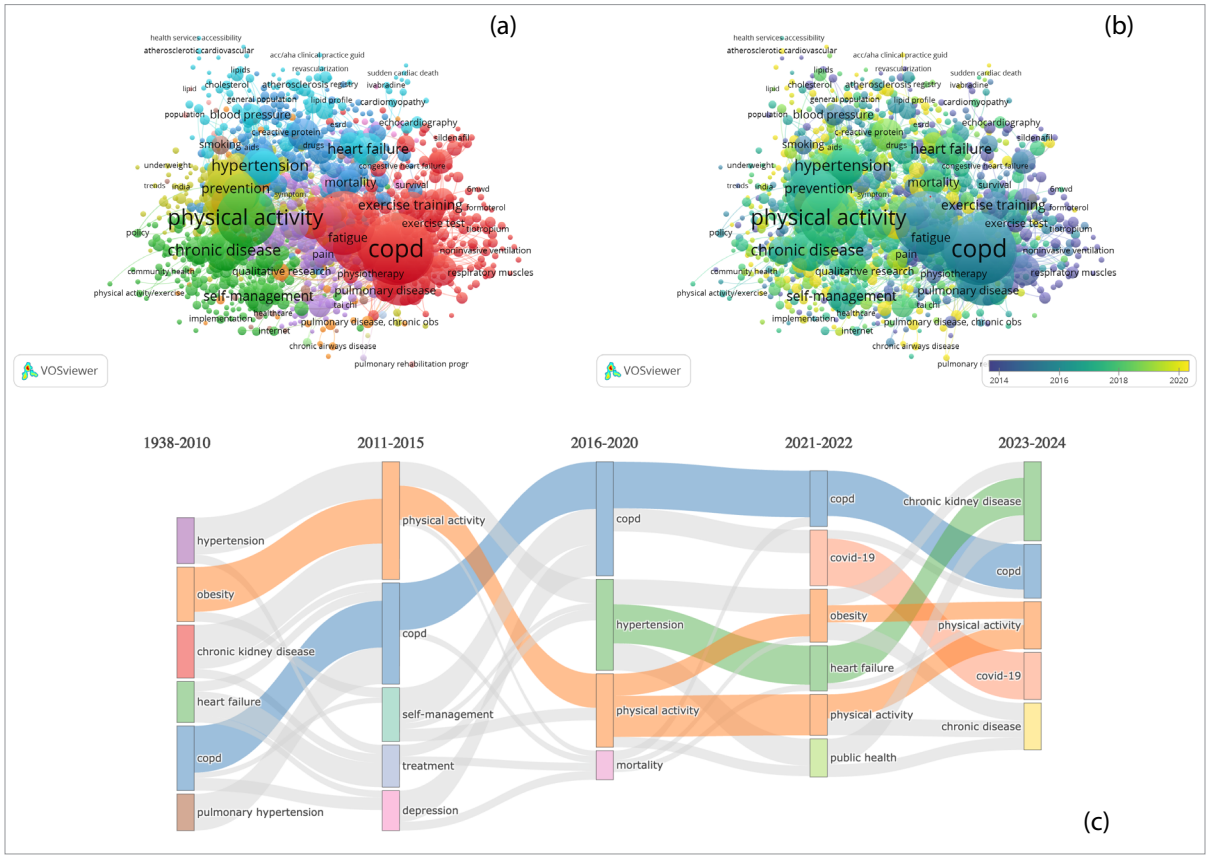

Figure 9. *Keywords Co-occurrence through (a) Network Analysis, (b) Overlay Analysis, and (c) Thematic Evolution of Research Topics in Exercise-based Chronic Disease Management*

Factorial Map: Multiple Correspondence Analysis (MCA)

Figure 10 presents the conceptual structure of the research field, derived from multiple correspondence analysis (MCA). The researchers organize the distinct thematic clusters along two principal dimensions. The

spatial distribution of these clusters reflects conceptual differentiation and underlying relationships among research themes in exercise-based chronic disease management.

One cluster is centered on physical activity, lifestyle, prevention, obesity, diabetes, and chronic disease, representing a population health and prevention-oriented domain. This cluster emphasizes the role of exercise as a behavioral and preventive strategy to reduce disease risk and to promote long-term health outcomes.

A second cluster focuses on pulmonary rehabilitation and chronic respiratory disease, anchored by COPD, exercise training, dyspnea, and quality of life. The finding reflects the field's clinical and rehabilitation foundation, in which structured exercise interventions are applied in specialized care settings.

A third cluster encompasses cardiovascular and metabolic conditions. These include hypertension, heart failure, chronic kidney disease, and public health. The cluster indicates a broad clinical expansion of exercise-based interventions across major chronic disease categories.

The fourth, smaller cluster focuses on health promotion and nutrition, highlighting complementary lifestyle interventions that go beyond physical activity alone. This cluster suggests an emerging holistic approach to chronic disease management that integrates multiple behavioral and preventive strategies.

The relative positioning and overlap among clusters show that the field is organized into distinct thematic domains. There is increasing conceptual convergence among clinical rehabilitation, public health, and lifestyle-based approaches. However, the persistence of clearly defined clusters suggests that disciplinary boundaries remain, indicating that full integration across clinical, public health, and behavioral domains is still evolving.

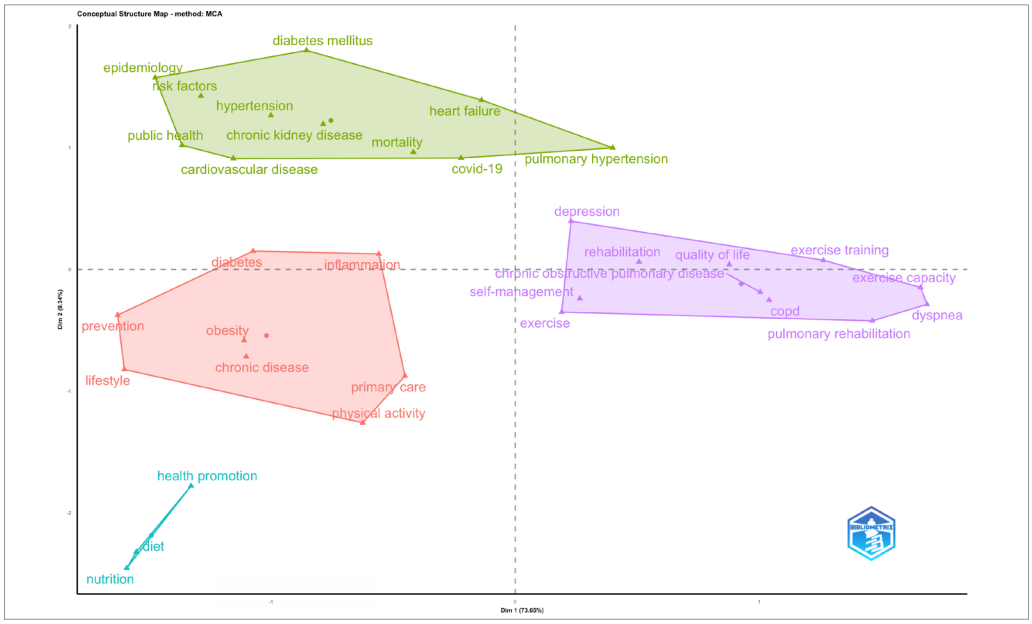

Figure 10. *Conceptual Structure of the Research Field based on a Four-clustered Multiple Correspondence Analysis*

DISCUSSION

This scientometric analysis offers a structural perspective on the evolution of research concerning exercise in chronic disease management, identifying patterns that extend beyond mere increases in publication output. The concentration of research productivity in high-income countries, particularly the United States, the United Kingdom, Canada, Australia, and Western Europe, highlights persistent structural inequalities in global scientific production. Countries that occupy central positions in international collaboration networks

also exhibit greater citation impact and institutional productivity, indicating that research visibility and influence are closely associated with access to established research infrastructures, funding mechanisms, and enduring academic networks (Adams, 2013; Wagner et al., 2017). These patterns align with the core–periphery structure commonly observed in global scientific collaboration, where a limited number of highly connected countries serve as primary hubs for knowledge production and dissemination (Leydesdorff & Wagner, 2008).

This concentration has significant implications for the field's future development. When research output is dominated by a small number of scientific hubs, research priorities and methodological approaches often reflect the healthcare systems and population contexts of those regions. Therefore, expanding international collaboration and enhancing research capacity in low- and middle-income countries may be essential to ensure that exercise-based interventions are adaptable across diverse healthcare systems and sociocultural contexts.

Citation structures further illustrate how intellectual authority is organized within the field. The predominance of cardiovascular and respiratory clinical guidelines among the most highly cited publications indicates that the knowledge base of exercise-related chronic disease research is strongly anchored in consensus-driven clinical frameworks. Guideline publications often accumulate substantial citation influence because they synthesize extensive empirical evidence and serve as authoritative reference points for both clinical practice and future research (Waltman, 2016). Consequently, the disciplines responsible for producing these guidelines, particularly cardiology and respiratory medicine, play a central role in shaping the field's intellectual trajectory. This concentration of citation influence also reflects cumulative advantage mechanisms described in the sociology of science, whereby highly visible publications and journals continue to attract disproportionate scholarly attention over time (Merton, 1968).

This pattern suggests that guideline-driven knowledge structures significantly influence the conceptualization and evaluation of exercise interventions within clinical contexts. While these guidelines provide essential evidence-based frameworks, they may also reinforce disciplinary dominance within specific medical specialties. Future research could benefit from increased interdisciplinary collaboration among rehabilitation science, public health, behavioral medicine, and implementation science to broaden the conceptual scope of exercise-based healthcare interventions.

The thematic structure of the literature underscores the clinical foundations of exercise-based research on chronic diseases. Keyword co-occurrence patterns and treemap visualizations indicate that dominant research clusters focus on chronic obstructive pulmonary disease, pulmonary rehabilitation, cardiometabolic disorders, and exercise training interventions. These disease domains were among the earliest clinical contexts in which exercise therapy was systematically integrated into treatment protocols. The sustained prominence of these themes suggests that cardiopulmonary rehabilitation has provided a foundational platform for the scientific development of exercise-based healthcare interventions. This orientation also highlights the historical role of rehabilitation sciences in establishing the clinical efficacy and safety of structured exercise programs for individuals with chronic disease (Booth et al., 2012).

The persistence of rehabilitation-oriented themes indicates that much of the evidence base for exercise interventions originates from specialized clinical programs. Although these programs have demonstrated substantial clinical benefits, a key challenge for healthcare systems is translating these interventions into scalable care models that reach larger patient populations. Expanding research beyond specialized rehabilitation settings may be necessary to support the effective integration of exercise-based interventions into routine healthcare delivery.

Temporal analyses further indicate that the field is undergoing a gradual conceptual expansion. Emerging topics such as digital health, telehealth, self-management, and primary care integration point to an increasing recognition that exercise interventions must extend beyond specialized rehabilitation settings to achieve broader population-level health impact. Additionally, digital technologies and remote monitoring systems

are under investigation as strategies to scale exercise interventions and facilitate sustained behavioral change among patients with chronic conditions (Bi et al., 2024).

These developments have important implications for healthcare systems. Technology-enabled exercise interventions can address common barriers to participation, such as geographic access, cost, and limited availability of specialized rehabilitation services. However, their effectiveness depends on patient engagement, digital literacy, and integration within existing healthcare infrastructures. Future research should focus not only on technological innovation but also on strategies that promote sustained patient adherence and equitable access to digital health solutions.

The increasing prominence of implementation-oriented research further reflects this transition. Contemporary implementation science frameworks emphasize that the public health impact of clinical interventions depends on their efficacy, scalability, adoption within healthcare systems, and long-term sustainability (Glasgow et al., 1999). For exercise-based interventions, integrating physical activity promotion into routine healthcare practice requires addressing organizational, behavioral, and systemic barriers within clinical settings (Silva et al., 2023). Implementation research suggests that the next phase of scientific development in the field may focus increasingly on health system integration. Strategies such as exercise prescription in primary care, community-based rehabilitation models, and interdisciplinary care pathways may play a critical role in translating evidence-based exercise interventions into sustainable healthcare practices.

Collaboration patterns observed in the author and country networks reveal similar structural dynamics. Highly productive research groups and institutions tend to form dense collaboration clusters, often centered within well-established academic medical centers. In contrast, many low- and middle-income countries remain peripheral to international collaboration networks, contributing fewer publications and exhibiting lower levels of cross-national research partnerships (Adams, 2013; Wagner et al., 2017).

These disparities have significant implications for global health equity. As the burden of chronic diseases rises in many underrepresented regions, strengthening international research partnerships and supporting collaborative capacity-building initiatives may be essential to ensure that exercise-based healthcare strategies are adaptable to diverse healthcare environments and resource settings (World Health Organization, 2023).

Overall, the findings suggest that research on exercise in chronic disease management has achieved considerable maturity within clinically oriented rehabilitation domains while simultaneously entering a phase of conceptual diversification. Early research primarily focused on establishing the therapeutic efficacy of exercise interventions for specific disease populations. More recent developments indicate growing attention to prevention, digital health integration, patient self-management, and health-system implementation. This evolution reflects a broader shift in healthcare research from efficacy-focused intervention studies toward implementation-oriented approaches that translate evidence-based interventions into routine clinical practice and population-level health strategies (Glasgow et al., 1999; Silva et al., 2023).

Structural Barriers to Integrating Exercise is Medicine

Research continues to highlight the growing role of exercise as a form of medicine; however, integrating the Exercise is Medicine (EIM) paradigm into healthcare systems remains constrained by several structural barriers.

Funding limitations continue to hinder large-scale implementation. In many healthcare systems, funding still prioritizes medications and procedures over preventive care or lifestyle-based care (Freeman et al., 2021). As a result, limited reimbursement reduces institutional incentives to incorporate exercise-based interventions into routine clinical practice (Freeman et al., 2021). To promote wider adoption, financing reforms such as bundled payments and value-based reimbursement models may be considered, as these approaches align financial incentives with patient outcomes and support preventive care.

Another challenge lies in policy misalignment, which often limits how exercise is integrated at the system level. Although physical activity is promoted through global and national initiatives, these efforts are not consistently embedded within formal healthcare delivery systems (Rennie et al., 2020). The absence of

standardized clinical pathways for exercise prescription further contributes to fragmented and inconsistent implementation across settings (Silva et al., 2023).

A further issue is the limited capacity of the healthcare workforce. Many healthcare professionals receive limited training in exercise prescription, behavioral counseling, and interdisciplinary care coordination (Coombes et al., 2021). This limitation constrains the translation of evidence into practice. Addressing this issue requires strengthening workforce development through curriculum integration, continuing education, and professional certification in exercise-based care.

Fragmentation between healthcare and community systems further limits the reach and sustainability of exercise interventions. These interventions are often confined to specialized rehabilitation programs and are rarely integrated into primary care or community-based services (Pavey et al., 2011).

Addressing these barriers requires coordinated strategies, including financing reforms that support preventive care, policy alignment to integrate exercise into clinical pathways, workforce development initiatives, and stronger linkages between healthcare systems and community-based programs.

Taken together, these barriers point to a persistent gap between evidence generation and system-level implementation. Although exercise-based interventions are well supported by clinical research, their integration into routine healthcare remains fragmented due to misaligned financing, policy, and workforce structures. In response, a coherent systems-oriented approach is needed. This study, therefore, proposes a conceptual framework to guide the integration of exercise-based interventions into healthcare systems.

The proposed framework consists of three interconnected levels that support the translation of evidence into practice and promote population-level impact.

At the clinical level, exercise is integrated into routine healthcare through standardized assessment, prescription, and referral processes. Physical activity is treated as a vital sign, and exercise prescriptions are incorporated into clinical workflows and electronic health records, establishing exercise as a structured component of patient care.

At the broader system level, institutional and policy structures support the implementation of exercise-based interventions. This includes aligning clinical guidelines, reimbursement systems, and interdisciplinary care models to facilitate collaboration among healthcare providers.

Beyond clinical settings, care is extended by connecting patients to community-based programs, digital health platforms, and self-management resources. This supports long-term adherence, improves accessibility, and enhances the sustainability of interventions.

These three levels are supported by enabling mechanisms such as workforce development, digital health infrastructure, and cross-sector partnerships. For instance, digital platforms can facilitate the exchange of patient data and enable remote monitoring, while partnerships between healthcare providers and community organizations can expand access to structured exercise programs. Such coordination ensures continuity of care and supports the scaling of interventions from clinical to community settings.

This framework aligns with global initiatives such as Exercise is Medicine, which promote physical activity in clinical practice. However, it extends beyond these efforts by positioning exercise within a broader, system-level care model. By conceptualizing exercise as both a clinical intervention and a population health strategy, the framework supports scalable, equitable, and sustainable healthcare implementation. It also enables adaptation in low-resource settings through strategies such as task-shifting, mobile health technologies, and community-based partnerships, ensuring broader accessibility and relevance across diverse populations.

CONCLUSION

This study provides a comprehensive, system-level evaluation of the global research landscape regarding exercise in chronic disease management. The field is characterized by sustained growth and a robust clinical foundation, with research production and collaboration primarily concentrated within high-income nations,

including the United States, the United Kingdom, Canada, Australia, and Western Europe. This geographic concentration reflects persistent structural inequalities in global scientific capacity, which continue to shape research visibility and agenda-setting. While the intellectual structure remains firmly anchored in clinically oriented, guideline-driven research influenced by established medical specialties, the field is undergoing a notable thematic evolution. The emergence of digital health, telehealth-based rehabilitation, self-management, and primary care integration signals a strategic shift toward population-health approaches and systemic implementation. These findings suggest that, while exercise-based interventions are well established in clinical rehabilitation, future research should prioritize scalable, technology-enabled, and interdisciplinary strategies to facilitate the broader integration of exercise into global healthcare systems for chronic disease prevention and management.

Funding
This research received no external funding.

Ethical Approval
This study utilized publicly available bibliographic data and did not involve human participants; therefore, ethical approval was not required.

Competing interest
The author declares no conflicts of interest.

Data Availability
Data will be made available by the corresponding author on request.

Declaration of Artificial Intelligence Use
In this work, the author utilized artificial intelligence (AI) tools, specifically ChatGPT, to assist with language editing and improving clarity. The author reviewed and edited the output carefully and assumes full responsibility for the final manuscript.

REFERENCES

Adams, J. (2013). The fourth age of research. Nature, 497(7451), 557–560. https://doi.org/10.1038/497557a
American College of Sports Medicine. (n.d.). Exercise is medicine®. https://www.exerciseismedicine.org/
Anderson, E., & Durstine, J. L. (2019). Physical activity, exercise, and chronic diseases: A brief review. Sports Medicine and Health Science, 1(1), 3–10. https://doi.org/10.1016/j.smhs.2019.08.006
Aria, M., & Cuccurullo, C. (2017). Bibliometrix: An R-tool for comprehensive science mapping analysis. Journal of Informetrics, 11(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007
Bi, S., Yuan, J., Wang, Y., Zhang, W., Zhang, L., Zhang, Y., Zhu, R., & Luo, L. (2024). Effectiveness of digital health interventions in promoting physical activity among college students: Systematic review and meta-analysis. Journal of Medical Internet Research, 26, e51714. https://doi.org/10.2196/51714
Booth, F. W., Roberts, C. K., & Laye, M. J. (2012). Lack of exercise is a major cause of chronic diseases. Comprehensive Physiology, 2(2), 1143–1211. https://doi.org/10.1002/cphy.c110025
Colberg, S. R., Sigal, R. J., Yardley, J. E., Riddell, M. C., Dunstan, D. W., Dempsey, P. C., Horton, E. S., Castorino, K., & Tate, D. F. (2016). Physical activity/exercise and diabetes: A position statement of the American Diabetes Association. Diabetes Care, 39(11), 2065–2079. https://doi.org/10.2337/dc16-1728
Coombes, J. S., Williams, A., & Radford, J. (2021). Training health professionals to provide physical activity counselling. Progress in Cardiovascular Diseases, 64, 76–82. https://doi.org/10.1016/j.pcad.2020.12.005
Cormie, P., Zopf, E. M., Zhang, X., & Schmitz, K. H. (2017). The impact of exercise on cancer mortality, recurrence, and treatment-related adverse effects. Epidemiologic Reviews, 39(1), 71–92. https://doi.org/10.1093/epirev/mxx007
Ding, D., Ramirez Varela, A., Bauman, A. E., Ekelund, U., Lee, I-Min., Heath, G., Katzmarzyk, P. T., Reis, R., & Pratt, M. (2020).

Towards better evidence-informed global action: Lessons learnt from the Lancet series and recent developments in physical activity and public health. British Journal of Sports Medicine, 54(8), 462–468. https://doi.org/10.1136/bjsports-2019-101001

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. Journal of Business Research, 133, 285–296. https://doi.org/10.1016/j.jbusres.2021.04.070

Freeman, K. J., Grega, M., Friedman, S., Patel, P., Stout, R., Campbell, T., Tollefson, M., Lianov, L., Pauly, K., Pollard, K., & Karlsen, M. (2021). Lifestyle medicine reimbursement: A proposal for policy priorities informed by a cross-sectional survey of lifestyle medicine practitioners. International Journal of Environmental Research and Public Health, 18(21), 11632. https://doi.org/10.3390/ijerph182111632

Hernández-Beltrán, V., Espada, M. C., Santos, F. J., Ferreira, C. C., & Gamonales, J. M. (2023). Documents publication evolution (1990–2022) related to physical activity and healthy habits, a bibliometric review. Healthcare (Basel), 11(12), 1669. https://doi.org/10.3390/healthcare11121669

Glasgow, R. E., Vogt, T. M., & Boles, S. M. (1999). Evaluating the public health impact of health promotion interventions: The RE-AIM framework. American Journal of Public Health, 89(9), 1322–1327. https://doi.org/10.2105/ajph.89.9.1322

Leydesdorff, L., & Wagner, C. S. (2008). International collaboration in science and the formation of a core group. Journal of Informetrics, 2(4), 317–325. https://doi.org/10.1016/j.joi.2008.07.003

Lobelo, F., Stoutenberg, M., & Hutber, A. (2014). The exercise is medicine global health initiative: A 2014 update. British Journal of Sports Medicine, 48(22), 1627–1633. https://doi.org/10.1136/bjsports-2013-093080

Merton, R. K. (1968). The matthew effect in science: The reward and communication systems of science are considered. Science, 159(3810), 56–63. https://doi.org/10.1126/science.159.3810.56

Pavey, T. G., Taylor, A. H., Fox, K. R., Hillsdon, M., Anokye, N., Campbell, J. L., Foster, C., Green, C., Moxham, T., Mutrie, N., Searle, J., Trueman, P., & Taylor, R. S. (2011). Effect of exercise referral schemes in primary care on physical activity and improving health outcomes: Systematic review and meta-analysis. BMJ, 343, d6462. https://doi.org/10.1136/bmj.d6462

Pedersen, B. K., & Saltin, B. (2015). Exercise as medicine – evidence for prescribing exercise as therapy in 26 different chronic diseases. Scandinavian Journal of Medicine & Science in Sports, 25(S3), 1–72. https://doi.org/10.1111/sms.12581

Rebar, A. L., Stanton, R., Geard, D., Short, C., Duncan, M. J., & Vandelanotte, C. (2015). A meta-meta-analysis of the effect of physical activity on depression and anxiety in non-clinical adult populations. Health Psychology Review, 9(3), 366–378. https://doi.org/10.1080/17437199.2015.1022901

Rennie, K., Ahern, A., King, B., Spillman, L., Hartley, P., Lawlor, E., & Wareham, N. (2020). Integration of physical activity promotion within primary and secondary care settings: Rapid evidence review and lessons from practice case studies. Public Health England. https://doi.org/10.17863/cam.64187

Sallis, R. E. (2009). Exercise is medicine and physicians need to prescribe it! British Journal of Sports Medicine, 43, 3–4. https://doi.org/10.1136/bjsm.2008.054825

Silva, C. S., Godinho, C., Encantado, J., Rodrigues, B., Carraça, E. V., Teixeira, P. J., & Silva, M. N. (2023). Implementation determinants of physical activity interventions in primary health care settings using the TICD framework: A systematic review. BMC Health Services Research, 23(1). https://doi.org/10.1186/s12913-023-09881-y

van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. Scientometrics, 84(2), 523–538. https://doi.org/10.1007/s11192-009-0146-3

Wagner, C. S., Whetsell, T. A., & Leydesdorff, L. (2017). Growth of international collaboration in science: Revisiting six specialties. Scientometrics, 110(3), 1633–1652. https://doi.org/10.1007/s11192-016-2230-9

Waltman, L. (2016). A review of the literature on citation impact indicators. Journal of Informetrics, 10(2), 365–391. https://doi.org/10.1016/j.joi.2016.02.007

Warburton, D. E. R., & Bredin, S. S. D. (2017). Health benefits of physical activity: A systematic review of current systematic reviews. Current Opinion in Cardiology, 32(5), 541–556. https://doi.org/10.1097/hco.0000000000000437

World Health Organization. (2022). Global status report on physical activity 2022. https://www.who.int/publications/i/item/9789240059153

World Health Organization. (2023). WHO report on the global tobacco epidemic, 2023: Protect people from tobacco smoke. https://www.who.int/publications/i/item/9789240077164

How to cite this article:
Codod, C. L. C. (2026). Scientific mapping of exercise integration in chronic disease management: Systemic pathways toward equitable and sustainable population health. *Recoletos Multidisciplinary Research Journal, 14*(1), 83–106. https://doi.org/10.32871/rmrj2614.01.07