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A BIBLIOMETRIC ANALYSIS OF RESEARCH PERFORMANCE AND COLLABORATION IN MEDICAL RESEARCH AT A CATHOLIC UNIVERSITY

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Abstract
This study aims to analyze publication performance, thematic trends, and the structure of scientific collaboration in medical research conducted within Catholic higher education institutions worldwide. Data were retrieved from the Scopus database covering the period 2006–2025, comprising a total of 604 articles. Bibliometric analysis was conducted using Microsoft Excel for descriptive statistical calculations and VOSviewer for visualizing research network structures. The findings indicate that publication output increased from 11 documents in 2006 to a peak of 46 documents in 2013, representing a growth rate of 318.18%, with an average of 30.2 documents per year. The largest contributions came from the Journal of Minimally Invasive Gynecology (20 documents) and The Catholic University of Korea (210 documents). Co-word keyword network analysis identified five major thematic clusters. Meanwhile, the co-authorship network analysis revealed two main clusters, with a total link strength of 311, led by Scambia G. (61 documents, 153 links) and Fagotti A. (38 documents, 112 links). International collaboration remains predominantly concentrated in two countries, namely South Korea (200 documents) and Italy (151 documents). In contrast, the participation of developing countries, including Indonesia, remains limited to nine documents (1.49% of the total publications). These findings highlight the importance of formulating strategies to strengthen cross-national collaborative networks and diversify research partnerships to enhance global scientific visibility and research impact.

Keywords: Bibliometrics, Medical Research, Scientific Collaboration, Catholic Higher Education Institutions, Scientific Publications, Scopus.

INTRODUCTION

Science and technology in the field of medicine have advanced rapidly over the past two decades. This growth is marked by a surge in the volume of scientific publications from higher education institutions worldwide. Publications are not merely an indicator of academic productivity; they also reflect research quality, contributions to the advancement of knowledge, and institutional competitiveness in the international arena. In higher education, including Catholic universities, research performance is one of the main criteria for assessing academic quality, measured by document output, journal reputation, citation impact, and the breadth of

scientific collaboration networks. Evaluating research performance and collaboration patterns requires a quantitative approach that is measurable and objective. Bibliometric analysis has emerged as a standard method in bibliographic mapping for measuring scientific productivity, the dynamics of topic development, and the structure of networks among authors, institutions, and countries.

Bibliometric studies in medicine and higher education show that quantitative analysis of large-scale bibliographic data has grown rapidly as a means of evaluating research roadmaps. Previous studies, such as those by Ellegaard & Wallin (2015) and Atmacasoy & Aksu (2020), confirm that bibliometrics is highly effective for mapping medical research trends and evaluating medical education at the macro level. At the regional and institutional levels, several bibliometric studies have focused on mapping health research publications in developing countries (Pratama & Suwandi, 2023; Wibowo & Hartono, 2020) or on research performance at a single university (Krauskopf, 2018). Moreover, evaluations of faith-based universities have generally been confined to local or national contexts; for example, Purwanto & Hidayat (2021) examined the research productivity of faith-based private universities within Indonesia.

Previous studies have largely been bounded by geography or by a single institution, leaving an empirical gap regarding the publication characteristics and collaboration structures of medical research across faith-based universities that operate in multiple countries. Catholic universities distributed globally, from South Korea and Italy to the United States and Indonesia, form consortia and share distinctive institutional characteristics. The small number of Indonesian journals indexed in Scopus is often attributed to its stringent selection requirements. The categories and criteria used in Scopus evaluation are presented in Table 1.

Table 1. Categories and Criteria for Scopus-Indexed Publications

No	Category	Criteria
1.	Journal policy (35%)	● Convincing editorial policy ● Geographical diversity of editors ● Geographical diversity of authors
2.	Content (20%)	● Academic contribution ● Clarity of abstracts ● Quality of, and conformity with, the stated aims and scope ● Readability of articles
3.	Journal standing (25%)	● Citedness of journal articles in Scopus ● Editor standing in Scopus
4.	Regularity (10%)	● No delays in the publication schedule
5.	Online availability (10%)	● Content available online ● English-language journal homepage available ● Quality of the journal homepage

This study makes a substantive contribution to library science, information science, and research evaluation. For library and information science, it enriches quantitative studies that use large-scale bibliographic data for co-word and co-authorship analysis. For policymakers and research evaluators in higher education, the findings can serve as an empirical basis for formulating resource allocation strategies, setting priorities for medical research, and

improving the effectiveness of international collaboration. Against this background, the study aims to provide a comprehensive analysis of publication performance, research topic trends, and patterns of scientific collaboration networks in medical research at Catholic universities worldwide indexed in Scopus during 2006–2025. VOSviewer is a freely available computer program for constructing, visualising, and exporting bibliometric knowledge maps (Leydesdorff & Rafols, 2012). Its advantage over other analytical tools is that it uses text mining to identify relevant noun-phrase combinations for mapping, together with an integrated clustering approach for examining co-citation and co-occurrence networks (Van Eck & Waltman, 2011; Waltman et al., 2010). Although many programs can analyse textual units and matrix similarity, the strength of VOSviewer lies in its visualisation (Van Eck & Waltman, 2010). Its interactive options and functions make bibliometric networks easy to access and explore, such as citation counts or co-occurrence relationships among key terms and concepts (Van Eck & Waltman, 2011; Waltman et al., 2010).

RESEARCH METHOD

Bibliographic data collection was designed to be structured and measurable through the Scopus database in order to ensure transparency, accountability, and replicability of the research process. Scopus was chosen as the sole data source because of its reputation for indexing global medical literature subject to rigorous peer review and for the completeness of its bibliographic metadata. The search strategy combined keywords, Boolean operators (AND, OR), field restrictions, and precise filtering criteria. The search syntax integrated three main domains: the medical field, the university affiliation, and the publication period. Thematic keywords included general and specific medical terms such as "medicine", "medical education", "gynecology", "oncology", "pediatrics", "ophthalmology", and "chronic disease". These terms were combined with affiliation restrictions for Catholic universities worldwide using search strings such as "Catholic University", "Universitas Katolik", "Universita Cattolica", and "Catholic Univ". The search was limited to the subject area of medicine for publications from 2006 to 2025.

Inclusion and exclusion criteria were applied strictly to maintain the relevance and quality of the data corpus. The inclusion criteria required documents to be original research articles or review articles published between 2006 and 2025 and authored by at least one author affiliated with a Catholic university. The affiliations covered the global network of Catholic universities, including The Catholic University of Korea, Catholic University of the Sacred Heart/Università Cattolica del Sacro Cuore, Atma Jaya Catholic University of Indonesia, The Catholic University of America, and the Pontificia Universidad Católica institutions in Latin America. The exclusion criteria removed non-article documents such as conference papers, editorials, book chapters, errata, notes, and short surveys, as well as documents published outside 2006–2025 or lacking a clear Catholic university affiliation.

RESULT AND DISCUSSION

Growth of Publications in Medicine

The analysis identified several fundamental dynamics in the structure of medical research publication and collaboration at Catholic universities worldwide. The findings reveal a sharp concentration of productivity among a small group of senior researchers (core authors), such as Scambia G. (61 articles), Fagotti A. (38 articles), and Fanfani F. (34 articles). This

distribution not only reflects high publication counts but also an author productivity concentration skewed towards an extreme Pareto pattern, providing empirical support for Lotka's law and the Matthew effect. The pattern is consistent with Lotka's law in bibliometrics and reflects the Matthew Effect in Science described by Robert K. Merton. Accumulated resources, access to multidisciplinary research grants, and advanced clinical facilities give senior researchers a cumulative advantage that allows them to continue dominating dissemination in leading journals such as the Journal of Minimally Invasive Gynecology, as also reported by Pratama & Suwandi (2023) and Aksnes et al. (2019). This hierarchical structure contrasts with the view of Wagner & Leydesdorff (2005), who argue that global science networks should ideally foster the democratisation of research and a more equitable distribution of roles among researchers across institutional levels.

With regard to network dynamics and the theory of the invisible college, the co-authorship map forms closed clusters with high network density and clustering coefficients among groups of surgical specialists. This exclusive networking can be explained by Derek J. de Solla Price's theory of the Invisible College, in which leading researchers form informal consortia to share clinical facilities and patient data and to accelerate publication. This result supports the findings of Nastase & Moldovan (2021) on the strong influence of specialist consortia over high-quality medical publications. However, the pattern runs counter to the views of Donthu et al. (2021) and Sweileh et al. (2017), who advocate open interdisciplinary collaboration to accelerate inclusive public health innovation rather than confinement within closed surgical specialist groups.

This finding is consistent with Pratama & Suwandi (2023) and Aksnes et al. (2019) on the influence of cumulative advantage on individual productivity. Nevertheless, it conflicts with the argument of Wagner & Leydesdorff (2005) that global science networks should ideally promote the democratisation of research and a more equitable distribution of roles among researchers from different career levels and institutions.

The co-authorship network forms two main, highly dense clusters. This closed networking can be explained by Derek J. de Solla Price's theory of the Invisible College, in which leading researchers build informal groups to exchange ideas, share facilities, and regularly co-author scientific work. This result supports the findings of Nastase & Moldovan (2021) on the strong control exercised by specialist consortia in high-quality medical publishing. However, the pattern contrasts with the views of Donthu et al. (2021) and Sweileh et al. (2017), who encourage open interdisciplinary collaboration to accelerate more inclusive public health innovation rather than a focus on exclusive surgical specialist groups.

The geographical contribution is unequal and dominated by high-income countries such as South Korea (200 documents) and Italy (151 documents), whereas Indonesia contributes only 9 documents (1.49%). This pattern reflects epistemic inequality and the centre–periphery model. Institutions in developing countries still act as peripheral actors facing limited access to funding, laboratories, and publication fees. Although this finding confirms the analyses of Mongeon & Paul-Hus (2016) and Purwanto & Hidayat (2021) on systematic biases in global databases, it contrasts with the expectation expressed by Handoko & Rahayu (2022) of growing global participation by faith-based universities. Indonesia's limited involvement indicates that research internationalisation has not yet developed evenly. Medical publications grew significantly between 2006 and 2025, with the highest number of Scopus-indexed publications recorded in 2013, at 46 publications (7.61%). The growth of international publications in medicine is presented in Table 2.

Table 2. Publication Trends in Medicine in Scopus (2006–2025)

Publication Year	Number	Percentage (%)
2025	38	6.29%
2024	32	5.29%
2023	25	4.13%
2022	34	5.62%
2021	32	5.29%
2020	36	5.96%
2019	32	5.29%
2018	31	5.13%
2017	24	3.97%
2016	34	5.62%
2015	37	6.12%
2014	39	6.45%
2013	46	7.61%
2012	42	6.95%
2011	30	4.96%
2010	24	3.97%
2009	20	3.31%
2008	19	3.14%
2007	18	2.98%
2006	11	1.82%
Total	**604**	**100.00%**

As shown in Table 2 and Figure 1, after peaking in 2013 (46 articles), publication output remained stable at around 30 or more articles per year, for example in 2012 (42 articles; 6.95%), 2014 (39 articles; 6.45%), and 2025 (38 articles; 6.29%). This consistent growth from 2006 to 2025 indicates a strengthening research commitment and a growing drive towards international publication among Catholic universities worldwide.

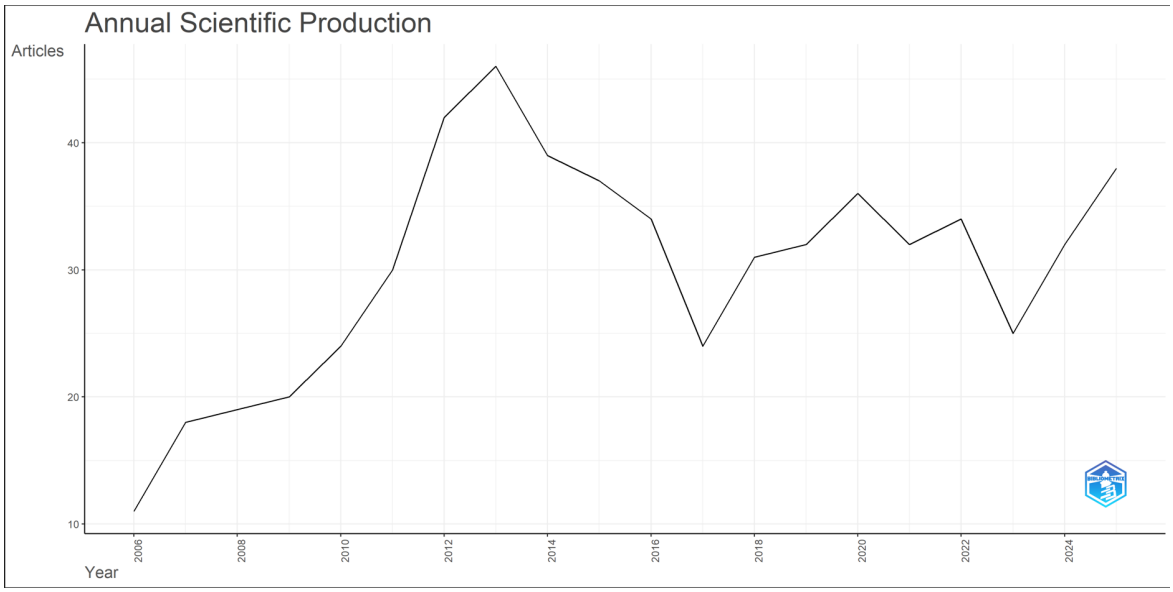


Figure 1. Annual Publication Trends in Medicine in Scopus (2006–2025)

Core Journals in Medicine

The extracted data show that the 604 articles were distributed across a range of highly reputable international journals. The ten core journals that published the most medical articles from Catholic universities are presented in Table 3 and Figure 2.

Table 3. Ten Most Productive Core Journals in Medicine in Scopus

Core Journal	Number
Journal Of Minimally Invasive Gynecology	20
Journal Of Cataract and Refractive Surgery	18
BMJ Open	12
Annals Of Surgical Treatment and Research	9
Medicine (United States)	9
European Journal Of Surgical Oncology	8
Gynecologic Oncology	8
Korean Journal Of Pediatrics	8
International Journal Of Gynecological Cancer	7
Fertility and Sterility	6

As shown in Table 3 and Figure 2, the Journal of Minimally Invasive Gynecology ranks first with 20 articles, followed by the Journal of Cataract and Refractive Surgery (18 articles), BMJ Open (12 articles), and Annals of Surgical Treatment and Research and Medicine (United States), with 9 articles each. This indicates that publication activity is concentrated in specialist surgical journals in gynaecology and ophthalmology, as well as in multidisciplinary general health journals.

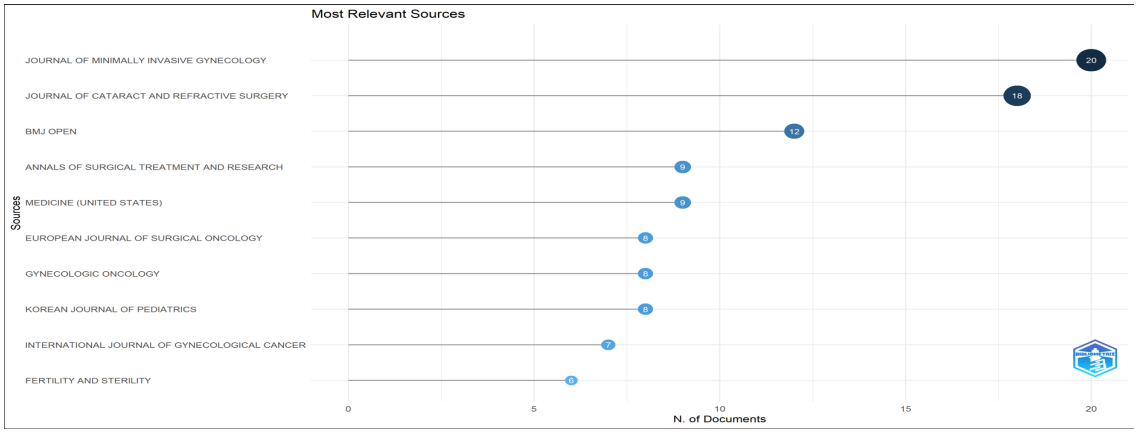


Figure 2. Ten Most Productive Core Journals in Medicine in Scopus

Most Productive Institutional Affiliations

Institutional productivity shows that Catholic institutions in the Asia-Pacific region and Europe dominate scientific publishing in medicine. The ten leading affiliations are presented in Table 4 and Figure 3.

Table 4. Ten Most Productive Institutional Affiliations in Medicine

Affiliation	Number
The Catholic University Of Korea	210
Catholic University Of Korea	145
Catholic University Of The Sacred Heart	75
Catholic University	73
Università Cattolica Del Sacro Cuore	35
Pontifica Universidad Católica De Chile	24
Atma Jaya Catholic University Of Indonesia	23
Fondazione Policlinico Universitario A. Gemelli IRCCS	22
Australian Catholic University	18
Catholic University Of Sacred Heart	15

As shown in Table 4 and Figure 3, The Catholic University of Korea is the most productive institution with the largest contribution (210 articles), followed by a variant spelling of the same institution, Catholic University of Korea (145 articles), and the Catholic University of the Sacred Heart in Italy (75 articles). Atma Jaya Catholic University of Indonesia is also among the ten most active affiliations, with 23 articles.

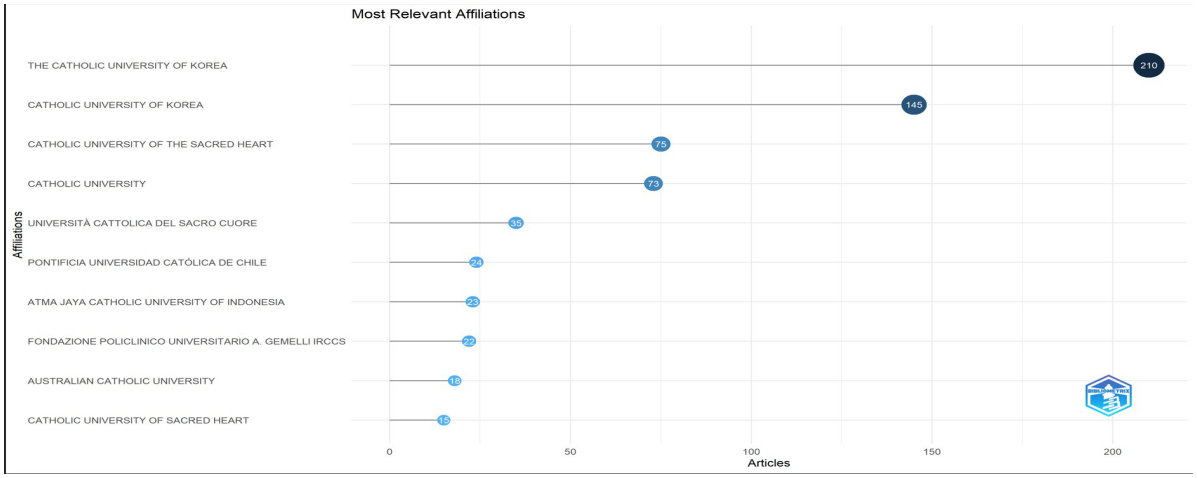


Figure 3. Ten Most Productive Institutional Affiliations in Medicine

Researcher Productivity in Medicine

The productivity of the leading researchers (core authors) in medicine at Catholic universities ranges from 12 to 61 articles. The ten most productive researchers are presented in Table 5 and Figure 4.

Table 5. Ten Most Productive Researchers in Medicine

Author	Number
Scambia G	61
Fagotti A	38
Fanfani F	34
Ferrandina G	22
Gallotta V	22
Costantini B	21
Vizzielli G	19
Lee SH	18
Kim JS	13
Joo C-K	12

Table 5 and Figure 4 confirm that Scambia G. is the most productive researcher, with 61 Scopus-indexed articles, followed by Fagotti A. (38 articles) and Fanfani F. (34 articles), while Ferrandina G. and Gallotta V. each have 22 articles.

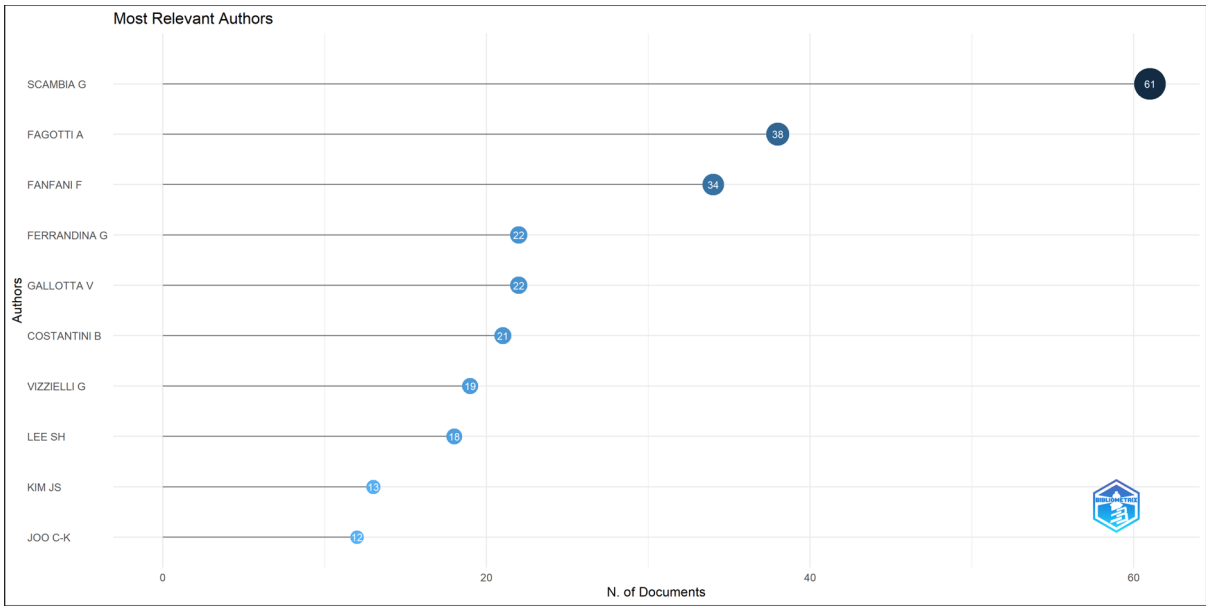


Figure 4. Most Productive Researchers in Medicine

Contributing Countries in Medical Publications

The geographical distribution of contributors to medical research shows that South Korea and Italy are the two main epicentres. The ten largest contributing countries are listed in Table 6.

Table 6. Ten Contributing Countries in Medical Publications

Country	Number
South Korea	200
Italy	151
Brazil	38
USA	22
Belgium	16
Spain	16
Chile	15
China	14
Australia	12
Indonesia	9

South Korea ranks first with 200 articles, followed by Italy with 151 articles. Other countries such as Brazil (38 articles), the United States (22 articles), Belgium (16 articles), and Spain (16 articles) also make meaningful contributions, while Indonesia ranks tenth with 9 articles.

Dominant Research Subjects in Medicine

Based on the frequency analysis of medical subjects and topics, issues related to morbidity and risk assessment emerge as the main topics. The distribution of the ten leading subjects is presented in Table 7 and Figure 5.

Table 7. Dominant Research Subjects in Medicine

Subject	Number
Morbidity	12
Risk Assessment	12
Statistical Significance	9
Stroke	9

Uterine Cervix Carcinoma	8
Lymphadenectomy	7
Gene Expression Profiling	6
Time	6
Tomography, X-Ray Computed	5
Artificial Ventilation	5

As shown in Figure 5, the subjects Morbidity and Risk Assessment each account for 15.2%. Other dominant subjects include Statistical Significance (11.4%), Stroke (11.4%), Uterine Cervix Carcinoma (10.1%), and Lymphadenectomy (8.9%).

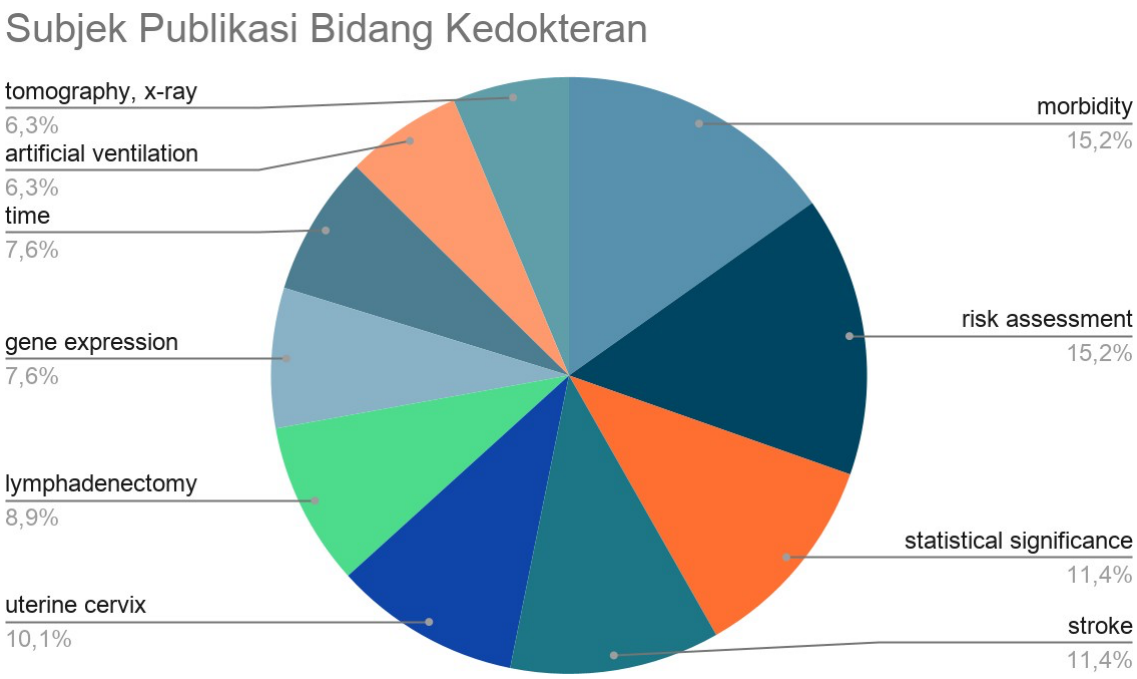


Figure 5. Proportion of Main Subjects in Medical Publications

Thematic Map Based on Keywords (Co-Word Analysis)

The visualisation of the keyword co-occurrence (co-word) network using VOSviewer produced a conceptual map divided into five thematic clusters (Figure 6). These clusters show the focal areas and branches of medical research developed at Catholic universities.

Cluster 1, Red (Gynaecological Oncology Surgery): The largest cluster, focusing on complications and surgical procedures for gynaecological cancers. Dominant keywords include retrospective studies, cancer staging, postoperative complications, neoplasm staging, tumor volume, operation duration, and uterine cervix.

Cluster 2, Light Blue (Ophthalmology and Eye Surgery): Focuses on research into visual acuity and cataract surgery. Key terms include prospective studies, visual acuity, cataract, microsurgery, aged, postoperative care, surgical equipment, and ultrasound.

Cluster 3, Dark Blue (Paediatrics and Child Health): Focuses on infectious diseases and the clinical management of children. Dominant keywords include adolescent, child, preschool, infant, diarrhea, vomiting, and histopathology.

Cluster 4, Green (Physiology and Chronic Diseases): Focuses on the pathophysiology of degenerative and metabolic diseases. Key terms include body mass, pathophysiology, age factors, medical history, physiology, hospital mortality, renal dialysis, and diabetes mellitus.

Cluster 5, Yellow (Medical Education and Public Health): Focuses on quantitative studies and social health issues. Dominant keywords include human, adult, medical student, catholic, coronavirus disease 2019, bibliometrics, questionnaire, and education.

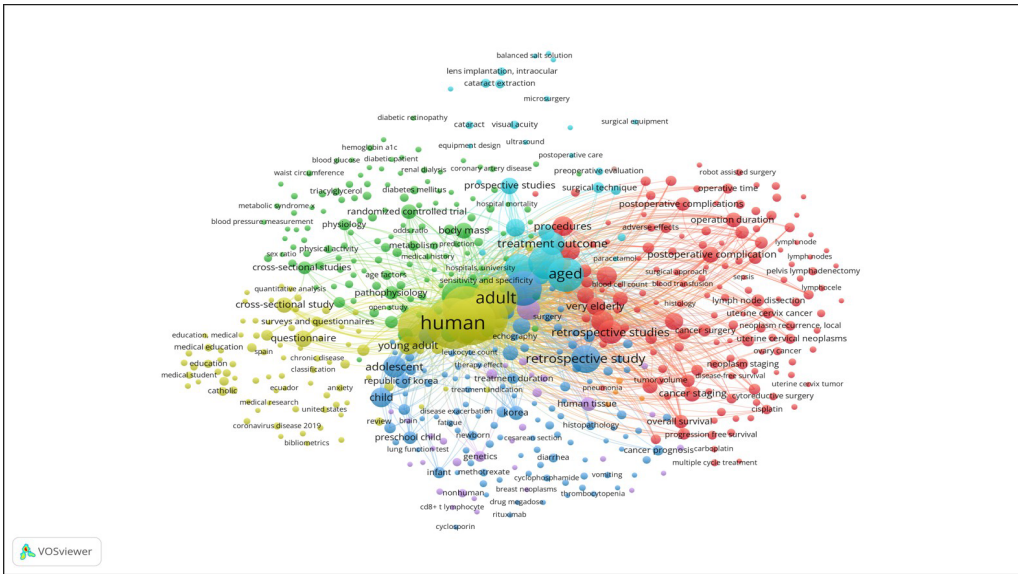


Figure 6. Keyword Co-Word Network Map of Medical Publications (VOSviewer)

Researcher Collaboration Network Map (Co-Authorship Analysis)

The visualisation of the author collaboration (co-authorship) network, with a minimum threshold of five documents, produced a tightly connected network divided into two main clusters (Figure 7). This structure reflects strong cohesion in collaboration among senior researchers.

Cluster 1, Green: Led by Francesco Fanfani as one of the main nodes, with members including Cristiano Rossitto, Giorgia Monterossi, Salvatore Gueli Alletti, Barbara Costantini, and Stefano Restaino. This cluster centres on collaborative research in minimally invasive gynaecological surgery.

Cluster 2, Red: The largest collaboration cluster, centred on Giovanni Scambia and Anna Fagotti. It has the highest link density, with members including Gabriella Ferrandina, Valerio Gallotta, Giuseppe Vizzielli, Carmine Conte, Marco Petrillo, Alfredo Ercoli, Vito Chiantera, and Francesco Legge.

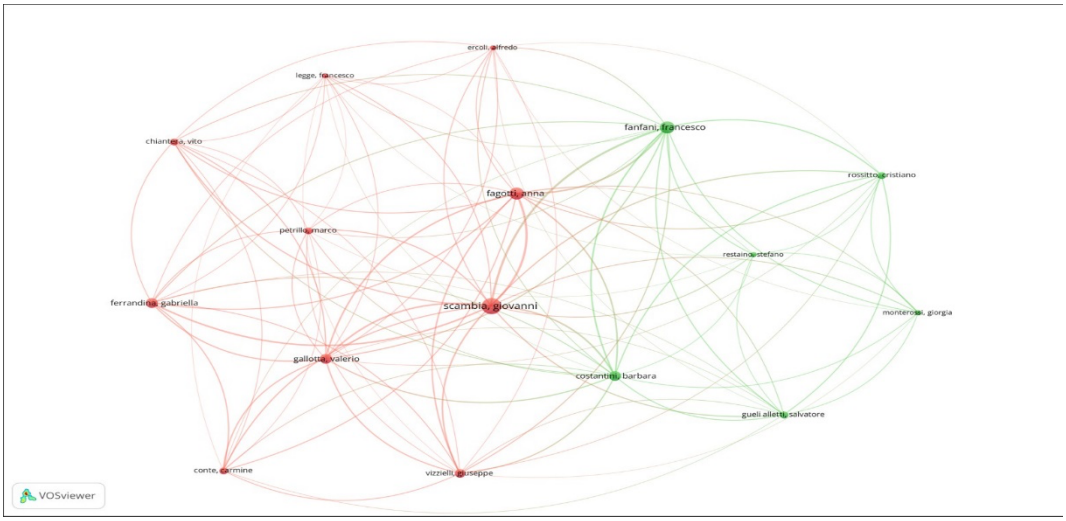


Figure 7. Author Co-Authorship Network Map in Medicine (VOSviewer)

CONCLUSION

Based on the analysis and discussion, the main scientific contribution of this study is a comprehensive empirical mapping of the structural dynamics, collaboration patterns, and knowledge concentration of medical research at Catholic universities worldwide during 2006–2025. Theoretically, the findings support the applicability of Lotka's law, the Matthew effect in science, and the invisible college phenomenon in the landscape of medical publishing. This is evident in the centralisation of productivity and in closed networks dominated by a small group of senior researchers, such as Scambia G., Fagotti A., and Fanfani F., and by specialist surgical consortia based in high-income countries, with The Catholic University of Korea as the largest institutional contributor. Through bibliometric mapping, the study shows that Scopus-indexed international publications peaked in 2013 with 46 documents (7.61%), and that the Journal of Minimally Invasive Gynecology is the main publication outlet. These findings carry important strategic and practical implications for the future development of medical research collaboration among Catholic universities. The sharp geographical imbalance in participation, with developing countries such as Indonesia contributing only 1.49% (9 documents), indicates that research internationalisation has not yet developed inclusively. To address the limitations of this study, future research should broaden the data search strategy by adding keyword variations and combining other scientific databases, such as Web of Science or PubMed. This would yield a broader and more representative corpus and allow deeper analysis of the social impact and citation quality of medical research at Catholic universities worldwide

SUGGESTION

Future studies are encouraged to broaden the bibliographic data sources by combining Scopus with other databases such as Web of Science (WoS) or PubMed. This would minimise the potential coverage bias of a single database and provide a more comprehensive picture of the medical publication landscape. In addition, co-citation analysis and bibliographic coupling could be applied to detect the evolution of the intellectual structure and the emergence of new research fronts more dynamically.

THANK YOU-NOTE

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