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Transformational Leadership and Employee Well-being in Healthcare: A Bibliometric Visualization for Service Management Innovation

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Abstract. This study investigates the research structure, knowledge evolution, and collaboration networks concerning transformational leadership and employee well-being in healthcare organizations, aiming to support innovation in hospital service management. Based on 391 peer-reviewed articles retrieved from the Web of Science Core Collection, bibliometric and visualization techniques using CiteSpace were employed to construct a data-driven knowledge map of this interdisciplinary domain. The analysis reveals that the field has developed around the theoretical nexus of transformational leadership, organizational commitment, and employee well-being, with *nurses* being the most frequently studied population. Research evolution shows a shift from early validation of leadership–well-being linkages toward the integration of complex mediating mechanisms such as empowerment, psychological capital, and work engagement. Collaboration network analysis indicates a "core–periphery" pattern dominated by the United States, China, and the United Kingdom, while institutional cooperation remains fragmented. The findings highlight the growing importance of leadership-based management innovation in healthcare service systems and suggest that cross-institutional collaboration and longitudinal data analytics are essential to advancing both theory and practice. This study contributes to the service-science literature by providing a macro-level, informatics-oriented view of how leadership research can enhance employee well-being and organizational performance in digital healthcare ecosystems.

Keywords: Transformational Leadership; Employee Well-being; Organizational Commitment; Bibliometric Analysis; Healthcare Management; Service Innovation; Knowledge Mapping

1. Introduction

The healthcare industry is among the most complex and information-intensive service systems in modern society. Hospitals must continuously coordinate medical expertise, technological infrastructures, and patient-centered services under conditions of uncertainty, urgency, and ethical responsibility. Within this dynamic environment, employee well-being has become a strategic concern. Beyond its personal and humanitarian dimensions, the psychological and physical well-being of healthcare workers directly influences the quality, reliability, and sustainability of medical services. Fatigue, burnout, and emotional exhaustion among healthcare professionals not only diminish work efficiency but also increase medical errors, reduce patient safety, and ultimately threaten organizational performance. According to the World Health Organization, work-related stress and mental health problems are responsible for nearly $1 trillion in annual global productivity losses—a challenge that demands systemic and managerial solutions rather than isolated interventions.

In this context, leadership serves as an essential coordination mechanism that integrates human motivation, organizational processes, and service innovation. Leadership effectiveness determines how hospitals mobilize knowledge, sustain engagement, and adapt to continuous environmental changes. Among various leadership paradigms, transformational leadership (TL) has attracted substantial attention for its ability to foster psychological empowerment, intrinsic motivation, and collective purpose in high-pressure service contexts. By articulating an inspiring vision, providing individualized consideration, and encouraging intellectual stimulation, transformational leaders transform employees' attitudes and behaviors through shared meaning rather than coercive control. This process not only enhances performance and innovation but also strengthens employees' affective commitment, which functions as a psychological buffer against job stress and professional burnout.

Healthcare systems—particularly public hospitals in emerging economies—represent unique environments for examining the relationship between transformational leadership and employee well-being. These institutions operate under resource constraints, hierarchical structures, and continuous patient demand, requiring leaders to manage both emotional and cognitive complexities. In such settings, leadership is not merely administrative but deeply informatic and relational, involving the interpretation and redistribution of knowledge flows across professional boundaries. Recent studies show that effective hospital leadership can significantly improve employee engagement, organizational learning, and patient satisfaction, revealing that leadership should be understood as a knowledge-driven service function within healthcare ecosystems.

Despite these advances, existing research on hospital leadership and well-being remains fragmented across multiple disciplinary and regional domains. Most studies rely on cross-sectional survey data focusing on specific populations (such as nurses or physicians) and individual outcomes (such as job satisfaction or burnout). Although these works provide valuable empirical insights, they lack a macroscopic, data-driven synthesis of how the field has evolved over time, what conceptual clusters it comprises, and where research frontiers are emerging. Without such systematic mapping, it is difficult for scholars and practitioners to integrate dispersed knowledge, identify dominant paradigms, and align leadership research with broader trends in digital transformation and service innovation.

In response to this research gap, bibliometric and scientometric methods have become indispensable tools in service science and informatics. By combining statistical modeling, network visualization, and citation analysis, these methods transform qualitative academic discourse into quantifiable data structures. Visualization tools such as CiteSpace enable researchers to identify key authors, institutions, journals, and co-occurring keywords, constructing a knowledge map that reveals the cognitive architecture and temporal evolution of a field. This data-driven perspective aligns well with the informatics orientation of JLISS, where service systems are viewed as networks of interacting agents generating and transforming information to create value.

Applying bibliometric analysis to healthcare leadership research is particularly timely for three

reasons.

First, leadership and well-being studies have expanded exponentially since the COVID-19 pandemic, which redefined the relationship between work conditions, digital health tools, and psychological resilience. Hospitals have increasingly adopted telemedicine platforms, AI-assisted diagnostics, and digital workflow systems, altering the communication and leadership dynamics between administrators and frontline professionals. Understanding this shift requires an integrative perspective that connects behavioral theories with data analytics and service management.

Second, the convergence of organizational psychology, knowledge management, and health informatics calls for a new interdisciplinary synthesis. Transformational leadership can be reconceptualized not only as a behavioral construct but also as an informational process that aligns human cognition, technology adoption, and organizational learning. This reconceptualization positions leadership as a logistical intelligence system, coordinating emotional and informational flows to sustain operational continuity and employee vitality.

Third, the healthcare industry exemplifies a high-stakes service ecosystem, where managerial inefficiency translates directly into social and ethical risks. Mapping how leadership and well-being research has evolved over four decades provides empirical evidence for designing data-supported managerial interventions and policy innovations that enhance system resilience.

Therefore, this study aims to conduct a comprehensive bibliometric and knowledge visualization analysis of global research on "hospital leadership and employee well-being," with a particular emphasis on the transformational leadership–organizational commitment–well-being nexus. Drawing on 391 high-quality publications from the Web of Science Core Collection, the research employs CiteSpace to identify knowledge clusters, high-frequency keywords, and influential nodes in the academic network. Through analyses of keyword co-occurrence, thematic clustering, burst detection, timeline evolution, and collaboration networks, the study constructs an evidence-based panorama of how this field has evolved, matured, and diversified.

This research pursues three specific objectives:

1. To identify the intellectual structure and knowledge base of leadership and well-being studies in healthcare, clarifying dominant theoretical constructs and methodological trends;
2. To trace the dynamic evolution of research themes and frontiers, revealing how the field has shifted from basic theoretical validation to complex models involving psychological mechanisms, contextual contingencies, and digital service integration;
3. To analyze global collaboration networks among authors, institutions, and nations, evaluating the degree of research connectivity and highlighting opportunities for cross-regional and interdisciplinary innovation.

The expected contribution of this study is twofold. Theoretically, it establishes a macroscopic, data-driven understanding of the leadership–well-being field, integrating insights from organizational behavior, psychology, and service science. Practically, it offers actionable implications for hospital administrators, policymakers, and researchers by identifying key knowledge hubs, underexplored research intersections, and potential pathways for leadership-based service innovation. In doing so, the study not only advances academic knowledge but also supports the strategic transformation of hospitals into learning-oriented, human-centered, and digitally enabled service systems.

2. Literature Review

2.1.Theoretical Analysis of Hospital Leadership Affecting Employee Well-being

The theoretical foundation of this study is rooted in three core constructs: transformational leadership, employee well-being, and organizational commitment. Transformational leadership theory,

systematized by Bass based on his early research, describes a leadership process that enhances subordinates' motivation and moral levels through four dimensions: idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration (Bass & Riggio, 2006). The importance of these soft skills has been validated across different leadership contexts; for instance, in virtual leadership environments, a leader's emotional intelligence has been identified as the single strongest predictor of their effectiveness, surpassing other key traits such as trust, training, and core beliefs (Dahal et al., 2025). This leadership style is particularly crucial in the high-pressure, high-emotional labor context of the healthcare industry, as it can effectively buffer healthcare professionals' burnout and stimulate their intrinsic motivation to cope with complex challenges (Cummings et al., 2010). The ultimate goal of transformational leadership is not only to improve performance but also to promote employee well-being, a broad construct encompassing everything from traditional job satisfaction to more positive psychological states (Bakker & Demerouti, 2007). In contemporary organizational behavior, well-being is increasingly measured through "work engagement," a positive, fulfilling work state characterized by vigor, dedication, and absorption, which better reflects employees' proactivity and psychological health (Schaufeli et al., 2002). Existing research indicates that a key mechanism through which transformational leadership affects employee well-being is its ability to effectively shape employees' organizational commitment, i.e., employees' emotional attachment, desire to remain, and sense of obligation to the organization (Meyer & Allen, 1991). Specifically, transformational leadership, by building trust and a shared vision, can significantly enhance employees' "affective commitment," meaning employees genuinely identify with the organization and are willing to contribute to it, and a high level of emotional connection is the core psychological basis for employees to experience job well-being and satisfaction (Shao et al., 2022).

2.2.Mechanism of Hospital Leadership's Influence on Employee Well-being

Regarding the mechanism of action among core variables, existing research has established a clear logical chain: the influence of transformational leadership on employee well-being is primarily achieved through the critical mediating variable of organizational commitment. Firstly, numerous meta-analyses have confirmed a significant direct positive relationship between transformational leadership and employee well-being; leaders, through empowerment, support, and vision provision, can effectively enhance employee job satisfaction and engagement, and reduce burnout (Teetzen et al., 2022; Asghar et al., 2022). However, the deeper mechanism of this influence is even more crucial. Research indicates that the primary role of transformational leadership is to shape employees' psychological connection to the organization, particularly through its inspirational vision and individualized consideration, which can promote the internalization of organizational values by employees, thereby greatly enhancing their level of affective commitment (Khaola & Rambe, 2021). Building on this, organizational commitment plays a vital mediating role. The logic of this mediation model is that transformational leadership does not directly "give" well-being, but rather first earns employees' high affective commitment by building trust and a sense of belonging (Jiatong et al., 2022). The intrinsic psychological capital stimulated by affective commitment enables employees to derive more meaning from their work and effectively cope with stress, ultimately experiencing higher job satisfaction and well-being. The mediating path of "leadership → commitment → well-being" has been empirically supported in multiple fields, including healthcare (Othman & Khrais, 2022). This mediating mechanism is corroborated by other related studies; for example, research has found that the Quality of Work Life not only directly enhances employees' work-life balance but also functions indirectly by strengthening their job commitment, further highlighting the bridging role of commitment in organizational management (Basnet, 2024). Although this mediating path is widely recognized, some studies also point out that organizational commitment often operates in parallel with other mediating variables such as psychological empowerment, suggesting that its mechanism of action may be a more complex multiple mediation model (Tuckey et al., 2012).

2.3.Limitations of Existing Research

Despite the solid empirical foundation provided by existing literature for understanding the impact of transformational leadership on employee well-being, it still has overall limitations, thus failing to form a complete knowledge landscape. Methodologically, research in this field heavily relies on cross-sectional data, which not only limits the inference of causal relationships between variables but also makes it susceptible to common method bias (Podsakoff et al., 2003). From a research context perspective, a large amount of theoretical and empirical work originates from Western cultural backgrounds, and whether its conclusions are equally applicable in non-Western, particularly Chinese public hospitals with their high-intensity, hierarchical, and culturally unique organizational environments, still requires careful verification (House et al., 2004). Similarly, organizational culture, as a key contextual factor influencing employee experience, may not have a significant direct impact on performance, but it can indirectly affect ultimate organizational effectiveness by significantly influencing employee stress levels (Lubis, 2024). Existing research often consists of "fragmented" isolated empirical tests, leading to a lack of a macroscopic understanding of the overall knowledge structure, core evolutionary context, and future frontier trends in this field within academia (Dinh et al., 2014). Positive factors in organizations often operate through complex chain reactions; one study found that a good quality of work life positively impacts employee performance, and this enhanced performance, in turn, acts as a mediating variable to further boost employee job satisfaction (Lubis & Lubis, 2025). The fragmented status reveals a clear knowledge gap: to date, no study has used bibliometric methods to conduct a visualized knowledge mapping analysis of the "hospital leadership's influence on employee well-being" field (Chen, 2017). Therefore, this study uses CiteSpace with the aim of achieving three major objectives: first, to objectively depict the overall knowledge landscape of this field, identify core literature, key themes, and influential authors, providing researchers with a structured knowledge base (Donthu et al., 2021); second, to dynamically reveal the evolutionary path of this field, tracking changes in research hotspots and frontier dynamics; and third, to provide a macro perspective based on data evidence for subsequent theoretical deepening and management practice, thereby promoting the systematic development and knowledge integration of this field.

3. Research Methodology

3.1.Bibliometrics

To overcome the limitations of traditional literature reviews in terms of objectivity and comprehensiveness, this study adopts a research approach that combines bibliometric analysis and knowledge mapping. This method uses mathematical and statistical tools to quantitatively analyze massive amounts of literature information, objectively revealing the knowledge base, evolutionary context, and frontier dynamics of a specific field (Donohue, 1973). This study will utilize the mainstream visualization software CiteSpace to map the scientific knowledge structure of the “hospital leadership's impact on employee well-being” field. Through keyword co-occurrence and cluster analysis, core research themes will be identified. Timeline views and keyword burst analysis will be used to track knowledge evolution paths and frontier trends. Furthermore, cooperation network analysis of authors, institutions, and countries will reveal the academic community structure in this field, thereby scientifically addressing the core questions of this study.

3.2.Data Sources

This study uses the Web of Science (WOS) Core Collection database as the sole data source to ensure the authority, comprehensiveness, and integrity of the literature. To ensure the accuracy and relevance of the search results, after repeated preliminary adjustments, the final search query was determined to be: TS=("transformational leadership") AND TS=("organizational commitment" OR "well being" OR wellbeing OR "job satisfaction" OR burnout OR "work engagement" OR "job stress") AND TS=(hospital* OR healthcare OR "health care" OR medical OR nurse* OR physician* OR "healthcare

worker*"). Furthermore, to focus on high-quality academic achievements, the document types were limited to Article and Review, and the language was limited to English.

After the rigorous search and screening process described above, a total of 391 highly relevant articles were obtained. All literature records were exported in Plain Text format, including full citation information (Full Record and Cited References), to meet the analysis requirements of CiteSpace software.

3.3.Data Analysis Process

This study used CiteSpace 6.1.R6 software to perform a visual analysis of the 391 retrieved articles.

First, import the raw data into the software and create an analysis project, setting the time span from 1985 to 2025 and the time slicing to 1 year.

Second, perform multi-dimensional network construction and analysis. At the knowledge network level, generate a co-occurrence map with "keywords" as network nodes to identify core research hotspots in the field; then use the LLR (Log-Likelihood Ratio) algorithm to cluster keywords, and combine with the Timeline View to deeply analyze the evolution of each core theme;

Finally, use the "Burst Detection" algorithm to identify cutting-edge dynamics that have received high attention from scholars within specific time periods. At the collaboration network level, select "Author," "Institution," and "Country" as network node types, respectively, to generate collaboration network maps, revealing the core research forces, academic community structure, and collaboration patterns within the field.

4. Findings and Discussion

4.1.Keyword Co-occurrence

Keywords are the condensation and refinement of the core content of a document. Keyword co-occurrence analysis is an important bibliometric method that reveals the main research topics within a discipline and the intrinsic relationships between these topics by statistically analyzing the frequency of keywords appearing together in a set of documents. In a co-occurrence network, each keyword forms a node, and the co-occurrence relationship between keywords forms a link. By analyzing the size and centrality of nodes in the network, as well as the strength of connections between nodes, research hotspots and the core knowledge structure of the field over a certain period can be effectively identified.

This study utilized CiteSpace to analyze the keywords from 391 documents, generating a keyword co-occurrence network map for the field of hospital leadership's impact on employee well-being (see Figure 4-1). This map includes 220 nodes (N=220) and 938 links (E=938), with a network density of 0.0389. A network density greater than 0.01 is generally considered a relatively dense network, indicating extensive and close connections between research topics in the field, forming a relatively mature knowledge system.

In terms of node size, high-frequency keywords represent the long-standing core research hotspots in this field. In Figure 1, the keywords with the largest node sizes are "job satisfaction," "transformational leadership," "organizational commitment," "performance," "nurses," and "commitment," among others. "Transformational leadership" as the core independent variable, "job satisfaction" and "organizational commitment" as the core outcome variables, and "nurses" as the main research subject, together form the most core and stable knowledge base in this research area. High-frequency terms are not only the "cornerstones" of this field but also represent the research directions that scholars pay the most attention to.

From the perspective of node centrality, Betweenness Centrality is a key indicator for measuring a node's "bridge" role in a network, usually identified by a Purple Ring in CiteSpace. Nodes with high

centrality are often critical hubs connecting different research sub-fields. In the map, keywords such as "job satisfaction," "transformational leadership," "impact," "empowerment," and "behavior" show a distinct purple outer ring, indicating their high centrality.

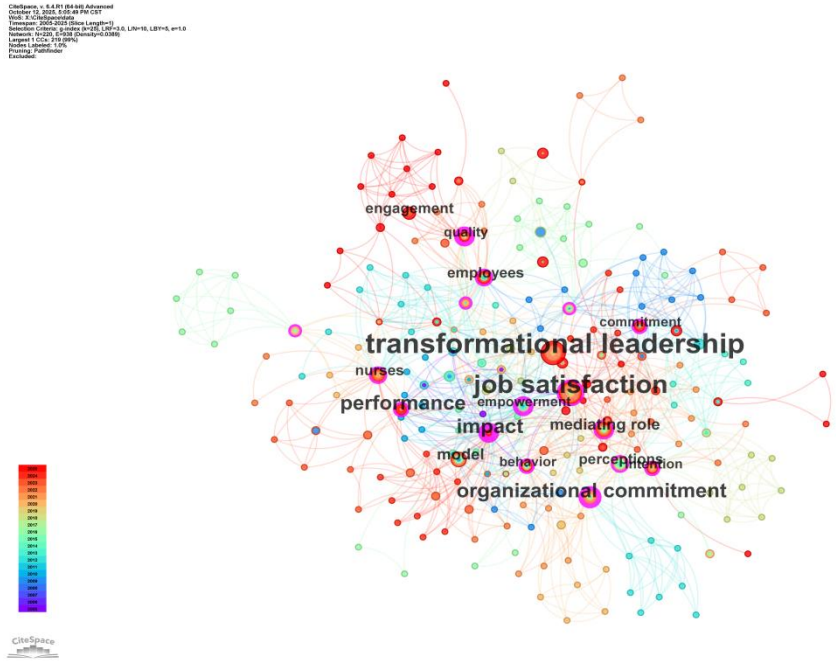

Fig.1: Keyword Co-occurrence Network Diagram

To further quantify the analysis, Table 1 presents the top 20 keywords by frequency and centrality. The data shows that "transformational leadership" (frequency=40, centrality=0.05), "job satisfaction" (frequency=30, centrality=0.19), and "organizational commitment" (frequency=14, centrality=0.21) have an absolute advantage in frequency, once again confirming their status as core cornerstones of research in this field. However, their centrality is extremely prominent. For example, "impact" (frequency=13) has a centrality as high as 0.43, ranking first among all keywords; "empowerment" (frequency=5) also reached a centrality of 0.32. This indicates that "impact" and "empowerment" are crucial "bridge" concepts in this research field, serving as core hubs connecting leadership with other variables (such as performance, satisfaction, etc.). A large number of studies revolve around the "impact" mechanism of leadership and "empowerment" as a key mediating process. In addition, the appearance of the keyword "mediating role" directly reflects that research in this field has moved from simple relationship exploration to the complex analysis of action mechanisms and pathways.

Table 1: Top 20 High-Frequency Keywords in Research Fields

No.	Count	Centrality	Year	Keywords
1	40	0.05	2009	transformational leadership
2	30	0.19	2005	job satisfaction
3	14	0.21	2012	organizational commitment
4	13	0.15	2005	performance
5	13	0.43	2009	impact
6	7	0.12	2013	mediating role
7	7	0.01	2009	model
8	6	0.17	2009	employees
9	6	0.11	2012	perceptions
10	6	0.17	2012	nurses

11	6	0.00	2023	engagement
12	5	0.11	2005	behavior
13	5	0.16	2018	intention
14	5	0.32	2009	empowerment
15	5	0.20	2015	quality
16	5	0.15	2009	commitment
17	4	0.00	2009	work
18	4	0.00	2018	work engagement
19	4	0.01	2009	transactional leadership
20	4	0.00	2016	burnout

4.2.Keyword Clustering

Keyword clustering analysis, based on the keyword co-occurrence network, utilizes specific algorithms (LLR) to identify closely related node groups and labels each group as a specific research theme, thereby revealing the core knowledge blocks and structure of the research field.

The keyword clustering network generated in this study has a clear structure, with a Modularity Q value of 0.6398, which is much greater than the critical value of 0.3; the Weighted Mean Silhouette S value is 0.8621, higher than the recommended value of 0.7. Both indicators show that the community structure formed by this clustering is significant, the clustering results are convincing, and the homogeneity within each theme is high. As shown in Figure 2, this analysis formed 11 main research theme clusters, from #0 to #10. Among them, the largest cluster is #0 job satisfaction, whose core nodes also include transformational leadership, organizational commitment, etc., indicating that "research on leadership effects with job satisfaction as the core" is the most mainstream and core research area in this field. In addition, several distinctive sub-themes emerged, such as #1 psychological wellbeing, which focuses on employees' internal feelings; #2 patient safety outcome, which focuses on the ultimate output of the organization; #8 mentoring relationship effectiveness, which focuses on the mechanism of leadership; and #4 longitudinal study and #5 multi-group analysis, which focus on research methods.

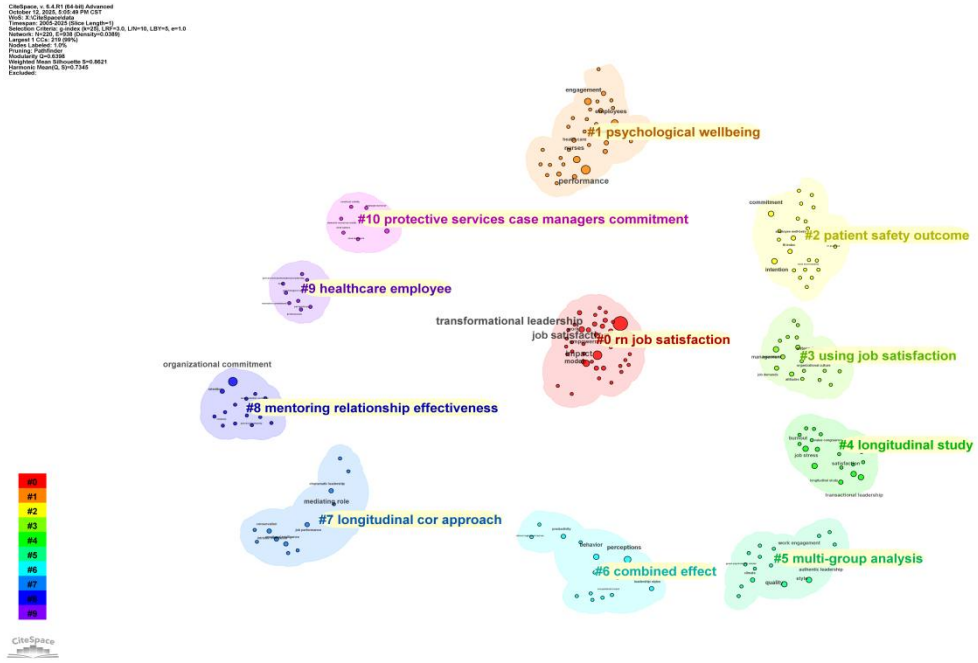

Fig.2: Research Hotspot Clustering Map

To further interpret the thematic connotations of each cluster, Table 2 details the size, silhouette

value, core keywords, and interpretation labels of the top 11 clusters. Specifically, the research themes can be summarized into three main sections.

First, core relationship exploration. Clusters represented by #0 "Transformational Leadership and Nurse Job Satisfaction/Well-being," #1 "Transformational Leadership and Mental Health," and #3 "Mediating Role of Organizational Culture and Job Satisfaction" constitute the main body of research in this field, focusing on the direct impact of leadership style on employees' core psychological indicators.

Second, organizational outcomes and contextualized applications. Clusters such as #2 "Transformational Leadership, Patient Safety, and Loyalty," #7 "Longitudinal Association of Transformational Leadership and Employee Burnout," and #10 "Buffering Effect of Transformational Leadership on Turnover Intention" expand the research perspective from the individual employee level to broader outcome variables such as organizational performance (e.g., patient safety) and negative behaviors (e.g., burnout, turnover), and focus on specific contexts (e.g., home care, protective service managers).

Third, psychological mechanisms and research methodology deepening. Clusters represented by #9 "Psychological Capital and Organizational Commitment" and #8 "Mentor Effectiveness and Nurse Well-being" delve into the intrinsic psychological mechanisms through which leadership operates; while #4 "Longitudinal Evidence of Transformational Leadership Behavior" and #5 "Multi-group Comparison of Job Satisfaction" indicate that the field is moving towards more rigorous longitudinal designs and cross-group comparisons in research methodology.

Table 2: Research Hotspot Cluster Analysis Table

Cluster ID (#)	Size	S	LLR Label	Core Keywords	Interpretation & Refined Label
#0	41	0.679	rn job satisfaction	transformational leadership; job satisfaction; nurse well-being	Transformational leadership and nurses' job satisfaction/well-being
#1	34	0.730	psychological wellbeing	transformational leadership; psychological well-being; multi-center cross-sectional study	Transformational leadership and psychological health (multi-center cross-sectional)
#2	23	0.992	patient safety outcome	transformational leadership; patient safety; home care workers' loyalty	Transformational leadership, patient safety, and loyalty in home care
#3	20	0.945	using job satisfaction	job satisfaction; organizational culture	Organizational culture with job satisfaction as mediator
#4	19	0.910	longitudinal study	transformational leadership behaviour; retired men	Longitudinal evidence on transformational leadership behaviour
#5	19	0.962	multi-group analysis	multi-group analysis; social workers' job satisfaction	Multi-group comparisons of job satisfaction
#6	16	0.922	combined effect	specific transformational leadership; private hospital	Combined effects of transformational leadership in private hospitals
#7	16	0.876	longitudinal cor approach	transformational leadership; managing healthcare employees'	Longitudinal association between transformational leadership and healthcare

				burnout	employee burnout
#8	15	0.968	mentoring relationship effectiveness	healthcare environment; nurse well-being	Mentoring effectiveness and nurse well-being in healthcare settings
#9	9	0.951	healthcare employee	organizational commitment; psychological capital; perceived transformational leadership	Psychological capital and perceived transformational leadership boosting organizational commitment
#10	7	1.000	protective services case managers commitment	transformational leadership; job burnout; commitment; intent to quit	Transformational leadership buffering burnout, enhancing commitment, reducing intent to quit among protective services case managers

4.3.Keyword Burst Detection

Keyword burst detection analysis aims to identify "burst words" that have received sudden and intense attention from scholars within a specific period. The frequency of these words significantly increases in the short term, thereby effectively revealing the cutting-edge dynamics and evolutionary trends of a research field. Figure 3 displays the 9 keywords with the highest burst strength, illustrating the changing path of research frontiers in this field over time. Research hotspots have gradually evolved from early explorations of basic leadership theories, mechanisms of action, and core outcome variables to in-depth studies of specific research contexts (nurses), complex models (moderating effects), and more positive psychological states (work engagement).

The evolution of research frontiers can be broadly divided into two stages:

The first stage was the exploration period of basic theories and mechanisms (approximately 2009-2016). During this stage, research frontiers mainly focused on constructing the core theoretical framework of the field. The emergence of the burst word "transactional leadership" reflects that scholars often use it as an important reference or opposing theory for comparative studies when discussing transformational leadership. At the same time, the bursts of "empowerment" and "perceptions" indicate that the research focus was on revealing how leadership influences employees' individual perceptions through psychological mechanisms such as empowerment, and ultimately impacts the key outcome variable of "organizational commitment." Research during this period laid a solid theoretical foundation for subsequent deepening.

The second stage is the period of situational deepening and frontier expansion (approximately 2018 to present). After entering this new stage, research frontiers show a more focused and deepened trend. First, there is a more pragmatic focus on research outcomes, such as the burst of "intention" (usually referring to turnover intention), indicating a shift in research towards solving practical management problems like hospital talent loss. Second, the research subjects are more focused, with "nurses" becoming a continuous burst word since 2020, indicating that special attention to this core medical group has become a frontier. Finally, the theoretical depth and breadth of research have expanded; the emergence of "moderating role" signifies the development of research models from simple mediation effects to more complex contingency theories; and "engagement" as the newest and strongest burst word (strength = 2.58) suggests that "work engagement" has replaced traditional job satisfaction as the latest frontier hotspot for measuring employees' positive work status.

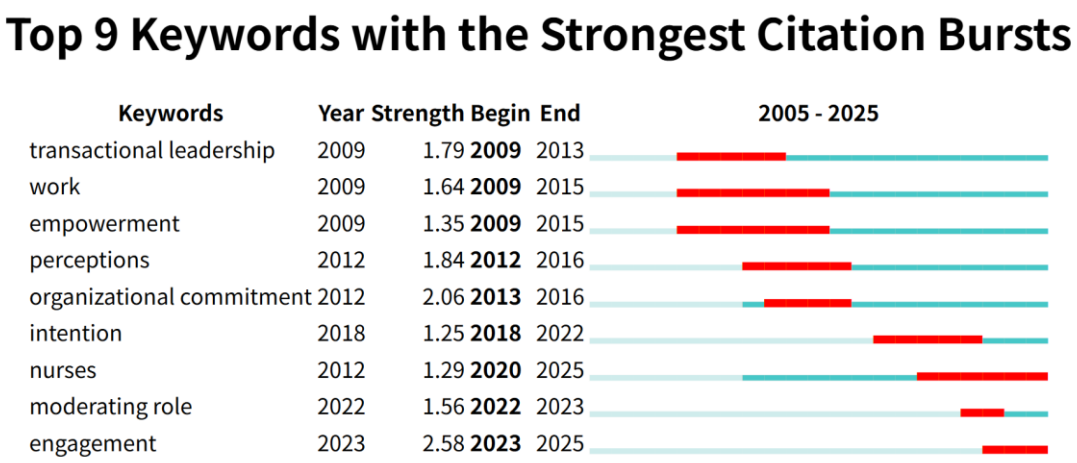

Fig.3: Keyword Bursts

4.4.Timeline View

The timeline view, based on the keyword clustering map, arranges keywords from each cluster along a horizontal timeline according to their first appearance year. This visually displays the emergence, development, duration, and historical span of various research topics. As shown in Figure 4, the horizontal axis represents the year, each row represents a cluster (research topic), and the position, size, and connections of the nodes represent the publication time, influence, and citation relationships of the core literature, respectively.

The evolution and life cycle of each research topic exhibit distinct characteristics. Firstly, research topics represented by #0 "job satisfaction," #1 "psychological well-being," and #8 "mentor relationship effectiveness" form the "main thoroughfare" that spans the entire research period. These clusters have the longest time span, extending from around 2005 to the present, and internal nodes (such as transformational leadership, job satisfaction, nurses) continuously emerge, indicating that they are the most vital, fruitful, and enduring core research directions in this field, attracting sustained attention from scholars.

Secondly, some research topics show clear phased characteristics. For example, nodes in topics such as #3 "using job satisfaction" and #7 "longitudinal cor approach" are mainly concentrated in the middle and late stages of the timeline. This reflects that as research deepens, scholars have begun to shift from focusing on "what it is" to "how to use it" and adopting more rigorous "longitudinal research" methods to verify causal relationships.

Finally, the right side of the map reveals the latest research frontiers. Nodes in clusters such as #2 "patient safety outcome" and #10 "protective services case managers commitment" have been active in recent years, which is highly consistent with the conclusion of "research shifting towards solving practical management problems" found in the previous burst word analysis. This indicates that combining leadership with specific organizational performance (such as patient safety) and specific management contexts is an important future development direction in this field.

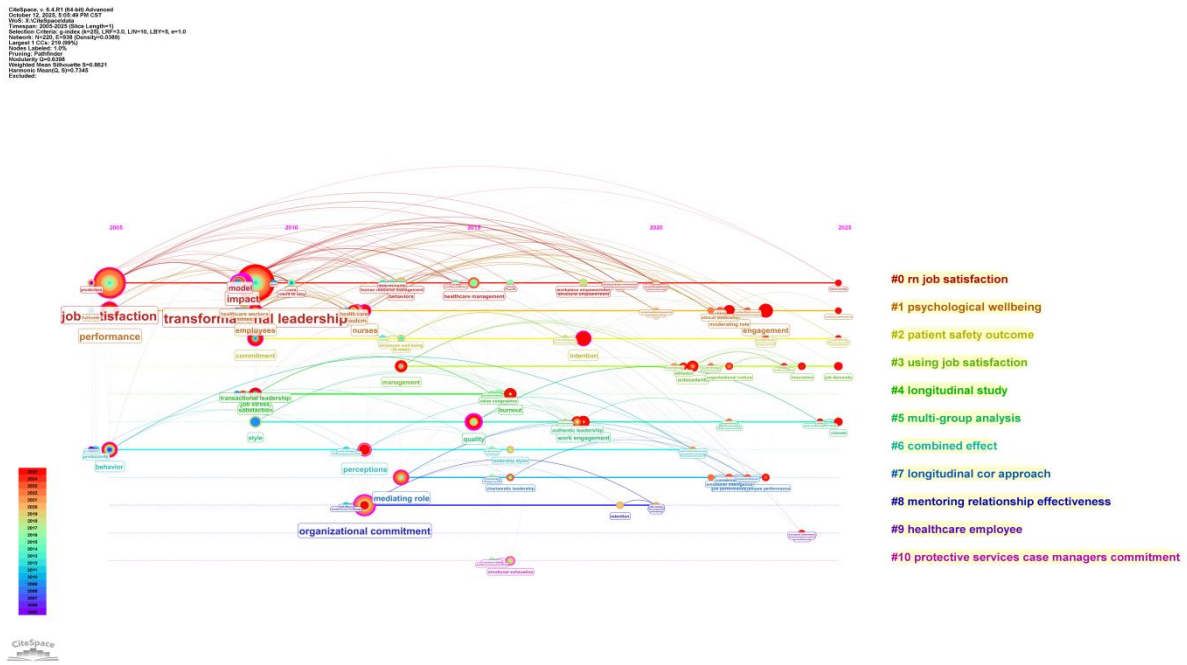

Fig.4: Timeline view

4.5.Author Collaboration Network Analysis

Author collaboration network analysis aims to reveal the core authors, academic communities, and their collaborative relationships within a specific research field. As shown in Figure 5, the author collaboration network in this research area generally exhibits a characteristic of "overall dispersion, local aggregation." Network nodes represent authors, node size indicates the number of publications by the author, and lines represent collaborative relationships between authors. The map shows that the entire network consists of multiple independent collaborative subnetworks and a large number of scattered nodes, with low network density, indicating that a unified large-scale collaborative network has not yet formed in this field. Most research is conducted independently by small teams, and widespread cross-team and cross-institutional collaboration is not yet common.

Combining the publication statistics in Table 3, the top two authors by publication count are Munir, Fehmida and Nielsen, Karina, both with 4 publications. From the collaboration network in Figure 5, it can be seen that these two authors form a relatively close collaborative subgroup and are important pioneers in the early research of this field. In addition, Top, Mehmet and Tarcan, Menderes (both with 2 publications) also form an independent collaborative group. Although most authors have only 1 publication, the map still shows several small collaborative teams centered around Boamah, Sheila A. and others.

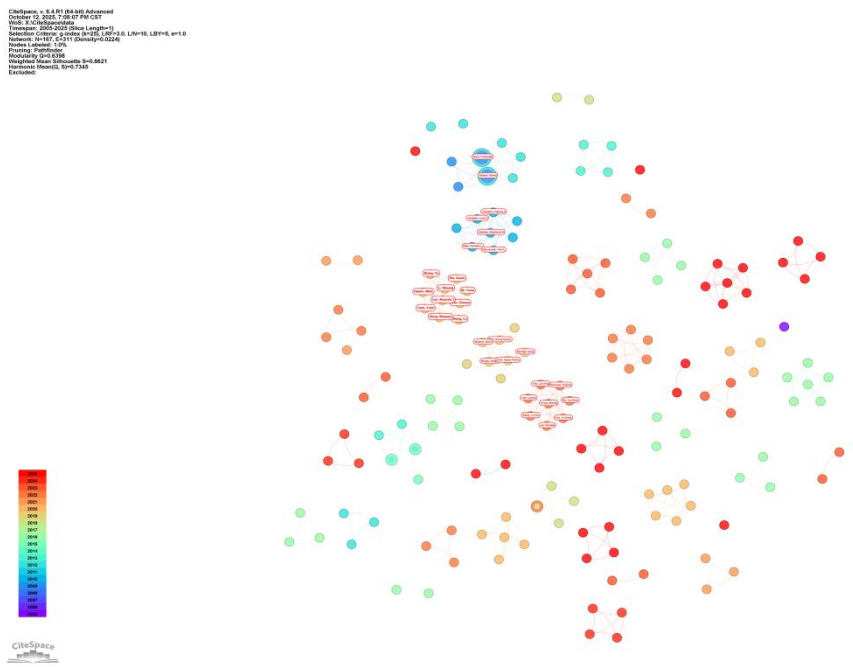

Fig.5: Author Atlas

Table 3: Top 10 Author Publication Statistics

No.	Author	Year	Number of publications	No.	Author	Year	Number of publications
1	Munir, Fehmidah	2009	4	6	Plummer, Virginia	2022	1
2	Nielsen, Karina	2009	4	7	Fan, Jun-Ying	2022	1
3	Boamah, Sheila A	2018	2	8	Johnson, Anya	2025	1
4	Top, Mehmet	2013	2	9	Chen, Rongxin	2023	1
5	Tarcan, Menderes	2013	2	10	Wang, Xiaohui	2012	1

4.6.National Collaboration Network Analysis

National collaboration network analysis can reveal the global academic landscape and the distribution of major research forces in this research field. As shown in Figure 6, the national collaboration network in this field exhibits a clear "core-periphery" structure, where a few highly productive countries form the core of the network and establish extensive cooperative relationships with other countries. The network's central nodes are prominent, and the connections are relatively dense, indicating that a certain scale of international collaborative research community has formed in this field, but cooperative relationships primarily revolve around a few core countries.

Based on the national publication statistics in Table 4, the United States (USA, 12 articles), China (Peoples R China, 8 articles), and the United Kingdom (England, 6 articles) are the top three countries with the highest number of publications in this field, and they also occupy the most central positions in the collaboration network map. From the perspective of network topology, international collaboration in this field is not homogeneously distributed but rather revolves around several hub countries. Among them, the role of the United States is particularly prominent; it is not only the node with the largest number of publications, but its extremely high network centrality (significantly indicated by the purple outer circle in the map) shows that it plays an indispensable "bridge" and "hub" role in the entire collaboration network. The United States has established close cooperative relationships with major research powers such as China in Asia, the United Kingdom in Europe, and Canada in North America, effectively connecting academic communities across different continents and serving as a key intermediary for global knowledge flow. This cooperation model, centered on a few countries and

radiating globally, suggests that future frontier explorations in this field will increasingly rely on deep cross-national and cross-cultural collaboration and academic exchange.

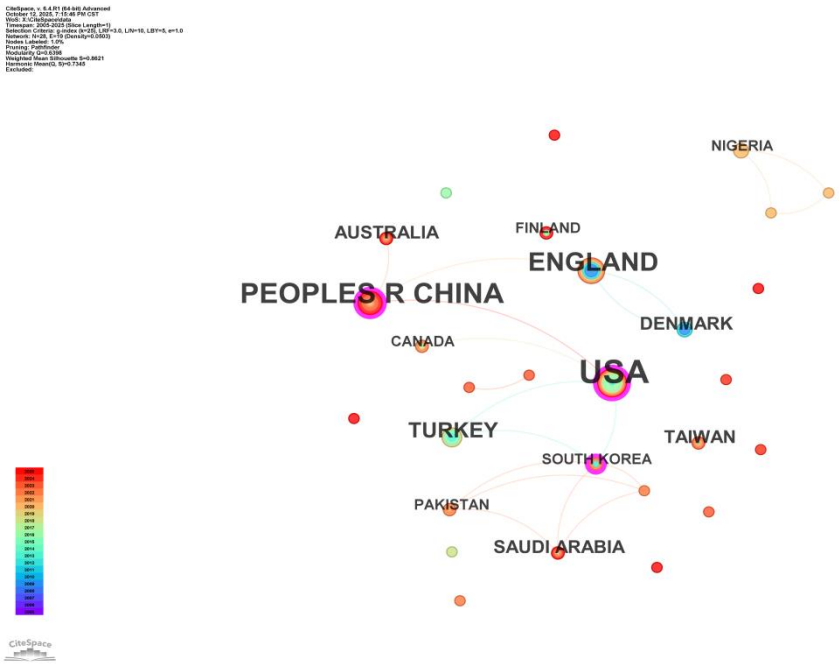

Fig.6: National Cooperation Map

Table 4: Top 10 Countries by Publication Volume

No.	Country	Year	Number of publications	No.	Country	Year	Number of publications
1	USA	2005	12	6	Australia	2016	3
2	Peoples R China	2012	8	7	Denmark	2009	3
3	England	2009	6	8	Saudi Arabia	2016	2
4	Turkey	2013	4	9	Canada	2018	2
5	Taiwan	2012	3	10	South Korea	2013	2

4.7.Analysis of Institutional Collaboration Networks

Analysis of research institution collaboration networks reveals (as shown in Figure 7 and Table 5) that academic collaboration in this field exhibits a significant characteristic of "overall dispersion, local aggregation," with low network density, and has not yet formed a unified, large-scale inter-institutional collaboration network. Research efforts are primarily led by a few core institutions, but most research is conducted independently by small-scale teams, and large-scale collaboration across teams and institutions is not yet widespread.

Specifically, core research strengths are prominent, but collaborative relationships are limited. According to publication volume statistics, Loughborough University (4 articles) in the UK and the National Research Centre for the Working Environment (3 articles) in Denmark are the most prolific research institutions in this field. The co-authorship network map further shows that these two institutions form a relatively close core collaborative subgroup within the field, serving as important founders of early research. In addition, Eskisehir Osmangazi University and Hacettepe University in Turkey also form an independent collaborative group. These "locally clustered" subnetworks indicate that existing collaborations are mostly based on specific research teams or regional academic connections.

However, from the perspective of the overall network structure, most institutions are isolated. There

are many scattered, unconnected nodes in the map, indicating that although many institutions contribute to this research field, most conduct research independently and have not integrated into a broader collaborative network. This "overall dispersed" pattern suggests that the knowledge creation and sharing model in this field is still dominated by internal institutional or small-group collaborations, lacking one or more core institutions with strong centripetal force to lead and integrate academic resources across the entire field. Large-scale inter-institutional and international collaborative projects need further development.

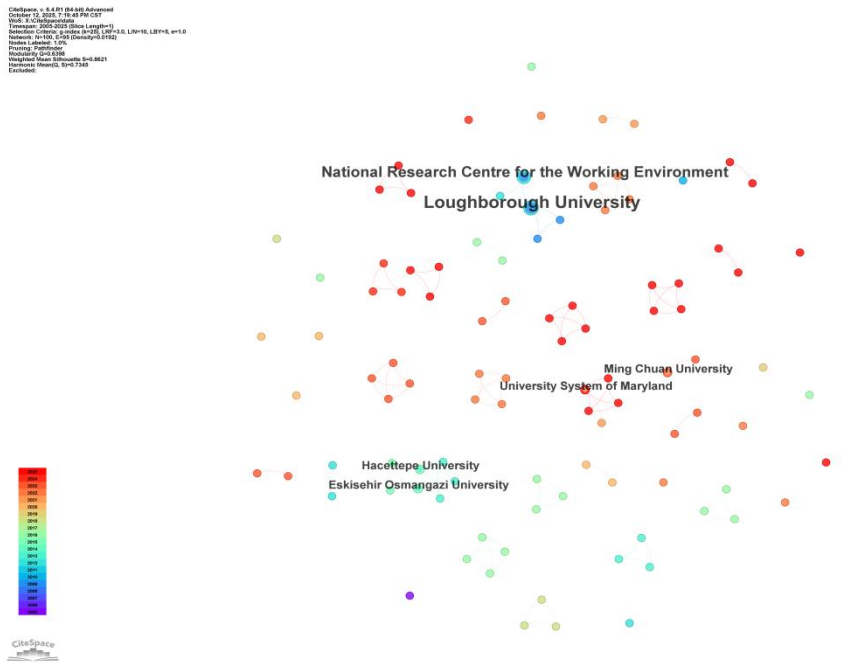

Fig.7: Institutional Collaboration Network Map

Table 5: Top 10 Institutions by Publication Volume

No.	Institution	Year	Number of publications	No.	Institution	Year	Number of publications
1	Loughborough University	2009	4	6	University System of Maryland	2021	1
2	National Research Centre for the Working Environment	2009	3	7	University of Nevada Las Vegas	2016	1
3	Eskisehir Osmangazi University	2013	2	8	University of Helsinki	2025	1
4	Hacettepe University	2013	2	9	Hunan University	2023	1
5	Ming Chuan University	2021	2	10	University of London	2009	1

4.8.Discussion

This study utilizes bibliometric and knowledge graph analysis to delineate the knowledge structure, evolutionary trajectory, and collaborative landscape within the field of hospital leadership's impact on employee well-being. The research reveals a stable knowledge core in this domain, centered around "transformational leadership" as the core independent variable, with "job satisfaction" and "organizational commitment" as key outcome variables, and "nurses" as the primary research subjects. The evolution of research themes presents three distinct sections: first, the exploration of relationships focusing on the direct impact of leadership on employees' psychological states; second, organizational

outcomes and contextualized applications, using patient safety and employee burnout as entry points; and third, in-depth exploration focusing on psychological mechanisms (such as empowerment, psychological capital) and research methods (such as longitudinal studies, multi-group analysis). From a temporal perspective, the research frontier has evolved from early basic theories and mechanism discussions (e.g., transactional leadership comparisons, empowerment) to contingency and longitudinal studies focusing on specific contexts (nurse groups), complex models (moderating effects), and more positive psychological states (work engagement). At the level of collaborative networks, this field exhibits significant multi-level characteristics: at the author and institutional level, it shows "overall dispersion, local aggregation," with no large-scale collaborative networks yet formed; at the national level, a "core-periphery" structure has been established with the United States, China, and the United Kingdom at its center, where the United States plays a crucial role in connecting global research forces.

The research field of hospital leadership and employee well-being has reached a high level in both theoretical depth and breadth, indicating that it is moving from an initial stage of theoretical construction and relationship verification to a mature stage that emphasizes theoretical deepening, contextual focus, and practical application. The research focus has shifted from the basic question of "is leadership useful?" to complex mechanisms and contingency situations of "how, when, and for whom is it more effective?", particularly from focusing on traditional job satisfaction to measuring the more proactive state of "work engagement," reflecting the refinement and foresight of theoretical perspectives. However, the research community structure in this field exhibits an inherent tension: while the evolution of theories and themes shows a high degree of focus and deepening, the organizational model of research forces (at the author and institutional level) is relatively dispersed. This coexistence of "theoretical maturity" and "collaborative dispersion" suggests that despite the formation of international exchanges at the macro level, there is still significant room for improvement in knowledge sharing and collaborative innovation at the micro level. This structural characteristic may, to some extent, limit the development of large-scale inter-institutional research projects and the universal validation of theories.

At the theoretical level, future research should move beyond simple mediation models to explore moderating variables and complex contingency factors, and actively adopt more rigorous designs such as longitudinal studies to establish causal relationships, while deeply exploring emerging positive psychology constructs like "work engagement" as core outcome variables. At the practical level, the research findings provide clear action guidelines for hospital administrators: systematically implementing transformational leadership training, combined with strategies such as empowerment management, serves as an effective management lever to alleviate healthcare professionals' burnout, enhance their well-being and retention intentions, and ultimately ensure patient safety and service quality. For instance, research indicates that leaders' mindfulness practices, such as mindful breathing and daily journaling, can significantly enhance the quality of their strategic decisions, suggesting that cultivating leaders' internal psychological capacities may be an effective path to improving their managerial effectiveness and ethical standards (Joshi & Subedi, 2024). At the academic development level, to break the current fragmented state of research forces, there is an urgent need to build inter-institutional and international academic communities. Future researchers and institutions should leverage existing national collaborative network foundations to actively establish closer cooperative relationships, and through multi-center, large-scale empirical research, integrate fragmented knowledge and test the applicability of theories in different cultural and healthcare system environments, thereby advancing the entire field towards a higher level of collaborative innovation.

5. Conclusion

This study provides a comprehensive bibliometric and visualization-based analysis of how transformational leadership research connects to employee well-being and organizational commitment in healthcare service systems. The findings demonstrate that this field has developed into a mature and structured knowledge domain with clear theoretical foundations and evolving empirical sophistication.

A stable knowledge core—centered on transformational leadership, job satisfaction, and organizational commitment—has emerged, while new research frontiers highlight multi-level mechanisms such as empowerment, psychological capital, and work engagement as mediators of leadership effectiveness.

From a service-science perspective, the results reveal that leadership functions as an informational coordination mechanism linking human resources, knowledge systems, and institutional processes. However, the collaboration networks at both author and institutional levels remain fragmented, limiting the diffusion of knowledge and interdisciplinary innovation. The dominance of the United States, China, and the United Kingdom in publication volume and centrality suggests a need to strengthen cross-regional cooperation and develop global digital research infrastructures for healthcare management.

Theoretically, future research should move beyond linear mediation models to explore dynamic, data-driven frameworks integrating leadership behavior, organizational culture, and digital service analytics. Methodologically, the use of longitudinal, cross-institutional, and AI-supported bibliometric techniques could enhance causal inference and predictive modeling in leadership studies. Practically, hospital administrators and policymakers should leverage the principles of transformational leadership as part of integrated digital service strategies—linking leadership development, employee empowerment, and informatic tools to enhance well-being, retention, and performance.

By aligning leadership research with the logic of service innovation and informatics, this study contributes to the strategic transformation of healthcare organizations into learning, adaptive systems capable of sustaining both human and operational excellence.

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