



Bibliometric Analysis on Artificial Intelligence in Gynaecology and Obstetrics

Kadın Hastalıkları ve Doğumda Yapay Zekâ Üzerine Bibliyometrik Analiz

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Abstract

Aim: Artificial intelligence (AI) has the potential to offer innovative solutions to long-standing problems in gynaecology and obstetrics, such as understanding foetal physiology, improving pregnancy monitoring, and unravelling the molecular complexity of gynaecological cancers. This study comprehensively examines the growing role of AI in this field of medicine and its reflections in scientific literature.

Material and Method: In this study, scientific publications addressing the applications of AI in gynaecology and obstetrics were analysed using bibliometric methods. The articles obtained from the Web of Science database search were examined based on key indicators such as publication numbers, citation trends, collaboration networks, main research areas, and the most influential countries/institutions. Analyses were performed using Vosviewer.

Results: A total of 701 articles reviewed and the majority of publications (more than 90%) were published after 2020, respectively, China and the United States were leading the publications. International cooperation was common, with Harvard and Oxford among the institutions mentioned. Most articles were OA, with the National Natural Science Foundation of China (NSFC) as the major funding organization. Based on topics and keywords we can concluded that the authors have focused on deep learning workout, foetal monitoring, and gynaecological cancers.

Conclusion: Focusing on critical issues such as foetal monitoring and gynaecological cancers, the global importance of this field is demonstrated by intensive international collaboration led by China and the United States.

Keywords: Bibliometric analysis, artificial intelligence, gynaecology, obstetrics

Öz

Amaç: Yapay zekâ (YZ), fetal fizyolojinin daha iyi anlaşılması, gebelik izleminin iyileştirilmesi ve jinekolojik kanserlerin moleküler karmaşıklığının çözümlenmesi gibi kadın hastalıkları ve doğum alanında uzun süredir var olan sorunlara yenilikçi çözümler sunma potansiyeline sahiptir. Bu çalışma, yapay zekânın kadın hastalıkları ve doğum alanındaki giderek artan rolünü ve bu gelişmelerin bilimsel literatüre yansımalarını kapsamlı bir şekilde incelemeyi amaçlamaktadır.

Gereç ve Yöntem: Bu çalışmada, kadın hastalıkları ve doğum alanında yapay zekâ uygulamalarını ele alan bilimsel yayınlar bibliyometrik yöntemler kullanılarak analiz edilmiştir. Web of Science veritabanında yapılan tarama sonucunda elde edilen makaleler; yayın sayıları, atıf eğilimleri, iş birliği ağları, temel araştırma alanları ile en etkili ülke ve kurumlar açısından değerlendirilmiştir. Tüm analizler VOSviewer yazılımı kullanılarak gerçekleştirilmiştir.

Bulgular: Toplam 701 makale incelenmiş olup, yayınların %90'dan fazlasının 2020 yılı sonrasında yayımlandığı görülmüştür. Yayın sayısı açısından Çin ve Amerika Birleşik Devletleri öne çıkarken, uluslararası iş birliğinin yaygın olduğu ve Harvard ile Oxford üniversitelerinin önde gelen kurumlar arasında yer aldığı saptanmıştır. Çalışmaların büyük bir kısmı açık erişimli olup, en önemli finansman sağlayıcısının Çin Ulusal Doğa Bilimleri Vakfı (NSFC) olduğu belirlenmiştir. Konu ve anahtar kelime analizleri, araştırmaların özellikle derin öğrenme yöntemleri, fetal izlem ve jinekolojik kanserler üzerinde yoğunlaştığını göstermektedir.

Sonuç: Fetal izlem ve jinekolojik kanserler gibi kritik alanlara odaklanan yapay zekâ araştırmaları, Çin ve Amerika Birleşik Devletleri öncülüğünde yürütülen yoğun uluslararası iş birlikleri ile bu alanın küresel düzeyde artan önemini ortaya koymaktadır.

Anahtar Kelimeler: Bibliyometrik analiz, yapay zeka, jinekoloji, obstetri



INTRODUCTION

Artificial intelligence (AI) is a technology that works similarly to the human neuron map and consists of neural networks. Machine learning and complex algorithms help medical doctors to diagnose and prevent diseases and monitor patients by analysing big data. Spending on AI in healthcare is rapidly increasing, and this technology is expected to play an important role in healthcare services in the future (1).

Although AI has been used in the field of medicine for a long time, it has made significant advances in maternal-fetal medicine and gynaecology and obstetrics, particularly in recent years, with advances in data processing capabilities. It holds great potential in areas such as interpreting ultrasound images, predicting pregnancy-related risks (such as preterm birth and preeclampsia), creating personalised treatment plans, and enhancing medical education (2).

Gynecology and obstetrics are legally sensitive areas of medicine that lead to high compensation payments. Half of the compensation payments in the UK in 2017-2018 were related to this field. Preventable errors in obstetrics, such as hypoxia caused by misinterpretation of fetal monitoring, lead to serious socioeconomic consequences (3).

In gynecology, difficulties in early diagnosis of cancers and the inadequacy of current classifications negatively impact treatment success (4).

In assisted reproductive techniques (IVF), issues such as embryo selection need to be improved. While traditional research methods address many of these challenges, the existence of "gray areas" that may be insufficient in clinical practice and the time-consuming and costly nature of these methods highlight the need for new approaches (5).

AI can help to minimize medical errors and to personalize treatment. AI is promising in addressing a number of intractable issues in the gynecology and obstetrics domain. The AI tool may be able to solve some of the toughest problems in obstetrics—such as gaining a better understanding of fetal physiology and creating a monitoring system that can forecast well-being during pregnancy. Also, by disentangling the molecular complexity of gynecology cancers, AI can increase our understanding of the diseases and avoid the poor results. Mastering AI in this application field may thus become a powerful helper for the treatment of patients, for the knowledge gained and to improve the quality of health care (6).

This study aims to synthesise the hotspots and frontiers of scientific literature on the role of AI in gynaecology and obstetrics using bibliometric methods.

This analysis aims to reveal the general structure and development dynamics of the subject through basic bibliometric indicators such as article counts, citation trends, key research areas, collaboration networks, and the most influential countries/institutions.

MATERIAL AND METHOD

Ethics committee approval is not required for this study. All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

This study is a bibliometric analysis that systematically reviews the scientific literature at the intersection of gynaecology and artificial intelligence.

The Web of Science (WoS) platform, a comprehensive scientific literature database, was used as the main data source for the analysis.

A systematic search was conducted on databases using Boolean operators. The search string was constructed as follows: TS: ((Artificial Intelligence OR Machine Learning OR Deep Learning OR Neural Networks OR Computational Models OR AI-based) AND (Gynecology OR Obstetrics OR Reproductive Medicine))

This search string covers all publications in which any of the terms in the first set of parentheses appear together with any of the terms in the second set of parentheses. The search was conducted on article titles, abstracts, and keywords (Topic Search - TS).

The final data set to be analysed was exported in plain text (.txt) format using the 'Full Record and Cited References' option for use in bibliometric analysis software. This data allowed for the analysis of detailed metadata for each publication, including title, author, abstract, keywords, and cited sources.

The time period has been selected up from the first publication to 1 August 2025.

A total of 837 publications were identified as a result of the search using the keywords determined at the outset. In accordance with the scope of the study, 828 publications were identified, excluding those published before 2000. Then, a publication type filter was applied to select only studies in the 'article' and 'review article' categories, resulting in 725 publications. Finally, when the publication language was restricted to English, 701 publications were obtained to form the study sample. This procedure was carried out systematically to ensure the methodological consistency of the literature review and the validity of the sample.

Analysis Method

The collected data set was examined using VOSviewer bibliometric analysis tool (VOSviewer_1.6.19) (7). The following methods were applied within the scope of these analyses. The historical development of the field, the most productive institutions and countries were identified by examining publication and citation trends. Collaboration relationships among researchers were mapped and global and regional research groups were identified using author co-authorship network analysis. Finally, the intellectual structure of the field and its main and sub-themes were identified through keyword analysis.

RESULTS

General features

A total of 701 articles were selected for this study according to the inclusion criteria. Some 561 studies (80.029%) were articles.

The distribution of index of publications is analyzed in Fig. 3; SCI-EXPANDED is the dominant source of reference with 590 documents (84.17%), followed by ESCI with 106 documents (15.12%) and SSCI with 34 documents (4.85%). the cumulative percentage is added to reach 104.14% because some publications are cross-listed.

Looking at the publishing model by the distribution of OA publications, 465 (66.33%) are available under different OA types: 304 (43.37%) at Gold OA journals, 84 (11.98%) in the Gold-Hybrid model, and 43 (6.13%) with free to read. Furthermore, 248 (35.38%) documents are accessible from institutional repositories as published version articles (Green Published), 30 (4.28%) as post-print articles (Green Accepted), and 40 (5.71%) as preprints (Green Submitted). Because some journals are in more than one OA category, the percentages sum to more than 100%.

Top Funding Organisations

If you look at who funds the publications, what you see is most of the research is funded by national and international organizations. The top two funders were the National Natural Science Foundation of china (NSFC) with 37 (5.28%) and US Department of Health and Human Services (HHS) with 35 (4.28%) and the third was National Institutes of Health (NIH) with 34 (4.85%). In national research programmes in China, the National Key Research and Development Programme of China, 12 (1.71%) publications and the National Key R&D Programme of China, 7 (0.99%) publications. On the European side, the UKRI has 10 publications (1.43%) -EU with 9 publications (1.28%) -EPSRC with 8 publications (1.14%). Additional important funding bodies are the German Projekt DEAL initiative (7 publications, 0.99%) and the Bill & Melinda Gates Foundation (6 publications, 0.86%).

Citation Topics Micro

In the analysis of the distribution of publications by citation topic we find that it was "AI Ethics" (11.13%), followed by the citation topics "Embryo Development (Embryo Development)" 8.13%, "PCOS and Infertility (PCOS And Infertility)" 4.57%, "Male Fertility (Male Fertility)" 4.42%, and "Gynecologic Oncology (Gynecologic Oncology)" 3.85%. 'Endometriosis' and 'Preeclampsia Factors' with 3.7%, 'Ovarian Cancer' (Ovarian Cancer) with 3.6%, 'Neonatal Hypoxia Effects' with 3.1% and 'Obstetric Hemorrhage Management' with 2.5%.

Among technology-focused topics, 'Deep Visual Recognition' at 2.43%, clinical research topics such as 'Prenatal Testing' at 2.28%, 'Childbirth Practices' and 'Reproductive Immunology' at 2%. Other topics that remain at lower rates but are still important include 'Maternal-Fetal Health' at 1.85%, 'Pulmonary Ultrasound' and 'Preterm Birth Causes' 1.43%, 'HPV and Cervical Cancer' 1.28%, 'Assisted Reproduction' 1.14%, 'Surgical Education' and 'Pelvic Floor Disorders' 1% each.

Publications and Citaton Numbers By Years

The number of the 701 publications in the included study over years is clearly rising (Figure 3). This early phase (2000-2009) recording only an average 1-2 publication per year (2.71%), with a steady rise in 2020-2019, reaching 50 publications (7.13%), of which 23 papers were published in 2019 (3.28%) proving to be particularly relevant. The breakthrough occurred after 2020 where there were 632 articles (90.16%) published after 2020 and that contributed with a dominant concentration in the literature. During this most recent period, 2024 increased to 175 publications (24.96%), and while the 2025 data (119 publications, 16.98%) is not finalized yet, it is clear that the positive trend persists. This increase also reflects the growing interest in the area by the academia in the last few years (Figure 1).

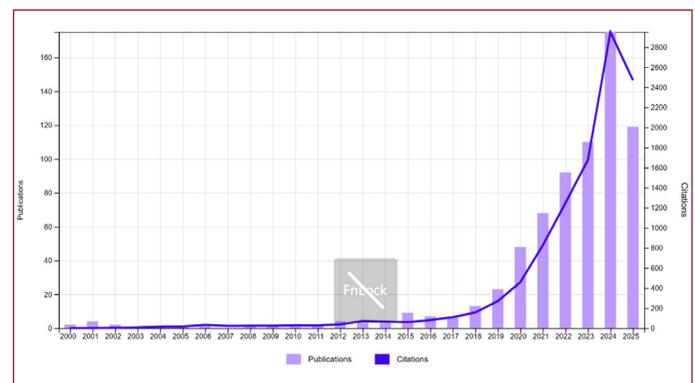


Figure 1.

Analysis of Citations On reviewing the citation analysis results, 701 articles were cited 10,672 times, with an average of 15.22 citations per article. Without self-citations, we receive 9922 citations in total.

As for the time-dependent citation distribution, 2024 is the year of maximum scholarly impact with 2,951 citations recorded (Figure 1).

Data regarding the 15 most cited articles are shown in Table 1.

Top Published Countries And International Collaborations

A total of 91 researchers from different countries participated in the studies examined. In these studies, it was determined that 41 countries had at least five publications.

Figure 2 visualises the number of publications by country for the academic studies examined and the collaboration links between these countries. This visualisation allows for the simultaneous assessment of each country's quantitative contribution to academic production (number of publications) and its position within international research networks (link strength). Upon examining the visualisation, it is clearly evident that some countries stand out with a high number of publications (larger circles indicate a higher number of publications), while others possess strong collaboration networks independent of publication numbers (thicker lines indicate stronger connections).

Table 1. Top cited 15 articles

Title	Authors	Source Title	Publication Date	Publication Year	DOI	Total Citations	Average citation per Year
3D bioprinting of tissues and organs for regenerative medicine	Vijayavenkataraman, et al.	Advanced Drug Delivery Reviews	2018	2018	10.1016/j.addr.2018.07.004	434	54.25
Molecular docking as a tool for the discovery of molecular targets of nutraceuticals in diseases management	Agu, et al.	Scientific Reports	2023	2023	10.1038/s41598-023-40160-2	413	137.67
Decidualization of the human endometrium	Okada, et al.	Reproductive Medicine and Biology	2018	2018	10.1002/rmb2.12088	243	30.38
The accuracy and reproducibility of the endometrial receptivity array is superior to histology as a diagnostic method for endometrial receptivity	Diaz-Gimeno, et al.	Fertility and Sterility	2013	2013	10.1016/j.fertnstert.2012.09.046	215	16.54
Artificial intelligence in medical imaging of the liver	Zhou, et al.	World Journal of Gastroenterology	2019	2019	10.3748/wjg.v25.i6.672	166	23.71
Perceived barriers in the use of ultrasound in developing countries	Shah, et al.	Critical Ultrasound Journal	2015	2015	10.1186/s13089-015-0028-2	145	13.18
The exciting potential for ChatGPT in obstetrics and gynecology	Grunebaum, et al.	American Journal of Obstetrics and Gynecology	2023	2023	10.1016/j.ajog.2023.03.009	144	48.00
Mid-infrared and Raman spectroscopy for medical diagnostics	Petrich, W	Applied Spectroscopy Reviews	2001	2001	10.1081/ASR-100106156	127	5.08
Introduction to artificial intelligence in ultrasound imaging in obstetrics and gynecology	Drukker, et al.	Ultrasound In Obstetrics & Gynecology	2020	2020	10.1002/uog.22122	125	20.83
Artificial intelligence in ultrasound	Shen, et al.	European Journal of Radiology	2021	2021	10.1016/j.ejrad.2021.109717	124	24.80
Accurate diagnosis of endometriosis using serum microRNAs	Moustafa, et al.	American Journal of Obstetrics and Gynecology	2020	2020	10.1016/j.ajog.2020.02.050	117	19.50
Ultrasound-based gestational-age estimation in late pregnancy	Papageorgiou, et al.	Ultrasound In Obstetrics & Gynecology	2016	2016	10.1002/uog.15894	116	11.60
Longer Operative Time During Benign Laparoscopic and Robotic Hysterectomy Is Associated With Increased 30-Day Perioperative Complications	Catanzarite, et al.	Journal of Minimally Invasive Gynecology	2015	2015	10.1016/j.jmig.2015.05.022	114	10.36
Artificial intelligence in reproductive medicine	Wang, et al.	Reproduction	2019	2019	10.1530/REP-18-0523	111	15.86
Artificial intelligence in human in vitro fertilization and embryology	Zaninovic, Nikica; Rosenwaks, Zev	Fertility and Sterility	2020	2020	10.1016/j.fertnstert.2020.09.157	99	16.50

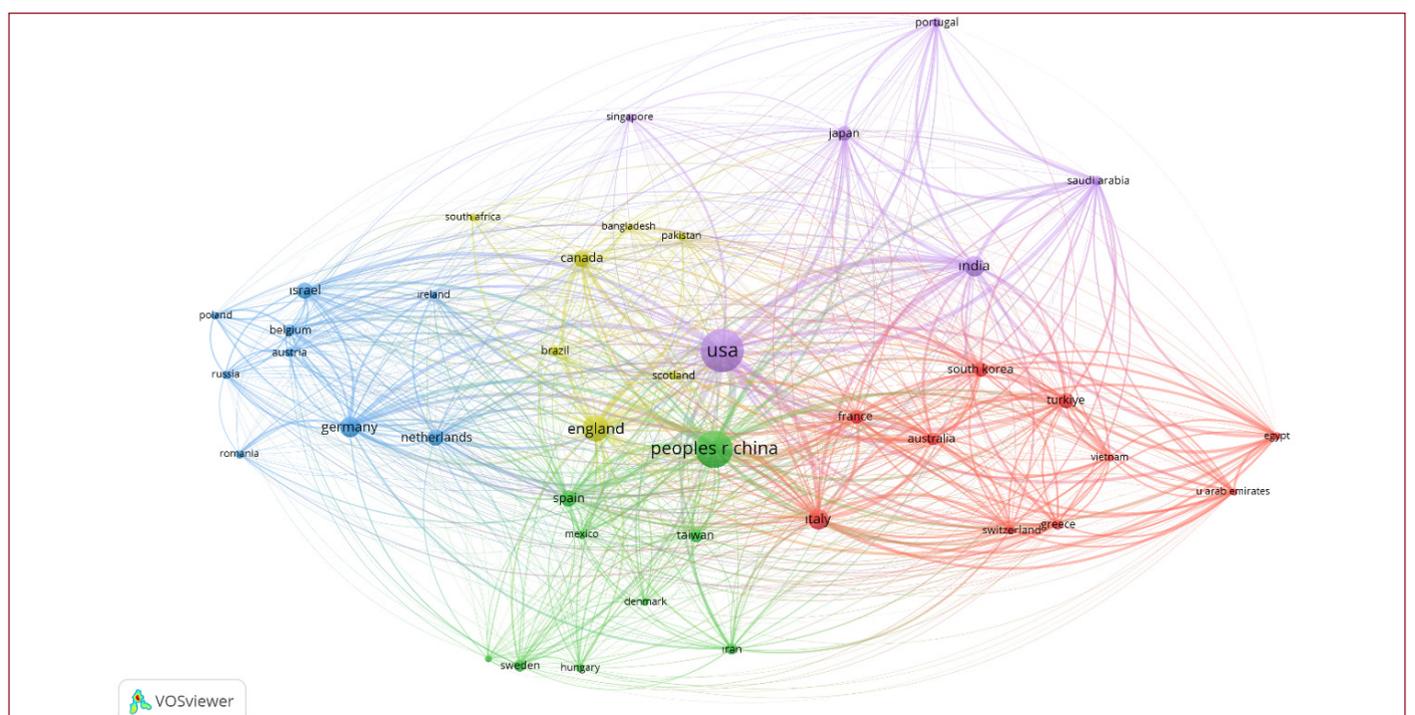


Figure 2.

Table 3. Top published organisations

Organization	Country	Number of Documents	Number of Citations	Total Link Strength
Harvard University	United States	19	235	1739
University of Oxford	United Kingdom	14	454	609
Max Planck Society	Germany	10	63	362
Indian Institute of Technology	India	10	295	837
University of Tokyo	Japan	9	104	518
Centre National de la Recherche Scientifique	France	9	200	592
Swiss Federal Institute of Technology Zurich	Switzerland	9	137	499
University of Cambridge	United Kingdom	9	147	234
Peking University	China	9	122	450
Seoul National University	South Korea	8	166	391
University of Toronto	Canada	8	99	823
Karolinska Institute	Sweden	8	228	766
Tel Aviv University	Israel	8	76	278
Middle East Technical University	Türkiye	7	63	95
National University of Singapore	Singapore	7	20	540
University of Sydney	Australia	7	80	609
King Saud University	Saudi Arabia	7	105	663
University of São Paulo	Brazil	7	57	59
Lomonosov Moscow State University	Russia	6	72	549
University of Cape Town	South Africa	6	59	113
Technical University of Munich	Germany	6	134	462
University of California, Berkeley	United States	6	118	545
Imperial College London	United Kingdom	6	42	602
University of Melbourne	Australia	6	190	669
Kyoto University	Japan	6	38	231
Tsinghua University	China	6	54	143
University of British Columbia	Canada	6	98	268
University of Amsterdam	Netherlands	6	75	133
University of Copenhagen	Denmark	6	562	244
University of Helsinki	Finland	6	40	466
University of Oslo	Norway	6	120	687
University of Vienna	Austria	6	42	271
University of Barcelona	Spain	6	93	356
Sapienza University of Rome	Italy	6	62	290
University of Warsaw	Poland	6	44	274
Charles University	Czech Republic	6	36	310
University of Zurich	Switzerland	6	243	218
University of Geneva	Switzerland	6	118	300
University of Edinburgh	United Kingdom	5	10	256
University of Manchester	United Kingdom	5	35	394
University of Bristol	United Kingdom	5	75	216
University of Glasgow	United Kingdom	5	27	256
University of Leeds	United Kingdom	5	27	184
University of Sheffield	United Kingdom	5	92	205
University of Birmingham	United Kingdom	5	63	320
University of Nottingham	United Kingdom	5	185	329
University of Liverpool	United Kingdom	5	62	112
University of Southampton	United Kingdom	5	31	367
University of Newcastle	United Kingdom	5	18	266
University of Exeter	United Kingdom	5	131	341
University of York	United Kingdom	5	84	337
University of East Anglia	United Kingdom	5	59	453
University of Reading	United Kingdom	5	96	341
University of Surrey	United Kingdom	5	48	159
University of Sussex	United Kingdom	5	297	537
University of Leicester	United Kingdom	5	67	151
University of Kent	United Kingdom	5	61	83
University of Essex	United Kingdom	5	11	368

This study found that the United States is the absolute leader in artificial intelligence (AI) research in gynaecology and obstetrics (192 articles, 3,365 citations). This finding is consistent with bibliometric studies in other fields: Xiao et al. (8) documented the United States' leadership in robotic surgery with 793 articles, while Huang et al. (10) documented the United States' second place in AI research on cervical cancer with 155 articles, behind China (315 articles). While China's second-place ranking in this study with 145 articles partially contradicts Zhao et al.'s (11) finding that China leads in cervical cancer AI research with 315 articles, it confirms Asia's rising influence in both fields. The United Kingdom (74 articles) consistently ranked in the top five in all studies (8-11).

At the institutional level, the leadership of Anglo-Saxon institutions such as Harvard University (19 articles) and Oxford University (454 citations) is differentiated by the prominence of the Mayo Clinic (8) in robotic surgery studies and the Chinese Academy of Sciences (Huang et al.) in cervical cancer research. This suggests that the United States and the United Kingdom are strong in the theoretical/algorithmic dimension of AI, while China is strong in clinically focused studies. In terms of geographical inequalities, the minimal contribution of low-income countries in this study aligns with Levin et al.'s (9) finding that 'there are no articles from low-income countries' in their robotic surgery study. However, India's unexpected performance in this study, with 44 articles and 11,264 link strength, indicates that AI research is more accessible than robotic surgery.

Our keyword analysis revealed that 'machine learning' and 'deep learning' are central themes, which is consistent with cervical cancer-focused studies (10,11). However, while cervical cancer research focuses on image analysis (e.g., 'classification'), our study highlights broader clinical application areas such as 'embryo development' and 'preeclampsia.' This underscores the diversity of AI in obstetric and gynaecological research. The prominence of ethical issues in AI research (11.13%) reflects the challenges these technologies face in clinical applications, as highlighted in Berner et al.'s (2008) cervical cancer AI study. On the other hand, the lesser prominence of ethical debates in robotic surgery can be explained by the fact that surgical techniques are a mature field. In terms of future research directions, while robotic surgery studies focus on relatively narrow areas such as pelvic organ prolapse and sentinel lymph node detection (8), AI research offers a wide range of potential applications, from IVF optimisation to maternal-fetal health monitoring. As predicted in Zhao et al.'s (11) cervical cancer study, the widespread adoption of deep learning-based diagnostic systems in obstetric and gynaecological imaging is anticipated. Unlike robotic surgery, AI research has greater potential for dissemination in LMICs. However, the lack of randomised controlled trials (as highlighted in Levin et al.'s study (9) on robotic surgery) remains a significant obstacle to AI applications meeting evidence-based medicine standards.

According to the results of a study examining artificial intelligence (AI) studies published in gynecology and obstetrics journals, although AI publications in this field have increased over the past 20 years, most of the studies are preliminary studies focused on developing new algorithms and methods rather than clinical applications. The majority of the articles examined have only been validated on a single dataset and have not undergone external validation. This indicates that AI applications in gynecology and obstetrics are still in their early stages and are not yet ready for widespread clinical use (12). According to a recent review article, although AI research in obstetrics is growing rapidly, most of it is outside the US and focuses on risk prediction. While applications such as AI-assisted ultrasound show promise, most models have not yet been integrated into clinical practice. The fact that studies are conducted on different populations creates generalisability issues. As this technology becomes more widespread, there will be a need for training to ensure that physicians can use AI effectively and safely (13). While Dhombres and Devoe's articles (12,13) describe the rise of AI in obstetrics and gynaecology, our study provides a more comprehensive view of the field by detailing who is driving this rise, with what financial resources, and in which regions, based on scientific data. While Devoe's study (13) highlights risk assessment and ultrasound applications, our keyword analysis confirms this finding by revealing the frequency of terms such as "ultrasound", "pregnancy" and "infertility". This gives us a clearer understanding of which clinical issues AI focuses on.

CONCLUSION

This bibliometric characteristics systematically demonstrate the development trend of articles on gynecology and obstetrics based on AI. The results from the study reveals that scientific attention has been growing rapidly during the last years with respect to this area. Notably, the sharp growth of publications since 2020 suggests that applications of artificial intelligence have been progressively adopted in women's health and reproductive medicine. The emphasis placed on these themes comes as no surprise, given the clinical and ethical relevance of subjects such as 'AI ethics', 'embryo development', and 'gynaecological oncology' in healthcare. When country-wise is evaluated, the US is standing out both in publication number and citation rate. But the rising participation of countries like China and India means that the research has gone global. Inter-institutional collaborations show the pioneering work of centres such as Harvard University and Oxford University in this field. Keyword analysis showed that there were some technology terms such as 'artificial intelligence', 'machine learning', and 'deep learning', as well as clinical topics such as "pregnancy" and "infertility".

These results indicate that artificial intelligence is increasingly entering into practice in gynaecology and obstetrics at all levels: from diagnosis to treatment and patient follow-up. Nevertheless, we can see that clinical investigations of

the effectiveness and accuracy of these technologies are warranted. In the future, an influx of studies that seek to address ethical issues and safeguarding of patient privacy is anticipated.

Strengths and limitations

This study has some limitations. First, we searched only WoS as the data source; publications in Scopus, PubMed or other academic databases were not considered. This could lead to the exclusion of articles not covered by WoS. Also, the study's analysis only took into account studies written in "English". Another issue is that the study of the research is limited to bibliometric analysis, and does not include qualitative approaches (ie content analysis). For instance, the scientific standard or practicality of the studies has not evaluated meticulously. Additionally, due to the keyword search method, some potentially relevant articles may have been excluded if they were written using alternate terminology. Finally, incompletely data for 2025, that will still grow as number of publications and citations in this year, them may show other values. With all these limitations, the study still offers a remarkable prism on research trends on AI in the field of gynaecology and obstetrics.

ETHICAL DECLARATIONS

Ethics Committee Approval: Ethics committee approval is not required for this study.

Informed Consent: Written informed consent is not required for this study.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

Financial Disclosure: The author declared that this study has received no financial support.

Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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