Section: Miscellaneous

Review Article

LEADERSHIP IN HEALTHCARE: A BIBLIOMETRIC ANALYSIS FOR ADVANCING PATIENT OUTCOMES AND TRANSFORMING EDUCATION (2001–2024)

Ruchira Sethi[1], Suparna Kapoor[2], Alok Tripathi[3]

[1]*Professor, Department of Anatomy & Principal UNS Autonomous State Medical College, Jaunpur, India.*
[2]*Industry Practitioner and Research Scholar, XLRI, Jamshedpur, India.*
[3]*Professor, Department of Surgery, Baba Kinaram Autonomous State Medical College, Chandauli, India*

Received *: 24/03/2025*
Received in revised form *: 29/05/2025*
Accepted *: 17/06/2025*

Corresponding Author:
Dr. Ruchira sethi
[1]Professor, Department of Anatomy & Principal UNS Autonomous State Medical College, Jaunpur, India
Email: ruchirasethi@gmail.com

DOI: 10.70034/ijmedph.2025.2.476

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (2); 2625-2634

ABSTRACT

Leadership in healthcare sector is a process of influencing, guiding, and empowering individuals, teams, and organizations to achieve shared goals that enhance patient outcomes and foster innovation and excellence in education. Leadership in this context emphasizes strategic decision-making, collaboration, and development of an environment that supports continuous learning, evidence-based practices, and transformative change in healthcare and related educational systems. However, the evolution of this field and its global research impact remain underexplored. This study conducts a bibliometric analysis to identify trends, research impacts, and key developments in Medical Leadership (ML) between the time period of 2001-2024. We analyzed data from Scopus database, focusing on publication volume, citation trends, regional contributions, leading authors, journals, and institutions. Social network analysis was used to assess trends and collaboration patterns, while keyword co-occurrence and thematic mapping helped identify emerging research hotspots. A total of 293 articles were accessed for interpretation on Vos Viewer and Biblioshiny tool for analysis. There is a steady increase in publications and citations for medical leadership published research. Regional analyses show that the United Kingdom, the United States, and select Asian countries are leading contributors. Key themes include transformational leadership, mentoring, curriculum, empathy and well-being. Collaboration networks indicate strong ties between institutions of high-income countries, while thematic analysis highlights an evolving focus on leadership centered curriculum development and patient-centered leadership. The findings offer valuable insights for researchers, practitioners, and policymakers aiming to enhance leadership efficacy in healthcare systems.

Keywords: #bibliometrics, #citation metrics, #clinical governance, #competency framework, #curriculum planning, #educational leadership, #gender equity, #healthcare, #leadership, #medical education.

INTRODUCTION

Leadership in healthcare sector is a process of influencing, guiding, and empowering individuals, teams, and organizations to achieve shared goals that enhance patient outcomes and foster innovation and excellence in education. Medical leadership (ML) plays a crucial role in shaping the healthcare systems, particularly in a country like India, which faces unique challenges such as a large population, varying healthcare infrastructure, and a significant burden of disease.[1,2] As healthcare becomes increasingly complex, the role of medical professionals as leaders in both clinical and administrative settings has become more critical.[3-5] Key reasons for why leadership is necessary in medical sector include patient outcome and safety, navigating medical complexity, team co-ordination and collaboration, resource management, adaptation to change and many others. However, ML in India remains fragmented and under-considered compared to other regions. A study by Gulati K in the year 2019

suggested statistically significant "leadership competency gap" for all 30 leadership competencies in public and private sector in India,[6] Medical leadership is still an emerging field, yet it remains underexplored and bibliometric analysis appears to be essential in identifying and addressing competency gaps in medical leadership which can provide insights to guide targeted training and development efforts. Conducting a bibliometric study from all parts of the globe, can provide a comprehensive overview of the current literature, including the amount of research produced, publication sources, and key contributors.[7] By examining trends over time, this analysis can reveal gaps in the literature, such as the under-explored areas of leadership in rural healthcare, women's leadership, and gender equality in leadership positions.[8-10] These insights can help guide future research directions in the field. It allows for the identification of the most influential studies, authors, and journals in the field of medical leadership. Understanding which works have had the most significant impact on the field can help medical professionals, policymakers, and researchers focus on critical evidence and benchmark best practices. By recognizing influential authors and institutions, the study can also highlight leading experts and research centres, paving the way for greater collaboration and dissemination of knowledge. Leadership in healthcare is not developed in isolation, and collaboration across institutions, regions, and even countries is critical. A bibliometric analysis can reveal important collaboration networks and partnerships between researchers, institutions, and countries. It can also show where healthcare system stands with respect to leadership curriculum and whether there is a need to strengthen international collaborations. Understanding the citation impact of research on medical leadership helps gauge the field's influence on healthcare practices and policies, which can help shape the future of healthcare in developing countries like India. High citation counts may indicate that certain studies or areas of research are shaping the leadership landscape, while low-citation topics might indicate areas that require more attention or dissemination.

India's healthcare system is in need of effective leadership to navigate its challenges, including healthcare access, quality, and equity.[11,12] By examining research on leadership practices, training and development, this study can provide critical insights for policymakers and educational institutions. The analysis can inform leadership training programs by highlighting key competencies and skills that are frequently discussed in the literature, thus contributing to the development of future healthcare leaders. Understanding the state of research in medical leadership can help pinpoint areas of healthcare systems and leadership which can be strengthened, ensuring that medical professionals are equipped with the necessary skills to lead effectively, particularly in a rapidly changing healthcare environment. By identifying competencies, best practices and successful leadership models, this study can indirectly support efforts to improve healthcare management and policy implementation globally. This bibliometric analysis is an attempt to explore the vast domain of leadership in context of medicine and healthcare, using bibliometric analytical tools and analyze the publication and citation trends in Medical Leadership over the last two decades, determine the most influential authors, articles, journals, and countries publishing extensively in the domain of Medical Leadership. This study will explore the gaps in current research themes and assess the evolving trends in this domain. Further this will help us define the emerging themes and provide future research directions in the domain of medical leadership.

REVIEW

For doing a bibliometric analysis literature search pertaining to medical, clinical and hospital leadership were searched. The SCOPUS database was selected as the primary data source for this study due to its comprehensive coverage of peer-reviewed literature, extensive metadata, and bibliometric indicators. An initial keyword search using the term "medical leadership" yielded 3,073 documents. This broad search was then refined using a structured Boolean search string:

(TITLE-ABS-KEY ("Medical Leadership" AND "Leader*" OR "Clinical" OR "Medical" OR "Medical school" OR "Hospital"), which resulted in 689 documents.

To further limit the research documents, clear inclusion and exclusion criteria were defined ensuring the relevance, quality, and focus of the dataset. Studies addressing medical leadership across healthcare systems, clinical environments, academic institutions, and health policy were considered. Articles discussing leadership development, training, competency frameworks, and governance in healthcare were included. The selection was further narrowed to research classified under medicine, nursing, and health professions. Review articles and original research published between 2001 and 2024, in English language, including articles in press, were eligible. Studies related to leadership in domains outside healthcare (e.g., business, accounting), articles on clinical/medical research with no leadership focus, and grey literature such as editorials, news articles, opinion pieces, and blogs were excluded.

Following this process, abstracts of the 689 documents were reviewed independently by all the three authors. After a consensus-based screening, 293 documents were finalized for in-depth analysis. The data was extracted as .csv file from Scopus and analyzed using two powerful bibliometric tools: VOS viewer (version 1.6.18) and Biblioshiny. VOS viewer specializes in constructing and visualizing

bibliometric networks, such as those based on citation, bibliographic coupling, co-citation, or co-authorship. Additionally, it incorporates text mining functionality to build and visualize co-occurrence networks of key terms from scientific literature. Biblioshiny, on the other hand, a web interface of the Bibliometrix R-package, offering analysis and visualization across four levels of metrics-sources, authors, documents, and clusters based on coupling. Furthermore, it explores three dimensions of knowledge structures: conceptual, intellectual, and social. The current research landscape for medical leadership can be visualized by active collaborations, dominant research themes, and highly cited works. By analyzing keyword co-occurrence and trends in emerging topics, gaps in the literature can be identified and future research directions can be predicted. Hence, both tools were utilized in the present study to provide a complete analysis of the published research in the area of medical leadership.

The main information acquired from Scopus database is shown in table1.

Table 1: The main information about the data on Medical Leadership

Description	Results
Timespan	2001:2024
Sources (Journals, Books, etc)	95
Documents	293
Annual Growth Rate %	8.1
Document Average Age	6.14
Average citations per doc	7.795
References	6974
DOCUMENT CONTENTS	
Keywords Plus (ID)	1084
Author's Keywords (DE)	418
AUTHORS	
Authors	892
Authors of single-authored docs	45
AUTHORS COLLABORATION	
Single-authored docs	49
Co-Authors per Doc	3.57
International co-authorships %	15.02
DOCUMENT TYPES	
article	246
review	47

A total of 95 sources with an annual growth rate percentage of 8.1% were defined with 246 original research articles and 47 systemic review or meta-analysis. The publication trend over the years is shown in Figure 1 for the period 2001 to 2024.

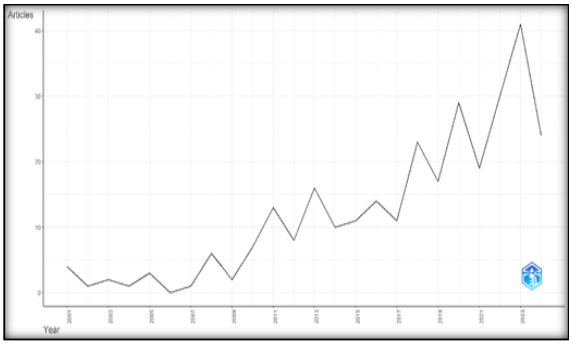

Figure 1: Annual scientific production trends for articles on Medical Leadership (2001-2024)

The scientific production has generally increased over time. In the early years (2001-2006), there were relatively few articles published, with some fluctuations. From around 2008, the number of publications began to rise more sharply, showing an upward trend. The highest peak in production occurred between 2022 and 2023, reaching above 40 articles. In 2024, there seems to be a slight drop from the peak observed in the previous year. The most recent document "Emotionally intelligent themes in medical leaders' decision-making during COVID-19" published in BMJ leader suggests incorporating emotional intelligence competencies into crisis leadership education for healthcare professionals.[13] These competencies could enhance medical leaders' preparedness to adapt, collaborate and communicate effectively in a crisis.

The 10 most globally cited articles by authors are shown in table 2.

Table 2: Top 10 Globally cited articles with number of total citations

Author/Year/ Journal	DOI	Total Citations	TC per year	Normalized TC
(Bismark M, Morris J, et al, 2015)/BMJ Open,[14]	10.1136/bmjopen-2015-009384	116	11.6	4.05
(Warren & Carnall, 2011)/Post Grad Med J,[1]	10.1136/pgmj.2009.093807	107	7.64	8.09

(Sheaff R, Rogers A, et al, 2003)/Sociol Health Illn,[15]	10.1111/1467-9566.00352	69	3.14	2.02
(Clay-Williams R, Ludlow K,et al, 2017)/BMJ Open,[16]	10.1136/bmjopen-2016-014474	67	8.38	5.63
(Wehner MR, Nead KT, et al., 2015)[17]	10.1136/bmj.h6311	61	10.1	2.13
(McAlearney AS, Fisher D, Heiser K, et al, 2005)/Hosp Top,[18]	https://pubmed.ncbi.nlm.nih.gov/16190516/	60	3	2.77
(Clark J, Armit K, 2010)/Leadership in Health Services,[19]	10.1108/17511871011040706	58	3.87	4.32
(Andersson, 2015)/Leadership in Health Services,[20]	10.1108/LHS-04-2014-0032	55	5.7	1.99
(Lloyd-Smith, 2020)/ BMJ Leader,[21]	10.1136/leader-2020-000245	55	11	5.03
(Quince T,Abbas M, Murugesu S, et al, 2014)/BMJ Open,[22]	10.1136/bmjopen-2014-005353	54	4.91	4.43

The highest cited article had 116 citations with 11.60 total citations per year. The article "Reasons and remedies for under-representation of women in medical leadership roles: a qualitative study from Australia" highlights a range of potential barriers to women's leadership in healthcare, categorized into three broad domains: perceptions of capability, capacity, and credibility. It also suggests targeted interventions to foster women-inclusive leadership, aiming to address these challenges and promote gender equity within healthcare systems.[14] Another article by Warren OJ (2011) "Medical leadership: why it's important, what is required, and how we develop it" discusses the lack of leadership credence in comparison to academic abilities.[1] Mentoring, coaching, action learning and networking are some aspects to improvise these abilities for better healthcare delivery systems. The document has total of 107 citation with 7.64 citations per year. The average citation per year trend represented in figure 2 suggests an upward trend maximally between the years 2014-2015.

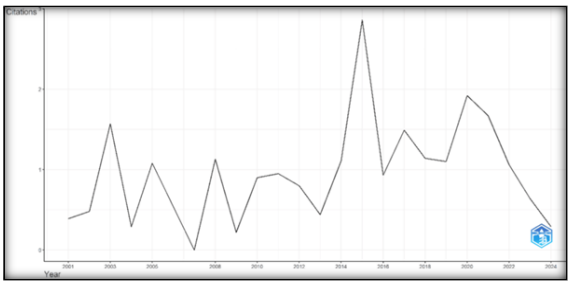

Figure 2: Average citation per year in published documents on Medical Leadership (2001-2024)

A network visualization for published documents with minimum 5 citations delineated 116 documents and of these 55 had largest connecting links. The clustering network (Figure 3) shows 7 clusters.

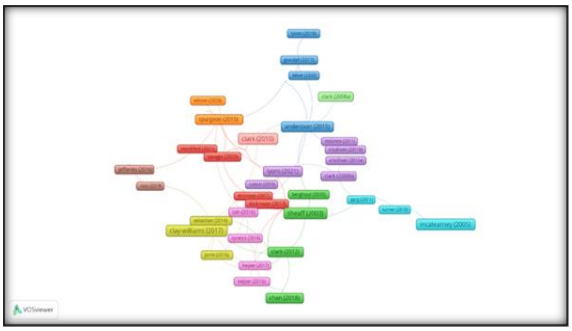

Figure 3: Network visualization for citation of documents by authors

This network visualization represents a citation network of authors, where each node corresponds to an author, and the edges connecting nodes represent citation relationships between them. The size of the nodes indicates the influence or number of citations of the respective authors, while the proximity and clustering of nodes show thematic or collaborative relationships. Authors with stronger connections and more citations are positioned centrally, often forming clusters that signify shared research areas or mutual influence within a particular field. The authors grouped in the Red Cluster work as the Central Theme that is - Organizational Leadership and Quality Improvement. It includes influential authors who focus on leadership practices within healthcare organizations, particularly related to quality improvement, organizational change, and healthcare policy. These works often explore how leadership frameworks affect performance and reform in healthcare systems. The Blue Cluster talks about Health Policy and Leadership Systems, focusing on the role of physicians in leadership and the interplay between clinical practice and management. The Purple Cluster deals with Leadership Competencies and Professional Development. This cluster includes authors whose work revolves around developing leadership competencies, education, and the professionalization of medical leadership. It bridges organizational theory with practical leadership

training and career progression. The Green Cluster delivers concept on Integration of Clinical and Managerial Roles. This cluster represents research focusing on the integration of clinical expertise into leadership roles. These studies often explore the tensions and synergies between clinical and administrative responsibilities in leadership. The Yellow Cluster talks about Patient Safety and Leadership Culture emphasizing leadership's role in fostering patient safety, resilience, and safety culture within healthcare institutions. Healthcare Reform and Policy Implementation is grouped in the Orange Cluster which explore broader themes of leadership in the context of healthcare reforms, public policy implementation, and organizational adaptation to systemic changes. Some isolated cluster works on Conceptual Frameworks. [2,3,16,19,21-25]

The top 10 authors with more than two publications on medical leadership is represented in figure 4.

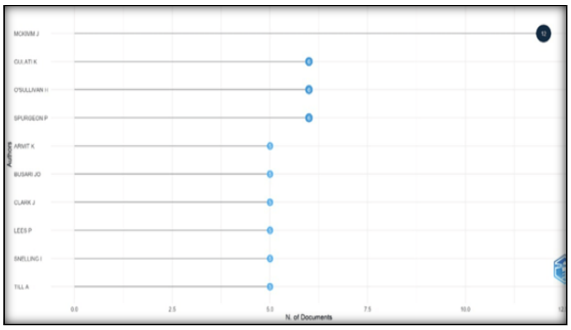

Figure 4: Top 10 most prolific authors in Medical Leadership

Mckimm J has the maximum number of documents published in relation to medical leadership. Apart from 12 published research articles his contribution towards book in leadership management is also significant. [26,27] Gulati K a senior scientist at All India Institute of Medical sciences has published articles on the theme of leadership-roles, goals and challenges in the medical and healthcare industry. His work focuses on addressing the competency gap in medical leadership by promoting leadership training for doctors from the undergraduate level onward, aiming to strengthen their leadership skills and improve patient care outcomes. [9,28-30]

The author's H index graph (figure 5) shows the local impact of the authors.

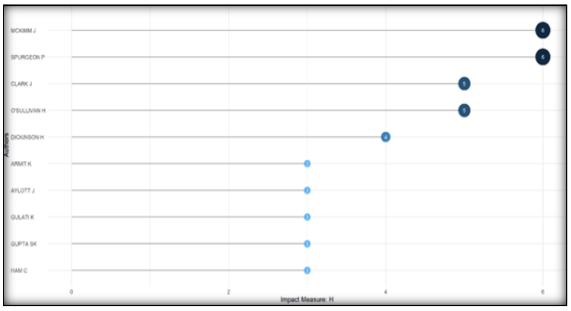

Figure 5: Authors' local impact via H-index

The citation network for authors is represented in figure 6.

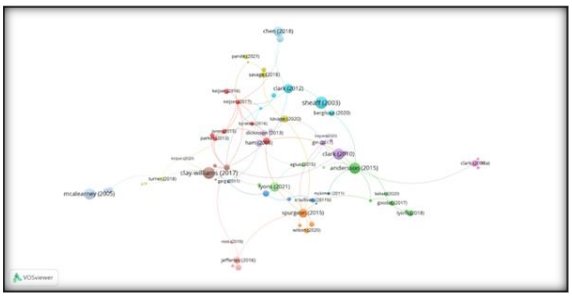

Figure 6: Citation dynamics of authors

This network visualization represents a citation network of authors, highlighting relationships based on how often they cite each other. Each node corresponds to an author, and the edges represent citation relationships. The clusters, differentiated by colors, indicate thematic or collaborative groups within the field. Larger nodes represent authors with more citations, suggesting higher influence or prominence in the field. The lines between nodes indicate citation relationships, with thicker or denser connections signifying stronger citation links. The peripheral nodes like McAlearney (2005) may highlight specialized or independent research while central nodes like Clark (2010) and Sheaff (2003) indicate foundational contributions. [15,19,20] Dense connections within clusters signify strong collaboration or thematic focus, while inter-cluster links indicate interdisciplinary influences.

The top 10 countries in production of research on the topic are shown in table 3 and the figure 7 illustrates the global distribution of published research.

Table 3: Top 10 countries with number of publications

Country	No. of Publications
UK	419
USA	187
CANADA	90
AUSTRALIA	81
NETHERLANDS	37
INDIA	30
IRELAND	16
SWEDEN	12
GERMANY	11
ITALY	11

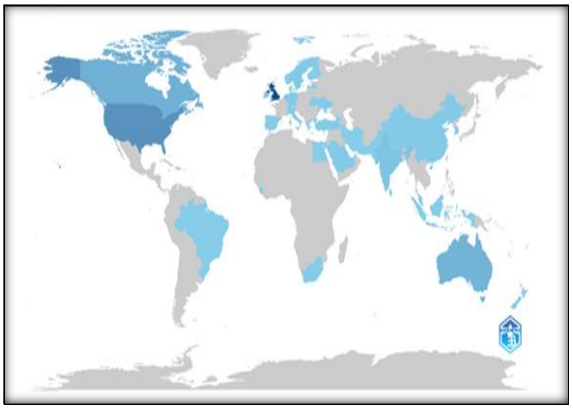

Figure 7: Global representation for production of research on ML; the density of the blue color indicates high production of ML-related publications

The United Kingdom ranks first, followed by USA and Canada in bringing out research in leadership in the field of medicine and healthcare. The collaboration between countries for research area is shown in figure 8.

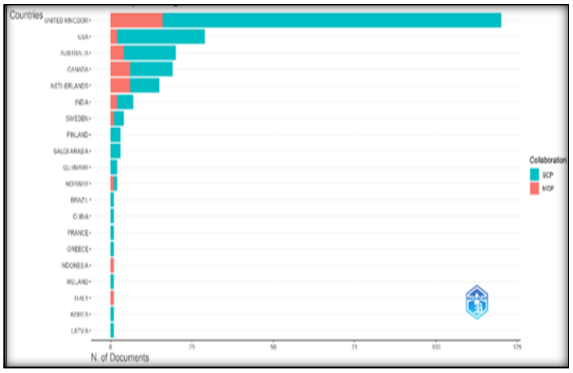

Figure 8: Collaboration Networks of Countries; Collaboration between countries (SCP) and within countries (MCP).

MCP (Multiple Country Publications) shown in orange, represents documents produced with international collaboration between multiple countries. SCP (Single Country Publications) shown in green, represents documents produced within a single country, without international collaboration. United Kingdom has the highest number of documents (~120), with a significant proportion being SCP. There is a smaller amount of international collaboration (MCP). The USA comes second in the number of documents produced, with a higher degree of MCP compared to other countries. Australia, Canada, and Netherlands; these countries also have a substantial number of documents, with a mix of both MCP and SCP. Countries like Sweden, India, Finland, Saudi Arabia, and Germany have fewer publications (between ~5 and 15 documents), with a predominance of SCP. Other countries like Latvia, Korea, and Italy appear at the lower end of the spectrum, contributing a few documents, mostly under SCP. The chart shows a dominance of SCP in scientific production for many countries, particularly the United Kingdom. Countries like the USA and a few others have a more significant portion of their output in MCP.

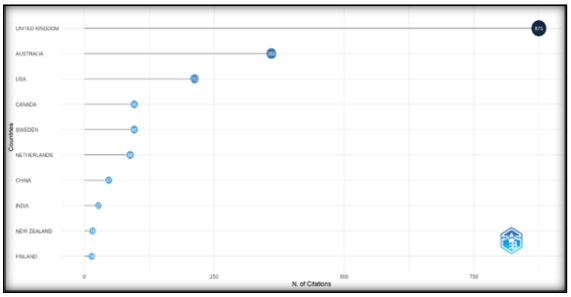

Figure 9: Most cited countries for published research articles on ML

The UK is the most cited country with 875 citations, significantly ahead of the others. This indicates a high impact of their scientific publications. Australia is the second-most cited country, with 360 citations. It stands out as a key contributor to impactful research. The USA comes in third with 212 citations. Canada, Sweden, and the Netherlands have citation counts ranging between 50 and 100. Their publications are moderately cited. China, India, New Zealand, and Finland have relatively fewer citations, ranging from 10 to 30 citations. The UK and Australia lead in terms of the citation impact of their publications, showing their research is highly referenced in the academic community. The USA also has a significant citation count, though less than the UK and Australia. Other countries like Canada, Sweden, and Netherlands have moderate citation counts, while countries such as China and India are among the lower-cited countries in this dataset.

For the total 293 documents, 95 journals were identified. List of top 10 journals with number of published research is shown in figure 10.

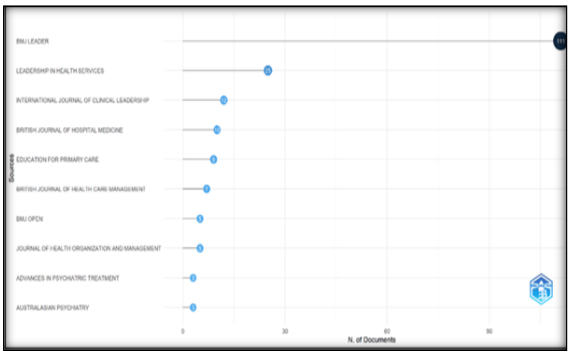

Figure 10: The top 10 journals with published research on leadership in healthcare

The maximum number of articles were published in the leading journal BMJ Leader (n=111). The first three journals are primarily focused on leadership in healthcare system. There were only 8 journals with 5 or more number of research documents on medical leadership. The impact of journals with documents on leadership is shown in figure 11.

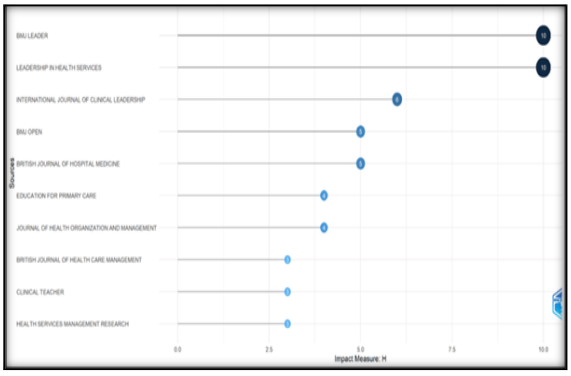

Figure 11: Impact of sources publishing research on medical leadership

The BMJ Leader (with n=111) and Leadership in Healthcare Services (n=25) has an impact of 10, followed by International Journal of Clinical Leadership (n=12) which has an H-index of 6.

The network visualization of journals (figure 12) with at-least one document with minimum one citation resulted in 78 documents that met the threshold and of these 37 items had the largest set of connections grouped into 4 clusters (min cluster size=5), 69 links with total link strength of 112', each representing a thematic or disciplinary grouping of journals.

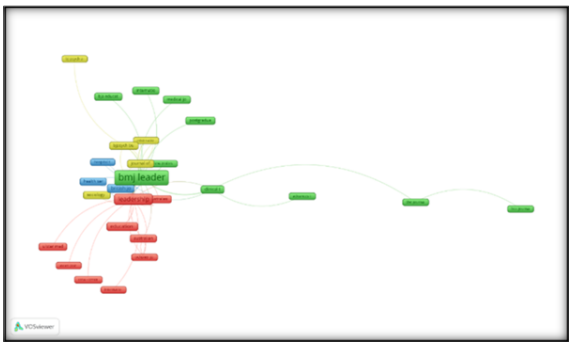

Figure 12: Recent journal-wise trend in Medical Leadership published documents

Green Cluster (e.g., BMJ Leader, Advances in Medical Education) represents journals that are more clinically or practically oriented, with themes surrounding leadership, healthcare management, and professional education. BMJ Leader central to the network, indicating its significant role in the field and strong citation connections to other journals. Dense interlinks with other clusters suggest BMJ Leader acts as a bridge between clusters. Red Cluster (e.g., Leadership, Education) revolves around journals emphasizing leadership, education, and professional training in healthcare. Leadership-related journals are central here, with a strong emphasis on healthcare systems and professional development. Strong internal links suggest a cohesive thematic focus, with some outward connections to BMJ Leader and related journals. Blue Cluster (e.g., British Journal, Health Serve) includes journals with a focus on health services, and broader systemic or interdisciplinary studies in healthcare. These journals connect to leadership and education-focused journals in the red cluster. The proximity to BMJ Leader indicates some overlap in themes related to healthcare leadership and organizational studies. Yellow Cluster (e.g., Medical Journal, International, Postgraduate journal) highlight international perspectives, postgraduate education, and broader medical education themes. This cluster is less densely connected compared to other clusters but maintains thematic relevance through links to BMJ Leader. BMJ Leader is Central to the network, this journal acts as a hub connecting clusters. Its high link strength and numerous connections suggest its pivotal role in the field of healthcare leadership and management. The Red and Blue Clusters are closely related, emphasizing education, leadership, and systemic healthcare themes. The Green Cluster bridges the clinical and practical aspects of healthcare with education and leadership themes. The Yellow Cluster brings in global and postgraduate perspectives, with more specialized focus areas. The total link strength of 112 indicates a moderately dense citation network, with journals within clusters showing strong thematic coherence and occasional interdisciplinary links. Sources' production of time graph (figure13) presented as line chart depicts the cumulative occurrences of documents over time for various sources.

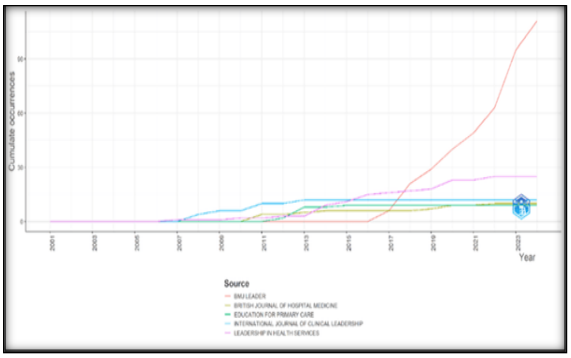

Figure 13: Sources' production over time

BMJ Leader (red line) has experienced a sharp increase in cumulative occurrences since around 2017, with a very steep rise after 2019. By 2023, it has the highest cumulative total, well over 90. Leadership in Health Services (purple line) shows steady growth between 2008 and 2017, after which it levels off and remains stable through 2023. International Journal of Clinical Leadership (blue line) had steady but slower growth between 2009 and 2020, remaining relatively flat after that. Education for Primary Care (green line) and British Journal of Hospital Medicine (yellow line) show relatively flat trends, with minor increases over the years, indicating slower accumulation of documents. Overall, BMJ Leader has shown the most dramatic growth in recent years, while the other sources have shown more moderate or flat trends. The chart provides a visual representation of how each source has contributed to the cumulative occurrences of

documents over time. BMJ Leader stands out as the dominant contributor in recent years.

The overlay visualization for keyword co-occurrence network is shown in figure 14, where different terms are represented as nodes, and connections between them are represented by edges.

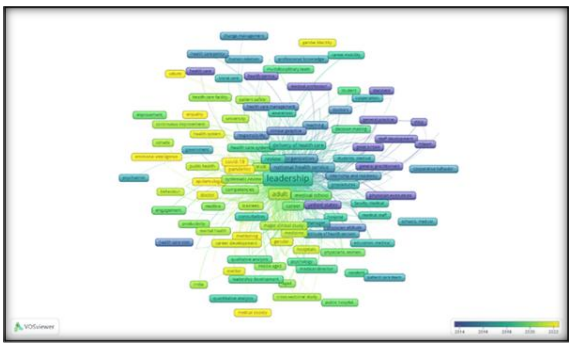

Figure 14: Overlay visualization for keyword co-occurrence

The nodes are color-coded based on the year of occurrence, ranging from 2014 (dark blue) to 2022 (bright yellow), with a gradient shown at the bottom of the chart. The network reveals the evolving focus on leadership in the healthcare field, with clusters of related terms showing areas of emphasis like medical education, management, and clinical leadership. The central keywords shown by larger nodes include Leadership, Medical leadership, Human, Medical education, Male, Female, Physicians, Management, Clinical leadership. These nodes are central to the network, indicating their frequent co-occurrence with other terms in the dataset. Keywords related to leadership and medical leadership are clustered together, associated with terms like "management," "clinical leadership," "learning," "career development," and "communication." The nodes' colors indicate when they became prominent. The keywords that have emerged more recently, such as pandemic, COVID-19, health system, and workplace, are in bright yellow, suggesting an increase in focus on these topics from 2020 onward. In contrast, earlier terms, like organization and management and physician's role, are shaded in darker colors (blue and green), indicating they have been studied consistently over the years. Terms related to gender (male, female), learning, and career development indicate ongoing discussions around gender roles and professional growth within healthcare leadership. The image (figure 14) is a network diagram illustrating various interconnected terms related to medical leadership. The keywords are clustered into different colors, suggesting related groups of terms, reflecting themes or topics in research literature focused on medical leadership. The most central keywords in the visualization (appearing larger) include "leadership," "human," "medical education," "physicians," and "organization and management." These may represent the most frequent or important terms in the dataset, suggesting they are core themes in the analyzed content. The 5 prominent clusters with maximum links are described as: Cluster 1(Red): Focuses on leadership in healthcare and medical systems, with keywords like "leadership," "medical leadership," "health care system," "communication," and "change management." This cluster likely represents themes around organizational management, leadership roles, and the impact on organizational development. Cluster 2(Green): Seems centred around medical education and training, including terms like "medical leadership," "communication," "development," "leadership assessment," and "learning." This cluster is likely related to research on education methodologies, student training, and professional development. Cluster 3 (Blue): Appears to represent themes related to leadership roles in times of pandemics; with words like "empathy", "pandemics", "well-being". Cluster 4(Yellow): Possibly related to professional development in healthcare, with terms like "teaching," "curriculum," "clinical competence". Cluster 5(Purple) focuses on "mentoring", "development", "training". The lines between the keywords show co-occurrences, meaning that the terms are frequently mentioned together in the analysed texts or documents. More connections indicate a higher degree of relatedness between the terms. This network highlights the relationships and thematic areas between different concepts, with a focus on leadership, education, and healthcare management. It can be useful for identifying key research trends or understanding how different topics in the field are interconnected. The figure 15 is a visual representation of how papers and authors are interconnected within a specific research area.

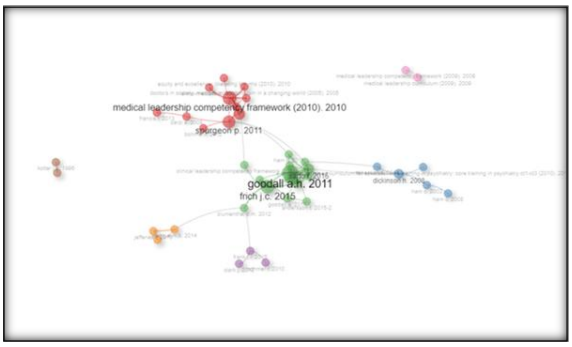

Figure 15: Co-citation analysis for published work

The clustering indicates thematic or research group similarities, and the prominent papers/authors act as key connectors in the intellectual discourse. The bigger and more central nodes represent more frequently cited or influential works. A paper "Physician-leaders and hospital performance: is there an association?" by Goodall A.H. (2011) seems to be a highly influential paper, given its central position and the number of connections.[2] It was an evidence based cross-sectional study with data collected from top 100 US hospitals that discussed the role of

physicians as leaders and aid in improvising the health care delivery. Frich JC (2015) work "Leadership Development Programs for Physicians: A Systematic Review" comprehensively analysed medical literature to explore physician leadership development programs.[31] It focused on examining the program settings, educational content, teaching methods, and the learning outcomes achieved. Notably, the study seems to have strong relevance and connection to other scholarly work in the field, indicating its influence and utility for advancing physician leadership education and training. Another work by Spurgeon P (2012) is important in connecting various groups of research.[32] Medical Leadership Competency Framework introduced by NHS Institute for Innovation and Improvement in planning, delivery and transformational changes in health care system. It discusses in detail the leadership competencies a doctor or a practitioner should acquire for better patient and healthcare outcomes.[33] Leadership and Management for All Doctors explores the role in management and leadership for medical learners and practicing doctors. It covers responsibilities relating to employment issues, teaching and training, planning, using and managing resources and helping to develop and improve services.[34] These documents appear to be the key frameworks or guiding documents in the field, as suggested by their prominence and centrality in the network. Red Cluster: represents publications focusing on competency frameworks and guidelines. Green Cluster indicates studies related to the practical aspects of medical leadership. Blue Cluster includes works on administrative or legislative aspects. Brown, Orange, and Purple Clusters signify other important themes or subfields within medical leadership. The size of each node may represent the number of citations that particular publication has received. Larger nodes likely indicate papers that are highly cited and thus influential within the field. The central nodes (larger and more connected) are key publications that play a significant role in the network. "Medical Leadership Competency Framework (2010)" is a central node in the red cluster, indicating its importance in competency frameworks.[32] "Goodall A.H. (2011)" in the green cluster, likely a key study in practical aspects of medical leadership.[2] The diagram shows how different publications are interlinked through citations, highlighting the flow of knowledge and influence across the field. For example, "Spurgeon P (2011)" is connected to the central red node, indicating its relevance to competency frameworks.[29]

To define the relationship between keywords, authors and journals of the main authors', construction of three -field plots were done (Figure 16).

Figure 16: Tree map for authors, journals, keywords relationship

The height of the blue rectangle being largest suggests the highest representation of the keywords in relation to other items of the map. Higher the significance and frequency of data points, larger the size of the rectangle. "Leadership" is the largest category, occupying 16% of the total, suggesting that it is the most discussed or prevalent theme in the dataset. "Human" (10%) and "Article" (7%) are also significant categories. "Humans" (6%), "Female" (4%), "Male" (4%), "Medical Education" (3%), and "Physician" (3%) are other key terms. The visualization also includes numerous smaller categories related to healthcare, research, demographics, education, and regions such as the "United Kingdom" (2%), "Australia" (1%), and "United States" (1%). Topics such as "Career" (1%), "Pandemic" (1%), "Patient Care" (1%), and "Medical School" (1%) indicate the dataset involves professional, educational, and healthcare topics. Research terms like "Qualitative Research," "Skill," and "Education" are also notable. The tree map effectively shows that the dataset is heavily oriented towards topics related to leadership in healthcare, medical education, and gender distribution (male/female), with strong mentions of regions and health.

CONCLUSION

This bibliometric analysis provides a comprehensive overview of the trajectory, scope, and influence of medical leadership research over the past two decades. Despite the progress made, several gaps persist. Research on medical leadership in underserved and rural settings remains limited. Similarly, the intersection of technology, digital transformation, and medical leadership is still an emerging topic, deserving more robust inquiry. While gender has received considerable attention, diversity beyond gender-including race, socioeconomic background, and intersectionality-remains underexplored. Addressing these gaps is essential for developing robust leadership models that provide effective patient care outcomes. This bibliometric review underscores the strategic importance of leadership in medical and healthcare

contexts. By mapping key contributors, dominant themes, and emerging frontiers, the study provides a solid foundation for future academic inquiry and practical intervention. Strengthening the global ecosystem of medical leadership research will depend on more collaborative, inclusive, and interdisciplinary approaches that can bridge academic knowledge with systemic practice. The insights generated here offer a compelling case for integrating leadership more deeply and deliberately into the fabric of healthcare delivery and education systems worldwide.

REFERENCES

1. Warren O: Carnall R: Medical leadership: why it's important, what is required, and how we develop it. Postgrad Med J. 2011, 87:27-32. 10.1136/pgmj.2009.093807
2. Goodall A H: Physician-leaders and hospital performance: is there an association?. Soc Sci. 2011, 73:535-539. 10.1016/j.socscimed.2011.06.025
3. Spurgeon P, Long P, Clark J, et al.: Do we need medical leadership or medical engagement?. Leadersh Health Serv. 2015, 28:173-84. 10.1108/LHS-03-2014-0029
4. Tasi MC, Keswani A, Bozic KJ: Does physician leadership affect Hospital quality, operational efficiency, and financial performance?. Health Care Manage Rev. 2019, 44:256-62. 10.1097/HMR.0000000000000173
5. Falcone R, Satiani B: Physician as Hospital chief executive officer. Vasc Endovascular Surg. 2008, 42:88-94. 10.1177/1538574407309320
6. Gulati K, Singh AR, Kumar S, et al.: Impact of a leadership development programme for physicians in India. Leadership in Health. 2019, 33:73-84. 10.1108/LHS-05-2019-0027
7. Passas I: Bibliometric Analysis: The Main Steps. Encyclopedia. 2024, 4:1014-1025. 10.3390/encyclopedia4020065
8. Naveen Donthu, Satish Kumar, Debmalya Mukherjee, et al.: How to conduct a bibliometric analysis: An overview and guidelines. Journal of Business Research. 2021, 133:285-296. 10.1016/j.jbusres.2021.04.070
9. Gulati K, Davies J, Gonzalez de la Fuente A, et al.: Striving for equity: exploring gender-inclusive medical leadership in India. BMJ Leader. 2024, 8:318-323. 10.1136/leader-2023-000970
10. Sabarwal S, Lamb J, Bhan S, et al.: Comparing barriers and enablers of women's health leadership in India with East Africa and NorthAmerica. The. Lancet Regional Health - Southeast Asia. 2023, 15:100239. 10.1016/j.lansea.2023.100239
11. Patel V, Mazumdar-Shaw K, Kang G, et al.: Reimagining India's health system: a Lancet Citizens' Commission.. The Lancet. 2021, 10283:1427 - 1430. 10.1016/s0140-6736(20)32174-7
12. Kasthuri A: Challenges to Healthcare in India - The Five A's. Indian J Community. 2018, 43:141-143. 10.4103/ijcm.IJCM_194_18
13. 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
14. Verma S, Gustafsson A: An Investigating the emerging COVID-19 research trends in the field of business and management: A bibliometric analysis approach. Journal of Business Research. 2020, 118:253-261. 10.1016/j.jbusres.2020.06.057
15. Bismark M, Morris J, Thomas L, et al.: Reasons and remedies for under-representation of women in medical leadership roles: a qualitative study from Australia. BMJ Open. 2015, 5:11. 10.1136/bmjopen-2015-009384
16. Sheaff R, Rogers A, Pickard S, et al.: A subtle governance: 'soft' medical leadership in English primary. care. Social Health. 2003, 25:408-28. 10.1111/1467-9566.00352
17. Clay-Williams R, Ludlow K, Testa L, et al.: Medical leadership, a systematic narrative review: do hospitals and healthcare organisations perform better when led by doctors?. BMJ Open. 2017, 7:014474. 10.1136/bmjopen-2016-014474
18. Wehner MR, Nead KT, Linos K, et al.: Plenty of moustaches but not enough women: cross sectional study of medical leaders. BMJ. 2015, 351:6311. 10.1136/bmj.h6311
19. McAlearney AS, Fisher D, Heiser K, Robbins D, Kelleher K: Developing effective physician leaders: changing cultures and transforming organizations. Hosp. 2005, 83:11-8.
20. Clark J and Armit K: Leadership competency for doctors: a framework. Leadership in Health Services. 2010, 23:115-129. 10.1108/17511871011040706
21. Andersson T: The medical leadership challenge in healthcare is an identity challenge. Leadersh Health Serv (Bradf Engl. 2015, 28:83-99. 10.1108/LHS-04-2014-0032
22. Lloyd-Smith M: The COVID-19 pandemic: resilient organizational response to a low-chance, high-impact event. BMJ Leader. 2020, 4:109-112. 10.1136/leader-2020-000245
23. Quince T, Abbas M, Murugesu S, et al.: Leadership and management in the undergraduate medical curriculum: a qualitative study of students' attitudes and opinions at one UK medical school. BMJ Open. 2014, 4:005353. 10.1136/bmjopen-2014-005353
24. C Jorm, M Parker: Medical leadership is the New Black: Or is it?. Australian Health Review. 2014, 39:1-3. 10.1071/AH14013
25. Lyons O, Su'a B, Locke M, Hill A: A systematic review of leadership training for medical students. The New. Zealand medical journal. 2018, 131:75-84. https://pubmed.ncbi.nlm.nih.gov/29346359/
26. Mckimm J, Spurgeon P, Needham G et al.: Clinical leadership: The challenge for senior leaders. British Journal of Hospital Medicine. 2011, 72:525-8. 10.12968/hmed.2011.72.9.525
27. Mckimm J, O'Sullivan, Helen: Medical leadership: From policy to practice. British journal of hospital medicine (London. 20052011, 72:282-6. 10.12968/hmed.2011.72.5.282
28. Gulati K, Madhukar V, Verma V, et al.: Medical leadership competencies: A comparative study of physicians in public and private sector hospitals in India. Int J Health Plann. 2019, 34:947. 10.1002/hpm.2709
29. Gulati K, Sarkar C, Duits A, et al.: A two-dimensional perspective of healthcare leadership in non-Western contexts. BMJ Leader. 2020, 4:178-184. 10.136/leader-2020-000214
30. Gulati K, Kirkpatrick Ian: Developing medical leadership in India: A mission impossible?. BMJ Leader. 2021, 5:247-251. 10.1136/leader-2020-000217
31. Frich JC, Brewster AL, Cherlin EJ,et al.: Leadership development programs for physicians: a systematic review. J Gen Intern Med. 2015, 30:656-74. 10.1007/s11606-014-3141-1
32. Spurgeon P, Klaber B, Green M. Becoming a better medical leader BMJ 2012; 344 : e663 doi:10.1136/bmj.e663
33. NHS Institute for Innovation and Improvement, A. o. M. R. C: Medical Leadership Competency Framework: Enhancing Engagement in Medical Leadership.2010s.l.NHS Institute for Innovation and Improvement. NHS Institute for Innovation and Improvement, Coventry House, University of Warwick Campus, Coventry, CV4 7AL, England.
34. Wilkie V: Leadership and management for all doctors. Br J Gen. 2012, 62:230-231. 10.3399/bjgp12X636290.