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ORIGINAL ARTICLE

Global trends in surgical ethics research: a bibliometric analysis

Özlem Kersu[1] · Selda Mert[2]

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Abstract
Advances in surgical technology have expanded diagnostic and treatment options; however, the increasing complexity of surgical procedures has also intensified ethical issues in surgical practice.This study aimed to evaluate the development and trends of publications in the field of surgical ethics and to synthesize the findings obtained.On August 12, 2025, a comprehensive search was conducted in the Web of Science Core Collection using predefined keywords related to "surgical ethics" OR "surgical ethics" OR "operating room ethics" OR "operating room ethics" OR "surgical ethics" OR "surgical ethics" OR "operating room ethics" OR "operating room ethics" were used to conduct a comprehensive search without any time restrictions. A total of 217 publications were included. Bibliometric analysis was performed using the Bibliometrix–Biblioshiny package in R(version 4.2.2). The data were analyzed in terms of publication characteristics, keyword trends, and thematic structures. Studies on surgical ethics had an average publication age of less than 10 years, and a significant increase in publication volume was observed as of 2023. Citation rates accelerated significantly after 2020, reaching an average of 5.9 citations per document. Editorial materials accounted for 22.5% of all publications. The main research topics were bioethics, informed consent, and medical ethics.Surgical ethics is an emerging and growing field of research that has attracted increasing scientific interest in recent years. Despite this growth, the limited number of studies with high-level evidence remains a significant shortcoming. These findings provide a comprehensive overview of the current state of the literature and highlight key areas for future research.

Keywords Bioethics · Ethics · Surgery · Bibliometric analysis

Introduction

The concept of ethics is defined as a system of moral principles and values that aim to regulate the behavior of individuals and communities by determining what is morally good or bad, right or wrong [1, 2]. The rules and behaviors that shape the framework of the ethical approach and ensure that decisions are regarded as right or good are referred to as ethical principles [3]. The four fundamental principles of ethics are autonomy, nonmaleficence, beneficence, and justice [4]. These universal ethical principles and values do not vary from person to person or from society to society. Accordingly, the ethical principles that guide individual behavior have also been adopted in professional life. This has given rise to the concept of professional ethics, which places upon professionals the responsibility to act in accordance with ethical values, principles, rules, and standards toward their clients, colleagues, and society [5]. In this regard, all healthcare professionals involved in service delivery are required to act in accordance with ethical principles in all aspects of treatment, care, interventions, and practices—particularly in communication and patient rights—parallel to ongoing changes in the healthcare field [2].

In the clinical setting, the ethical principles that guide decisions and behaviors concerning patients constitute the main focus of medical ethics. Surgical ethics, on the other hand, is defined as a specialized subfield—or, according to some scholars, a distinct branch—of medical ethics [6]. The technological complexity of surgical disciplines, the

✉ Özlem Kersu
oozkaya@ogu.edu.tr

Selda Mert
selda.mert@ahievran.edu.tr

[1] Faculty of Health Sciences, Nursing Department, Eskişehir Osmangazi University, Meşelik Campus, 26040 Odunpazarı, Eskişehir, Turkey

[2] Faculty of Health Sciences, Nursing Department, Kırşehir Ahi Evran University, Kırşehir, Turkey

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environmental and patient-related risks faced by surgical team members (such as infection, injury, or exposure to hazardous materials), and the dual demands of patient vulnerability and the need for rapid decision-making during surgery all underscore the particular importance of surgical ethics [1]. Surgical procedures inherently involve a high degree of uncertainty and risk. Consequently, surgical team members are often required to make critical decisions under pressure, decisions that may directly affect patient outcomes and well-being. For instance, ethical dilemmas frequently arise in the implementation of new surgical technologies or procedures, where uncertainty about potential benefits and risks poses significant ethical challenges [7]. The literature emphasizes the importance of maintaining a balance between the principles of beneficence and nonmaleficence, given the inherent potential for surgical interventions to cause harm. Moreover, in cases where surgical procedures may be futile, the principle of autonomy should be duly considered [8].

Today's rapidly advancing scientific developments offer new opportunities in the diagnosis and treatment of diseases, contributing significantly to the improvement of individuals' quality of life. However, these advancements have also increased the complexity of surgical interventions and the frequency with which patients undergo surgical procedures. During this process, surgical team members may encounter various ethical challenges as they strive to provide care that preserves patients' dignity while participating in advanced medical treatments [9]. Therefore, conducting technically complex and high-risk surgical processes from an ethical perspective is of great importance. Understanding ethical practices in surgery and their implications for society, surgical teams, and patients is a critical requirement for strengthening the ethical foundations of the surgical process [8].

Bibliometric research is a quantitative research method that has become increasingly popular in recent years, as it provides insight into the structure, impact, and development of a specific research field, helps identify gaps in the literature, and facilitates the emergence of new research areas [10]. Bibliometric analyses define an interdisciplinary framework by identifying the dynamics and boundaries of a research field, thereby enabling the creation of a knowledge map for that field [11].

In the literature, there are various studies examining the concept of ethics in surgical practice, surgical units, surgical research, and surgical populations [12–15]. However, no bibliometric study has been identified that comprehensively explores the structure, impact, and research trends of the concept of ethics in surgery or that maps the body of knowledge in this field. Conducting a bibliometric analysis of surgical ethics—a concept that plays a key role in the management of the surgical process—has the potential to identify the dynamics and boundaries of the field, define its interdisciplinary framework, and create a knowledge map that could guide future research.

Materials and methods

Objective

In this study, the aim was to obtain a general overview of ethical issues in the field of surgery; to reveal the structure of the knowledge network within the field; to identify existing gaps within this network and guide the development of new research ideas; and to summarize and strengthen the contributions of surgical ethics research to the discipline.

Research questions

What are the number, types, contributing authors, yearly distribution, international collaborations, and citation counts of publications in the field of surgical ethics?

1. Which are the most influential articles, and who are the most productive and impactful authors, countries, institutions, and journals in surgical ethics research?
2. Apart from the keywords used in the studies, what are the prominent concepts addressed?
3. What are the characteristics of the most frequently researched topics and concepts?

Research design

Bibliometric research is a quantitative method used to provide insights into the structure, impact, and development of a specific research field; to reveal new perspectives and contributions within the field; and to identify potential future directions for research [10, 16]. Bibliometric analyses evaluate and measure the influence and relationships among publications, authors, institutions, and countries. Moreover, they serve as an important tool not only for examining the performance of researchers, journals, and institutions but also for mapping the intellectual structure of different disciplines [16].

This study employed a descriptive and retrospective design to conduct a bibliometric analysis of publications in the field of surgical ethics. The research followed the sequential stages of defining the study's aim and scope, selecting an appropriate analytical technique, collecting data from the relevant literature, performing analyses, and interpreting the results obtained [10, 17, 18].

Data source

The Web of Science Core Collection (WoS), one of the most widely recognized and accepted international databases for analyzing scientific publications, was used as the data source due to its high-quality standards [19]. The study data were obtained through searches conducted within the WoS database.

Data collection

From the inception of the database up to August 2025, a comprehensive search was conducted in all categories of the Web of Science (WoS) database using the following keywords: "surgery ethics," "surgical ethics," "operating room ethics," "operating theatre ethics," "surgery ethical," "surgical ethical," "operating room ethical," and "operating theatre ethical." The search included the article title, abstract, Keyword Plus, and author keywords fields.

The inclusion criteria were defined as follows: studies written in English and classified as research articles, reviews, proceeding papers, editorial materials, or book chapters. Based on these criteria, a total of 225 publications were initially identified. All bibliographic data were downloaded in BibTeX format and imported into the analysis software. Publications that did not meet the inclusion criteria were excluded from the analysis (language: German $n=4$, Turkish $n=1$, Spanish $n=1$, Italian $n=1$; article type: correction $n=1$). After this screening, 217 publications were included in the bibliometric analysis.

Subsequently, the bibliometric data file was exported to Excel, where all records were reviewed again in line with the research objectives and duplicates were removed, finalizing the dataset. The dataset was then uploaded to the software, and the analysis was initiated without excluding any keywords.

Data analysis

Bibliometric analysis consists of two main dimensions: performance analysis and science mapping. Performance analysis focuses on indicators such as the number of publications and citations to assess the productivity and impact of a research field. In contrast, science mapping explores how often specific authors or articles are co-cited and examines the relationships among various elements, thereby revealing the conceptual, intellectual, and social structure of the research field [16].

One of the most widely used tools for analyzing large and unstructured datasets is the R software and its Bibliometrix package [20, 21]. The main features that make R a preferred choice include its ability to facilitate quick and efficient data analysis, generate clear visualizations, offer diverse analytical options, merge data from multiple databases, and benefit from continuously updated web interfaces such as Biblioshiny [21].

In this study, only author keywords were used for analysis. Descriptive statistics were presented as numbers, percentages, or proportional values. In the Word Cloud and Treemap analyses, the top 20 author keywords were used, while no time restriction was applied for the Trend Topics analysis. For thematic analysis, 100 author keywords and the Walktrap algorithm were employed. The minimum cluster frequency was set at five, and the cluster level was set at one or two for each cluster. The data analysis was conducted using the R (version 4.2.2) software with the Bibliometrix package and Biblioshiny interface, and the results were reported and visualized accordingly [22].

Ethical considerations

Since this study did not involve human or animal subjects, contained no interventions, and utilized secondary, publicly available data through a retrospective design, ethical approval was not required.

Results

According to the research findings, various publications on the subject were released between 1981 and 2025. A marked increase in studies addressing the topic has been observed, particularly since 2023 ($n=32$ in 2023, $n=30$ in 2024, and $n=22$ in 2025). The year 2023 stands out as the peak year of publication productivity, reaching the highest output with a total of 32 publications (Fig. 1).

The analyzed publications have an average age of 7.3 years, with an annual growth rate of 7.28%. A total of 823 authors contributed to these studies, and the rate of international collaboration was calculated as 16.13%. The average number of citations per publication was 5.9. Approximately half of the publications (57.6%) were identified as research articles, followed by editorial materials (22.5%) (Table 1).

The United States (USA) was identified as the country with the highest scientific output on the subject. Among the analyzed journals, BMJ Open ranked first in terms of publication count, with 28 articles and an h-index of 3, indicating the highest publication impact. Regarding the m-index, which reflects the average annual impact, the Journal of Medical Ethics ($m=0.7$) stood out distinctly from other journals. In terms of total citations, the Journal of the American College of Surgeons achieved the highest count with 67

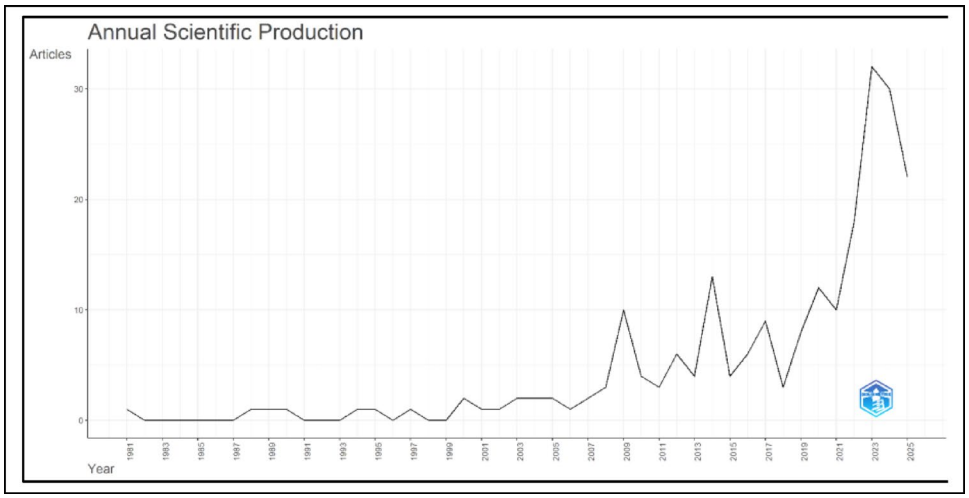


Fig. 1 Distribution of publications by year

Table 1 Basic data on publications

Basic information	Results
Data	
Timespan	1981–2025
Sources	106
Documents	217
Average age	7.3
Annual growth rate %	7.28%
Authors	
Authors	823
Single-authored docs	43
International co-authorships %	16.13%
Published content	
Author's keywords	565
References	5510
Average citations per doc	5.9
Publication type	n (%)
Research article	125 (57.6)
Review	31 (14.3)
Editorial material	49 (22.5)
Proceeding paper	10 (4.6)
Book chapter	2 (1)

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Research article	125 (57.6)
Review	31 (14.3)
Editorial material	49 (22.5)
Proceeding paper	10 (4.6)
Book chapter	2 (1)

citations. The most cited study in the field was "Jehovah's Witnesses: The surgical/ethical challenge" by Dixon and Smalley (1981) [23] (Table 2).

Among the concepts that stood out beyond the keywords used in the study were "bioethics" (n = 12, 6%), "informed consent" (n = 11, 5%), and "medical ethics" (n = 7, 3%) (Fig. 2).

It was determined that "informed consent" was also among the trending topics, while "medical ethics" stood out as one of the long-standing core themes in the field. In the last three years, topics such as "adult anaesthesia", "neurosurgery", and "artificial intelligence" have become increasingly prominent (Fig. 3).

According to the thematic map analysis, the topics "adult anaesthesia," "cardiac surgery," and "laparoscopy" are identified as basic themes that continue to develop within the field. The topics "neurosurgery" and "pain" emerge as motor themes, representing the central and driving areas of research. In contrast, "composite tissue allotransplantation," "abdominal surgery," "colorectal surgery," "orthopaedic & trauma surgery," and "postoperative surgery" are classified as niche themes, indicating specialized areas of focus with a relatively limited number of studies (Fig. 4).

Discussion

Every profession operates according to its own set of ethical codes and principles, which guide practitioners toward the expected standards of professional behavior and public service [33]. While surgical ethics shares core foundations with general medical ethics, it distinguishes itself through its focus on the unique moral questions and decisions inherent to surgical interventions that directly affect patients therapeutically. The importance of ethical principles deeply embedded within surgical culture has increased in parallel with the complexity and risks introduced by modern innovations in surgical techniques. Notably, advancements in surgical science and technology throughout the 19th and 20th centuries underscored the need to establish ethical guidelines governing surgical practice [6]. However, ethical discussions have been relatively rare in the surgical literature over the past two decades [8]. This finding aligns with the results of the present analysis, suggesting that the relatively young average age of publications and the recent

Table 2 Scientific information of countries, sources, and documents

Most relevant country	Freq	Average article citations	Total citation
USA	371	5.9	523
China	118	1.90	56
UK	53	13.6	218
Canada	42	8.8	53
Netherlands	42	5	20
Spain	42	2.5	10
Australia	40	9.5	105
Italy	33	5.8	35
India	25	5.2	31
Rwanda	20	4	4
Most relevant sources	**Articles**	**h_index/g_index/m index**	**Total citation**
BMJ Open	28	3/5/06	32
Annals of Surgery	15	3/6/0.2	46
Journal of Surgical Research	9	4/5/0.2	25
Journal of the American College of Surgeons	8	4/8/0.3	67
International Journal of Surgery	7	2/4/0.1	18
World Journal of Surgery	7	4/7/0.1	56
American Journal of Surgery	6	3/6/0.1	65
British Journal of Surgery	5	2/5/0.1	44
Journal of Medical Ethics	4	2/4/0.7	45
Journal of Surgical Education	4	2/4/0.1	19
Most relevant documents	**Year**	**Journal**	**Total citation**
Dixon JL and Smalley MG; Jehovah's Witnesses: The Surgical/Ethical Challenge. https://www.https://doi.org/10.1001/jama.1981.03320210037021 [23]	1981	JAMA – Journal of the American Medical Association	85
Wall LL et al.; Humanitarian ventures or 'fistula tourism?': the ethical perils of pelvic surgery in the developing World. https://doi.org/10.1007/s00192-005-0056-8 [24]	2006	International Urogynecology Journal	62
Cobianchi L et al., Artificial Intelligence and Surgery: Ethical Dilemmas and Open Issues, https://www.https://doi.org/10.1097/XCS.0000000000000242 [25]	2022	Journal of the American College of Surgeons	46
Savulescu J et al., Randomised placebo-controlled trials of surgery: ethical analysis and guidelines, https://doi.org/10.1136/medethics-2015-103333 [26]	2016	Journal of Medical Ethics	42
Ives J and Huxtable R, Surgical ethics during a pandemic: moving into the unknown?. https://doi.org/10.1002/bjs.11638 [27]	2020	British Journal of Surgery	40
Schwarz E, Prescription drones: On the techno-biopolitical regimes of contemporary 'ethical killinghttps://https://doi.org/10.1177/0967010615601388 [28]	2016	Security Dialogue	38
Haddad A et al., Innovative Bariatric Procedures and Ethics in Bariatric Surgery: the IFSO Position Statement. https://doi.org/10.1007/s11695-022-06220-8 [29]	2022	Obesity Surgery	37
Little M, The Five-fold Root of an Ethics of Surgery https://doi.org/10.1111/1467-8519.00281 [30]	2002	Bioethics	36
Rajan Vivakaran TT, The role of decompressive craniectomy in cerebral venous sinus thrombosis https://doi.org/10.3171/2012.6.JNS11102 [31]	2012	Journal of Neurosurgery	30
Wall LL, Brown D. The perils of commercially driven surgical innovation, https://doi.org/10.1016/j.ajog.2009.05.031 [32]	2010	American Journal of Obstetrics and Gynecology	29

surge in research productivity may reflect a renewed interest in ethical issues accompanying scientific and technological progress.

Research fundamentally represents a systematic process of collecting, analyzing, and interpreting data to address a specific problem and derive meaningful conclusions. Selecting the appropriate research methodology for the problem under study is crucial in ensuring validity and reliability. While various research designs possess their own strengths and limitations, all share the common objective of generating evidence to enhance understanding and inform

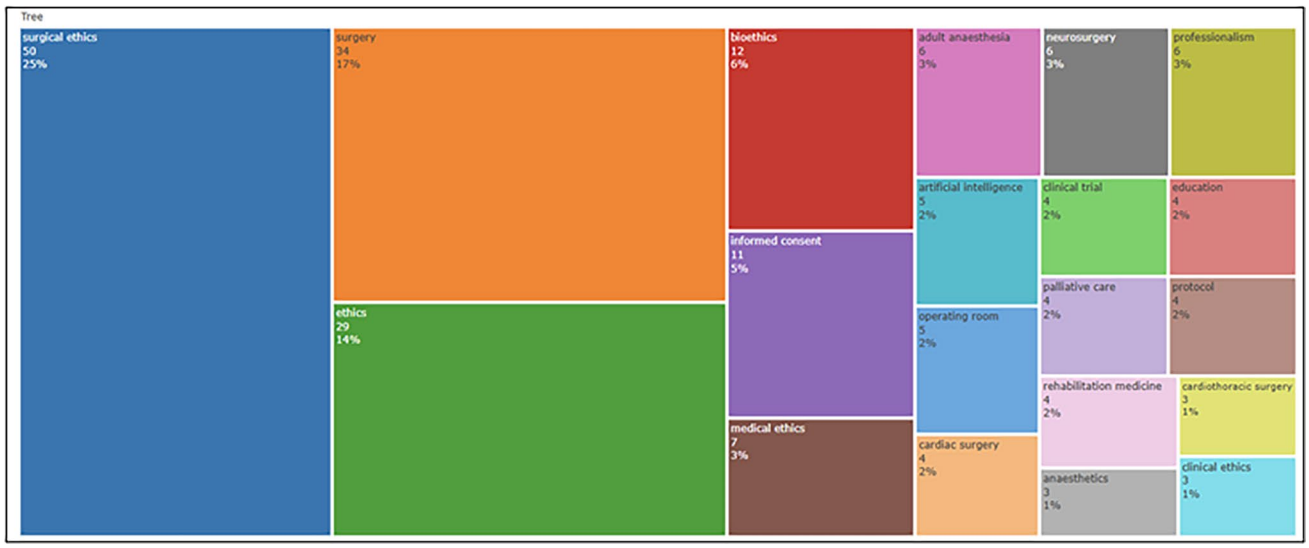


Fig. 2 Treemap

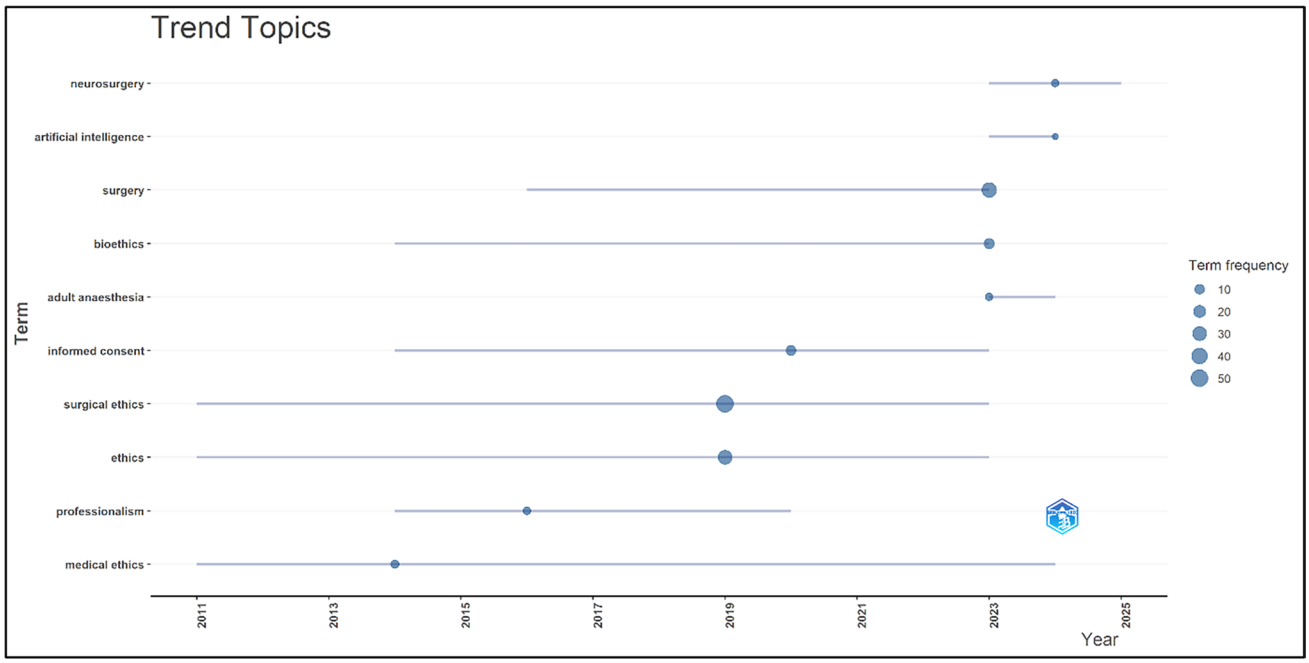


Fig. 3 Trend topics of research

decision-making [34]. High-quality evidence is essential for guiding medical practice, improving patient outcomes, and ensuring that procedures remain both safe and effective. In this regard, research methods are hierarchically structured according to the strength and reliability of the evidence they produce [35]. Within this hierarchy, systematic reviews and randomized controlled trials (RCTs) occupy the highest level, whereas case reports, expert opinions, and editorial materials reside at the lower end [35, 36].

Editorial materials, though valuable for presenting concise perspectives and commentary, do not constitute original research and therefore contribute less to the generation of new empirical knowledge [37]. In the present study, approximately one-fourth of the publications in surgical ethics were identified as editorial materials. While this prevalence allows for brief reflections and professional discourse, it also highlights a limitation in the production of high-level evidence within the field. Consequently, there is a clear need for more robust, evidence-based research designs—such as systematic reviews and randomized studies—to strengthen the scientific foundation of surgical ethics. Furthermore, the predominance of editorial content may partially explain the

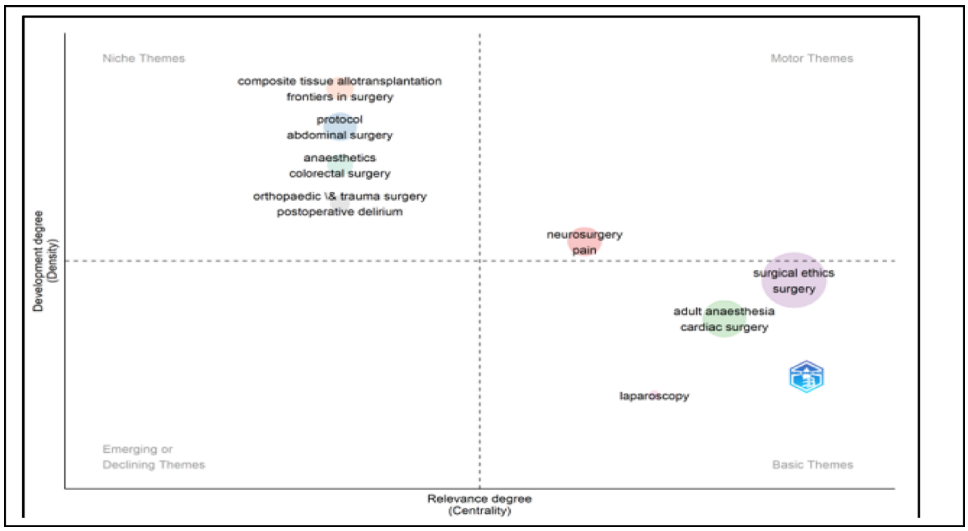


Fig. 4 Thematic map of research

relatively low average citation rate observed in this study. As the volume of high-quality empirical research increases, citation impact within the domain of surgical ethics is likewise expected to rise.

When examining the historical development of surgical ethics, it becomes evident that certain cultures and societies have played a pioneering role. The foundational principles of modern medical ethics can be traced back to the 1847 American Medical Association (AMA) Code of Ethics [38]. Within the framework of these rules, the advancement of science and technology in surgery created new ethical challenges, leading to the need for a professional community to specifically address such issues, oversee the establishment and maintenance of surgical standards, and ensure ethical conduct. Consequently, the American College of Surgeons (ACS) was founded in 1913 [39]. The ACS pioneered the development of the earliest surgical ethics guidelines and led efforts in this domain. In subsequent years, surgical societies in other countries published their own ethical codes and principles, ensuring adherence among members and contributing to the preservation of the highest professional and ethical standards. Furthermore, the 1948 United Nations Declaration of Human Rights and the 1964 Declaration of Helsinki, issued by the World Medical Association, provided a global ethical framework that guided surgical ethical practices amid rapid scientific and technological advancements [40]. In the present study, the United States (USA) was identified as the country with the highest number of scientific outputs in the field of surgical ethics. Moreover, the Journal of the American College of Surgeons achieved the highest total citation count (67 citations). This finding appears to be associated with the historical contributions of the United States to the evolution of surgical ethics. Despite the historical influence of other nations, the relatively low number of publications from those countries highlights the need to expand research in surgical ethics worldwide.

Citation analysis, which aims to acknowledge sources and verify the validity and origin of academic claims, is frequently used as an indicator of performance and scientific impact in research fields [41, 42]. In this context, publications with higher citation counts are generally regarded as more influential [42]. In this study, the citation count of an editorial by Ives and Huxtable (2020)—which discussed elective surgeries and resource allocation during the COVID-19 pandemic—was compared with that of a 2022 Delphi-based study by Cobianchi et al. on artificial intelligence in surgery [25, 27]. The comparison revealed a rapid increase in citation rates among recent publications, indicating that research in surgical ethics is keeping pace with scientific developments. However, it was also observed that highly cited papers often occupy the lowest level of the evidence hierarchy. Therefore, conducting surgical ethics studies designed with high-evidence research methodologies and aligned with current scientific advances would likely yield greater contributions to the field.

Laparoscopic surgery has advanced rapidly worldwide over the past two decades. Although nearly all operations can now be performed laparoscopically, robotic surgery has recently gained prominence. While the cost-effectiveness of such technologies remains debated, the integration of digital data and artificial intelligence (AI) into robotic systems is expected to play a major role in improving surgical practice [43]. Current AI applications primarily focus on preoperative risk assessment. However, it is predicted that AI may reduce human error and, in some areas, even surpass human intelligence to achieve superior outcomes [44]. However, these technologies also raise significant ethical concerns—particularly regarding accountability, transparency, patient autonomy, and bias [45]. In this study, "artificial

intelligence" was identified as one of the trending topics over the past three years, while "laparoscopy" emerged as a developing theme. This finding can be attributed to the increasing use of AI technologies in surgical procedures and the widespread adoption of laparoscopic techniques across nearly all surgical specialties. In addition, "informed consent" appeared as a recurring trending topic, whereas "adult anaesthesia" continued to develop as an emerging theme in recent years. These trends likely reflect the increasing need to clarify ethical and legal issues surrounding anaesthesia practices, as well as the enduring importance of patient autonomy and informed consent. Among the influential topics, "pain" was found to be central to the field, likely due to the multidisciplinary nature of surgical pain management and the continuous revision of clinical guidelines in line with medical advancements.

Conclusion

Based on the evaluation of surgical ethics publications indexed in the Web of Science (WOS) database, this study found that 2023 marked a turning point with a sharp increase in publication activity. Although citation rates for recent studies have risen rapidly, most publications were found to be editorial materials rather than empirical research. Apart from "informed consent," several other key concepts and trending topics were identified, while thematic analysis revealed "laparoscopy" as one of the main developing themes. These findings are expected to contribute to a deeper understanding of the core dimensions of surgical ethics research and to guide the design of future high-evidence studies aimed at addressing existing gaps in the field.

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Declarations

Conflict of interest The authors declare no competing interest.

Ethical approval Not applicable.

Consent to participate Not applicable.

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