




Research Trends and Hotspots in Minimally Invasive Gynecologic Surgery: A Bibliometric and Visualization Analysis

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Abstract: Minimally invasive gynecologic surgery (MIGS) has changed gynecologic care over the past thirty years by introducing techniques like multiport laparoscopy, robotic-assisted laparoscopy, and single-site surgery. MIGS offers advantages like reduced blood loss, shorter recovery times, and comparable oncological outcomes to open surgery. However, existing literature lacks a systematic synthesis of global research trends and academic performance of researchers. This cross-sectional bibliometric analysis examined 5,379 MIGS-related publications indexed in the Web of Science Core Collection database spanning 2014 to 2023, utilizing tools like VOSviewer and CiteSpace to map academic trends. The study revealed global contributions from 1,888 institutions across 97 countries, with the United States (1,156 publications) and China (1,090 publications) emerging as leading contributors. High-income countries dominated research output, though metrics varied regionally. Key institutions driving innovation included Mayo Clinic (n = 97), Harvard Medical School (n = 87), and Brigham & Women's Hospital (n = 83). Journal performance showed disparities influenced by impact factors, accessibility, and editorial focus, while research hotspots centered on endometriosis, laparoscopy, and hysteroscopy. The findings highlight a dynamic, collaborative global landscape in MIGS research, with disease prevalence and journal specialization shaping academic priorities. This analysis underscores the field's evolution and anticipates future directions, emphasizing the role of multidisciplinary collaboration and technological advancements in advancing clinical practice.

Keywords: minimally invasive gynecologic surgery, MIGS, laparoscopy, robotic-assisted laparoscopy, bibliometric

Introduction

Minimally invasive approaches have been the preferred choice for treating benign and malignant gynecologic conditions over the last three decades. Minimally invasive gynecologic surgery (MIGS) typically encompasses multiport laparoscopy, robotic-assisted laparoscopy and laparoendoscopic single-site surgery.^{1,2} Their benefits are well understood, featuring reduced intra-operative bleeding, less postoperative discomfort, shorter hospitalizations, and smaller scars compared to trans-abdominal operations.² Most importantly, minimally invasive radical hysterectomy was associated with inferior disease-free and overall survival compared to open surgery.³ For the healthcare system, MIGS reduces the financial burden by decreasing hospital stays and operation related complications. It is reported that a 10% increase in the use of MIGS for endometrial cancer is projected to result in a cost savings of \$2.8 million and a reduction of 41 postoperative complications.⁴ Therefore, MIGS plays a critical role in routine clinical practice and garners significant acclaim from both surgeons and patients alike.

MIGS has transformed clinical managements in gynecologic surgeries and is still developing. Laparoscopies, hysteroscopies, and colposcopies represent conventional procedures that rely on endoscopy techniques.⁵ Robotic surgery

is safe and effective technology for intricate gynecologic surgeries or cases with certain comorbidities. The da Vinci surgical system has seen improvements like 3D optics, stable cameras, tremor-free performance, and faster learning curves.^{6,7} Although it is limited by high cost, lack of haptic feedback, and often more incisions.^{8,9} Overall, the advent of MIGS marks fundamental changes in the medicine evolution, and deserves more attention.

The development of MIGS was well established before 2014 (Figure 1). Recent literature reviews have described the state of MIGS on specific aspects, such as surgical methods,^{10,11} procedures,¹² and diseases.¹³ However, innovative approaches like ultra-minimally invasive surgery, enhanced recovery after surgery, and telemedicine are substantially reforming medical management. There is a dearth of comprehensive literature covering the entirety of MIGS along with its latest progress. Therefore, this study aimed to fill this gap by identifying the research patterns and trends of MIGS over the past decade using bibliometric analysis. We conducted a qualitative and quantitative evaluation of the contributions from countries, institutions, and publishers, and illuminated key topics related to gynecological disorders, treatment strategies, and surgical methods. Ultimately, this investigation provides clinicians and researchers with a comprehensive overview of current academic progress to inform future studies.

Methods

Data Collection

To characterize the academic performance of countries, institutions, researchers in the MIGS field, the Web of Science Core collection database, one of the leading citation search platforms, was searched to identify all relevant publications. A specific search was carried out with the query: ((TS = (minimally invasive surgery OR laparoscop* OR single port surgery OR robotic surgery OR microinvasive surgery OR hysteroscopy OR Da Vinci surgical system)) AND TS = (gynecology)). We selected documents that were written only in English. The data were obtained on 15th November 2023. Articles were further independently manually reviewed by two researchers (T.W. and K.B.N).

Deduplication and Screening

A “plain text” file recording fundamental data (authors, institutions, countries/regions, journals, keywords, and references) was finally downloaded. To deduplicate, all bibliometric data were imported into Endnote 20. We independently screened the titles, abstracts, and full texts of the papers to identify studies that fit the exclusion criteria. Exclusion criteria were as follows: (1) Literature irrelevant to the MIGS procedure. For instance, studies focusing solely on minimally invasive techniques in other medical fields—such as laparoscopic procedures for gallbladder removal in general surgery—were excluded.¹⁴ Similarly, research examining gynecologic conditions treated exclusively with non-minimally invasive methods was also excluded; (2) Non-research articles, including editorial materials, letter, meeting abstract, and proceedings paper. The publication screening and bibliometric analysis flowchart are presented in Figure 2.

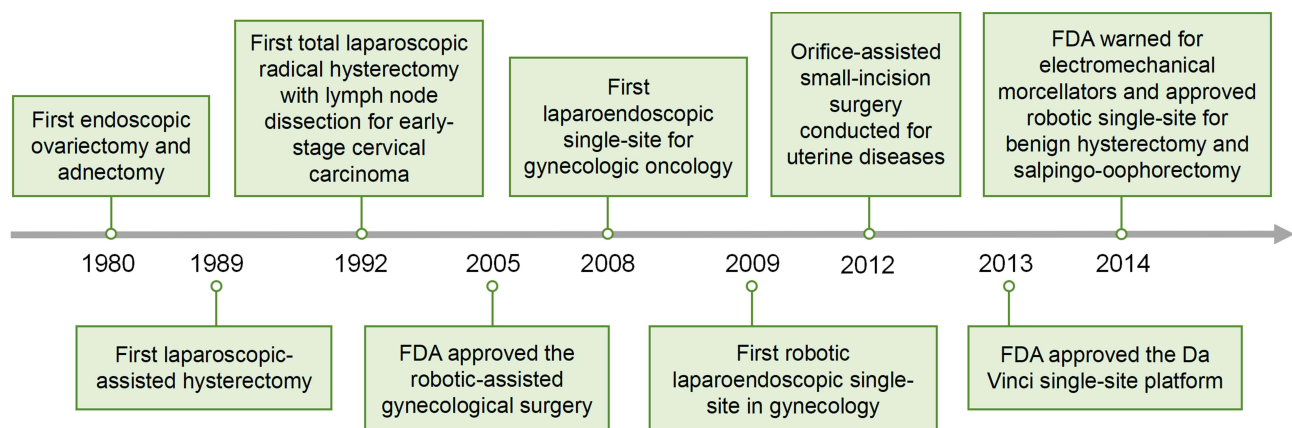


Figure 1 Timeline of minimally invasive gynecologic surgery research and major accomplishments.

Abbreviation: FDA, Food and Drug Administration.

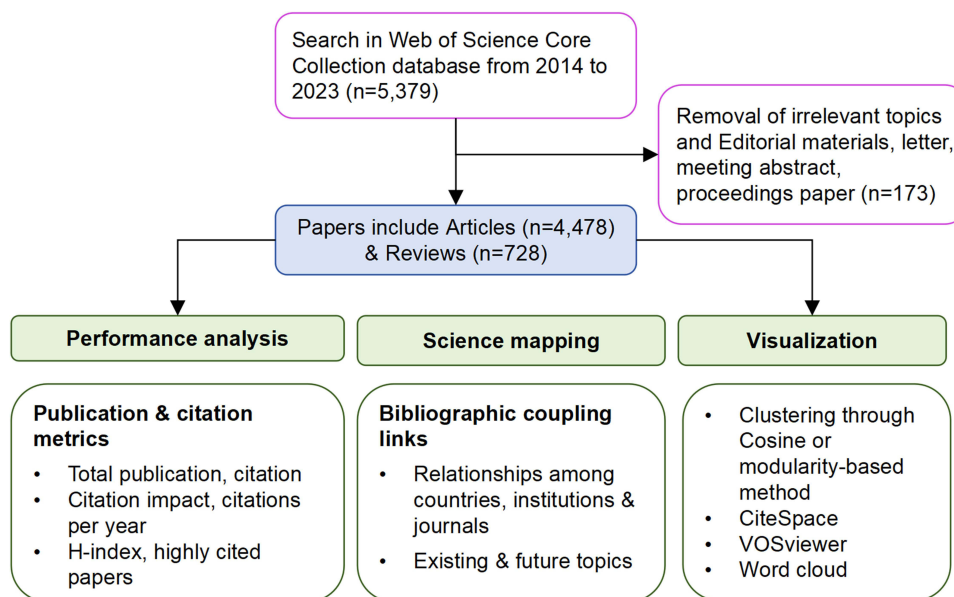


Figure 2 Search and analysis strategies of the minimally invasive gynecologic surgery papers.

Data Analysis and Visualization

VOSviewer 1.6.18 was utilized to cluster countries, journals, and institutions, while CiteSpace 6.2.4 was employed to analyze burst keywords, correlation relationship, and centrality. Highly cited papers (HCPs) are those that rank in the top 1% of citations in the Web of Science database, categorized by subject over the past decade.¹⁵ Average citations per year (CPY) is computed by dividing the sum of citations by the number of years since the work was published. Citation impact is the ratio of citations to the number of publications. Impact Factor (IF) was utilized to analyze the scientometric results, with IF values derived from the 2023 Journal Citation Reports released by Clarivate Analytics. Journal quartiles (Q1 to Q4) were classified based on these IF values within each subject category: with the top 25% designated as Q1, the next 25% as Q2, the subsequent 25% as Q3, and the bottom 25% as Q4. Journal quartiles providing a comparative framework to evaluate the standing of journals within their disciplinary domains.

In CiteSpace, total Link Strength is computed to quantify the collaborative connections between institutions. The modularity Q (Q value) reflects the significance of cluster structure, with a value greater than 0.3 indicating a significant community structure in the clustering result. The mean silhouette S (S value) assesses the effectiveness of clustering; a value of 0.7 or higher indicates highly efficient and convincing clustering, while a value greater than 0.5 suggests a reasonable and valid clustering result.

Keywords with similar meanings were combined into one during extraction. For instance, “fibroids”, “myoma”, “uterine myoma” and “leiomyoma” were combined into “fibroid”. Using the OmicShare online tool (<https://www.omicshare.com>), the word cloud was created based on the frequency of each keyword. We further examined the keywords list to classify them into three types: disease, therapy, and surgical method. Some general and non-specific words, such as carcinoma, cancer, tumor, surgery, minimally invasive surgery, gynecologic surgery, etc., were removed to make the results more readable.

Classification of Income Levels

The 2023 World Bank data was used to define the country’s income level. Nations are classified into four groups according to their gross national income per person per annum: low income (up to \$1,135); lower-middle income (\$1,136 to \$4,465); upper-middle income (\$4,466 to \$13,845); and high income (\$13,846 and above).

Results

Baseline Characteristics

Initially, 5,379 publications were retrieved from the search (Figure 2). We excluded irrelevant papers and Editorial materials, letter, meeting abstract, proceedings paper (n = 173). Ultimately, 5,206 articles were included in the analysis, of which 4,478 were original articles and 728 were reviews papers. The number of publications per year did not significantly fluctuate across types, indicating that MIGS has entered a steady production period (Figure 3A). A peak of 515 articles was reached in 2021, and the peak for reviews was in 2022 with 119 publications. There has been a yearly decrease in article citations since 2016, with 2022 publications receiving only one-seventh of the citations compared to those from 2016 (Figure 3B). However, when adjusting for the year, the CPY of reviews has been stable, but the CPY of articles has demonstrated a significant reduction (Figure 3C). Despite there being more article publications, the citation impact was higher for reviews, with an even 2.7-fold change in 2016 (Figure 3D). This is consistent with the observation that review papers are generally cited more frequently than original research articles.¹⁶

Distributions of Countries/Regions

There are 97 countries participating in MIGS research, of which 46% were high-income countries, 26% upper-middle income countries, 20% lower-middle income countries, and 8% low-income countries (Figure 4A). The top 10 countries/regions in terms of publication numbers are detailed in Table 1. The most prolific contributors were the USA, with 1156 publications, accounting for 21.8% of all articles and 230 reviews, comprising 19.4% of all reviews. Following closely

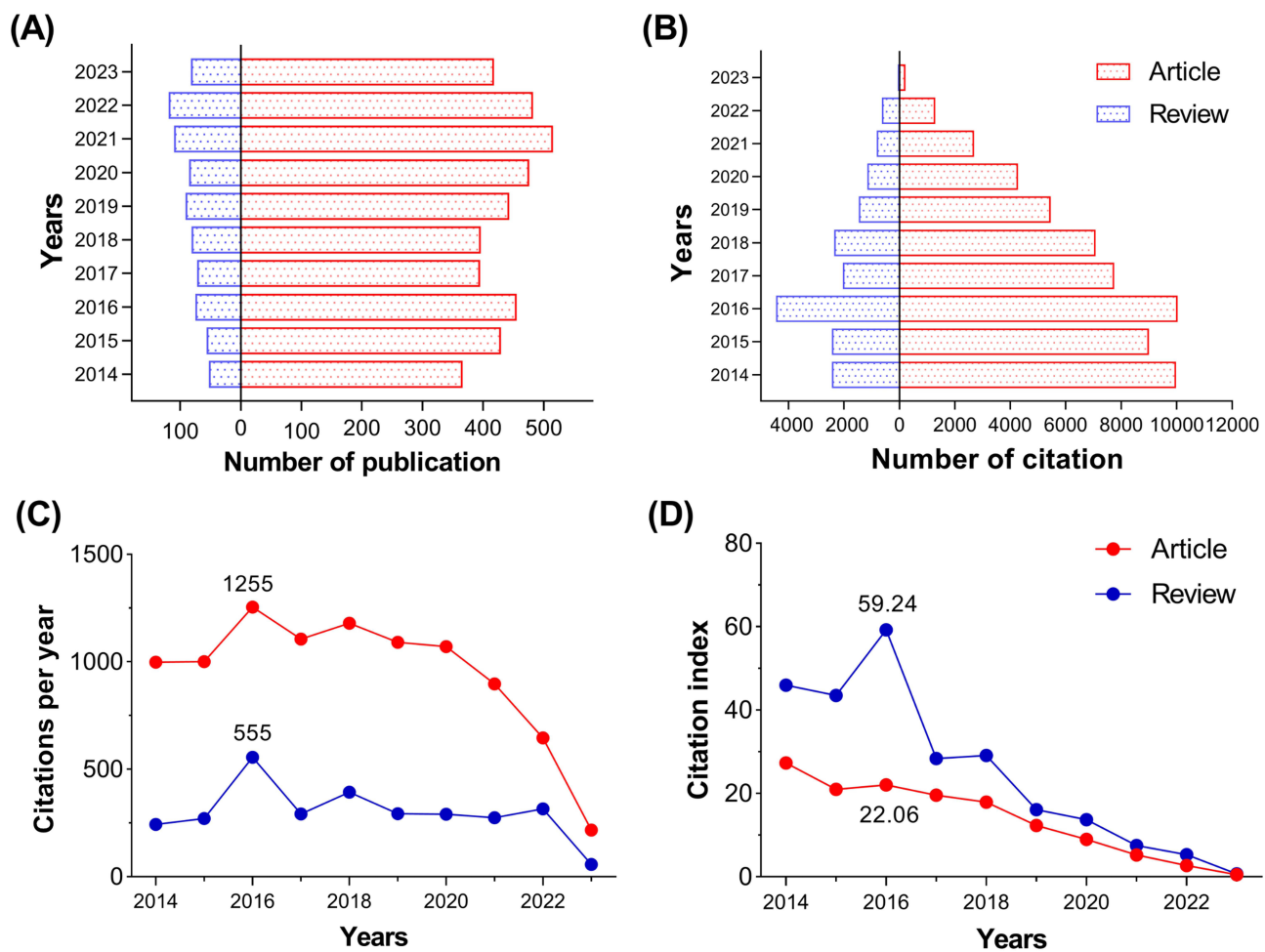


Figure 3 Baseline characteristics of all eligible documents. (A) Annual publications, (B) citations, (C) citations per year, and (D) citation impact in terms of original articles and review papers.

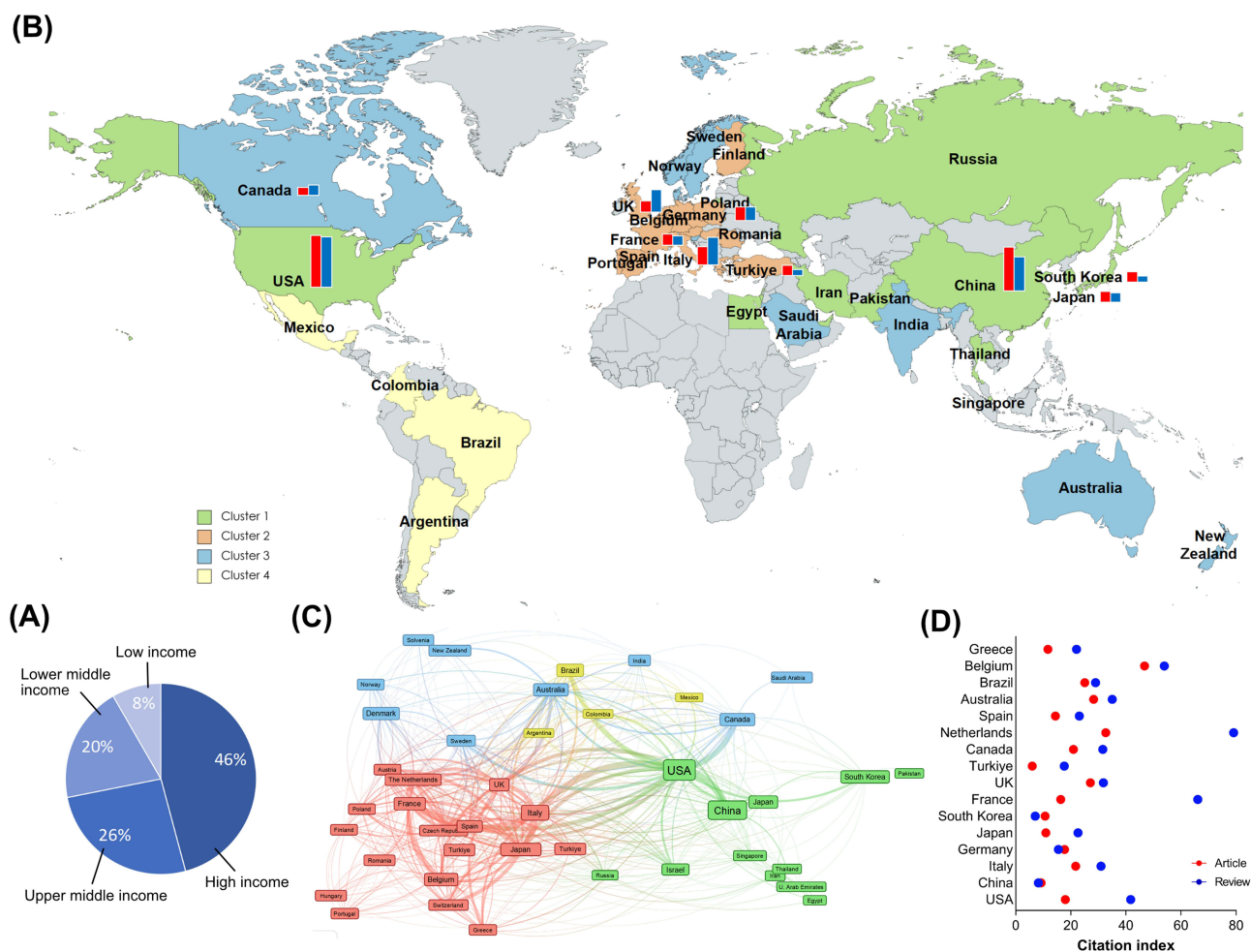


Figure 4 Clusters and connections of countries. **(A)** Worldwide activity based on percentages of publications (red bar) and citations (blue bar) in the literature. **(B)** Classification of publications according to the income levels. **(C)** Cooperative relationship in various countries. **(D)** Change of citation impact for the top 16 countries that published most papers.

were China (n = 930 for articles and n = 160 for reviews) and Italy (n = 423 for articles and n = 121 for reviews) (Figure 4B). The USA achieved the top H-index of 73, exceeding Italy’s second-place score of 54. The cooperative ratio reflects the degree of cooperation in papers co-authored with authors from different countries. The UK had significant collaborations, with Italy and the USA being the most important partners.

Table I Top 10 Countries Publishing Most Publications Related to Minimally Invasive Gynecologic Surgery

Country	Income	Count	Percent	H-Index	Citation	Total Link Strength	Citation Impact	Cooperative Ratio
USA	High	1,386	21.18%	73	30,408	6,325	21.94	27.50%
China	Upper middle	1,083	16.55%	37	9,763	3,896	9.01	7.60%
Italy	High	554	8.31%	54	12,963	4,274	23.83	62.25%
Germany	High	317	4.84%	30	5,509	2,092	17.38	62.56%
Japan	High	257	3.93%	29	3,248	1,081	12.64	17.57%
UK	High	241	3.68%	39	7,341	1,882	30.46	121.21%
France	High	236	3.61%	36	5,499	1,913	23.30	74.14%
South Korea	High	219	3.35%	24	2,291	1,216	10.46	12.18%
Türkiye	Upper middle	177	2.70%	18	1,287	585	7.27	60.97%
Canada	High	174	2.66%	34	4,083	1,447	23.47	53.67%

Additionally, clustering analysis revealed the formation of four groups, each exhibiting distinctive regional distribution patterns (Figure 4B and C). Notably, the USA and China were clustered together, alongside several other Asian countries, such as Japan, South Korea, and Iran. The European region was highly represented by France and Italy. Moreover, most countries showed a higher citation impact for reviews, with the exceptions of China, Germany, and South Korea (Figure 4D).

Contributions of Institutions

These 5,206 papers were produced with contributions from 1,888 institutions, as identified by the author addresses. The eight institutions with the most publications are shown in Figure 5A and Table 2. The Mayo Clinic was the leading institution in terms of the number of publications and citations, with 75 articles and 22 reviews, and it was the only one among the top eight organizations to have a highly cited review. Five institutions published one highly cited article each. The Brigham & Women’s Hospital emerged with the largest strength score of 30.3, while Harvard Medical School displayed strong performance in total links, indicating extensive collaborative relationships with other institutions in the MIGS field. It is noteworthy that despite the high volume of papers published by the Chinese institutions, Fudan University and Sichuan University, they received less attention compared to other institutions.

The findings revealed a notable trend as the majority of institutions from the USA were predominantly associated with the category of “Endometriosis”, indicating a greater prevalence of MIGS being performed for endometriosis (Figure 5B). In contrast, European institutions were distinguished by their emphasis on Guidelines and hysteroscopy. Key themes for Chinese institutions were centered around Gynecology.

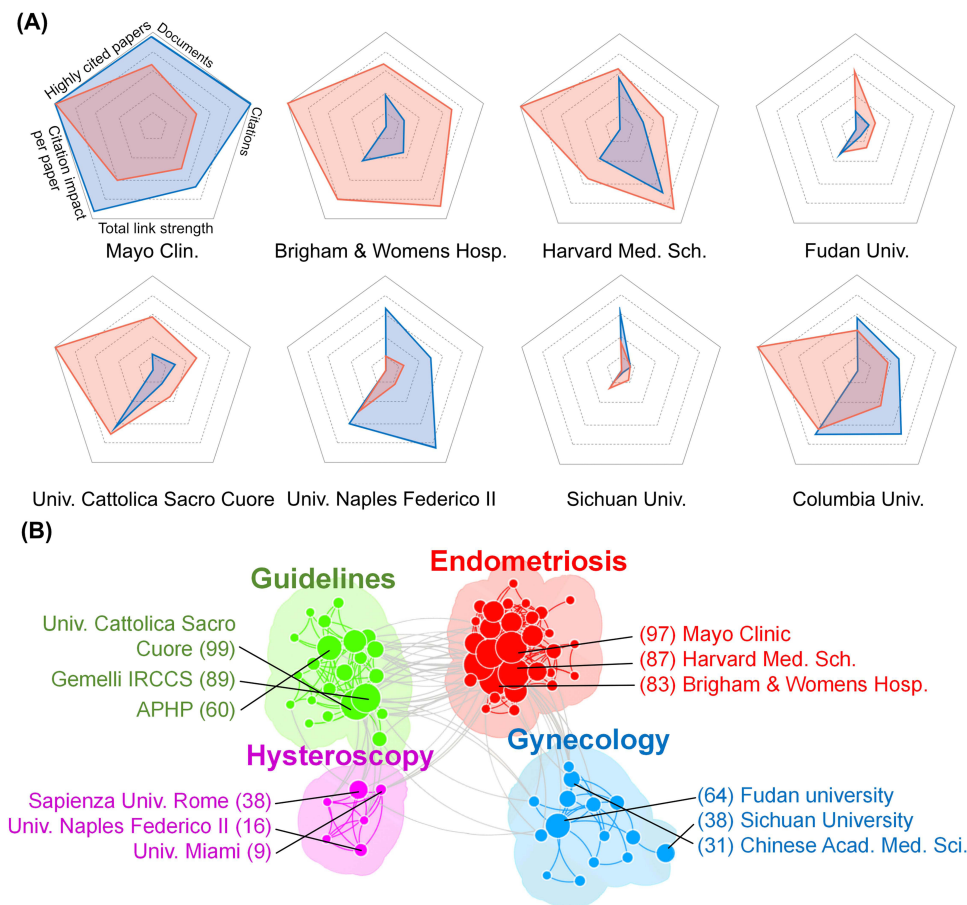


Figure 5 Bibliometric analysis of top institutions. (A) Performance of each institution in five aspects. (B) Cluster of all involved institutions and enriched text were showed.

Table 2 Institutions That Published the Most Publications or Received the Most Citations for Articles or Reviews

Pregnancy	Pregnancy					Pregnancy				
	Pregnancy	Pregnancy	Total Link Strength	Citation Impact	Highly Cited Paper	Count	Citation	Total Link Strength	Citation Impact	Highly Cited Paper
Mayo Clin.	75	1562	98	20.83	1	22	766	25	34.82	1
Brigham & Women's Hosp.	74	2243	183	30.31	1	9	130	12	14.44	0
Harvard Med. Sch.	74	1494	185	20.19	1	13	159	25	12.23	0
Fudan Univ.	69	576	41	8.35	0	7	79	2	11.29	0
Univ. Cattolica Sacro Cuore	63	1610	62	25.56	1	6	141	5	23.50	0
Univ. Naples Federico II	24	413	27	17.21	0	16	317	35	19.81	0
Sichuan Univ.	41	239	13	5.83	0	14	52	0	3.71	0
Columbia Univ.	49	1051	82	21.45	1	13	299	24	23.00	0

Table 3 Top 10 Researchers Publishing Most Publications About Minimally Invasive Gynecologic Surgery

Author	Count	H-Index	Citation	Total Link Strength	Citation Impact
Scambia G.	61	26	1461	80	23.95
Wright D.	48	17	1165	26	24.27
Ghezzi F.	37	20	981	50	26.51
Missmer S.	33	18	747	0	22.64
Fagotti A.	28	17	816	47	29.14
Ramirez P.	28	17	1905	4	68.04
Fanfani F.	26	19	875	53	33.65
Uccella S.	26	18	730	53	28.08
Bogani G.	25	13	735	18	29.40
Hershman D.	25	12	368	25	14.72

Author Analysis

The bibliometric analysis included 23,306 writers and 56,658 co-cited authors. Table 3 listed the ten most creative authors. It revealed that Scambia G (61 papers), Wright D (48 papers), and Ghezzi F (37 papers) published the most papers. Figure 6 shows the keyword clustering of papers and a certain degree of collaboration between different authors was evident. The Q value of this clustering was 0.7964, and the peak value of the average profile S value was 0.9484, indicating that the network was homogeneity and the clustering had a prominent impact. The most scholars focused on “early ovarian cancer”, followed by “endometrial cancer”.

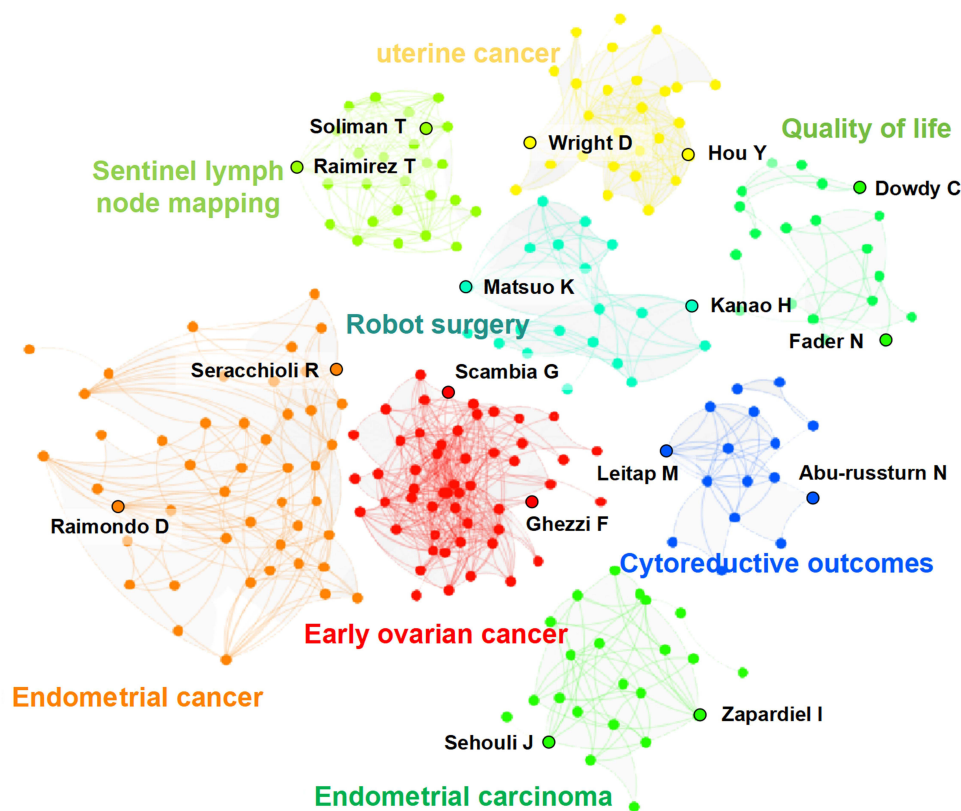


Figure 6 Visualization of the author’s network. Each circle represents an author, and the different colors represent a different group of authors. The top two authors with the most posts in each cluster are identified.

Publishing Journals

The pertinent journals are divided into three categories according to their co-citation connection: reproduction and endocrinology, oncology, and general gynecology, represented by Arch. Gynecol. Obstet., Gynecol. Oncol., and J. Minim. Invasive Gynecol, respectively (Figure 7A). The top 10 journals that issued the most papers and obtained the most citations for articles and reviews separately were selected, leading to the identification of 15 journals (Figure 7B and Table 4). Among them, six journals were found to be overlapped, all of which belonged to the Obstetrics and Gynecology category. Four of the six journals were from Elsevier, the world’s leading scientific publisher. The inclusion of certain journals that published most MIGS papers may be partially attributed to their large circulations. For instance, Medicine publishes 3,955 papers annually. Furthermore, some journals receive more citations due to their multidisciplinary characteristics; like, Plos One, a multidisciplinary journal covering over 200 subject areas, published 14,950 papers per year. Interestingly, Human Reproduction Update, which published the fewest papers (n = 39 per year), had the highest IF (13.3). Plos One also has the greatest Golden Open Access percentage (99.18%), followed by Eur.

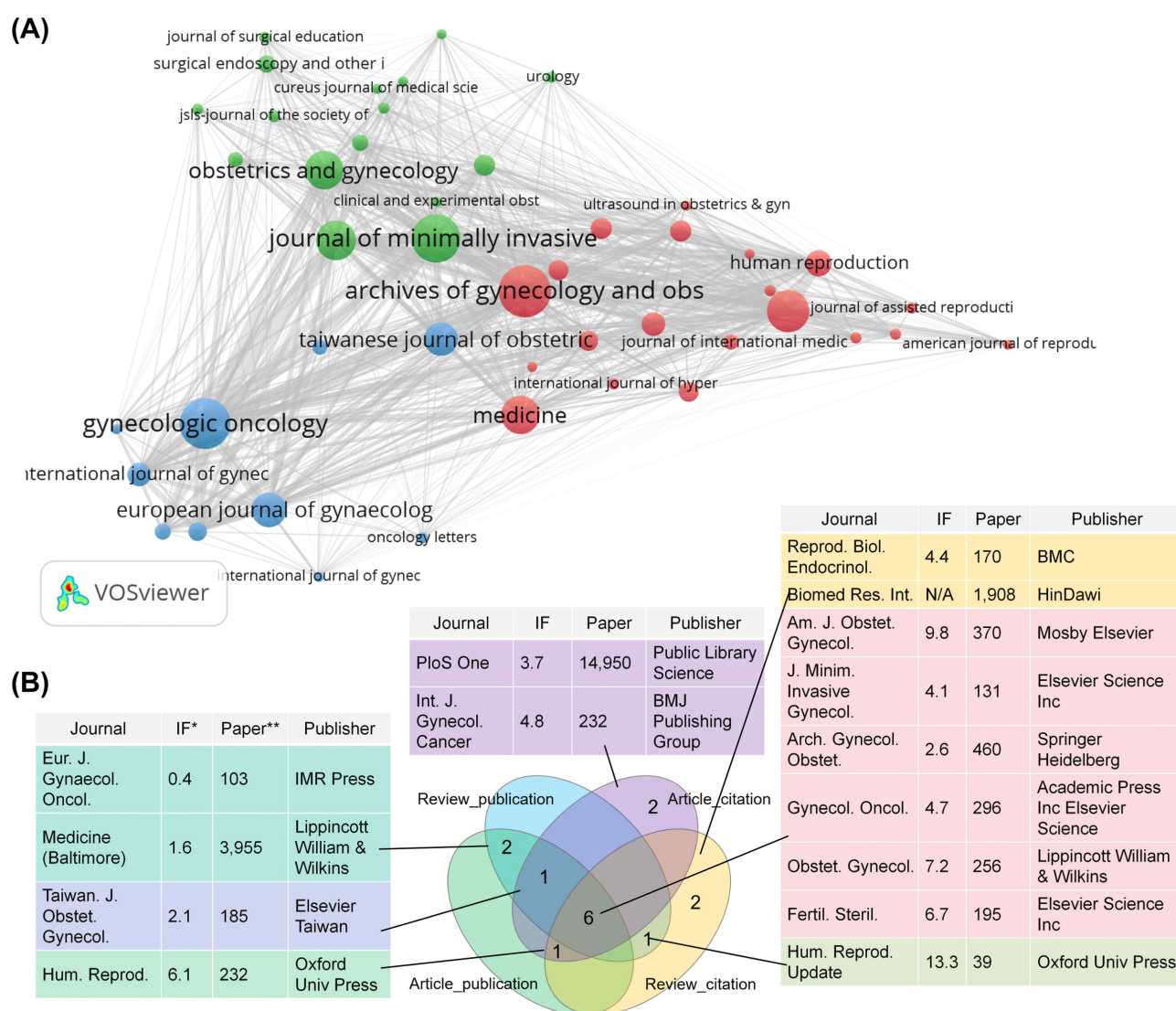


Figure 7 Participants of journals in minimally invasive gynecologic surgery. (A) Relationship of representative journals. (B) Venn map of top ten journals that published the most papers and received the most citations. * indicates the influence factor of 2023 Journal Citation Reports. ** indicates the annual circulation of the journal. **Abbreviations:** BMC, BioMed Central; BMJ, British Medical Journal; IF, influence factor.

Table 4 Baseline Features of the Selected 15 Journals

Journal	Article		Review		Journal Quartile	Open Access Gold	H-Index
	Count	Citation	Count	Citation			
Hum. Reprod. Update	-	-	21	2,568	Q1	25.17%	20
Am. J. Obstet. Gynecol.	176	4707	25	1,284	Q1	15.20%	43
J. Minim. Invasive Gynecol.	242	1,988	44	807	Q1	5.84%	25
Arch. Gynecol. Obstet.	270	2,561	49	701	Q3	28.64%	28
Gynecol. Oncol.	282	6,245	27	1,010	Q1	19.59%	45
Obstet. Gynecol.	173	3,933	22	528	Q1	12.66%	38
Fertil. Steril.	182	5,627	40	1,610	Q1	74.87%	49
Biomed Res. Int.	55	663	13	467	Q2	96.67%	19
Reprod. Biol. Endocrinol.	18	348	6	478	Q1	13.54%	15
Eur. J. Gynaecol. Oncol.	132	205	10	98	Q4	98.76%	8
Medicine (Baltimore)	146	855	47	166	Q3	97.81%	17
Hum. Reprod.	98	4,801	5	566	Q1	23.04%	37
PloS One	54	925	8	210	Q3	99.18%	20
Int. J. Gynecol. Cancer	855	1,221	4	98	Q1	8.93%	21
Taiwan. J. Obstet. Gynecol.	133	1,035	21	351	Q3	93.02%	19

J. Gynaecol. Oncol. (98.76%) and Medicine (97.81%), and it might affect their journal performance, since all these three are beyond Q3. While Fertil. Steril. received the highest H-index, however, it was interesting to find the H-index for HRU is similar with many Q2 and Q3 journals (Table 4).

Overall Keywords and Future Trends

Keywords are essential for conveying the main ideas of a subject, and their frequency can offer insights into current topics and possibly predict future research trends. The top 5 most frequent keywords were management, surgery, laparoscopy, hysterectomy and women (Figure 8A). We further categorized the keywords into three groups according to diseases, treatment and surgical methods. The most common therapy was laparoscopy, followed by hysteroscopy and minimally invasive surgery (Figure 8B). The occurrence of hysterectomy far surpassed that of other surgical methods. Regarding MIGS-associated diseases, endometriosis, endometrial cancer and fibroid were ranked as the top three ones.

Citation burst analysis is an effective method for examining specific research fields, offering insights into areas of high interest and emerging trends for a specific year. By analyzing the top 50 keywords with the most significant bursts, it is evident that in vitro fertilization and infertility garnered increased attention around 2013 (Figure 8C). Notably, keywords unrelated to surgery, such as cost, quality-of-life, and care have emerged in recent years, indicating a shift towards post-operative managements.

Topics Preferences for Journals and Countries

We next explored whether journals or countries had preferences for specific diseases or surgical methods. As shown in Table 5, both endometriosis and endometrial cancer were prevalent topics across most journals. However, the three main gynecologic cancers (endometrial cancer, cervical cancer and ovarian cancer) were frequently reported in Gynecol. Oncol. It was also unsurprising to find that lymphadenectomy emerged as the most commonly reported surgical method in this journal. Similarly, Fertil. Steril. demonstrated significant attention to infertility and pregnancy conditions, which clearly fall within its scope.

The occurrence of topics could indicate the disease spectrum of a country. Our examination revealed a widespread prevalence of gynecological cancers, endometriosis and infertility as common areas of concern faced by most countries (Table 6). Particularly, pelvic organ prolapse (POP) was the fourth top discussed disease in the US, and this phenomenon might account for that Am. J. Obstet. Gynecol. published the most papers concerning POP and corresponding vaginal hysterectomy (Table 6).

Table 5 (Continued).

Journal	Top Three Diseases	Top Three Surgical Methods
Gynecol. Oncol.	Endometrial cancer Cervical cancer Ovarian cancer	Lymphadenectomy Hysterectomy Radical hysterectomy
Fertil. Steril.	Endometriosis Infertility Pregnancy	Myomectomy Transplantation*
Am. J. Obstet. Gynecol.	Endometrial cancer Endometriosis Pelvic organ prolapse	Hysterectomy Laparoscopic hysterectomy Vaginal hysterectomy

Notes: *, The threshold for keywords occurrence was set at 10, so that only two keywords were generated.

Table 6 Preferences for the Top Five Countries That Published Most Papers

Country	Top Five Diseases	Top Three Surgical Methods
The USA	Endometrial cancer Endometriosis Infertility Pelvic organ prolapse Cervical cancer	Hysterectomy Laparoscopic hysterectomy Lymphadenectomy
China	Endometriosis Cervical cancer Pregnancy Infertility	Hysterectomy Radical hysterectomy Lymphadenectomy
Italy	Endometrial cancer Endometriosis Infertility Cervical cancer Pregnancy	Hysterectomy Lymphadenectomy Neoadjuvant chemotherapy
Germany	Endometriosis Cervical cancer Endometrial cancer Pelvic pain Pregnancy	Hysterectomy Radical hysterectomy Laparoscopic hysterectomy
Japan	Endometrial cancer Endometriosis Cervical cancer Infertility Pregnancy	Lymphadenectomy Radical hysterectomy Hysterectomy

had longer to accumulate citations than recent publications. Representative journals that published MIGS papers and their keywords in diseases, therapy and surgical method are also listed. As far as we know, this bibliometric analysis is the first to thoroughly outline the recent advancements in MIGS over the past decade.

Results of the Study in Context

Nearly half of the papers are produced by high-income countries, and it is similar with previous studies that 87% publications concerning gynecologic oncology were from high-income countries.¹⁷ Cooper et al also found that large, urban teaching hospitals were more likely to conduct minimally invasive surgery for four common surgical procedures than rural ones.¹⁸ The reasons could stem from patients' unawareness of surgical options or a lack of necessary surgical equipment, staff, or support in rural settings. Even in high-income countries such as Germany, there is still a shortage of standardized training curricula and access to equipment for minimally invasive surgery.¹⁹ In addition to the economic levels, racial and cultural disparities, as well as the quality of education also influence the utilization of MIGS.^{20,21} To sum up, although the advantages of MIGS have been widely recognized in most surgeons, there is still a long way on its education and training.

The USA, East Asia and European countries perform well in invigorating MIGS. The USA and China are at the forefront regarding the volume of MIGS-related publications. It is reported that more than half of gynecology-associated publications originate in the USA and European countries,¹⁷ and indeed, these countries perform well in groundbreaking gynecologic surgeries, such as the ovarian tissue transplantation and uterus transplantation.^{22,23} Dursun et al evaluated the contribution of worldwide countries in gynecologic oncology, and found that most studies originated in the USA and Western European countries.²⁴ Overall, these observations are consistent with previous findings on representation in publishing stratified by the worldwide regions. China is rising and especially active in research productivity, and it happens in many other research fields.^{25–27} However, there is a massive decrease in citations from China. It might be due to the fact that China has inadequate teamwork with other countries, as suggested by the cooperative parameter. Therefore, it is recommended for Chinese researchers to have more communications with western countries and elevate their academic influence.

Human Reproduction and Human Reproduction Update are official publications of the European Society of Human Reproduction and Embryology (ESHRE). ESHRE is active in developing clinical guidelines to improve the quality of healthcare, abiding by strict criteria. So, it is reasonable to observe that the representative keyword for European institutions is “Guidelines”. The highest IF of Human Reproduction Update suggests that high-quality reviews are highly valued, as they can aid researchers in comprehending, evaluating, and navigating new areas more effectively.²⁸ When assessing the performance of a journal or institution, it may be biased to only use citation, the IF, or the number of HCPs, as open access journal generally gather more citations.^{16,29} It is more reasonable to also cover metrics including the self-citations, citation rate, belonging category, and issue period. Generally, nonspecialty general medicine (Plos One, Obstet. Gynecol., and Am. J. Obstet. Gynecol.) reach broader audiences and have higher IF than surgery journals (J. Minim. Invasive Gynecol., Gynecol. Oncol). Although previous studies found that self-citations are not important contributors to IF trends in Obstetrics and Gynecology journals.^{30,31}

It is noticed that MIGS is preferred for treating endometrial, cervical and ovarian cancers, and most methods abide by clinical guidelines. Laparoscopic treatment for cervical cancer has been controversially discussed since 2018. Ramirez et al conducted an international, multicenter, randomized study on cervical cancer, and revealed that endoscopic radical surgery was associated with significantly lower rates of disease-free survival (91.2% vs 97.1%) and 3-year overall survival (93.8% vs 99.0%) compared to the open procedure.^{3,32} Using the Surveillance, Epidemiology, and End Results database, another retrospective cohort study came to a similar conclusion.³³ They discovered that minimally invasive radical hysterectomy was linked to a lower overall survival rate (5.3%) compared to abdominal radical hysterectomy (9.1%).

Enhanced recovery after surgery (ERAS), known as a joint, comprehensive approach to perioperative care, has become the standard practice in most surgical fields.³⁴ Therefore, it is not surprising to observe that “anesthesia”, “cost”, “quality-of-life”, “feasibility” and “care” are found. These burst words were frequently used when talking about ERAS. The recent 2023 updated barriers of ERAS include penicillin allergies, intraoperative analgesia and same-day discharge programs.³⁴ After ERAS was implemented, total hospital costs fell by 12%, largely attributed to room expenses.³⁵ In a study aimed at evaluating patient satisfaction, 61% of patients undergoing gynecologic oncology surgery reported being very satisfied, and 33% reported being quite satisfied with the quality of care.³⁶ ERAS continues to be a vital area that has not been thoroughly investigated. Improving ERAS compliance will contribute to superior surgical quality outcomes for gynecologic patients around the world.

Conclusion

This study suggests that MIGS research has entered a steady development period, and scholars are still engaging in it. Most countries contribute to the clinical practice of MIGS, regardless of the publication types. Academic journals have field-specific preferences for submitting papers and differences in disease prevalence also exist among countries/regions. Future research may come to outpatient surgery, ultra-minimally invasive surgery and modern telemedicine are emerging, and will certainly bring new blood to MIGS.

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Disclosure

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References

- Ramos A, Fader AN. Minimally Invasive Surgery in Gynecology: underutilized? *Curr Obstet Gynecol Rep*. 2015;4(3):152–158. doi:10.1007/s13669-015-0126-y
- Stewart KI, Fader AN. New Developments in Minimally Invasive Gynecologic Oncology Surgery. *Clin Obstet Gynecol*. 2017;60(2):330–348. doi:10.1097/GRF.0000000000000286
- Ramirez PT, Frumovitz M, Pareja R, et al. Minimally Invasive versus Abdominal Radical Hysterectomy for Cervical Cancer. *New Engl J Med*. 2018;379(20):1895–1904. doi:10.1056/NEJMoa1806395
- Scalici J, Laughlin BB, Finan MA, Wang B, Rocconi RP. The trend towards minimally invasive surgery (MIS) for endometrial cancer: an ACS-NSQIP evaluation of surgical outcomes. *Gynecologic Oncol*. 2015;136(3):512–515. doi:10.1016/j.ygyno.2014.11.014
- Rabinovich A. Minimally invasive surgery for endometrial cancer: a comprehensive review. *Arch Gynecol Obstetrics*. 2015;291(4):721–727. doi:10.1007/s00404-014-3517-9
- Conrad LB, Ramirez PT, Burke W, et al. Role of Minimally Invasive Surgery in Gynecologic Oncology: an Updated Survey of Members of the Society of Gynecologic Oncology. *Int J Gynecol Cancer*. 2015;25(6):1121–1127. doi:10.1097/IGC.0000000000000450
- La Verde M, Riemma G, Tropea A, Biondi A, Cianci S. Ultra-minimally invasive surgery in gynecological patients: a review of the literature. *Updates Surg*. 2022;74(3):843–855. doi:10.1007/s13304-022-01248-y
- Lyons YA, Stephan JM, Gonzalez Bosquet J, Goodheart MJ. Gynecologic Oncology: challenges of Minimally Invasive Surgery In a Field of Maximal Complexities. *Clin Obstet Gynecol*. 2020;63(1):30–39. doi:10.1097/GRF.0000000000000505
- Delameilleure M, Timmerman S, Vandoren C, et al. Approaches for hysterectomy and implementation of robot-assisted surgery in benign gynaecological disease: a cost analysis study in a large university hospital. *Eur J Obstet Gynecol Reprod Biol*. 2024;301:105–113. doi:10.1016/j.ejogrb.2024.07.060
- Alkatout I, Mechler U, Mettler L, et al. The Development of Laparoscopy-A Historical Overview. *Front Surg*. 2021;8:799442. doi:10.3389/fsurg.2021.799442
- Matanes E, Lauterbach R, Boulus S, Amit A, Lowenstein L. Robotic laparoendoscopic single-site surgery in gynecology: a systematic review. *Eur J Obstet Gynecol Reprod Biol*. 2018;231:1–7. doi:10.1016/j.ejogrb.2018.10.006
- Nezhat C, Zurawin RK. Development and history of morcellators. *Curr Opin Obstet Gynecol*. 2018;30(1):65–68. doi:10.1097/GCO.0000000000000425
- Huang CC, Lo TS, Huang YT, Long CY, Law KS, Wu MP. Surgical Trends and Time Frame Comparison of Surgical Types of Hysterectomy: a Nationwide, Population-based 15-year Study. *J Minimally Invas Gynecol*. 2020;27(1):65–73.e61. doi:10.1016/j.jmig.2019.02.020
- Tan YY, Zhao G, Wang D, Jm W, Tang JR, Ji ZL. A new strategy of minimally invasive surgery for cholecystolithiasis: calculi removal and gallbladder preservation. *Digest Surg*. 2013;30(4–6):466–471. doi:10.1159/000357823
- Waltman L. A review of the literature on citation impact indicators. *J Informetrics*. 2016;10(2):365–391.
- Miranda R, Garcia-Carpintero E. Overcitation and overrepresentation of review papers in the most cited papers. *J Informetrics*. 2018;12(4):1015–1030. doi:10.1016/j.joi.2018.08.006
- Levin G, Pareja R, Harrison R, Ramirez PT, Meyer R. Association of literature metrics in gynecologic oncology with country classification by income level. *Int J Gynecol Cancer*. 2023;33(6):957–963. doi:10.1136/ijgc-2023-004380
- Cooper MA, Hutfless S, Segev DL, Ibrahim A, Lyu H, Makary MA. Hospital level under-utilization of minimally invasive surgery in the United States: retrospective review. *BMJ*. 2014;349:g4198. doi:10.1136/bmj.g4198
- von Bechtolsheim F, Schneider A, Schmidt S, et al. Satisfaction of surgeons with the current state of training in minimally invasive surgery: a survey among German surgeons. *Surg Endosc*. 2023;2023:1.
- Wood KL, Haider SF, Bui A, Leitman IM. Access to common laparoscopic general surgical procedures: do racial disparities exist? *Surg Endosc*. 2020;34(3):1376–1386. doi:10.1007/s00464-019-06912-w
- Rose JS, Waibel BH, Schenarts PJ. Disparity between resident and faculty surgeons' perceptions of preoperative preparation, intraoperative teaching, and postoperative feedback. *J Surg Educ*. 2011;68(6):459–464. doi:10.1016/j.jsurg.2011.04.003
- Dolmans MM, Donnez J. Fertility preservation in women for medical and social reasons: oocytes vs ovarian tissue. *Best Pract Res Clin Obstet Gynaecol*. 2021;70:63–80. doi:10.1016/j.bpobgyn.2020.06.011

23. Brännström M, Racowsky C, Carbonnel M, et al. Uterus transplantation: from research, through human trials and into the future. *Human Reproduction Update*. 2023;29(5):521–544. doi:10.1093/humupd/dmad012
24. Dursun P, Gultekin M, Ayhan A. World gynecologic oncology publications and the Turkish contribution to the literature between 2000 and 2007. *APJCP*. 2011;12(4):861–864.
25. Ma Q, Li Y, Zhang Y. Informetric Analysis of Highly Cited Papers in Environmental Sciences Based on Essential Science Indicators. *Int J Environ Res Public Health*. 2020;17(11):3781. doi:10.3390/ijerph17113781
26. Woolston C. What China's leading position in natural sciences means for global research. *Nature*. 2023;620(7973):S2–s5. doi:10.1038/d41586-023-02159-7
27. Zhou Y, Kwon J-W. Overview of Hofstede-Inspired Research Over the Past 40 Years: the Network Diversity Perspective. *SAGE Open*. 2020;10(3):2158244020947425. doi:10.1177/2158244020947425
28. Teixeira MC, Thomaz SM, Michelan TS, et al. Incorrect citations give unfair credit to review authors in ecology journals. *PLoS One*. 2013;8(12):e81871. doi:10.1371/journal.pone.0081871
29. Foley JA. Peer Review, Citation Ratings and Other Fetishes. *Springer Sci Rev*. 2013;1(1):5–7. doi:10.1007/s40362-013-0003-x
30. Brandt JS, Hadaya O, Schuster M, Rosen T, Sauer MV, Ananth CV. A Bibliometric Analysis of Top-Cited Journal Articles in Obstetrics and Gynecology. *JAMA Netw Open*. 2019;2(12):e1918007. doi:10.1001/jamanetworkopen.2019.18007
31. Blackledge KT, Ananth CV, Brandt JS. The influence of journal self-citations on impact factors in obstetrics and gynecology. *Am J Clin Exp Obstet Gynecol*. 2022;226(5):736–737.e731. doi:10.1016/j.ajog.2021.12.036
32. Giampaolino P, Della Corte L, Mercurio A, et al. Laparoscopic gynecological surgery under minimally invasive anesthesia: a prospective cohort study. *Updates Surg*. 2022;74(5):1755–1762. doi:10.1007/s13304-022-01310-9
33. Melamed A, Margul DJ, Chen L, et al. Survival after Minimally Invasive Radical Hysterectomy for Early-Stage Cervical Cancer. *New Engl J Med*. 2018;379(20):1905–1914. doi:10.1056/NEJMoal804923
34. Nelson G, Fotopoulou C, Taylor J, et al. Enhanced recovery after surgery (ERAS®) society guidelines for gynecologic oncology: addressing implementation challenges - 2023 update. *Gynecologic Oncol*. 2023;173:58–67. doi:10.1016/j.ygyno.2023.04.009
35. Chapman JS, Roddy E, Ueda S, Brooks R, Chen LL, Chen LM. Enhanced Recovery Pathways for Improving Outcomes After Minimally Invasive Gynecologic Oncology Surgery. *Obstetrics Gynecol*. 2016;128(1):138–144. doi:10.1097/AOG.0000000000001466
36. Ferraioli D, Poulliquen C, Jauffret C, et al. EVAN-G score in patients undergoing minimally invasive gynecology oncologic surgery in an Enhanced Recovery After Surgery (ERAS) program. *Int J Gynecol Cancer*. 2020;30(12):1966–1974. doi:10.1136/ijgc-2019-001173

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