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Mapping Global Research on Infection Prevention and Control for Patient Safety: A Scopus, and VOSviewer Based Bibliometric Analysis (2019–2024)

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ABSTRACT

Introduction: Infection prevention and control (IPC) have a significant impact on patient safety and healthcare quality, particularly in global health catastrophes such as the COVID-19 pandemic. The study aims to examine global research trends in infection prevention and control (IPC) and patient safety between 2019 and 2024. In addition to providing insight into the development and direction of IPC research, it highlights significant authors, issue fields, and notable works.
Methods: A bibliometric analysis was conducted using the Scopus database, encompassing a total of 180 documents as of April 1, 2025. The inclusion criteria were documented type 'Articles' and 'reviews' subject area 'medicine' and 'nursing' language 'English' from 2019- 2024. Data were analysed using Scopus, VOSviewer version 1.1.20.
Results: The COVID-19 pandemic led to a significant increase in IPC research, culminating in the highest output in 2024. The United States and the United Kingdom were major contributors, while Switzerland, India, South Africa, and Australia showed strong regional participation. Notably, rising contributions from low- and middle-income countries (LMICs) signal growing global inclusivity. Mainly, institutional contributors included the World Health Organisation (WHO) and Hôpitaux Universitaires de Genève. D. Pittet was recognised as the most productive author. Citation analysis identified highly influential studies, with the top-cited article being 129 citations. Keyword co-occurrence mapping revealed nine thematic clusters, including infection control practices, personal protective equipment, and healthcare quality improvement.
Conclusion: As demonstrated by the growing research output and global collaboration, the findings reflect the evolution of IPC into a multidisciplinary domain, exposing underexplored regions and themes in the literature. IPC has emerged as a central pillar of
Contemporary health systems. Rising contributions from low— and middle-income countries indicate increased global engagement and adherence to international standards.

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INTRODUCTION

A widespread outbreak of nosocomial Staphylococcus aureus and the realisation of the need for nosocomial infection monitoring led to the establishment of the hospital discipline of infection control in the United States in the 1950s (1). Infections which occur in hospitals, previously known as nosocomial infections (2), and thereafter referred to as Healthcare-Associated Infections (HAIs), are infections acquired during medical treatment in healthcare facilities (3). Additionally, HAIs happen in healthcare systems that vary significantly in terms of medical specialisation, available resources, and management approaches, reflecting socioeconomic and cultural disparities (4). Long-term Care Facility (LTCF) patients' morbidity and mortality are influenced by healthcare-associated infections (HAIs), a serious health issue (5). In long-term care facilities (LTCFs), healthcare-associated infections (HAIs) present substantial challenges to resident safety and care quality. A recent comprehensive systematic review and meta-analysis, which synthesised data from 33 countries, determined a pooled point prevalence of HAIs at 3.5% among residents of LTCFs (6). The analysis identified urinary tract infections as the most prevalent, accounting for 38.9% of reported cases, followed by respiratory tract infections at 33.6% and skin or soft tissue infections at 23.7% (6).

Infection Prevention and Control (IPC) is an essential aspect of healthcare focused on avoiding healthcare-associated infections (HAIs) in patients, staff, and visitors (7). Infection prevention and control (IPC) mitigates the environmental consequences of infections and their treatment, rendering it crucial for providing safe, effective, and sustainable healthcare (8),(9). However, HAIs continue to occur and present a risk to patients and healthcare workers (10). Moreover, increasing the use of many successful IPC strategies may prevent more than half of HAIs (11). Healthcare-associated infections (HAIs) correlate with heightened morbidity and mortality, as well as higher expenses; as a substantial fraction of these illnesses are avoidable, they serve as an indicator of the quality of patient treatment (12),(13). Comprehensive recommendations that highlight the role of healthcare professionals in avoiding HAIs via appropriate training, surveillance, and prompt interventions have been created by the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) (14).

In light of the worldwide disruption caused by COVID-19 and the subsequent increase in IPC-related research, a bibliometric synthesis is necessary to carefully delineate the discipline's evolution, focal areas, and principal contributions. This analysis contextualises responses to current health emergencies and defines strategic directions for future research and policy in infection prevention and control. A previous bibliometric study conducted in 2019 utilised Medline/PubMed as a literature source, which had certain constraints. Although PubMed is a reputable database in biomedical research, its limited scope and restricted inclusion of multidisciplinary or international journals may exclude broader global health perspectives. Additionally, previous bibliometric research by (15) The Web of Science database provided significant findings but did not incorporate comprehensive network visualisation tools. This study integrates the extensive coverage of the Scopus database, which indexes peer-reviewed literature across several fields, with sophisticated network mapping with VOSviewer. This methodological integration facilitates a more comprehensive examination of co-authorship, keyword co-occurrence, and citation relationships within infection prevention and control (IPC) research. Our technique adds granularity by capturing the evolution of topics and the global research architecture from 2019 to 2024, revealing transdisciplinary tendencies and highlighting emergent research area dimensions that are frequently neglected in prior bibliometric analyses. This research aims to explore several key questions regarding infection prevention and control (IPC) and patient safety. Firstly, it seeks to understand the global research trends and the evolution of bibliometric studies in these fields from 2019 to 2024. Additionally, it will identify the most influential contributors to the IPC and patient safety research landscape, including notable authors, institutions, and countries. The study also aims to identify the journals and publications that have had the greatest impact on the literature surrounding IPC and patient safety. Finally, it will conduct a co-occurrence analysis to uncover the dominant themes, keyword clusters, and emerging areas of research within IPC and patient safety. This bibliometric analysis provides comprehensive insights into global research trends in patient safety and infection prevention and control (IPC), benefiting patients, healthcare systems, and the broader health research community in several ways. It facilitates strategic planning, helps evidence-based decision-making, and directs the efficient distribution of funds to high-impact IPC projects by examining Scopus-indexed literature. The research emphasises essential principles and best practices for healthcare practitioners to enhance patient outcomes, minimise healthcare expenditures, and decrease healthcare-associated infections (HAIs). Improving safety and

reducing the risk of infection during treatment also benefits patients. The discovery of essential contributors, citation trends, and new study fields benefits researchers by encouraging cooperation and guiding further investigations. Furthermore, the research assesses the global impact of World Health Organisation (WHO) and Centres for Disease Control and Prevention (CDC) guidelines, providing valuable insights into their implementation in diverse healthcare settings. Its use of the Scopus database guarantees scientific integrity and vast coverage, making it an invaluable resource for developing global IPC strategies and health policy.

METHOD

Research Type

This study employed a bibliometric quantitative content analysis method, systematically assessing trends in the scientific literature using statistical and graphical tools. The aim is to identify research trends, key contributors, and advancements in theme areas related to infection prevention and control (IPC) and their impact on patient safety. The research comprised a comprehensive search of internationally recognised peer-reviewed journals within the Scopus database, a rigorously curated repository that adheres to a stringent selection process. Articles included in this database are meticulously reviewed and selected by an independent Content Selection and Advisory Board (CSAB) comprised of experts from various scientific disciplines, thereby ensuring that only high-quality content is indexed and affirming the credibility of Scopus (17). The Scopus database also provided numerous studies focusing on infection prevention and control as integral to patient safety, utilising the specified keywords "infection prevention," "control," and "patient safety." Bibliometric methods, such as citation analysis, keyword co-occurrence mapping, and authorship network analysis, were employed utilising VOSviewer. These methodologies enabled the depiction of academic communication patterns and theme groupings, improving our comprehension of IPC research output from 2019 to 2024.

Data Collection Procedures

This study utilised the Scopus database, esteemed for its comprehensive compilation of peer-reviewed literature, to explore infection prevention and control as a fundamental component of patient safety. The investigation focused on research articles published between 2019 and 2024, with a systematic search executed on April 1, 2025. These five years were selected to observe the progression of IPC research during and after the COVID-19 pandemic, a time characterised by increased worldwide focus on infection control measures, health system robustness, and growing interdisciplinary issues. The literature search was designed to identify topics amenable to in-depth exploration while retaining a sufficient breadth for both theoretical and practical applications. The inclusion criteria stipulated that selected articles and reviews be published in the domains of medicine and nursing in the English language and completed between (2019 -and 2024). Excluded from the review were articles not yet in their final publication stage and those outside the specified fields. Key information variables—including title, authorship, publication year, journal, keywords, and citation metrics—were meticulously preserved during the exportation of the selected dataset in CSV format. Thematic saturation was evaluated by analysing keyword frequency and co-occurrence patterns until no new predominant themes appeared over subsequent time intervals. To guarantee dataset representativeness, articles were sourced solely from Scopus, which provides extensive disciplinary and geographical coverage; nonetheless, this dependence may lead to an underrepresentation of regional publications not indexed in the database. Ultimately, the review yielded a total of 180 documents. A detailed methodology is presented in Figure 1.

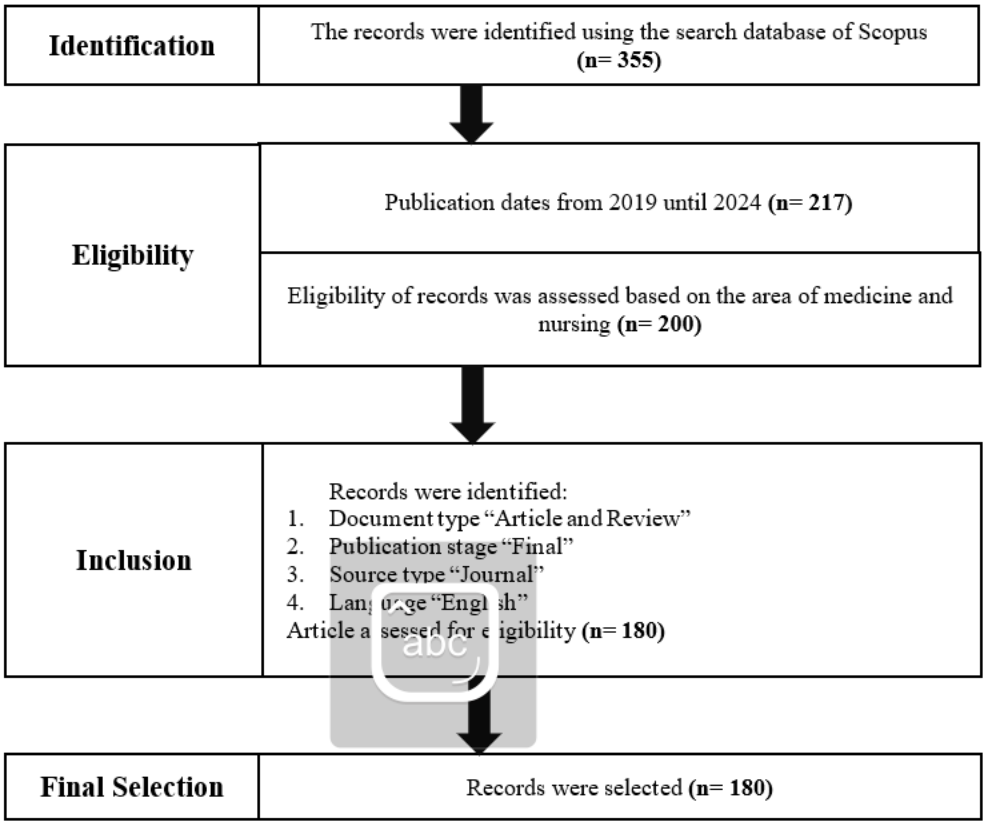

Figure 1. Article Selecting Process

Data Analysis

Data were systematically exported in Research Information Systems (RIS) format to enable the generation and potential sharing of bibliometric maps via external platforms such as academic repositories or collaborative research tools. The analyses were conducted utilising the VOSviewer tool, which employed descriptive methodologies to evaluate Scopus results across various dimensions, including publication year, country, and thematic focus. In this context, VOSviewer generated a bibliometric map that delineated research advancements related to infection prevention and control in the interest of patient safety. The analysis was performed using VOSviewer version 1.6.18 (developed by Leiden University's Centre for Science and Technology Studies, Leiden, Netherlands, and released on January 24, 2022). The data underwent rigorous refinement on multiple occasions to ensure a comprehensive understanding of infection prevention and control, particularly in relation to patient safety. Furthermore, VOSviewer enabled the visualisation of the most prevalent terms associated with the investigation of infection prevention and control for patient safety. Keywords derived from authors or titles were employed to construct the contextual framework surrounding this critical topic. The resultant dataset comprised 180 documents sourced from the Scopus database.

RESULTS

Documents Publications

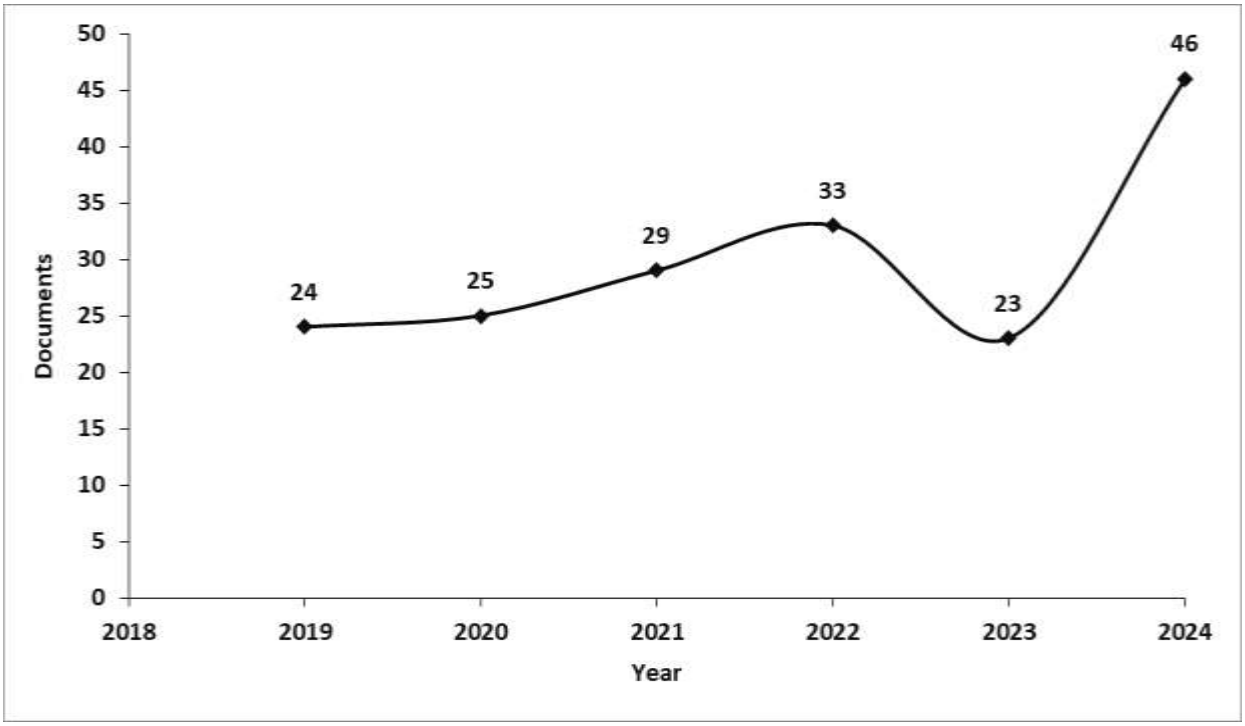

Figure 2. Number of document publications by year. (Source: Scopus Database)

The development of publications on mapping global research in infection prevention and Control for patient safety over the past five years is quite interesting**.** As shown in Figure 2. Between 2019 and 2020, the number of publications remained at a stable level of around 24 papers, indicating ongoing interest in the subject. There was a notable increase in 2022, with more than 36 papers being released. In early 2020, the World Health Organisation (WHO) officially declared the COVID-19 pandemic a global public health emergency, prompting increased research on infection prevention and control (IPC). Publication production increased dramatically in 2021(19,20) This peak was likely caused by increased attention to infection prevention and control (IPC) initiatives aimed at improving patient safety. Following the peak, there was a dip, with publishing numbers levelling at around 23 papers in 2022 and 2023. In 2024, there was a noticeable increase in publications, reaching approximately 46, which new studies and advancements in IPC tactics may have contributed to. Overall, the graph illustrates how external influences, such as the pandemic, have impacted research output and how interest in IPC initiatives has persisted over time.

Documents by Affiliation

Table 1. Top Affiliates Related to the Topic

Affiliation	Number of Publications	%
Organisation Mondiale de la Santé	16	8.90%
Hôpitaux Universitaires de Genève	14	7.80%
Centers for Disease Control and Prevention	8	4.40%
Université de Genève	7	3.90%
University of Cape Town	6	3.30%
Imperial College London	6	3.30%
Johns Hopkins University School of Medicine	5	2.80%

Johns Hopkins University	5	2.80%
Thomas Jefferson University	5	2.80%
The University of Sydney	5	2.80%

Source: Scopus database

According to Table 1, over the past 5 years, the bibliometric data highlight the research contributions of various institutions, with the Organisation Mondiale de la Santé (World Health Organisation (WHO)) leading with 16 publications, followed closely by Hôpitaux Universitaires de Genève (HUG) with 14. It suggests that the World Health Organisation (WHO) plays a central role in global health research, while HUG makes significant contributions to medical and clinical studies. Other key contributors include the Centres for Disease Control and Prevention (CDC), with eight publications; Université de Genève, with seven; and Imperial College London and the University of Cape Town, each with six. The presence of institutions from different continents—including North America (Johns Hopkins University, Thomas Jefferson University, Centers for Disease Control and Prevention (CDC)), Europe (WHO, Université de Genève, Imperial College London), Africa (University of Cape Town), and Australia (The University of Sydney) indicates a global research collaboration network. Many of these institutions are renowned for their expertise in public health, epidemiology, and clinical medicine, thereby reinforcing their pivotal role in advancing medical science. The high publication count suggests strong funding, well-established research infrastructures, and significant scientific contributions. Further bibliometric analysis, such as co-authorship networks and citation impact, could provide deeper insights into institutional collaborations and the influence of research.

Documents by Country

Table 2. Top Countries with the Most Publications Related to the Topic

Country	Number of Publications	%
United States	47	26.10%
United Kingdom	40	22.20%
Switzerland	19	10.60%
Australia	17	9.40%
Germany	12	6.70%
South Africa	12	6.70%
India	11	6.10%
Italy	11	6.10%
Canada	8	4.40%
France	8	4.40%

Source: Scopus database

The United States and the United Kingdom are the two countries that contribute the most to research, with 47 and 40 articles, respectively, according to the bibliometric data. Their significant financing, well-established academic institutions, and robust research infrastructure all contribute to their supremacy and high levels of scientific production. The existence of substantial international institutions, such as the World Health Organisation, and esteemed colleges that actively support global health research likely contributed to Switzerland's 19 publications, which ranked second. Australia also makes significant contributions, with 17 articles showcasing its involvement in scientific and medical research. Each country has 12 publications, but South Africa's involvement is particularly noteworthy, as it highlights the country's significant contributions to epidemiology, public health, and infectious disease research, notably in areas such as HIV/AIDS and TB. Italy and India have 11 publications that demonstrate the extensive research conducted in the fields of medicine, medical advancements, and public health. Although on a somewhat smaller scale than the top nations, Canada and France also contribute to international research initiatives, with each country having eight publications listed in Table 2. Although the data generally indicate that Western and

wealthy nations still control most of the research output, it also emphasises the increasing contributions of emerging research hotspots, such as South Africa. In 2020, South Africa created the National Infection Prevention and Control Strategic Framework to decrease healthcare-associated infections and antibiotic resistance. This framework conforms to international standards and prioritises enhancing patient safety and health outcomes (21), and also India the Indian Council of Medical Research (ICMR) and the National Centre for Disease Control (NCDC), with assistance from the U.S. Centres for Disease Control and Prevention, have launched initiatives to evaluate and enhance infection prevention and control procedures systematically. These initiatives seek to establish sustainable nationwide networks for the standardised implementation and reporting of healthcare-associated infections (HAIs) and infection prevention and control (IPC) policies (22). Additional examination of cooperation networks, citation impact, and topic study fields may provide a more comprehensive understanding of the importance and scope of these papers in shaping global scientific breakthroughs. While the data indicate significant contributions from high-income nations, noticeable deficits exist in Southeast Asia and Latin America. Countries such as Brazil, Indonesia, and the Philippines are underrepresented and face substantial IPC concerns. Additionally, South-South interactions are uncommon, with most research partnerships concentrating on North-South dynamics. Addressing these gaps is vital to creating fair, context-specific IPC solutions.

Documents by Authors

Table 3. Top Authors with the Most Publications

Author Name	Number of Publications
Pittet, D.	15
Peters, A.	7
Allegranzi, B.	6
Kilpatrick, C.	5
Tartari, E.	5
Manning, M.L.	4
Van Poel, E.	4
Willems, S.	4
Zingg, W.	4
Ahmad, R.	3

Source: Scopus database

Table 3 shows that D. Pittet is the most prolific contributor, with 15 publications, much exceeding the output of other writers. This indicates that Pittet is a prominent researcher in the field, likely influencing scholarly dialogue in domains such as infection control, patient safety, or hospital epidemiology. A. Peters, the second most prolific author, with seven articles, followed by B. Allegranzi with 6, suggesting their significant contributions, maybe in conjunction with Pittet, since Allegranzi is recognised for expertise in infection control. Numerous other authors, such as C. Kilpatrick and E. Tartari, each with five publications, have a robust research presence, indicating their participation in noteworthy initiatives or partnerships. Authors M. L. Manning, E. Van Poel, S. Willems, and W. Zingg, each with four publications, make significant contributions but with a lesser output than the leading contributors. Ultimately, R. Ahmad, with three articles, concludes the list, signifying participation in research but on a very modest scale. This distribution indicates a central cohort of prominent academics steering the field, notably Pittet, Allegranzi, and their immediate associates, likely operating within the same institutions or initiatives. Subsequent analysis may investigate co-authorship networks, research impact via citation analysis, and theme study areas to elucidate the links and effects of these writers within their respective research fields.

Documents by Journal

Table 4. Top Journals with the Most Publications

No	Journal Name	Number of Publications
1	Antimicrobial Resistance and Infection Control	26
2	American Journal of Infection Control	17
3	Journal of Hospital Infection	11
4	International Journal of Environmental Research and Public Health	6
5	BMC Health Services Research	3
6	Infection, Disease and Health	3
7	Radiography	3
8	Antibiotics	2
9	BMC Infectious Diseases	2
10	BMJ Open	2

Source: VOSviewer

The prevalence of specialist publications, such as Antimicrobial Resistance and Infection Control and the American Journal of Infection Control, in the publication arena, signifies a robust, concentrated epistemic community in infection prevention and control (IPC). This concentration suggests that IPC research is primarily shared among a closely knit network of professionals comprising infection control specialists, hospital epidemiologists, and public health authorities. This approach guarantees focused distribution and upholds methodological integrity in the discipline. However, it may restrict wider interdisciplinary collaboration, especially in health policy, behavioural science, and digital health. The inclination towards domain-specific publications bolsters the validity and coherence of IPC as a unique knowledge domain defined by shared norms, global standards, and institutional leadership—especially by the World Health Organization (WHO) and associated specialists. This insularity may hinder the dissemination of IPC ideas into the broader health system dialogue. Consequently, broadening publication efforts to include more multidisciplinary or general medical publications may enhance the field's prominence and facilitate its integration into broader health policy and systems-strengthening activities.

Co-occurrence of Keywords

The network visualisation of co-occurrence based on keywords, generated with VOSviewer, comprises 48 items categorised into 9 clusters, each signifying unique thematic domains within the research landscape. Cluster 1, containing nine items, features keywords such as primary health care, personal protective equipment (PPE), and pandemic, signifying an emphasis on healthcare systems, protective measures, and pandemic challenges. Cluster 2, comprising eight items, encompasses infection prevention and control (IPC), healthcare-associated infections (HAIs), and disinfection, highlighting research on infection control methodologies and hospital hygiene protocols. Cluster 3, comprising eight items, encompasses healthcare-associated infections, the COVID-19 pandemic, and nursing, underscoring the influence of infectious diseases on healthcare professionals and patient care. Cluster 4, comprising five items, emphasises healthcare planning, quality, organisation, management, program development, program evaluation, and public health services, highlighting the significance of policy and healthcare system enhancements. Clusters 5, 6, 7, and 8, each containing four items, presumably indicate specialist subtopics within infection control, healthcare administration, and epidemiology. Cluster 9, comprising only two items, may indicate a niche study field with a lower prevalence. Several clusters exhibit theme overlaps, underscoring the increasing multidisciplinary integration in IPC research. The proximity of concepts such as nursing, public health, program assessment, and pandemic response suggests a shift from viewing IPC as a clinical matter to recognising it as a multifaceted public health need. The links indicate that effective IPC increasingly requires integrated efforts across health systems, policy, and community levels. The COVID-19 pandemic expedited this transition, fostering cross-sector collaboration and a systems-thinking paradigm that encompasses leadership, training, and behavioural modification. These discoveries provide a basis for forthcoming multidisciplinary study, especially in resource-constrained environments.

High Cited Documents

Table 5. Top Cited Documents Related to the Topic

No	Title	Authors	Year	Citations
1	Overview of guidance for endoscopy during the coronavirus disease 2019 pandemic	Lui RN, Wong SH, Sánchez-Luna SA, Pellino G, Bollipo S, Wong MY, et al (23)	2020	129
2	Hand hygiene in hospitals: anatomy of a revolution	Vermeil T, Peters A, Kilpatrick C, Pires D, Allegranzi B, Pittet D (24)	2019	82
3	Primary Health Care Facility Preparedness for Outpatient Service Provision During the COVID-19 Pandemic in India: Cross-Sectional Study	Garg S, Basu S, Rustagi R, Borle A. (25)	2020	81
4	Patient safety in inpatient mental health settings: a systematic review	Thibaut B, Dewa LH, Ramtale SC, D'lima D, Adam S, Ashrafian H, et al (26)	2019	81
5	Implications of identifying the recently defined members of the Staphylococcus aureus complex S. argenteus and S. schweitzeri: a position paper of members of the ESCMID Study Group for Staphylococci and Staphylococcal Diseases (ESGS)	Becker K, Schaumburg F, Kearns A, Larsen AR, Lindsay JA, Skov RL, et al (27)	2019	69
6	Mental health among healthcare personnel during COVID-19 in Asia: A systematic review	Thatrimontrichai A, Weber DJ, Apisarnthanarak A. (28)	2021	62
7	Guidelines: Anaesthesia in the context of the COVID-19 pandemic	Velly L, Gayat E, Quintard H, Weiss E, De Jong A, Cuvillon P, et al (29)	2020	57
8	The great nursing brain drain and its effects on patient safety	Peters A, Palomo R, Pittet D. (30)	2020	52
9	Implementation of hand hygiene in health-care facilities: results from the WHO Hand Hygiene Self-Assessment Framework Global Survey 2019	de Kraker MEA, Tartari E, Tomczyk S, Twyman A, Francioli LC, Cassini A, et al (31)	2022	50
10	Efficacy of a Test-Retest Strategy in Residents and Health Care Personnel of a Nursing Home Facing a COVID-19 Outbreak	Blain H, Rolland Y, Tuaillon E, Giacosa N, Albrand M, Jaussent A, et al. (32)	2020	49

Source: VOSviewer

Table 5 provides a concise overview of the most significant scholarly contributions to healthcare research during the COVID-19 pandemic. The most cited article, "Overview of Guidance for Endoscopy During the Coronavirus Disease 2019 Pandemic", by Lui (2020), garnering 129 citations, consolidates essential information and recommendations for safe endoscopic procedures. This research emphasises crucial safety protocols, including stringent infection control measures, the use of appropriate personal protective equipment, thorough patient assessments, and staff welfare, to minimise cross-infection and ensure the continuity of healthcare services. Complementing this, Vermeil's "Hand Hygiene in Hospitals: Anatomy of a Revolution" (2019), cited 82 times, explores the historical evolution of hand hygiene practices and underscores their importance in preventing healthcare-

associated infections (HAIs), advocating for the adoption of alcohol-based hand sanitisers and the World Health Organization's multimodal approach.

Other significant studies further highlight critical issues in healthcare delivery. Garg's evaluation of Indian Primary Health Centers during the pandemic (2020), with 81 citations, reveals substantial deficiencies in service readiness. Thibaut's systematic review on patient safety in mental health settings identifies multiple safety concerns, with 81 citations. Research by Thatrimontrichai (2021) explores the psychological impact of COVID-19 on healthcare personnel, revealing alarming rates of depression and anxiety. Peters (2022) discusses the implications of nurse migration on patient safety, advocating for legislative measures to improve working conditions. Additionally, De Kraker's assessment of global hand hygiene practices (2022) emphasises the need for improved compliance across different economies. Blain's study on infection control strategies in nursing homes underscores the efficacy of recurrent testing. Collectively, these studies provide vital insights into the multifaceted challenges faced by healthcare systems during and beyond the pandemic, influencing policy and practice in infection control, mental health, and workforce management. These extensively referenced studies indicate significant transformations in IPC research, including a shift toward pandemic resilience and the incorporation of mental health as a crucial element of infection control. They expanded the domain beyond clinical hygiene to systemic readiness and staff welfare, strengthening IPC's contribution to overall health system resilience.

DISCUSSION

As depicted in Figure 1, the systematic selection process in this bibliometric analysis underscores methodological rigour and thematic relevance. Initially, a comprehensive pool of 355 records was extracted from the Scopus database; following meticulous screening based on criteria such as publication year, document type, topical relevance, and language considerations, 180 publications were ultimately retained. This selection methodology adheres to established bibliometric standards that prioritise quality over quantity, thereby enhancing the scientific integrity of the study. (33). The annual distribution of publications, illustrated in Figure 2, demonstrates a dynamic evolution in research output. Between 2019 and 2020, the volume of scholarly publications remained relatively stable, indicating a consistent baseline interest in infection prevention and control (IPC). However, a notable surge in 2021 coincided with the worldwide escalation of the COVID-19 pandemic, serving as a compelling example of how global health emergencies can catalyse scientific inquiry and facilitate knowledge dissemination. Furthermore, the ongoing increase projected through 2024, culminating in a peak, may signify an expanding recognition of IPC's pivotal role in fortifying health systems, particularly during the phases of post-pandemic recovery and strategic reassessment. (34).

Table 1 outlines the key institutions at the forefront of Infection Prevention and Control (IPC) research, with the World Health Organisation (WHO) leading the way by publishing 16 scholarly works. The prominence of esteemed institutions such as Imperial College London and Hôpitaux Universitaires de Genève underscores the significant contributions of globally engaged clinical and academic entities. This landscape illustrates the dual impact of top-down policy leadership and bottom-up innovation occurring within clinical settings, highlighting the essential role of these collaborations in effectively translating global health priorities into actionable practice. (35,36). To comprehend bibliometric dominance and its policy ramifications, IPC research participants can be categorised into four roles: global policy leaders, exemplified by the World Health Organization (WHO), which establishes international standards; academic knowledge centres, such as Imperial College London, recognised for substantial, methodologically sophisticated output; translational agencies, like the Centers for Disease Control and Prevention (CDC), that connect research and practical application; and nascent regional innovators from LMICs, such as the University of Cape Town, which offer locally tailored strategies. This typology highlights the unique yet synergistic roles of institutions in the global formulation and dissemination of IPC knowledge. Additionally, the geographical distribution depicted in Table 2 further substantiates this observation. The United States and the United Kingdom have emerged as dominant contributors to IPC research output, a trend attributable to their robust research infrastructures and sustained funding mechanisms. However, the notable participation of countries such as South Africa and India signals a critical evolution as these nations increasingly assert themselves as active contributors. This shift denotes a broader transition toward a more globally representative framework in IPC research, reflecting

ongoing efforts to internationalise health sciences bolstered by transnational partnerships and capacity-building initiatives in the Global South. (37).

In Table 3, the analysis of prolific authors reveals that specific individuals have a significant influence on the field of Infection Prevention and Control (IPC). Didier Pittet, who leads with 15 publications, is widely acknowledged for his pioneering contributions to hand hygiene and the formulation of IPC policy. Alongside him, scholars such as Benedetta Allegranzi and Alexandra Peters have made notable contributions, many of which are closely linked to initiatives led by the World Health Organisation (WHO). This concentration of intellectual influence among distinguished experts suggests that thought leadership remains a pivotal driver of advancement in the IPC domain (38,39). Furthermore, as outlined in Table 4, the publication venues corroborate the field's maturity. The pre-eminence of specialised journals, such as "Antimicrobial Resistance and Infection Control" and "The American Journal of Infection Control", signifies a well-established and focused scholarly community. Concurrently, the emergence of interdisciplinary journals highlights an increasing intersection of IPC research with broader domains, including environmental health, public health systems, and antimicrobial stewardship (40). Table 5, which enumerates the most highly cited articles, emphasises the substantial impact of publications generated during the pandemic era. These highly referenced works, addressing critical topics such as COVID-19 preparedness, hospital infection control, and hand hygiene, have significantly shaped academic discourse and produced tangible implications for policy and practice. These publications illustrate that IPC is no longer perceived as a niche concern but has emerged as a fundamental pillar of health security (41,42).

Delving into these findings reveals a compelling narrative: global health events, such as pandemics, significantly reshape the landscape of Infection Prevention and Control (IPC) research in terms of quantity and thematic focus. The onset of the pandemic acted as a catalyst, sparking an unprecedented wave of financial investments and elevating public and institutional interest in IPC strategies. This period marked a crucial turning point, where the urgency of the crisis gave rise to a collective consciousness surrounding health security. The prominent roles assumed by major international organisations, such as the World Health Organisation, alongside a select cadre of renowned researchers, vividly illustrate how strategic leadership can profoundly influence research agendas and the overarching responses to global health crises. Their concerted efforts have cultivated a more directed and efficient approach to addressing the complexities of infectious disease transmission and prevention. Additionally, the expanding geographical network of contributors paints a hopeful picture of a collaborative international community. Researchers from diverse backgrounds and regions are coming together, breaking down barriers that once limited participation and fostering a spirit of inclusivity. This trend toward global collaboration signifies a collective commitment to addressing health challenges with a unified approach, reflecting the interdependence of nations in their pursuit of practical solutions to pressing health issues. A thematic synthesis of the term clusters identifies three intersecting domains: workforce and clinical practice, health system policy, and multidisciplinary innovation. Workforce clusters prioritise nursing, personal protective equipment, and frontline safety, whereas policy clusters concentrate on program development and public health services. Interdisciplinary themes such as environmental health, antibiotic resistance, and digital tools indicate the expanding breadth of the subject. Although these topics frequently overlap, especially in relation to labour and policy, new technical issues appear to be isolated, indicating both integration and divergence within IPC research.

These bibliometric patterns illustrate fundamental aspects of health system resilience, particularly the capacity to adapt and evolve in times of crisis. The post-COVID-19 surge in IPC research signals a shift toward evidence-based, adaptive systems. Enhanced contributions from LMICs such as India and South Africa indicate a shift towards a more inclusive framework for global knowledge creation. The increasing emphasis on public health policy, digital tools, and worker safety underscores the need for a comprehensive, cross-sectoral strategy. Collectively, these patterns align with the WHO's resilience pillars—awareness, integration, and adaptability—and highlight IPC's evolving role in enhancing health system preparedness. Compared to earlier bibliometric analyses, such as Sweileh's 2017 investigation into infection prevention and control (IPC) research trends, our study elucidates both continuity and evolution within the field (43). Fitria et al. (2023) identified motivation and workload as pivotal factors influencing the performance of infection control nurses during the COVID-19 pandemic, indicative of a paradigm shift toward examining workforce dynamics (44). This facet is only indirectly addressed in our bibliometric analysis, which primarily emphasises publication outputs and institutional affiliations (44). Similarly, Abdul-Mumin et al.

(2023) highlighted the necessity for adaptive IPC strategies in the post-COVID-19 landscape, underscoring a substantial qualitative transformation in IPC practices; our findings corroborate this by documenting a quantitative surge in publications related to pandemic preparedness and resilience in 2021 and subsequent years (45). Alkurdi et al. (2024) critically examined IPC guidelines within dental settings, pinpointing discrepancies in global recommendations (46). Although our research does not explicitly engage with clinical sector-centric guidelines, it supports the overarching conclusion that the COVID-19 pandemic has spurred a re-evaluation of guidelines across various disciplines (46). Additionally, Kuntari et al. (2023) conducted a bibliometric analysis focused on hospital waste management and environmental IPC concerns, signifying a trend toward integrating ecological health considerations; our keyword mapping similarly suggests an increasing interdisciplinary orientation within the literature (47). Lastly, Yang and Qi (2022) explored the literature surrounding global public health governance during the pandemic, revealing an uptick in collaboration among nations and institutions (48). This resonates with our observations of an expanding geographic footprint and institutional diversity in IPC research (48). Collectively, these comparisons reinforce the credibility of our findings and highlight potential avenues for more granular or sector-specific bibliometric investigations that could yield complementary insights.

The study offers valuable insights into the evolving landscape of infection prevention and control (IPC) research from 2019 to 2024; however, several limitations warrant acknowledgement. Firstly, the analysis was solely conducted using the Scopus database. While Scopus is recognised for its extensive coverage of peer-reviewed literature, reliance on a singular source may have excluded pertinent studies indexed in other significant databases, such as Web of Science, PubMed, or various regional repositories. This reliance limits comprehensiveness and may introduce selection bias, particularly concerning underrepresented geographic areas. Secondly, the study employs bibliometric indicators, such as publication counts and citation frequency, which, while widely accepted metrics, fail to adequately capture the qualitative impact or practical utility of research findings. Highly cited studies may predominantly reflect topical interest rather than methodological rigour or real-world influence. Furthermore, newer publications, specifically those from 2023 and 2024, may not have had the opportunity to accumulate a meaningful number of citations, thereby potentially distorting perceptions of their impact. Thirdly, although the study identifies leading authors and institutions, it does not thoroughly analyse author collaboration networks, funding sources, or policy outcomes. These aspects are crucial for understanding the broader ecosystem underpinning IPC research and effectively translating findings into practical applications. The thematic categorisation based on keyword co-occurrence may also risk oversimplifying complex research topics and neglecting interdisciplinary nuances. Finally, the study's retrospective nature implies an inability to capture evolving trends in real time. Given the rapidly changing landscape of IPC, particularly in global health emergencies, there is an inherent lag between research production and bibliometric visibility. Accordingly, readers should interpret the results as a snapshot of the field rather than a definitive mapping of its entirety.

These findings open the way for various important avenues in future IPC research. Initially, research should extend beyond Scopus to include regional and grey literature, reducing database bias. Secondly, it is essential to examine underexplored contexts—such as IPC strategies in humanitarian crises, refugee camps, and informal health systems—where traditional methodologies may be inapplicable. Third, the emergence of digital health technologies introduces a new domain: AI-driven bibliometric studies may reveal real-time knowledge patterns, deficiencies, and nascent collaborations with enhanced accuracy. Subsequently, future investigations should examine methods for decentralising knowledge creation to facilitate equal representation and innovation across all global areas.

CONCLUSION

A significant and continuous rise in worldwide research on infection prevention and control (IPC) and patient safety, notably accelerated during the COVID-19 pandemic, highlights the impact of public health catastrophes in driving scientific innovation. Recent contributions from nations such as India and South Africa indicate a shift toward a more inclusive and geographically diverse research environment driven by enhanced national capabilities and governmental commitments to healthcare quality and system resilience. These developments underscore the importance of IPC as a technological necessity and a strategic and ethical imperative crucial for reducing healthcare-associated infections, protecting healthcare personnel, and enhancing patient outcomes. The results provide essential information to inform future research goals, influence policy formulation, and promote global cooperation to improve

patient safety in various hospital settings. The main limitation of this study is its sole reliance on Scopus-indexed literature, which presents a coverage limitation and may potentially underrepresent research contributions from low- and middle-income countries (LMICs). It may compromise the comprehensiveness and global relevance of the findings. To mitigate this, subsequent research should integrate bibliometric analysis with qualitative methodologies, such as expert interviews or case studies, to gain deeper contextual insights and enhance the validity of the conclusions. As the global health community transitions from pandemic response to resilience enhancement, IPC research must be integrated into comprehensive health policy frameworks, focusing on workforce capacity, implementation science, and digital technologies to anticipate and mitigate future threats. In closing, it is imperative that the global research community not only advances scientific knowledge but also ensures equitable participation from all regions. Actual progress demands respecting data sovereignty and fostering inclusive collaboration so that the benefits of research are shared fairly and reflect the diversity of our world.

AUTHOR'S CONTRIBUTION STATEMENT

Abdullah Miry: Conceptualized the research framework, conducted the systematic review, and contributed to data analysis, assisted in data extraction, quality assessment, and manuscript writing. Maria Ulfa: Provided critical revisions, ensured adherence to PRISMA guidelines, contributed to the methodology and discussion sections and assisted in final manuscript editing and submission.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest related to this study.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors employed Grammarly as a tool to facilitate the review of grammatical accuracy and the structural integrity of the sentences.

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