

Analysis of Scientific Publications on the Use of Artificial Intelligence in Childhood Cancer: A Descriptive Study

Çocukluk Çağı Kanserinde Yapay Zeka Kullanımına İlişkin Bilimsel Yayınların Analizi: Tanımlayıcı Bir Çalışma

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ÖZET

Amaç: Bu çalışma, çocukluk çağı kanserlerinde yapay zeka (YZ) kullanımına ilişkin bilimsel literatürü bibliyometrik bir yaklaşımla analiz etmeyi ve tanımlayıcı analizleri sentezle birleştirerek yayın eğilimlerini, öncü ülkeleri, dergileri, kurumları ve başlıca araştırma temalarını belirlemeyi amaçlamıştır.

Yöntem: Web of Science Core Collection veri tabanından 2003-2025 yılları arasında erişilen yayınlar kullanılarak bibliyometrik bir analiz gerçekleştirilmiştir. Analize toplam 1091 yayın dahil edilmiştir. İngilizce olarak yayımlanmış makale ve derleme türündeki çalışmalar kapsama alınmıştır. Yayın çıktısı, ülkeler arası iş birliği, etkili dergiler, kurumlar ve anahtar kelime eğilimlerinin değerlendirilmesinde Bibliometrix (R), VOSviewer ve betimsel analizlerden yararlanılmıştır.

Bulgular: Bulgular, özellikle 2017 sonrasında bilimsel yayınlarda istikrarlı bir artış olduğunu ortaya koymuştur. Yayınların ağırlıklı olarak yüksek gelirli ülkelerde kümelenildiği görülmüş, yayın sayısı ve uluslararası iş birliği açısından ABD ile Çin öne çıkmaktadır. Anahtar kelime analizinde makine öğrenmesi, derin öğrenme, tanı, risk tabakalandırması, radyomiks ve sağkalımın en sık çalışılan konular arasında olduğu belirlenmiştir.

Sonuç: Bu bibliyometrik analiz, YZ uygulamalarının çocukluk çağı kanserlerinin tahmin, tanı ve tedavi süreçlerinde nasıl yaygın olarak kullanıldığına dair yapılandırılmış bir genel bakış sunmakta olup, bu alandaki bilimsel üretimin son yıllarda belirgin şekilde arttığını ve ağırlıklı olarak yüksek gelirli ülkelerde yoğunlaştığını ortaya koymaktadır. Gelecekteki araştırmalar, özellikle pediatrik onkoloji için tasarlanmış YZ destekli değerlendirme araçlarının ve tanı modellerinin geliştirilmesine, doğrulanmasına ve klinik uygulamasına öncelik vermelidir.

Anahtar Kelimeler: Yapay Zeka, Bibliyometrik, Kanser, Çocukluk Çağı, Haritalama.

ABSTRACT

Aim: This study aimed to analyze the scientific literature on the use of artificial intelligence (AI) in childhood cancers through a bibliometric approach, combining descriptive analyses with analytical synthesis to identify publication trends, leading countries, journals, institutions, and major research themes.

Methods: A bibliometric analysis was conducted using publications retrieved from the Web of Science Core Collection database between 2003 and 2025. A total of 1,091 publications were included in the analysis. Articles and review papers published in English were included. Bibliometrix (R), VOSviewer, and descriptive analyses were used to evaluate publication output, country collaboration, influential journals, institutions, and keyword trends.

Results: The findings revealed a steady increase in scientific output, particularly after 2017. Research activity was predominantly concentrated in high-income countries, with the United States and China leading publication output and international collaboration. Keyword analysis indicated that machine learning, deep learning, diagnosis, risk stratification, radiomics, and survival were the most frequently studied topics.

Conclusion: This bibliometric analysis provides a structured overview of how AI applications are widely used in the prediction, diagnosis, and treatment processes of childhood cancers, with scientific output increasing markedly in recent years and predominantly concentrated in high-income countries. Future research should prioritize the development, validation, and clinical implementation of AI-supported assessment tools and diagnostic models specifically designed for pediatric oncology.

Keywords: Artificial Intelligence, Bibliometric, Cancer, Childhood, Mapping.

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INTRODUCTION

Childhood cancers remain one of the leading causes of morbidity and mortality worldwide and represent a major public health challenge within pediatric healthcare (Siegel et al., 2022; Sultan et al., 2025; Wang et al., 2025; Widemann, 2023). According to global reports published in 2022, there were 211,080 new cases and 78,441 deaths attributable to childhood cancers worldwide. Among these, leukemia accounted for 66.73%, brain and central nervous system cancers for 45%, and lymphomas for 17.64%, making them the most prevalent childhood cancer types (Wang et al., 2025). According to the 2025 report published by the Cancer Department of the General Directorate of Public Health of the Turkish Ministry of Health, the most common childhood cancer in Türkiye is leukemia, accounting for 36.5% of cases, followed by lymphomas (15.1%) and central nervous system tumors (12.3%). A population-based study evaluating the incidence of childhood cancers reported an increase from 14.23 cases per 100,000 children in 1975 to 18.89 cases per 100,000 in 2019, indicating a steady upward trend over time, with an average annual increase of 0.73% (Sultan et al., 2025). According to the Global Cancer Observatory (GLOBOCAN) 2022 report, there were 4,817 cancer cases among children aged 0–19 years in Türkiye, with an age-standardized incidence rate of 18.3 per 100,000 and a crude mortality rate of 18.1 per 100,000 globally (International Agency for Research on Cancer, 2025). While survival rates among children and adolescents under 20 years of age with cancer have improved, cancer-related mortality has declined from 4.9 to 2.3, largely due to advances in diagnosis, treatment, and clinical management. Despite these improvements, limitations persist in the treatment processes of childhood cancers, underscoring the need for further research to better understand factors influencing survival and to reduce treatment-related adverse effects (Sultan et al., 2025). Moreover, challenges related to early and accurate diagnosis, monitoring of treatment response, and management of treatment-

associated complications remain unresolved (Ofosu-Appiah, 2024; Sultan et al., 2025; Varga et al., 2024). Inadequate risk stratification may result in overtreatment for some patients while allowing disease progression in others (Ofosu-Appiah, 2024; Quintás et al., 2020; Varga et al., 2024). A study conducted in Ghana reported that limited access to specialized oncology services, delays in early diagnosis, and insufficient healthcare infrastructure exacerbate the burden of childhood cancer, contributing to poorer treatment outcomes and increased mortality rates (Ofosu-Appiah, 2024). Consequently, there is an urgent need for innovative solutions to improve early diagnosis, treatment, follow-up, and survival outcomes in childhood cancers (Bohr & Memarzadeh, 2020; Gangas et al., 2025; Ofosu-Appiah, 2024; Nyarko et al., 2025; Quintás et al., 2020; Varga et al., 2024).

In recent years, artificial intelligence (AI) has emerged as a promising tool to address these challenges, particularly through the application of big data analytics, machine learning, and deep learning techniques (Bohr & Memarzadeh, 2020; Gangas et al., 2025; Mirnezami, 2020; Nyarko et al., 2025; Varga et al., 2024; Wen et al., 2024). The applications of AI in pediatric oncology have expanded to include early diagnosis, outcome prediction, advanced imaging analysis, and clinical decision support systems (Bohr & Memarzadeh, 2020; Gangas et al., 2025; Ngiam & Khor, 2019; Nyarko et al., 2025; Varga et al., 2024; Wen et al., 2024). Varga et al. (2024) demonstrated that AI-based prognostic models for non-central nervous system solid tumors exhibit superior predictive performance and enhance accurate risk stratification in pediatric oncology. Gangas et al. (2025) emphasized the absence of AI technologies specifically designed for childhood cancer and reported that the UNICA4EU project, titled “A Unique European Vision for Artificial Intelligence to Fight Childhood Cancer,” aims to co-design a Europe-wide methodology to support AI-based, childhood cancer-specific interventions

(UNICA4EU, 2025). The authors further highlighted that AI could contribute to improving standards of care throughout the cancer trajectory by addressing unmet needs of patients, caregivers, and healthcare professionals at all stages (Gangas et al., 2025; UNICA4EU, 2025). Another study reported that AI is currently utilized in childhood cancer care for oncologist consultations, patient symptom assessment, diagnosis, treatment planning, and research data management, with the potential to enhance diagnostic accuracy, advance personalized medicine, optimize resource allocation, and overcome geographical barriers, thereby significantly improving pediatric cancer care (Nyarko et al., 2025). However, Tozzi et al. (2022) noted that while AI is widely applied in diagnostic imaging within pediatric oncology, there is a lack of evidence regarding its use in process mining, clinical pathway modeling, and computer-interpreted clinical guidelines.

Guidance is therefore needed to support the effective implementation and integration of AI in childhood cancer care (Wen et al., 2024). The rapid growth of research in this field reflects both the opportunities and complexities associated with integrating AI into pediatric cancer care (Bohr & Memarzadeh, 2020; Gangas et al., 2025; Ngiam & Khor, 2019; Nyarko et al., 2025; Tozzi et al., 2022; Varga et al., 2024; Wen et al., 2024). Nevertheless, systematic evaluations of research trends, global collaboration networks, and thematic directions remain limited. Therefore, a bibliometric approach is needed to map the current state of knowledge, highlight emerging research areas, and provide insights to guide future research in this rapidly evolving field.

Aim of the research

This research used bibliometric analysis to explore the landscape of studies conducted in the Web of Science Core Collection database on the use of AI in childhood cancer since 2003 and to present them to researchers from a holistic perspective. To identify current trends in the use of AI in childhood cancer and ensure methodological consistency, the relevant

literature between 2003 and 2025 was evaluated. The aim was to combine these studies with descriptive analyses and analytical synthesis.

Research Questions

1. What is the distribution and trend of scientific publications on the use of AI in childhood cancers over the years?
2. Which countries produce the most publications in this field, and what is the level of cooperation between countries?
3. Which journals, authors, and institutions publish research on AI applications in childhood cancers?
4. What are the prominent keywords in publications in this field?

METHODS

Research design

This research is descriptive and bibliometric in design. To ensure transparency, rigor, and quality in the analysis and reporting of this descriptive research, the BIBLIO Checklist was adhered to (Özkan et al., 2025).

Data collection and search strategy

The Web of Science Core Collection (WoS) database was used in this study to access a wide range of high-impact peer-reviewed publications, with data retrieved using specific search criteria. The search strategy used in this research is aimed at identifying AI applications in childhood cancers. Accordingly, the keywords “artificial intelligence,” “pediatric,” and “cancer” were identified using the MeSH Browser, and their related synonyms were incorporated into the Web of Science Core Collection search strategy using the Topic Search (TS) field tag and Boolean operators (AND, OR). The inclusion criteria were as follows: (1) studies focusing on AI and childhood cancer; (2) publication types Article, Review Article, or Early Access; (3) studies published in English; and (4) studies published between 1 January 2003 and 14 September 2025. The exclusion criteria were as follows: (1) duplicate publications and (2) retracted publications. In the first stage, a total of 1,264 records were identified using the search

keywords. During the screening process, publications that did not meet the predefined eligibility criteria, including book chapters, proceedings papers, editorial materials, and other non-eligible publication types, were excluded, resulting in 1,099 eligible records. Subsequently, eight retracted publications were removed, and a total of 1,091 studies were included in the final bibliometric analysis. The four authors independently screened the retrieved records against the predefined eligibility criteria and removed duplicate and retracted publications during the data refinement stage. The bibliometric data were then independently extracted and verified by the authors, and any disagreements at each stage were resolved through discussion until consensus was reached.

Statistical analysis

In this study, the bibliometric R package (R version 4.4.1), Biblioshiny (Bibliometrix 5.0), VOSviewer (version 1.6.17), and Microsoft Excel 2010 (Microsoft) were used (Aria & Cuccurullo, 2017). Data were retrieved from the WoS database in Plain Text File format. The Bibliometrix R package was downloaded and installed in the R Studio environment. Subsequently, the Biblioshiny application was launched by typing the ‘biblioshiny’ command into the R console. This interface was used to

load the WoS files of the obtained publications in Plain Text format. In this study, bibliometric analysis and science mapping techniques were used to identify key features such as institutions, authors, frequent keywords, countries, citations, and trending topics.

Ethical consideration

As this study was obtained from publicly available databases and did not involve direct interaction with patients or healthy participants or sensitive personal information, ethical approval was not sought.

RESULTS

Publication outputs of AI use in childhood cancer

A search of the Web of Science Core Collection database yielded a total of 1,264 publications. Following the literature screening process, 1,091 articles were eligible for inclusion in the final analysis. Publication trends regarding the use of AI in childhood cancers show a general upward trajectory over the last eight years, albeit with fluctuations. It is noteworthy that annual publications have consistently exceeded 100 since 2021, reaching 236 articles in 2025. Between 2021 and 2025, a total of 927 articles were published (2021: n=125; 2022: n=160; 2023: n=182; 2024: n=224; 2025: n=236), accounting for 85% of the total output.

Table 1. Top 10 countries by number of publications

Rank	Country	Publications, n (%)
1.	United States	272 (25.1)
2.	China	247 (22.8)
3.	England	55 (5.1)
4.	India	52 (4.8)
5.	Canada	47 (4.3)
6.	Germany	36 (3.3)
7.	Italy	36 (3.3)
8.	Netherlands	31 (2.9)
9.	Japan	25 (2.3)
10.	South Korea	21 (1.9)
Top 10 countries (total)		822 (75.9)

Note: Percentages were calculated based on the 1083 publications with reported country information (n=1083); country data were missing for 8 of the 1091 total publications (0.7%) and these were excluded from the percentage calculations.

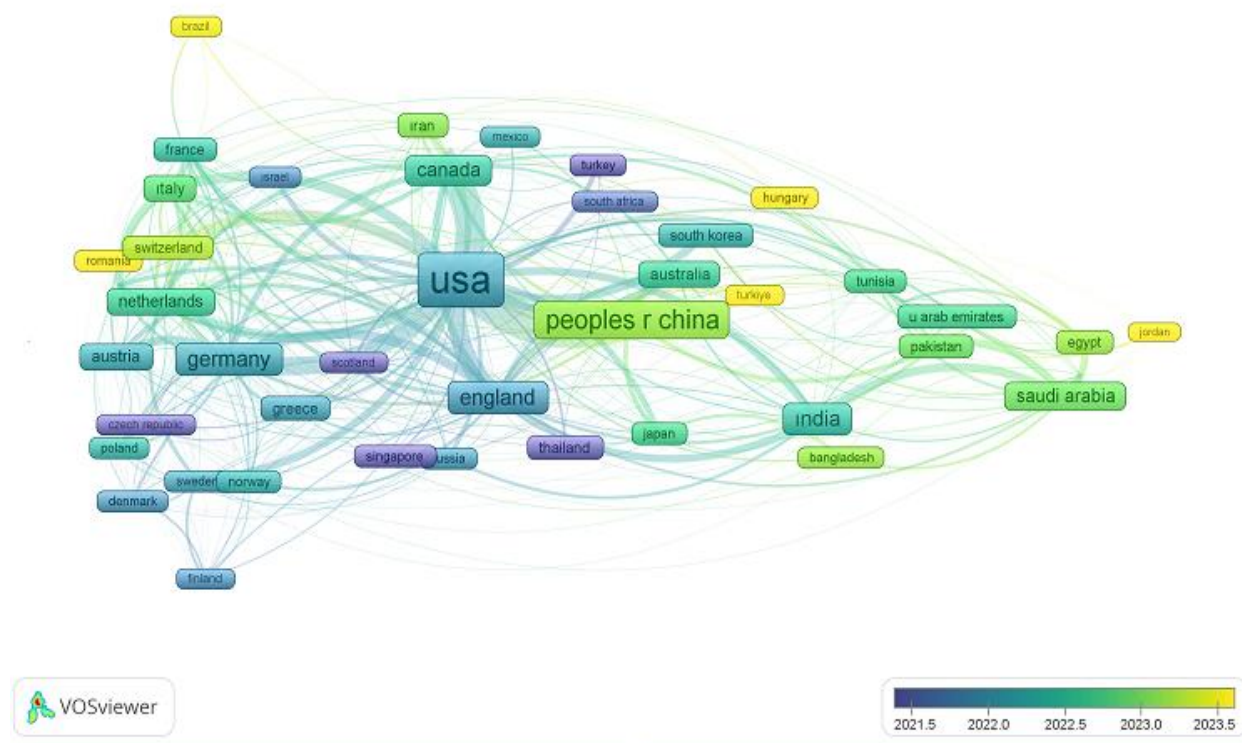


Fig. 1. International cooperation map in the use of artificial intelligence in childhood cancer

Distribution of countries conducting research on the use of AI in childhood cancer

A total of 60 countries have contributed to the publication of articles on the use of AI in childhood cancers. Table 1 lists the top 10 contributing countries, with the United States ranking first with 272 publications (25.1% of the total), China second with 247 publications (22.8%), and the United Kingdom third with 55 publications (5.1%). Figure 1 shows that the United States and China occupy a central position in terms of cooperation between countries in the field of AI use in childhood cancers. Work in this field shows that the countries shown in blue (United States, Germany, China) focused on it before 2021, while the countries shown in yellow (Jordan,

Hungary, Romania) focused on it after 2023. Consequently, Table 1 and Figure 1 reveal that the use of AI in childhood cancers is growing rapidly on a global scale and that there is cooperation between countries.

Publication journals on the use of AI in childhood cancers research

Figure 2 shows the use of AI in childhood cancers research, with academic journals, including the top 10 journals in this field of study. Scientific Reports ranked first with 38 publications, followed by Cancers and Frontiers in Oncology with 33 publications each, and Diagnostics and Medical Physics with 13 publications each (Figure 2).



Fig. 2. Top 10 journals publishing most on the use of artificial intelligence in childhood cancer

Most influential authors on the use of AI in childhood cancer

In publications related to the use of AI in childhood cancers, Xin Chen, Ali Nabavizadeh, and Xunan Zhang are the most prolific authors with 13 publications, respectively, while Neda

Khalili, Arastoo Vossough, and Samuel H. Cheshier follow with 12. Since 2019, Xin Chen has been an active researcher in the field of AI in childhood cancers, while Samuel H. Cheshier is among the prominent researchers in terms of both production and citations (Figure 3).

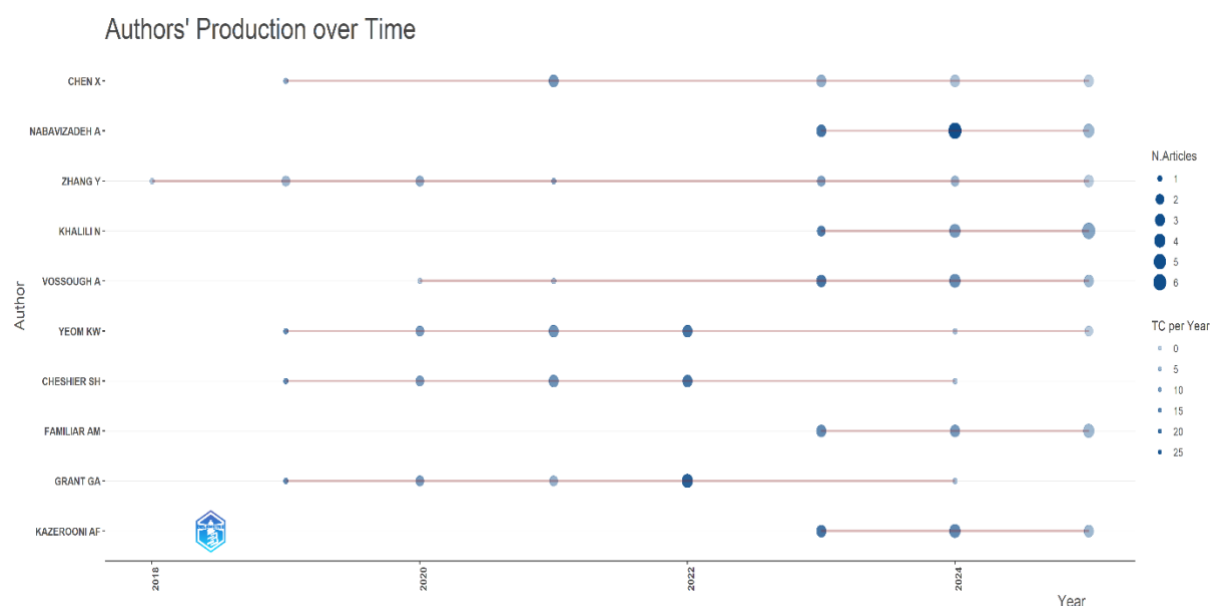


Fig. 3. Authors' production over time on the use of artificial intelligence in childhood cancer

The most productive institutions in publications on the use of AI in childhood cancer

Table 2 lists the most productive institutions in publications on the use of AI in childhood cancer. The University of Toronto (n=163) was identified as the most relevant institution in this

study. The University of Pennsylvania (n=142) is the second most contributing academic institution. Harvard University (n=135) follows in third place with articles. Table 2 highlights that the United States, England, and Canada have contributed significantly to publications on the use of AI in childhood cancer worldwide

Table 2. The most productive institutions in publications on the use of artificial intelligence in childhood cancer.

Affiliation	Articles
University of Toronto	163
University of Pennsylvania	142
Harvard University	135
Stanford University	101
Harvard University Medical Affiliates	96
University of California System	81
University of London	79
Hospital For Sick Children (Sickkids)	76
Childrens Hospital of Philadelphia	75
Harvard Medical School	75

Keyword trends in publications on the use of ai in childhood cancer

This study presents 1,567 keywords related to research on the use of AI in childhood cancer. The most important and central terms in the word cloud and pie chart are “machine learning” (n=324), “cancer” (n=241), and “children” (n=203), indicating that the research focused on the use of AI in childhood cancer. Additional key terms include “deep learning, classification, artificial intelligence, diagnosis, risk, radiomics, survival.”

DISCUSSION

Although the evolution of AI in healthcare dates back to the 1970s, its application within the health sector has shown a marked increase over the past decade (Xsolis, 2025). Globally and in Türkiye, research focusing on the use of AI in the diagnosis, treatment, and follow-up of childhood cancers has become a major area of interest (Bohr & Memarzadeh, 2020; Gangas et al., 2025; Mirnezami, 2020; Nyarko et al., 2025; Varga et al., 2024). Gangas et al. (2025)

reported that the number of publications addressing the use of AI in healthcare indexed in the PubMed database increased steadily from 2015 (n = 15) to 2024 (n=791). Accordingly, a substantial growth in research articles focusing on AI applications in healthcare has been observed over the past decade (Bohr & Memarzadeh, 2020; Gangas et al., 2025; Mirnezami, 2020; Nyarko et al., 2025; Varga et al., 2024; Wen et al., 2024).

In the present study, the use of AI in childhood cancers demonstrated a steady increase from 2003 to 2025, with a particularly pronounced growth observed from 2017 onward, contributing to the emergence of a comprehensive body of literature in this research area. This increase in publications in this field reveals that the research focus on the use of AI in childhood cancers has increased and highlights the growing importance of AI applications in pediatric oncology research. The expanding body of evidence indicates that AI has the potential to improve diagnosis,

treatment, and follow-up processes in childhood cancer care, as well as to enhance healthcare professionals' workflows, clinical documentation, patient care delivery, and patient education (Bohr & Memarzadeh, 2020; Gangas et al., 2025).

The upward trend in published research highlights the urgent need to address challenges related to early diagnosis, treatment, follow-up, and survival outcomes in childhood cancers (Bohr & Memarzadeh, 2020; Dalboni da Rocha et al., 2025; Gangas et al., 2025; Gurumurthy et al., 2025; Mirnezami, 2020; Nyarko et al., 2025; Singh et al., 2024; Sultan et al., 2025). This study is expected to provide important insights into existing research gaps regarding the use of AI in childhood cancers and to contribute to a better understanding of future research trends. As a bibliometric analysis examining scientific outputs and bibliometric indicators related to AI research in childhood cancers, this study addresses a critical knowledge gap in the literature. This study findings may guide future research directed toward patients and families, healthcare professionals, AI experts, and policymakers, and may also contribute to strengthening collaboration between governments and healthcare institutions in the development of health policies. In this study, the United States emerged as the most productive country and the one with the highest level of international collaboration. The broad geographical distribution of 60 countries conducting research on AI applications in childhood cancers indicates substantial global interest and engagement in this field.

A bibliometric study conducted in Europe on AI applications in pediatric brain tumors revealed that the United Kingdom maintains extensive collaborations with both European and non-European institutions, particularly with the United States, highlighting strong cooperation between EU and non-EU countries (Tozzi et al., 2023). The authors further emphasized that multicenter studies were more prevalent than single-center studies; however, the overall number of publications remained limited, underscoring the need for further research

development in this area (Tozzi et al., 2023). The present study demonstrates that research on AI use in childhood cancers is predominantly conducted in high-income countries such as the United States, Germany, China, and England, while studies from low-income countries remain underrepresented. This finding highlights the necessity for more detailed investigations addressing this disparity. Bolacalı et al. (2026) stated that the level of development of high-income countries such as the United States, UK, Italy, and Canada plays an important role in their pioneering contributions to scientific research. Factors contributing to insufficient research activity on childhood cancers in low- and middle-income countries include limited availability of reliable data, inadequate clinical trials, restricted research funding, insufficient research infrastructure in academic institutions, shortages of trained human resources, and lack of institutional support (Pramesh et al., 2022). Hesso et al. (2024), in the INCISIVE project (A multimodal AI-based toolbox and an interoperable health imaging repository for the empowerment of imaging analysis related to the diagnosis, prediction and follow-up of cancer) involving nine European countries, reported that although most countries have National Cancer Plans, cancer care and treatment resources remain largely dependent on government funding. This dependency contributes to inequalities in diagnosis and treatment, as well as gaps in national data governance; however, the authors emphasized that AI holds transformative potential to improve cancer prevention and treatment. Accordingly, high-income countries should leverage AI-based solutions to address disparities in low- and middle-income countries by integrating AI into childhood cancer care, enhancing survival outcomes, and improving the quality of life of survivors (Gangas et al., 2025; Hesso et al., 2024; Nyarko et al., 2025; Pramesh et al., 2022; Tozzi et al., 2023).

Keywords identified by authors serve as fundamental elements that provide a concise summary of the research topic, convey the core

content of the study, and facilitate the identification of focal research areas within a field (Liu et al., 2022; Lu et al., 2021). According to the keyword analysis in this study, the most frequently researched and discussed topics were machine learning, cancer, children, deep learning, classification, artificial intelligence, diagnosis, risk, radiomics, and survival, reflecting current research trends in the field. The use of these keywords in studies on AI applications in childhood cancers contributes to defining the scope of the literature, increasing the visibility of research, identifying knowledge gaps, and enhancing citation potential (Liu et al., 2022; Lu et al., 2021). Between 2003 and 2025, although journals such as Scientific Reports, Cancers, Frontiers in Oncology, Diagnostics, and Medical Physics which have relatively high impact factors published studies in this area, the majority of scientific publications on AI and childhood cancers appeared in journals not exclusively dedicated to oncology. However, since 2020, an increasing number of publications have been published in oncology-specific journals, particularly Frontiers in Oncology and Cancers. The growing number of articles published in these journals aligns with the rising interest in AI applications in childhood cancers, and researchers are therefore encouraged to consider these journals when reviewing the literature and disseminating their findings.

Implications for nursing

The integration of AI into clinical practice for childhood cancers enables more effective patient monitoring, standardisation in symptom assessment, and support for more objective diagnostic processes. AI-based applications offer more objective, faster, and reliable approaches in the evaluation of childhood cancers. These technologies contribute to improving the quality of patient care and have the potential to reduce the workload of healthcare professionals by enabling earlier, more accurate, and standardised diagnosis of clinically critical symptoms and treatment-related side effects. In pediatric oncology, AI

applications are increasingly focused on predicting chemotherapy-related complications, analyzing survival, predicting disease recurrence, and identifying treatment-related symptom risks. Accordingly, there is a need to develop AI-supported standard assessment tools and diagnostic procedures specific to pediatric oncology. With technological advancements, AI models have become important tools supporting clinicians' diagnostic and decision-making processes, particularly in the field of oncology. The scientific findings obtained within this scope are expected to contribute to future research and evidence-based clinical practices in the field of pediatric oncology.

Strengths and limitations

The inclusion of only English-language publications in the bibliometric analysis related to the research topic constitutes one of the limitations of this study. Despite this limitation, our bibliometric analysis provides a valuable contribution to understanding the existing literature on the use of artificial intelligence in childhood cancers. Another of the strengths of this study is that it is the first bibliometrics study to address the topic of scientific publications on the use of artificial intelligence in childhood cancer in more detail. Additionally, the study was evaluated by a multidisciplinary research team with experience in the fields of pediatric nursing, childhood cancer, and artificial intelligence.

CONCLUSION

In line with this study, it has been determined that artificial intelligence applications are widely used in prediction, diagnosis, therapeutic, and treatment processes of childhood cancers. In recent years, scientific output in this field has increased, with research predominantly concentrated in high-income countries. This analysis provides a general framework of the existing literature on the use of artificial intelligence in childhood cancers and is intended to guide future research in this field.

Yazarlık katkısı

Çalışma fikri: BA, ŞS, SB, ACC

Tasarım: BA, ŞS, SB, ACC

Veri toplama: BA, ŞS

Sonuçların analizi ve yorumlanması: BA, ŞS

Taslak çalışmayı hazırlama: BA, ŞS, SB, ACC

Eleştirel inceleme: BA, ŞS, SB

Tüm yazarlar (BA, ŞS, SB, ACC) sonuçları gözden geçirdi ve makalenin son halini onayladı.

Author contributions

Conception: BA, ŞS, SB, ACC

Design: BA, ŞS, SB, ACC

Data collection: BA, ŞS

Analysis and interpretation of data: BA, ŞS

Drafting the manuscript: BA, ŞS, SB, ACC

Critical review: BA, ŞS, SB

All authors (BA, ŞS, SB, ACC) reviewed the results and approved the final version of the article.

Çıkar çatışması beyanı

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Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Etik Kurul

Bu çalışma, insan katılımcılarından birincil veri toplanmasını içermemesi ve kişisel/kimlik belirleyici veri kullanılmaması nedeniyle etik kurul onayı gerektirmemektedir.

Ethics Committee

This study does not require ethics committee approval because it does not involve the collection of primary data from human participants and does not use any personal or personally identifiable information.

Yazarlık Sürecinde Üretken Yapay Zeka ve Yapay Zeka Destekli Teknolojilerin Kullanımının Beyanı

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Declaration of Generative AI and AI-Assisted Technologies in The Writing Process

During the of this study the authors used Grammerly and DeepL programs in order to language editing. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Lisans Bilgisi

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