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Bibliometric Analysis of Bioethics and Medical Ethics Publications Originating from Türkiye

Türkiye Kaynaklı Biyoetik ve Tıp Etiği Yayınlarının Bibliyometrik Analizi

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ABSTRACT

Aim: This study aimed to provide a comprehensive bibliometric analysis of the bioethics and medical ethics literature affiliated with Türkiye in order to determine the conceptual structure and intellectual framework of publications addressing bioethics and medical ethics.
Material and Methods: The data utilized in this research were obtained from the Web of Science (WoS) Core Collection database. A search using the keywords "bioethic*" and "medical ethic*" identified 26,097 publications. Only publications categorized as "article," "review," and "early access" were included in the analysis, while other types were excluded. Publications originating from Türkiye were identified, and the analysis was conducted on 181 selected publications. Bibliometric analyses were performed using the Bibliometrix software.
Results: A total of 525 authors contributed to the 181 analyzed documents, with an average of 3.56 authors per publication. The annual growth rate was calculated as 9.33%, indicating a significant increase in the number of publications. The documents contained a total of 5,479 references, with an average citation count of 8.221 per publication. Co-occurrence analysis identified thematic clusters such as "Clinical Research and Informed Consent", "Medical Education and Ethics", "Bioethics and Health Policies", "Anatomy and Research Ethics", and "Bioethics and End-of-Life Issues".
Conclusion: The study not only maps the evolution of bioethics and medical ethics research in Türkiye but also fills a significant gap by systematically identifying thematic and methodological trends, thereby contributing a valuable reference for future academic endeavors in the field.
Keywords: Bioethics; medical ethics; bibliometric analysis; Türkiye.

ÖZ

Amaç: Bu çalışmada, biyoetik ve tıp etiği alanında yapılan yayınların kavramsal yapısı ve düşünsel çerçevesini belirlemek amacıyla Türkiye kökenli biyoetik ve tıp etiği literatürünün kapsamlı bir bibliyometrik analizinin yapılması amaçlanmıştır.
Gereç ve Yöntemler: Bu araştırmada kullanılan veriler Web of Science (WoS) Core Collection veri tabanından elde edildi. "biyoetik*" ve "tıp etiği*" anahtar kelimeleri kullanılarak yapılan arama sonucunda 26.097 yayın belirlendi. Sadece "makale", "derleme" ve "erken erişim" olarak kategorize edilen yayınlar analize dahil edildi, diğer türler hariç tutuldu. Türkiye kökenli yayınlar belirlendi ve analiz seçilen 181 yayın üzerinden yapıldı. Bibliyometrik analizler, Bibliometrix yazılımı kullanılarak gerçekleştirildi.
Bulgular: Analiz edilen 181 belgeye toplamda 525 yazarın katkıda bulunmuştu ve her yayında ortalama 3.56 yazar yer almaktaydı. Yıllık büyüme oranı %9,33 olarak hesaplandı ve bu, yayın sayısında önemli bir artış olduğunu göstermekteydi. Belgeler toplamda 5.479 referans içeriyordu ve yayın başına ortalama atıf sayısı 8.221 idi. Ortak kelime analizi sonucunda, "Klinik Araştırma ve Bilgilendirilmiş Onam", "Tıp Eğitimi ve Etik", "Biyoetik ve Sağlık Politikaları", "Anatomi ve Araştırma Etiği" ve "Biyoetik ve Hayat Sonu Sorunları" gibi tematik kümeleri belirlendi.
Sonuç: Bu çalışma, Türkiye'deki biyoetik ve tıp etiği araştırmalarının evrimini haritalamakla kalmayıp, tematik ve metodolojik eğilimleri sistematik olarak ortaya koyarak önemli bir boşluğu doldurmakta ve alandaki gelecekteki akademik çalışmalar için değerli bir başvuru kaynağı sunmaktadır.
Anahtar kelimeler: Biyoetik; tıbbi etik; bibliyometrik analiz; Türkiye.

INTRODUCTION

Bioethics and medical ethics are disciplines of both theoretical and practical significance, addressing ethical issues encountered in healthcare services and medical research (1,2). These fields encompass a wide range of ethical concerns, including patient rights (2), clinical trials (3), genetic interventions (4), and end-of-life care decisions (5). In the contemporary era, rapidly advancing medical technologies and evolving social values (6) have further complicated bioethical and medical ethics issues, thereby increasing the importance of research in these domains.

In Türkiye, bioethics and medical ethics have garnered growing academic interest in recent years. This increased interest parallels the observed rise in the number of scientific publications originating from Türkiye. In a bibliometric analysis of global publications on bioethics, Kürklü (7) reported that between 1975 and 2019, 51 publications with a Turkish affiliation were indexed in the WOS database. Roy et al. (8) conducted a bibliometric analysis of the 100 most cited SCOPUS-indexed publications on medical ethics education. They observed a significant rise in interest and engagement in ethics education in countries such as Türkiye, India, and Pakistan in recent years. Their study also highlighted a strong commitment to integrating ethics education into medical and health curricula in these regions. Given the increasing number of Türkiye-affiliated publications on bioethics in the WOS database in recent years, a comprehensive bibliometric analysis has become an essential necessity. Such an investigation is expected to provide valuable insights into trends, key themes, and academic interactions within the field.

This study focuses on several key aspects, including the chronological distribution of Türkiye-originated publications, the most prolific authors and institutions, the most cited studies, and the extent of international collaborations in these publications. Furthermore, the identification of the conceptual structure and intellectual landscape through co-occurrence and co-citation analyses is of critical importance in shedding light on current and future research directions in the field. These analyses will enhance our understanding of the positioning of bioethics and medical ethics research in Türkiye within the global scientific community and the nature of scholarly dialogues in this domain.

The objectives of this study were to analyze the performance of Türkiye-originated publications on bioethics and medical ethics, including publication and citation trends over time, the most prolific institutions, journals, and authors, as well as the most highly cited articles, and to determine the conceptual structure (co-occurrence) and intellectual framework (co-citation) of publications addressing bioethics and medical ethics.

This study offers an original contribution by providing a multidimensional examination of bioethics and medical ethics publications originating from Türkiye—not only in terms of quantitative performance, but also by revealing the field's intellectual structure, conceptual development, and thematic trends. By employing both co-occurrence and co-citation analyses, the study enables a comprehensive assessment of the field's evolution and visualizes Türkiye's position within the global bioethics literature. In this regard, it stands out as one of the first systematic bibliometric analyses that holistically maps the dynamics of Türkiye-based contributions to the domain.

MATERIAL AND METHODS

The data used in this study were obtained from the Web of Science (WoS) Core Collection database. To identify relevant literature on bioethics, a search was conducted using specific keywords: "bioethic*" (Topic) OR "medical ethic*" (Topic), yielding a total of 26,097 publications. Only publications categorized as articles, early access, and reviews were selected, resulting in 19,543 records. After excluding duplicate records and certain publication types (Publication with Expression of Concern, Poetry, Item About an Individual, Retracted Publication, Excerpt, Data Paper, Meeting, Software Review, Retraction, Correction, Addition, Bibliography, Reprint, Discussion, Biographical-Item, Note, Correction, Book, News Item, Meeting Abstract, Letter, Book Chapters, Proceeding Paper, Book Review, Editorial Material), the number of publications was refined to 18,127.

In the final refinement process, publications affiliated with Turkey or Türkiye were identified, and following the final search strategy, a total of 187 publications were included in the analysis. Publications originating from Türkiye were identified using the "Countries/Regions" filter provided by the WoS database. Both "TURKEY" and "TÜRKİYE" entries were selected to ensure comprehensive inclusion. This filtering was based on the institutional affiliation address of the authors. Thus, only records in which at least one author listed a Türkiye-based institutional address were included in the analysis. The workflow of this data refinement process resulted in 181 studies. The discrepancy between the numbers of 187 and 181 publications is due to a technical issue wherein six publications, although originally published in 2024, were recorded as 2025 in the WoS plaintext export file. These six publications were excluded from the annual growth rate calculation, as the system interpreted them as 2025 entries. However, they were included in all other analyses (e.g., collaboration networks, thematic analysis). Bibliometric analysis was performed on this dataset (Figure 1). To calculate the annual growth rate, publications from the year 2025 were excluded, while they were included in other analyses.

The WoS database is widely recognized as an essential resource for bibliometric studies. By providing a vast collection of scientific publications, WoS enables researchers to assess their academic impact and track trends within the literature (9). The extensive coverage of WoS, its access to high-quality peer-reviewed journals, the availability of impact factors, citation analyses, and detailed collaborative networks offer a robust foundation for bibliometric research (10). Additionally, the advanced search and filtering tools provided by WoS facilitate in-depth analyses of specific research topics (11). These features make WoS the preferred database for bibliometric analyses. This study exclusively utilized the WoS Core Collection database. As a result, publications not indexed in WoS but present in other databases could not be included in the analysis. Therefore, the scope of the study is limited to the WoS database, which should be considered a methodological limitation potentially affecting the generalizability of the findings.

Bibliometric evaluations in this study were conducted using the Bibliometrix software. These analyses identified collaborative networks of authors, keywords, and publications, as well as research trends. Co-occurrence and

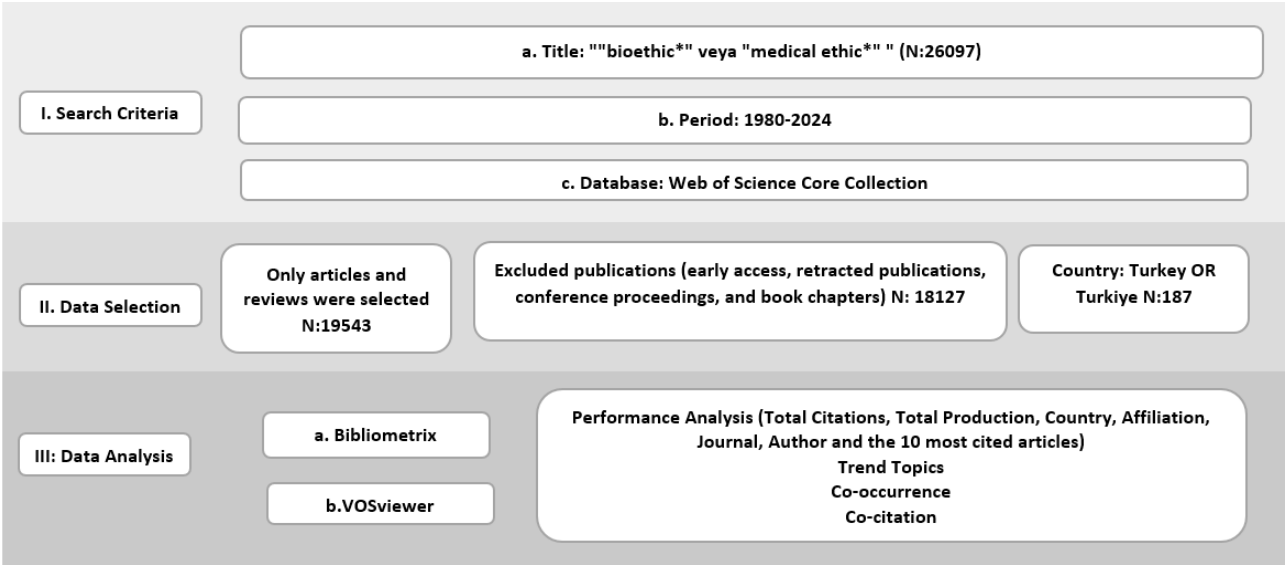


Figure 1. Analysis process and flowchart

co-citation analyses were employed to elucidate key trends in bioethics research, leading scholars, overarching themes, and research networks. The structuring of this study and the presentation of results were based on a 2024 article template published by Tengilimoğlu et al. (12).

This study employed co-citation and co-occurrence analysis methods. Co-occurrence analysis helps identify thematic clusters by examining the frequency with which keywords appear together, thereby uncovering the conceptual structure of the literature. Co-citation analysis, on the other hand, maps the intellectual structure of the field by analyzing how frequently pairs of documents are cited together. The combined use of these methods enables a multidimensional understanding of both the thematic development and theoretical foundations of bioethics and medical ethics research. Therefore, these techniques were deliberately selected to provide a comprehensive and systematic evaluation of the literature.

RESULTS

Performance Analyses

The analysis covers 181 documents published between 1999 and 2023 across 116 different sources (Figure 2). The annual growth rate was calculated as 9.33%, indicating a notable increase in the number of publications. A total of 525 authors contributed to these documents, with an average of 3.56 authors per publication. The number of single-author documents was 41, while the international co-authorship rate was 13.26%. The analyzed documents



Figure 2. Key information (six publications from 2024 were filtered out to calculate the annual growth rate during the analysis period. All other bibliometric analyses were conducted based on a total of 187 publications)

contained a total of 5,479 references, with an average of 8.221 citations per document. The total number of keywords used by authors was 522, and the average document age was 8.21 years. These metrics provide significant insights into research dynamics in the field of bioethics and highlight international collaborations, enabling an evaluation of developments in the area.

The findings show that Türkiye-based bioethics publications cover a wide range of topics. The analysis reveals trends in publication volume, author involvement, and citation patterns. Such a bibliometric analysis plays a crucial role in assessing bioethics research activities and facilitating strategic decision-making for future studies.

The annual number of bioethics publications from Türkiye and their total citation counts between 1999 and 2024 were illustrated in Figure 3. The blue bars represent the number of articles published per year, while the red line indicates the total citations received annually. As observed in the graph, there is a general upward trend in the number of publications over the years. Notably, a significant increase in publication output has been observed since 2010. The year 2021 recorded the highest number of publications (19 articles), a trend likely influenced by the surge in coronavirus disease 2019 (COVID-19)-related publications. The total citation count, however, has fluctuated over the years, reaching its highest level in 2021.

This graphical representation provides a visual overview of the evolution and academic impact of bioethics research over the years. The fluctuations in citation counts serve as an important indicator for evaluating the influence and visibility of publications within the academic community.

The distribution of bioethics publications originating from Türkiye based on universities, journals, authors, and countries was illustrated in Figure 4.

Ankara University ranks first with 37 publications, followed by Hacettepe University with 18, and Istanbul University with 15 publications (Figure 4A).

The journals "Medicine and Law" and "Nursing Ethics" are the most frequently chosen outlets, each hosting 10 publications. "Journal of Medical Ethics" follows with 8 publications (Figure 4B).

In terms of distribution of authors, Arda B leads with 16 publications, followed by Ekmekci PE with 12, and Akpinar A with 6 publications (Figure 4C).

Türkiye has the highest number of publications with 187, while collaborations exist with countries such as the United States with 15, India with 10, and Italy with 7 publications (Figure 4D).

The most cited study emphasizes that research in anatomical sciences relies heavily on human cadaveric tissues and that without such donors, most human anatomy research would come to a standstill (Table 1). The article highlights the need for standardizing acknowledgments and recognitions for donors in studies utilizing human cadaveric tissues. To address this, 19 chief editors from 16 anatomical journals have developed formal recommendations on how to properly acknowledge cadaveric donors in research. This initiative aims to properly honor donors while simultaneously encouraging future donations, ultimately contributing to the advancement of anatomical sciences and patient care (13).

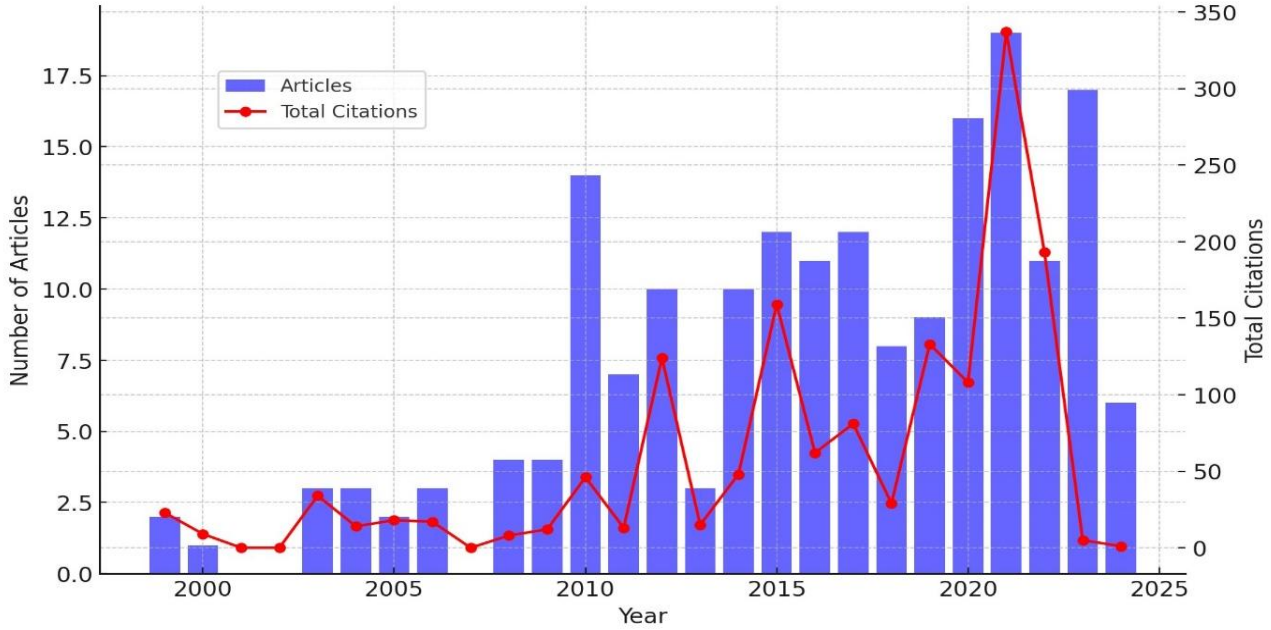


Figure 3. Publication and citation counts by year

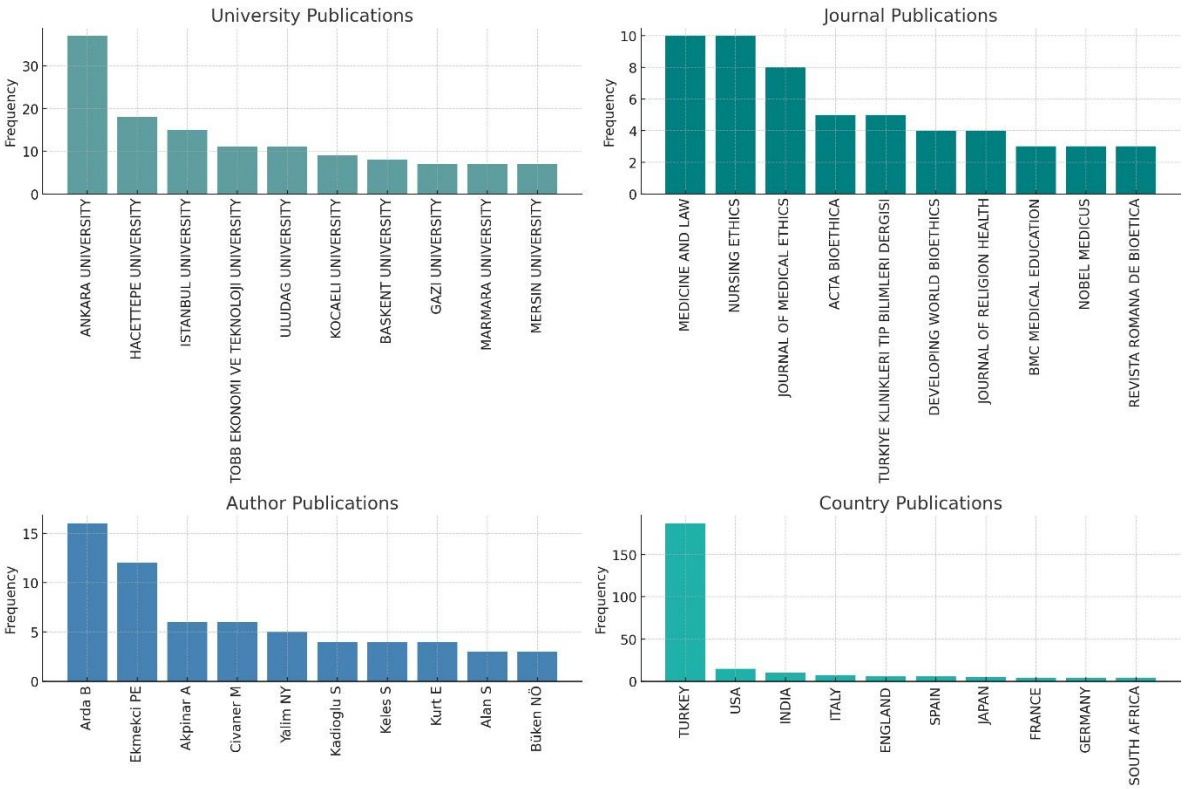


Figure 4. Most cited **A)** institutions, **B)** journals, **C)** authors, and **D)** countries

Table 1. Top 10 most cited studies

Paper	TC	TC per Year
Iwanaga et al., 2021, Clin Anat (13)	301	75.25
Iwanaga et al., 2022, Clin Anat (14)	133	44.33
Keskinbora KH, 2019, J Clin Neurosci (15)	90	15.00
Avci et al., 2015, BMC Med Educ (16)	69	6.90
Civaner et al., 2022, BMC Med Educ (17)	48	16.00
Ulman et al., 2015, Sci Eng Ethics (18)	43	4.30
Ayanoglu et al., 2020, Turk J Biol (19)	40	8.00
Efferth et al., 2016, Phytomedicine (20)	36	4.00
Alcalar et al., 2012, Jpn J Clin Oncol (21)	32	2.46
Civaner, 2012, Health Policy (22)	32	2.46

TC: total citations

The second most cited article discusses the ethical aspects of using human cadaveric tissues in anatomical sciences and underscores the necessity of developing a standardized acknowledgment statement. To achieve this, 22 chief editors from 17 countries' anatomical journals collaborated to establish a standardized and simplified ethical language regarding the use of human cadaveric tissues. This approach is expected to enhance the credibility of anatomical research and encourage the adoption of uniform terminology in other disciplines that utilize cadaveric tissues, as well as in media representations (14).

The third most cited article explores the current and potential ethical challenges posed by artificial intelligence (AI) in medical ethics. AI systems are designed as robots and computers incorporating values and choices, yet their practical implementation relies on programming by engineers. Errors that may occur in AI algorithm development can lead to unintended consequences. Therefore, it is crucial to implement preventive measures to monitor technological advancements and protect individuals from direct or indirect coercion. While AI researchers hold the responsibility to ensure that future impacts remain positive, ethicists and philosophers should be actively involved in the development process from the outset to guide ethical considerations in AI applications (15).

The fourth most cited article evaluates the social media usage and attitudes of medical students at Afyon Kocatepe University Faculty of Medicine. The survey results indicate that 93.4% of students use social media, and 89.3% utilize it for professional purposes. Despite the widespread use of social media among medical students, they are largely unaware of the potential ethical issues associated with its use. Therefore, the study emphasizes the necessity of developing social media guidelines for medical professionals (16).

The fifth most cited study assesses the potential impact of AI on future physicians and the need for restructuring the medical education curriculum. The findings reveal that AI is perceived as a tool that can facilitate access to information for doctors (85.8%), enhance patient access to healthcare services (76.7%), and reduce medical errors (70.5%). However, approximately half of the participants expressed concerns that AI might reduce job opportunities for physicians (44.9%), devalue the medical profession (58.6%), undermine trust in medical practice (45.5%), and negatively impact doctor-patient relationships (42.7%). Additionally, 44.7% of participants believed they could maintain professional confidentiality while using AI applications, whereas 16.1% feared that AI could lead to breaches of professional confidentiality. Only 6.0% of participants reported having sufficient knowledge to inform patients about the features and risks of AI. The study highlights that medical students require training on AI applications, strategies for reducing medical errors, and education on preventing and resolving ethical challenges arising from AI use. These findings underscore the need to update medical curricula to help future healthcare professionals adapt to AI-driven transformations in healthcare (17).

Another highly cited study examines ethical issues in neuromarketing. Neuromarketing has emerged as a practical field with the potential to revolutionize traditional marketing research through various neuroimaging tools. However, due to numerous uncertainties surrounding this emerging practice, the use of neuroimaging technologies in marketing research remains scientifically and ethically inconclusive in the context of human health and well-being. The article argues that public discourse on these technologies must be expanded and that their use on human subjects should align with ethical principles and legal regulations that respect human rights and dignity. The study calls for the urgent establishment of interdisciplinary scientific committees, such as ethics boards, that uphold scientific and ethical values, including non-maleficence, beneficence, autonomy, privacy, the right to confidentiality, and the protection of vulnerable populations (18).

Another study addresses the bioethical issues of CRISPR-Cas9 technology in gene editing. While CRISPR-Cas9 has yielded positive results in the treatment of diseases such as Duchenne muscular dystrophy, AIDS, and cystic fibrosis, some studies have reported that it can also trigger unwanted immune system responses by activating the Type 1 Interferon pathway. Its applications in humans, animals, and the environment, particularly concerning the genetic modification of human germline cells and embryos, have led to significant ethical debates. Among the ethical concerns discussed are unintended genetic modifications, issues surrounding informed consent, and eugenics (human enhancement). Additionally, its potential impact on the environment, agriculture, and livestock must also be considered. The article recommends the establishment of global regulatory frameworks to ensure the safe application of CRISPR-Cas9 and explores its various applications (19).

Another highly cited study examines the issue of biopiracy and best practices in bioprospecting. Biopiracy refers to the exploitation of biological resources and traditional knowledge of local communities without providing them with a fair share of economic benefits or other incentives. The study discusses these issues within the "PhytCancer" platform, a collaborative initiative involving scientists from five continents. The article highlights that pharmaceutical companies patent herbal products without properly recognizing indigenous knowledge, despite existing international agreements aimed at ensuring fair benefit-sharing. The study proposes recommendations for preventing biopiracy and promoting the equitable use of natural resources, particularly by encouraging scientists to adopt ethical bioprospecting practices (20).

Another study investigates the relationship between depression levels, coping styles, and cognitive distortions in women undergoing breast cancer treatment. The findings indicate that among non-depressed patients, the "fighting spirit" was the primary coping strategy, whereas in the depressed group, "helplessness/hopelessness," "anxious preoccupation," and "fatalism" were the dominant coping mechanisms. No significant association was found between depression and socio-demographic or cancer-related variables, except for educational level. These results suggest that depression is closely linked to cognitive patterns and comorbid anxiety, and that higher levels of depression are inversely related to fighting spirit and educational attainment. The findings may assist clinicians in diagnosing and treating depression more effectively in cancer patients (21).

The tenth most cited article examines the sales strategies of pharmaceutical companies operating in the "pharmerging" market and explores ways to mitigate their negative impacts. The study conducted in-depth interviews with 22 physicians and company employees across six major cities in Türkiye, using content analysis as the research method. The findings reveal that both legal and illegal sales strategies are being employed. Pharmaceutical companies intervene immediately to counteract developments that might reduce sales, often exploiting educational and infrastructural needs for their benefit. Physicians, on the other hand, remain vulnerable due to overconfidence in their ability to resist marketing influence and insufficient training in this regard. The study suggests several interventions to address this issue, including the establishment of a national pharmaceutical policy, reducing exposure to pharmaceutical marketing, and addressing physicians' educational needs. Without such measures, companies will continue to exploit regulatory gaps to their advantage, perpetuating ongoing marketing-related issues (22).

Trend Topic Analysis

This analysis illustrates how publications in bioethics and related disciplines have focused on specific concepts over time and highlights evolving research trends (Figure 5).

Historical and Stabilized Concepts

Examinations, Virginity (1999): These concepts were highly discussed in 1999, but later saw a decline or stabilization in academic interest. This pattern suggests that the topic gained temporary attention, possibly due to specific events or policy changes.

Persistently Relevant Concepts

Confidentiality (2005-2016): The long-term discussion of this topic reflects the ongoing significance of patient privacy and data security in bioethics.

Stem, Cell (2009-2017): Stem cell research and its ethical implications gained significant academic attention during this period, likely driven by scientific advancements and novel applications.

Emerging and Increasingly Relevant Concepts

Artificial, Intelligence (2020-2022): AI and its associated technologies have become central themes in recent bioethics discussions, emphasizing the growing importance of AI in medical applications and its ethical challenges.

Reproductive, Women (2022-2023): Topics related to reproductive health and women's rights have seen a surge in academic interest, reflecting ongoing debates about reproductive autonomy and healthcare ethics.

Broadly Discussed and Continuously Relevant Concepts

Ethical, Medical, Ethics (2012-2022): Ethical issues in medicine have been intensively discussed over a broad timeframe, indicating that ethical principles and practices remain central concerns in medical research and practice.

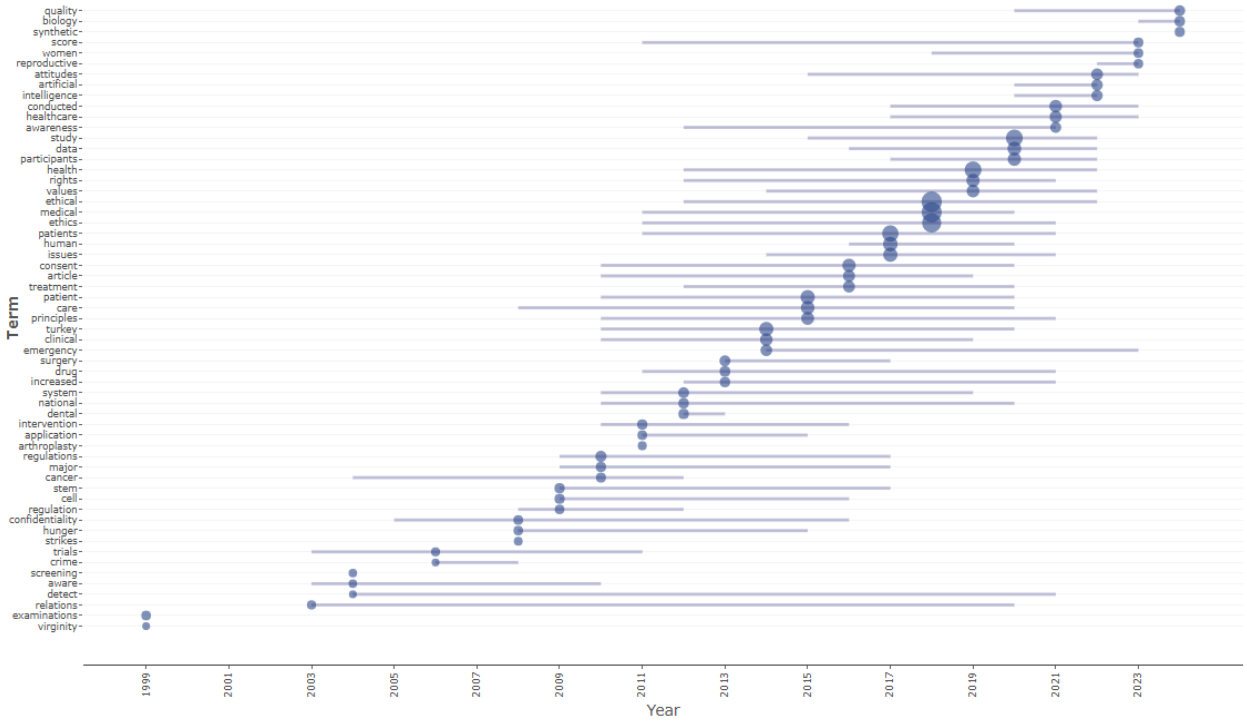


Figure 5. Trend topic analysis

Health, Rights (2012-2022): The topic of health rights has been a key subject of discussion over the past decade, reflecting global concerns regarding healthcare inequalities and patient rights.

Key Specific Topics

Confidentiality, Consent (2005-2020): Patient confidentiality and informed consent are among the most frequently debated bioethical issues, underscoring their critical role in clinical practice and research ethics.

Clinical, Patient, Healthcare (2010-2023): Discussions surrounding clinical practices, patient care, and healthcare services have intensified over the past decade, mirroring efforts to enhance healthcare quality and accessibility.

Future Research Areas

Quality, Biology, Synthetic (2020-2024): Topics related to quality standards, biology, and synthetic biology are expected to emerge as significant areas of debate in bioethics. This trend is closely linked to rapid advancements in biotechnology and their ethical implications.

This analysis provides valuable insights into how bioethical topics have evolved over time, demonstrating shifts in academic interest and research priorities. The findings of this study not only reveal academic trends but also offer a guiding framework for policymakers, regulatory bodies, and ethics committees in Türkiye. In this respect, the study has the potential to support the development of more participatory, transparent, and accountable decision-making processes in the field of bioethics and medical ethics.

Bibliometric Analyses

Co-Occurrence Network Analysis (Figure 6)

Red Cluster-Clinical Research and Informed Consent: Clinical research plays a critical role in advancing medical knowledge, and ensuring ethical standards in such studies is of paramount importance. In this context, informed consent is an essential element in protecting participants' rights. The preservation of ethical principles and standards in clinical research is crucial for participant safety and research reliability. Informed consent ensures that participants are fully informed about the research and voluntarily agree to participate, reinforcing ethical compliance in clinical trials.

Blue Cluster-Medical Education and Ethics: Medical ethics is a fundamental area of education for medical students and professionals, serving as a guide in clinical practice. Medical education plays a vital role in teaching and applying ethical principles. Ethical issues are integral to every stage of medical practice, and therefore, ethics education for medical students is essential in shaping their future medical practices and decision-making processes.

Green Cluster-Bioethics and Health Policies: Bioethics has a broad impact on health policies and practices. Topics such as bioethics committees, public health policies, and social media ethics help safeguard ethical standards in healthcare delivery. In countries like Türkiye, bioethical discussions provide a crucial foundation for ensuring that healthcare services are delivered fairly and ethically. Ethics committees and public health policies serve as guiding frameworks in the development of strategic decisions aimed at protecting and improving public health.

Purple Cluster-Anatomy and Research Ethics: Anatomy studies and the use of cadavers are fundamental components of medical education and research. Dissection and cadaver utilization introduce significant ethical discussions in both educational and research contexts. Ensuring that such studies are conducted in accordance with ethical standards is crucial for research integrity and the quality of medical education. Guiding ethical principles and bioethical considerations help prevent ethical violations in anatomical and medical research practices.

Orange Cluster-Bioethics and End-of-Life Issues: End-of-life bioethics concerns encompass topics such as death, euthanasia, and end-of-life care decisions. These issues are ethically sensitive and require in-depth discussions on patient rights, quality of life, and the management of the dying process. Bioethical principles ensure that end-of-life decisions are made fairly, respectfully, and ethically while prioritizing the well-being of patients and their families.

Each theme is supported by cluster members, and these concepts play a key role in shaping academic discussions in bioethics. Each of these themes is critical for maintaining ethical standards in healthcare service delivery and medical research.

Document-Based Co-Citation Analysis

Document-based co-citation analysis examines instances where two or more documents are cited together in other works, helping to identify key studies and influential authors in the literature. The network structure in the figure visualizes citation relationships between specific authors and their works over time, highlighting the intensity of these connections (Figure 7).

Red Cluster: This cluster is primarily centered around the influential works of Beauchamp and Childress (2), Elçioğlu et al. (23), and Aydın E (24). Principles of Biomedical Ethics by Beauchamp and Childress (2) is a foundational text that comprehensively discusses medical ethics principles. The study by Elçioğlu et al. (23) examines books and journals on medical deontology and ethics during the Republic of Türkiye era, making a significant contribution to the medical ethics literature in Türkiye. Aydın's (24) article on respect for patient autonomy emphasizes the importance of patient rights in medical ethics. These works frequently receive co-citations and address interrelated topics within the bioethics literature.

Orange Cluster: This cluster is centered around Petersen and De Vries et al. (26). Petersen's The Importance of Governance and Business Ethics is a key study emphasizing corporate governance and business ethics (25). The study by de Vries et al. (26) discusses the necessity of ethical standards in social, behavioral, and economic research. These works represent highly cited documents focused on a specific area within the literature.

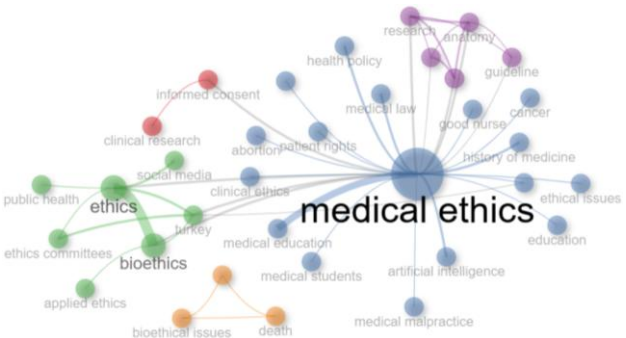


Figure 6. Co-occurrence network analysis

Purple Cluster: This cluster is primarily formed around the studies of Ersoy and Gündoğmuş (27) and Aydın and Ersoy (28). The study by Ersoy and Gündoğmuş (27), titled a study of the ethical sensitivity of physicians in Turkey, examines the ethical awareness of physicians in Türkiye. The work by Aydın and Ersoy (28), ethical decision-making process in clinical settings, discusses the ethical decision-making processes in clinical environments. This cluster consists of studies conducted within a specific timeframe and focusing on similar themes.

Green Cluster: This cluster is primarily associated with Ersoy N (29) and focuses on ethics in oncology nursing. Ersoy's (29) study, ethics in oncology nursing, examines ethical issues specific to oncology nursing practice. Although this cluster has fewer connections, it highlights studies focused on a specific topic. Additionally, an anonymous publication within this cluster could not be identified due to a missing citation reference.

Blue Cluster: This cluster includes Aydın ZD in 1999 and Anonymous in 2004, representing a smaller yet meaningful relationship within the literature. However, as access to these two sources was unavailable, the content of this cluster could not be fully clarified.

This co-citation network analysis reveals the central role of specific authors and studies in the bioethics literature, as well as their influence within academic discussions. The clustering highlights groups of studies that focus on particular topics and their interconnections. Such analyses help researchers identify key works and trends in the literature, shaping future research directions. Studies like these in bioethics are valuable tools for understanding interdisciplinary relationships and academic impact.

Methodology and Topic Analysis

The co-occurrence network analysis, co-citation analysis, and trend topic analysis classified bioethics and medical ethics publications based on three primary research methodologies: quantitative research, qualitative research, and secondary research methods (e.g., reviews, personal opinions, etc.). Quantitative research aims to quantify data and generalize findings obtained from a study sample through various analytical perspectives. It involves data collection, analysis, and interpretation of numerical data to support or refute hypotheses generated in a study. The most common quantitative research methods include experimental research, correlational research, and descriptive research (e.g., case studies, observational studies, survey research, cross-sectional studies, and longitudinal studies) (30). In this study, quantitative publications were categorized based on these defined methods. Unlike quantitative research, which relies on measurable and numerical data, qualitative research collects non-numerical data to understand how individuals live, think, and respond to various situations. As a result,

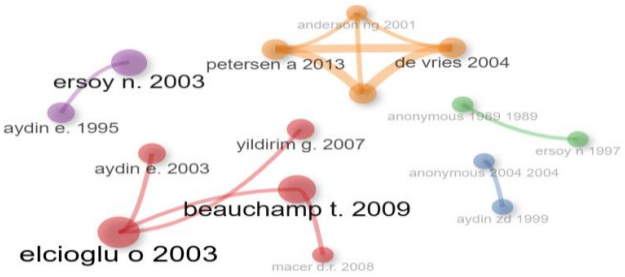


Figure 7. Co-citation network analysis

qualitative studies aim to provide insights into human experiences, behaviors, beliefs, attitudes, and motivations. These studies typically involve population observation, in-depth interviews, or focus group discussions (31).

There are five main qualitative research methods: phenomenological research, ethnographic research, grounded theory research, narrative research, and case studies. The most frequently used techniques in qualitative research include semi-structured interviews, open-ended questionnaires, focus group techniques, and observations. In this study, qualitative studies were categorized based on their methodology as qualitative research, semi-structured interviews, and case reports. Case reports were included in both quantitative and qualitative research categories, as they may incorporate elements from both methodologies (32). Therefore, they were classified as a separate category.

Publications categorized as reviews were considered as a distinct group, as they represent literature-based studies reflecting the accumulated knowledge on a given topic. Consequently, all publications were categorized into four groups: qualitative studies, quantitative studies, reviews, and case reports. The study identified 80 review articles, 44 quantitative studies, 9 qualitative studies, and 7 case reports published between 1999 and 2024. A document-based analysis of all publications revealed that 47 studies merely mentioned bioethics without making significant contributions to the field. The remaining 140 publications were methodologically and thematically classified.

The methodological distribution of the bioethics and medical ethics publications originating from Türkiye demonstrates significant increases and shifting trends over time (Table 2). In the early years (1999-2005), the total number of publications was limited, but a notable increase in publication volume has been observed since 2008. Only two publications in 1999 and one in 2000 were recorded. However, after 2010, the annual number of publications increased substantially, with 10 publications in 2010, 7 in 2011, 10 in 2017, and a peak of 16 publications in 2021. This trend reflects the growing interest in bioethics research over time and the increasing methodological diversity within the field.

Table 2. Methodologies of articles by year

Topic	1999	2000	2003	2004	2005	2006	2008	2009	2010	2011	2012	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
Review	1	1	2	2	1	2	3	4	6	5	4	3	7	5	7	2	5	1	9	5	3	2	**80**
Quantitative	1		1	1					2	1	1	1	1	1	3	2	2	7	5	6	7	2	**44**
Qualitative											1		1	1		1		1	2		2		**9**
Case Report					1				2	1				1				2					**7**
Total	**2**	**1**	**3**	**3**	**2**	**2**	**3**	**4**	**10**	**7**	**6**	**4**	**9**	**8**	**10**	**5**	**7**	**11**	**16**	**11**	**12**	**4**	**140**

Review articles have emerged as the most (57.14%) prevalent methodology, with 80 review publications, indicating a strong emphasis on systematic evaluations and literature-based research. In contrast, qualitative studies remained relatively limited (6.43%), with only 9 publications, suggesting a lack of focus on in-depth qualitative analysis in bioethics and medical ethics research. Quantitative studies accounted for 44 (31.43%) publications, particularly gaining prominence in 2020, 2021, and 2023, highlighting an increased interest in data analysis and methodological diversification. Case reports, with only 7 publications, had the lowest (5.0%) share among all methodological approaches, indicating their limited representation in the field.

When analyzing yearly trends, it becomes evident that review and quantitative studies have grown significantly since 2010, with a particularly sharp increase in quantitative studies in 2020 and 2021. This trend suggests that researchers have placed greater emphasis on data collection, statistical analysis, and generalizing research findings. On the other hand, the low number of qualitative studies and case reports suggests a limited inclination toward in-depth qualitative analyses and individual case examinations. The total value of 140, in general, may represent either the total number of publications analyzed or the total number of publications originating from Türkiye. This suggests that the analyzed methodologies constitute only a subset of the total body of literature.

Overall, while methodological diversity exists in the bioethics and medical ethics literature, review and quantitative studies dominate, whereas qualitative and case report-based research remains underrepresented. These findings indicate that bioethics research has been predominantly shaped by systematic literature reviews and quantitative analyses, whereas qualitative and case-based approaches have been relatively neglected. In future research, increasing methodological diversity and supporting qualitative approaches could be emphasized to enhance the depth and scope of bioethics studies.

The distribution of bioethics topics between 1999 and 2024 was presented in Table 3. The most frequently studied topic was "patient rights" with 26 publications, indicating that bioethics research has developed strongly in alignment with patient-centered approaches. This is followed by "medical ethics education" with 19 publications, highlighting the importance of ethical training in the education of healthcare professionals. The category of "other ethical issues," with 14 publications, includes diverse topics such as commercial medical products, cadaver donations, and stem cell research, suggesting that the bioethical framework has expanded over time. Other frequently discussed topics include "nursing ethics", "clinical research ethics", and "informed consent", each ranging between 8 and 9 publications, reflecting a multi-dimensional ethical discourse spanning from patient-physician relationships to research ethics. Studies on "malpractice" with 6 publications gained prominence after 2010, whereas "COVID-19 and ethics", with 5 publications, emerged rapidly in 2020, accumulating a notable body of research in a short period. Other topics, such as "organ donation", "end-of-life issues", and "sexuality and gender ethics", have been explored less frequently but continue to be examined periodically, indicating ongoing diversity in bioethical discussions.

Table 3. Analysis of publications by topic headings

Topic	1999	2000	2003	2004	2005	2006	2008	2009	2010	2011	2012	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
Patient Rights			1	2	1		1	1	1			3	2	1	1		1	2	2	4	2	1	**26**
Medical Ethics Education		1				1	1	2	1		1		1			1	3	1	1	3	2		**19**
Other Ethical Issues (Commercial Medical Products, Stem Cells, Cadaver Donation, Promotion)	1		1							1	1		1	3	1		1	1	2			1	**14**
Informed Consent									3					1		1	1	1	2				**9**
Patient-Physician Relationship										2	1		1			1		1	1		1		**8**
Clinical Research Ethics			1				1	1			1				2	1						1	**8**
Nursing Ethics				1					1	1			1		2				1				**7**
Malpractice					1				2	1			1		1								**6**
COVID-19 and Ethics																			3	1	1		**5**
Organ Donation									1			1		1				1		1			**5**
End-of-Life Issues														1		1		1	1	1			**5**
Sexuality and Gender Ethics	1														1			1	1				**4**
Artificial Intelligence in Medical Ethics																	1		1	1	1		**4**
Animal Ethics													1		1						2		**4**
Genetic Testing and Screening										1	1							1					**3**
Public Health Ethics											1										1	1	**3**
Resource Allocation									1				1						1				**3**
Privacy						1												1			1		**3**
Assisted Reproductive Technologies and Their Applications															1						1		**2**
Environmental Ethics, Public Health Ethics														1									**1**
Patient Privacy										1													**1**
Total	**2**	**1**	**3**	**3**	**2**	**2**	**3**	**4**	**10**	**7**	**6**	**4**	**9**	**8**	**10**	**5**	**7**	**11**	**16**	**11**	**12**	**4**	**140**

From a broader perspective, there has been a consistent interest in bioethics over the years, with increasing specialization in certain topics. The chronological analysis of topics reveals that between 1999 and 2005, bioethics research was relatively scarce, but since the 2010s, both the number of topics and the frequency of publications have expanded significantly. For example, topics such as "patient rights" and "medical ethics education" have shown a steady rise since the early 2000s, whereas "malpractice" and "nursing ethics" became more prominent after 2010. Additionally, the emergence of "COVID-19 and ethics" in 2020 and its rapid integration into bioethics discussions demonstrate how global health crises have been swiftly reflected in academic research. Similarly, topics like "organ donation" and "end-of-life issues" have been explored at a steady but lower frequency since their first appearance. In contrast, "sexuality and gender ethics" and "artificial intelligence in medical ethics" have only gained attention in recent years, yet they have not yet reached the level of prominence observed in "patient rights" or "medical ethics education".

Overall, bioethics research has evolved both quantitatively and qualitatively over the years, closely mirroring societal and healthcare developments. The field has expanded in scope, shifting from general ethical discussions to more specialized topics that align with emerging healthcare and technological challenges.

DISCUSSION

This study, based on the bibliometric analysis of bioethics and medical ethics publications originating from Türkiye, has provided significant findings regarding both publication performance and the conceptual and intellectual structure of the field. Between 1999 and 2024, the number of publications increased steadily. During this period, collaboration networks among researchers and institutions also expanded. Notably, leading institutions such as Ankara University, Hacettepe University, and Istanbul University have played a pivotal role in publication output, reflecting the growing dynamism of academic collaboration and competition. Furthermore, co-occurrence and co-citation analyses reveal clusters centered around key themes such as clinical research, informed consent, medical education, and health policies, highlighting both the theoretical and applied dimensions of bioethical discussions (1,2).

The co-occurrence analysis reveals five main themes in Türkiye-based bioethics research. These include: *i)* clinical research and informed consent, *ii)* medical education and ethics, *iii)* bioethics and health policies, *iv)* anatomy and research ethics, and *v)* end-of-life issues.

The most frequently studied topic is "patient rights", emphasizing the importance of patient protection and advocacy in clinical practice. Similarly, "medical ethics education" holds a significant position, underlining the role of ethical awareness in improving healthcare quality. Topics such as clinical research ethics, informed consent, and nursing ethics align with the broader thematic clusters identified in the co-occurrence analysis. Additionally, emerging topics such as COVID-19, AI in medical ethics, and sexuality-gender ethics reflect the field's responsiveness to contemporary healthcare challenges and its continuous evolution. The combined evaluation of co-occurrence and co-citation analyses illustrates that both traditional and contemporary ethical issues are comprehensively addressed within a rich methodological and thematic framework.

The co-citation analysis further highlights four key thematic areas in the literature: *i)* principles of medical ethics, *ii)* governance and business ethics, *iii)* ethical sensitivities of physicians in Türkiye, and *iv)* ethical decision-making in clinical settings.

The findings indicate that patient rights, medical ethics education, informed consent, and clinical research ethics remain dominant topics. The "principles of medical ethics" cluster aligns with patient rights and informed consent, demonstrating the importance of fundamental ethical principles in clinical practice. Similarly, the "governance and business ethics" cluster corresponds with bioethics and health policies, reinforcing the necessity of ethical approaches in institutional governance and public health policy. The "ethical sensitivities of physicians in Türkiye" cluster is linked to medical ethics education and clinical research ethics, emphasizing the ethical dilemmas encountered in professional practice and medical training. Lastly, the "ethical decision-making in clinical settings" cluster relates to practical ethical challenges, particularly in informed consent and clinical research ethics. These comparisons demonstrate that both co-citation analysis and topics provide a holistic and multi-dimensional perspective on the theoretical foundations and clinical applications of ethics in medical research and practice.

The analysis of Türkiye-originated publications in the WoS database from 1999 to 2024 reveals that qualitative studies are significantly underrepresented compared to quantitative and review-based research. A study by Wangmo and Provoost (33), involving researchers from bioethics and medical ethics research centers across 12 European countries, found that approximately 60% of researchers utilized both qualitative and quantitative methods, 33% relied exclusively on qualitative methods, and only 7% used quantitative methods. In their latest projects, 51% of researchers reported using qualitative methods, highlighting a stronger presence of qualitative methodologies in European bioethics research. Moreover, the study indicated that bioethics researchers require methodological training, particularly in qualitative research approaches. The findings from the European study suggest that there is a need for more widespread methodological training in Türkiye, including the implementation of qualitative data analysis software and research methodologies. Expanding training programs for qualitative research in bioethics could enhance the methodological diversity and depth of the field.

A study conducted by Bystranowski et al. (34) analyzed 19,488 publications in seven leading bioethics journals from 1971 onward, exploring thematic trends over time. Their findings revealed that some topics followed a continuous, monotonous trend, while others gradually declined in relevance (e.g., history, privacy, science, philosophy), and new topics emerged as major areas of interest (e.g., enhancement, public health emergencies, circumcision).

The most prominent topics in recent years included public health emergencies, genetics, privacy, race, disability, vaccination, dementia, gender, and abortion (34). The findings of the present study align with these trends, with "patient rights" and "medical ethics education" remaining

the most frequently studied topics over time, while "malpractice" and "nursing ethics" gained more attention after 2010. The topic of "COVID-19 and ethics" emerged in 2020, reflecting a rapid academic response to the pandemic. Although "artificial intelligence in medical ethics" has gained increasing attention, further studies in this area are expected in the future.

The methodological framework of this study was based on a search conducted in the WoS database using the keywords "bioethic*" and "medical ethic*", which largely capture human-centered ethical literature. However, an examination of the dataset reveals that topics such as environmental ethics, animal ethics, and veterinary medical ethics are addressed in only a limited number of Türkiye-affiliated publications. "animal ethics" appears in only four studies, while "environmental ethics" is represented in just one. In this context, while the existence of ethical relationships unique to veterinary medicine is acknowledged, we were compelled to focus primarily on human health-oriented ethical publications due to the content characteristics of the dataset. This limitation stems both from the keyword-based search strategy and the low representation of these topics in the national literature.

This study is subject to certain limitations. The analysis was conducted using data from a single database, WoS, meaning that additional sources from Scopus and PubMed could provide broader insights. Furthermore, only two bibliometric analyses were performed, whereas additional techniques such as text mining, author collaboration analysis, and bibliometric mapping could further enhance the findings. Additionally, comparisons between Türkiye-originated publications and those from leading global research hubs could provide valuable insights into the thematic and methodological differences in bioethics research.

CONCLUSION

This study presents a bibliometric analysis of bioethics and medical ethics publications from Türkiye, offering a comprehensive perspective on research trends and collaborations in the field. Performance analyses, including publication trends, leading authors and institutions, most cited works, and international collaborations, reveal the dynamics of bioethics and medical ethics research in Türkiye. The findings indicate a steady increase in publication volume over time, with "patient rights" and "medical ethics education" emerging as the most frequently studied topics, while qualitative research remains notably underrepresented. Through co-citation and co-occurrence analyses, five major thematic clusters were identified. Overall, the results offer a comprehensive view of the intellectual structure, conceptual focus, and developmental trajectory of bioethics research in Türkiye. The co-occurrence and co-citation analyses provide insights into the conceptual and intellectual structure of the field, offering important directions for future research. The findings suggest that strategic priority should be given to qualitative research to diversify methodological approaches in bioethics and medical ethics. Additionally, future research should focus on bioethics topics that are well-established internationally but have not been adequately explored in Türkiye. This approach could enhance the contribution of Turkish research to the international bioethics literature and guide the development of academic research in this field.

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