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A Bibliometric Analysis of the Most Influential and Impactful Plastic Surgery Publications From Saudi Arabia

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A Bibliometric Analysis of the Most Influential and Impactful Plastic Surgery Publications From Saudi Arabia

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ORIGINAL ARTICLE

A Bibliometric Analysis of the Most Influential and Impactful Plastic Surgery Publications From Saudi Arabia

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ABSTRACT

Objective: To analyze the most cited plastic surgery articles from Saudi Arabia, focusing on publication trends, leading contributors, collaboration patterns, and thematic areas.
Methods: We conducted a bibliometric analysis using the Web of Science Core Collection (1990–2025). Keywords covering plastic surgery subfields were combined with geographic identifiers ("Saudi Arabia," "KSA," "Kingdom of Saudi Arabia") using Boolean operators. Only English-language original and review articles were included. Citation metrics, authorship networks, and keyword co-occurrence were analyzed with VOSviewer and the bibliometrix R package.
Results: We identified 1,013 Saudi-affiliated plastic surgery publications, receiving 7,929 citations. The top 100 most-cited articles averaged 39.3 citations (range: 19–283). King Saud University was the leading institution, contributing 59 articles. Dr. Mohammad M. Al-Qattan was the most prolific author, with first authorship on 52 publications. Hand surgery dominated the thematic spectrum (36%), followed by peripheral nerve (14%) and aesthetic surgery (12%). International collaboration occurred in 21 articles (22.8%), mainly with the United States and Canada. Nearly half of the studies (49%) were Level IV evidence.
Conclusion: Saudi Arabia has achieved a notable presence in plastic surgery literature, especially in hand and peripheral nerve surgery. However, the concentration of authorship and reliance on lower-level evidence highlight the need for broader collaboration, prospective study designs, and greater methodological rigor to strengthen future contributions.

Keywords: Bibliometric analysis, Plastic surgery, Citation trends, Saudi Arabia, VOSviewer, Research collaboration

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Introduction

Plastic surgery is a rapidly evolving surgical specialty characterized by a continual expansion in global research output [1]. In recent years, bibliometric studies have emerged as valuable tools for quantitatively assessing the academic impact of scientific publications and identifying prevailing research trends [2]. Bibliometric methodologies encompass citation analysis, co-authorship networks, and keyword mapping, offering insights into the development of subspecialties within plastic surgery, including aesthetic surgery, craniofacial surgery, and reconstructive microsurgery [3–6].

Several bibliometric investigations have outlined publication trends in key plastic surgery domains, such as cleft lip and palate surgery [5], rhinoplasty [7], breast reduction [8], and facelift surgeries [9]. These studies consistently indicate that scholarly contributions are predominantly driven by high-income nations, particularly the United States and the United Kingdom. Nevertheless, emerging economies—such as Turkey and Brazil—are increasingly contributing to the literature, signaling a broader shift in the global academic landscape [3–9].

A prior study by Almarghoub and Al-Qattan (2019) identified 141 plastic surgery publications from Saudi Arabia (2014–2018), mostly case reports and hand surgery topics, with output concentrated at King Saud University. However, the study lacked citation analysis and broader database coverage, highlighting the need for a more comprehensive evaluation [10].

Despite Saudi Arabia's significant investments in medical education, healthcare infrastructure, and scientific research, its bibliometric footprint in plastic surgery remains underexplored [11]. While the Kingdom has demonstrated substantial growth in publication output across biomedical fields, no comprehensive analysis has evaluated its most impactful contributions to plastic surgery. This study aims to address this gap by conducting a bibliometric analysis of the most cited plastic surgery publications originating from Saudi Arabia, with a focus on citation metrics, institutional affiliations, collaboration networks, and thematic clusters.

Methods

This study was designed as a bibliometric analysis aimed at evaluating publication trends, citation impact, research collaborations, and thematic clusters in plastic surgery research affiliated with Saudi Arabia. Ethical approval was not required, as the analysis involved only publicly available bibliographic data without human or animal subjects. The study followed the BIBLIO (Bibliometric Review of Biomedical Literature) reporting guideline, which outlines minimum requirements for transparent and standardized reporting of bibliometric studies [12]. Ethical approval was not required because only bibliographic metadata was analyzed.

The Web of Science Core Collection (Clarivate Analytics) was selected as the primary data source due to its comprehensive indexing of high-impact biomedical literature and validated use in bibliometric research [13, 14]. A systematic search was performed on March 15, 2025 using the following Boolean string applied across all searchable fields: ("plastic surgery" OR "aesthetic surgery" OR "burn surgery" OR "craniofacial surgery" OR "microsurgery" OR "cosmetic surgery" OR "reconstructive surgery" OR "hand surgery") AND ("Saudi Arabia" OR "KSA" OR "Kingdom of Saudi Arabia"). The search was conducted with no restrictions on publication date, and filtered by document type to include only original articles and review articles published in English. Editorials, conference abstracts, and other non-research documents were excluded.

The final analysis included the top 100 most-cited publications that met the following inclusion criteria: (1) at least one author affiliated with a Saudi institution; (2) publication in a peer-reviewed journal; and (3) availability of citation, co-authorship, or keyword metadata. Non-peer-reviewed documents and articles irrelevant to plastic surgery were excluded.

Metadata were exported from the Web of Science platform, including article title, publication year, total citations, author names, institutional affiliations, journal name, journal impact factor, author h-index, and keyword data. Additional variables included co-authorship details, keyword co-occurrence, and international collaboration information.

Statistical analysis

Key bibliometric indicators analyzed included total citation counts, author h-index, institutional productivity, international collaboration frequency, and journal impact metrics. Data were compiled and organized in Microsoft Excel for descriptive analysis. Visualization of co-authorship networks and keyword clusters was conducted using VOSviewer (v1.6.10) [15], while statistical analyses and bibliometric mapping were carried out using the bibliometrix R package [16]. The level of evidence for each article was assessed using the Oxford Centre for Evidence-Based Medicine (OCEBM) classification system [17].

Visual data outputs included co-authorship network diagrams, keyword co-occurrence maps, and

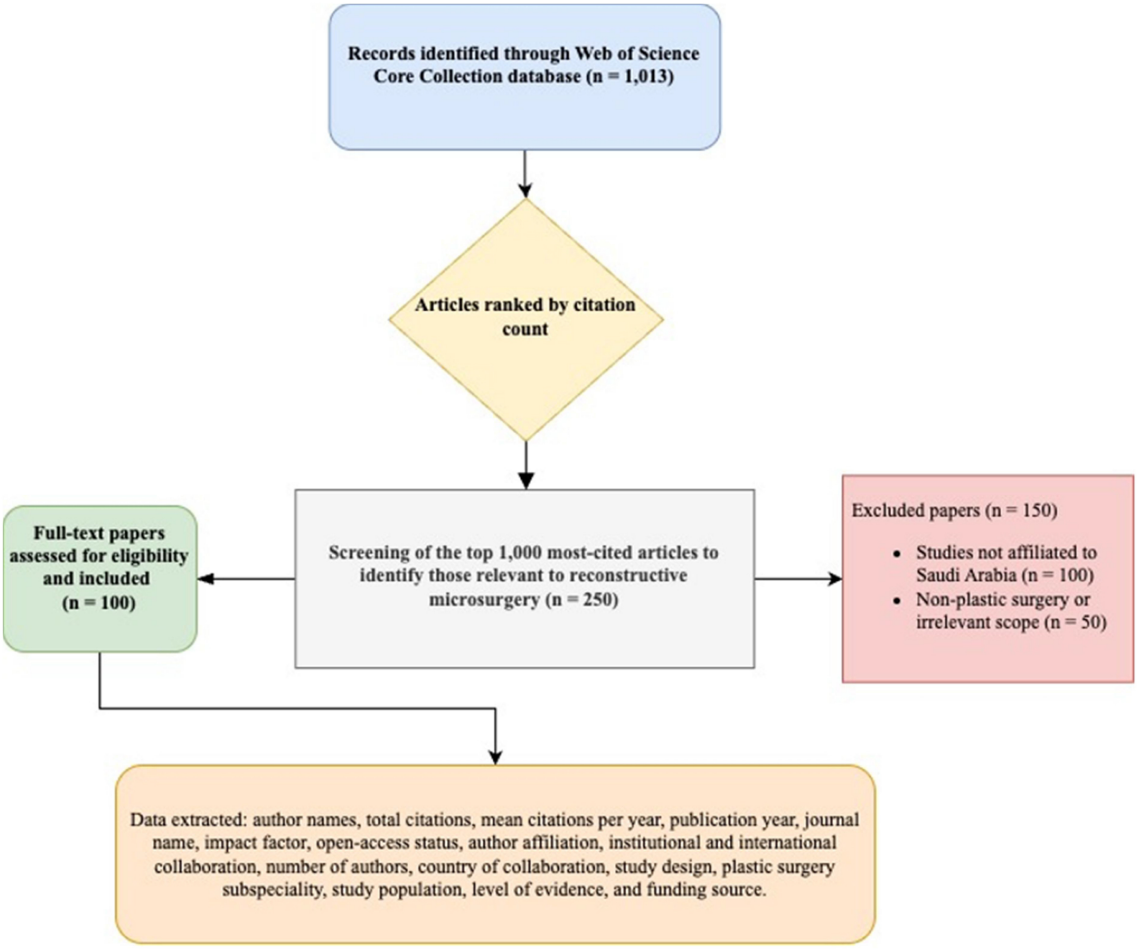

Fig. 1. Flowchart of the screening process.

annual publication trends. VOSviewer was employed for generating network visualizations, while Microsoft Excel was used for producing frequency tables, institutional rankings, and bar charts representing publication trends.

Results

Article selection and citation analysis

A total of 1013 plastic surgery-related publications affiliated with Saudi Arabia were identified in the Web of Science Core Collection between 1990 and 2025. These publications received 7929 citations in total, with 7244 citations excluding self-citations. The average number of citations per item was 7.83. In total, 6701 unique citing articles were recorded (6430 without self-citations). The cumulative H-index for the retrieved publications was 37. After ranking articles by citation count, the top 250 most-cited plastic surgery publications affiliated with Saudi Arabia were screened for relevance and adherence to predefined inclusion criteria. Following this screening, the 100 most-cited articles were selected for final bibliometric analysis (Fig. 1). Full bibliographic details for the top 100 articles are provided in Table 1. The mean citation count of the top 100 selected articles was 39.31±30.10, with a range from 19 to 283 citations. The top quartile (75th percentile) included articles with 48 or more citations, while the median citation count was 30.5. Only two articles exceeded 100 citations, and 23 articles received more than 50 citations.

Publication trends, authorship and institutional contributions

The articles were published between 1991 and 2022, with a median publication year of 2007. The most frequent publication year was 2001. The distribution showed a notable increase in publications after the year 2000, with 7 articles published in 1998 and 6 in 2016. The distribution of citations over time is illustrated in Fig. 2, highlighting peaks in citation

Table 1. List of the top 100 most-cited plastic surgery articles from Saudi Arabia.

#	Study ID	Title	Journal	Volume	Issue	Beginning Page	Ending Page	Total Citations	Average per Year
1	Hu, 2016	Bacterial Biofilm Infection Detected in Breast Implant-Associated Anaplastic Large-Cell Lymphoma	Plastic And Reconstructive Surgery	137	6	1659	1669	283	28.3
2	Arab, 2019	Influence of Social Media on the Decision to Undergo a Cosmetic Procedure	Plastic And Reconstructive Surgery-Global Open	7	8			101	14.43
3	Al-Qattan, 2005	Magnetic resonance imaging in the diagnosis of glomus tumours of the hand	Journal Of Hand Surgery-British And European Volume	30B	5	535	540	88	4.19
4	Al-Qattan, 2001a	A modified technique for harvesting the reverse sural artery flap from the upper part of the leg: Inclusion of a gastrocnemius muscle cuff around the sural pedicle	Annals Of Plastic Surgery	47	3	269	274	80	3.2
5	Al-Qattan, 2001b	Giant cell tumours of tendon sheath: Classification and recurrence rate	Journal Of Hand Surgery-British And European Volume	26	1	72	75	79	3.16
6	Alharbi, 2013	Conventional vs. micro-fat harvesting: How fat harvesting technique affects tissue-engineering approaches using adipose tissue-derived stem/stromal cells	Journal Of Plastic Reconstructive And Aesthetic Surgery	66	9	1271	1278	75	5.77
7	Al-Qattan, 2001c	Terminolateral neurorrhaphy: Review of experimental and clinical studies	Journal Of Reconstructive Microsurgery	17	2	99	108	70	2.8
8	Abduljabbar, 2016	Complications of hyaluronic acid fillers and their managements	Journal Of Dermatology Dermatologic Surgery-Jdds	20	2	100	106	69	6.9
9	Al-Qattan, 2001d	Phalangeal neck fractures in children: Classification and outcome in 66 cases	Journal Of Hand Surgery-British And European Volume	26	2	112	121	67	2.68
10	Al-Qattan, 1998	Variables affecting axonal regeneration following end-to-side neurorrhaphy	British Journal Of Plastic Surgery	51	3	238	242	65	2.32
11	Al-Kahtani, 2009	NARAKAS CLASSIFICATION OF OBSTETRIC BRACHIAL PLEXUS PALSY REVISITED	Journal Of Hand Surgery-European Volume	34E	6	788	791	64	3.76
12	Kar, 2018	Is it possible to define the ideal lips?	Acta Otorhino-laryngologica Italica	38	1	67	72	57	7.13
13	Al-Qattan, 2001e	Classification of hand anomalies in Poland's syndrome	British Journal Of Plastic Surgery	54	2	132	136	57	2.28
14	Tashkandi, 2004	The surgical management of high-grade gynecomastia	Annals Of Plastic Surgery	53	1	17	20	56	2.55
15	Al-Qattan, 1998b	Classification of the mirror hand-multiple hand spectrum	Journal Of Hand Surgery-British And European Volume	23B	4	534	536	56	2
16	Ducournau, 2020	COVID-19: Initial experience of an international group of hand surgeons	Hand Surgery & Rehabilitation	39	3	159	166	55	9.17
17	Al-Qattan, 1996	The outcome of Erb's palsy when the decision to operate is made at 4 months of age	Plastic And Reconstructive Surgery	106	7	1461	1465	55	2.12
18	Al-Qattan, 2016	Obstetrical brachial plexus injury in newborn babies delivered by Caesarean section	Journal Of Hand Surgery-British And European Volume	21B	2	263	265	55	1.83
19	Mowafi, 2008	Defining the Indications of Pedicled Groin and Abdominal Flaps in Hand Reconstruction in the Current Microsurgery Era	Journal Of Hand Surgery-American Volume	41	9	917	928	54	5.4

(Continued.)

Table 1. Continued.

#	Study ID	Title	Journal	Volume	Issue	Beginning Page	Ending Page	Total Citations	Average per Year
20	Al-Qattan, 2016b	Melatonin improves tourniquet tolerance and enhances postoperative analgesia in patients receiving intravenous regional anesthesia	Anesthesia And Analgesia	107	4	1422	1426	54	3
21	Al-Qattan, 1997	Abdominoplasty in multiparous women with severe musculoaponeurotic laxity	British Journal Of Plastic Surgery	50	6	450	455	54	1.86
22	Al-Qattan, 1996	Gantzer's muscle - An anatomical study of the accessory head of the flexor pollicis longus muscle	Journal Of Hand Surgery-British And European Volume	21B	2	269	270	52	1.73
23	Al-Qattan, 2006	Factors in the pathogenesis of Dupuytren's contracture	Journal Of Hand Surgery-American Volume	31A	9	1527	1534	51	2.55
24	Al-Qattan, 2009	Embryology of the Upper Limb	Journal Of Hand Surgery-American Volume	34A	7	1340	1350	49	2.88
25	Al-Qattan, 2003	Obstetric brachial plexus palsy associated with breech delivery	Annals Of Plastic Surgery	51	3	257	264	48	2.09
26	Al-Qattan, 2001	Extra-articular transverse fractures of the base of the distal phalanx (Seymour's fracture) in children and adults	Journal Of Hand Surgery-British And European Volume	26	3	201	206	48	1.92
27	Alharethy, 2017	Trends and demographic characteristics of Saudi cosmetic surgery patients	Saudi Medical Journal	38	7	738	741	45	5
28	Al-Qattan, 2000	Prevention and treatment of painful neuromas of the superficial radial nerve by the end-to-side nerve repair concept: An experimental study and preliminary clinical experience	Microsurgery	20	3	99	104	44	1.69
29	Alasseri, 2020	Patient-specific implants for maxillofacial defects: challenges and solutions	Maxillofacial Plastic And Reconstructive Surgery	42	1			42	7
30	Shash, 2017	A systematic review of complications associated with direct implants vs. tissue expanders following Wise pattern skin-sparing mastectomy	Journal Of Plastic Reconstructive And Aesthetic Surgery	70	9	1191	1199	42	4.67
31	Al-Qattan, 2001	Lipofibromatous hamartoma of the median nerve and its associated conditions	Journal Of Hand Surgery-British And European Volume	26	4	368	372	42	1.68
32	Liu, 2014	A Prospective Study of Pediatric Hand Fractures and Review of the Literature	Pediatric Emergency Care	30	5	299	304	41	3.42
33	Alotaibi, 2021	Demographic and Cultural Differences in the Acceptance and Pursuit of Cosmetic Surgery: A Systematic Literature Review	Plastic And Reconstructive Surgery-Global Open	9	3			40	8
34	Al-Qattan, 2010	Variations in the Course of the Thenar Motor Branch of the Median Nerve and Their Relationship to the Hypertrophic Muscle Overlying the Transverse Carpal Ligament	Journal Of Hand Surgery-American Volume	35A	11	1820	1824	40	2.5
35	Algahtani, 2018	Extrusion-Based 3D Printing for Pharmaceuticals: Contemporary Research and Applications	Current Pharmaceutical Design	24	42	4991	5008	39	4.88
36	Al-Qattan, 2002	Rotation osteotomy of the humerus for Erb's palsy in children with humeral head deformity	Journal Of Hand Surgery-American Volume	27A	3	479	483	39	1.63

(Continued.)

Table 1. Continued.

#	Study ID	Title	Journal	Volume	Issue	Beginning Page	Ending Page	Total Citations	Average per Year
37	Al-Qattan, 2011	Tuberculosis of the Hand	Journal Of Hand Surgery-American Volume	36A	8	1413	1421	37	2.47
38	Al-Qattan, 2011	WNT PATHWAYS AND UPPER LIMB ANOMALIES	Journal Of Hand Surgery-European Volume	36E	1	9	22	35	2.33
39	Al-Qattan, 2009	FLEXOR TENDON REPAIR IN ZONE 2 USING A SIX-STRAND 'FIGURE OF EIGHT' SUTURE	Journal Of Hand Surgery-European Volume	34E	3	322	328	35	2.06
40	Al-Qattan, 2001	Type 5 avulsion of the insertion of the flexor digitorum profundus tendon	Journal Of Hand Surgery-British And European Volume	26	5	427	431	35	1.4
41	Shalhoub, 1993	EPIDEMIOLOGY OF FACIAL CLEFTS IN THE CENTRAL PROVINCE OF SAUDI-ARABIA	British Journal Of Plastic Surgery	46	8	673	675	35	1.06
42	Aldahmash, 2022	Real-time 3-dimensional Dynamic Navigation System in Endodontic Microsurgery: A Cadaver Study	Journal Of Endodontics	48	7	922	929	33	8.25
43	Alharethy, 2017	Surgical Outcomes of Bony Batten Grafting to Correct Caudal Septal Deviation in Septoplasty	Jama Facial Plastic Surgery	19	6	470	475	33	3.67
44	Al-Qattan, 1996	Obstetric brachial plexus injury in subsequent deliveries	Annals Of Plastic Surgery	37	5	545	548	33	1.1
45	Samargandi, 2016	Methodologic Quality of Systematic Reviews Published in the Plastic and Reconstructive Surgery Literature: A Systematic Review	Plastic And Reconstructive Surgery	137	1	225E	236E	32	3.2
46	Garri, 2005	Retrospective analysis of secondary alveolar cleft grafts using iliac of chin bone	Journal Of Craniofacial Surgery	16	5	864	868	32	1.52
47	Al-Qattan, 2000	The prognostic value of concurrent Horner's syndrome in total obstetric brachial plexus injury	Journal Of Hand Surgery-British And European Volume	25B	2	166	167	32	1.23
48	Almarghoub, 2020	FACIAL CLEFTS IN SAUDI-ARABIA - AN EPIDEMIOLOGIC ANALYSIS IN 179 PATIENTS	Plastic And Reconstructive Surgery	88	6	955	958	32	0.91
49	Al-Hoqail, 2008	Plastic Surgery on YouTube	Plastic And Reconstructive Surgery-Global Open	8	1			31	5.17
50	Ross, 2005	Anatomic dissection of the arterial supply of the lips: An anatomical and analytical approach	Journal Of Craniofacial Surgery	19	3	785	794	31	1.72
51	Hashem, 1999	Successful replantation of penile amputation (post-circumcision) complicated by prolonged ischaemia	British Journal Of Plastic Surgery	52	4	308	310	30	1.15
52	Aldrees, 2017	Burnout among plastic surgery residents National survey in Saudi Arabia	Saudi Medical Journal	38	8	832	836	30	3.33
53	Alnaeem, 2016	A Systematic Review and Meta-Analysis Examining the Differences Between Nonsurgical Management and Percutaneous Fixation of Minimally and Nondisplaced Scaphoid Fractures	Journal Of Hand Surgery-American Volume	41	12	1135	1144	30	3
54	Al-Qattan, 2003	Assessment of the motor power in older children with obstetric brachial plexus palsy	Journal Of Hand Surgery-British And European Volume	28B	1	46	49	30	1.3
55	Al-Qattan, 1999	Self-mutilation in children with obstetric brachial plexus palsy	Journal Of Hand Surgery-British And European Volume	24B	5	547	549	30	1.11

(Continued.)

Table 1. Continued.

#	Study ID	Title	Journal	Volume	Issue	Beginning Page	Ending Page	Total Citations	Average per Year
56	Al-Qattan, 2008	OUTCOME OF CONSERVATIVE MANAGEMENT OF SPIRAL/LONG OBLIQUE FRACTURES OF THE METACARPAL SHAFT OF THE FINGERS USING A PALMAR WRIST SPLINT AND IMMEDIATE MOBILISATION OF THE FINGERS	Journal Of Hand Surgery-European Volume	33E	6	723	727	29	1.61
57	Al-Qattan, 2005	Lower-limb reconstruction utilizing the reverse sural artery flap-gastrocnemius muscle cuff technique	Annals Of Plastic Surgery	55	2	174	178	29	1.38
58	Al-Qattan, 2000	Conservative management of zone II partial flexor tendon lacerations greater than half the width of the tendon	Journal Of Hand Surgery-American Volume	25A	6	1118	1121	29	1.12
59	Aldosari, 2019	Effect of Media on Facial Plastic Surgery in Saudi Arabia	Cureus Journal Of Medical Science	11	11			28	4
60	Al-Qattan, 2010	Nonunion and Avascular Necrosis Following Phalangeal Neck Fractures in Children	Journal Of Hand Surgery-American Volume	35A	8	1269	1274	28	1.75
61	Al-Qattan, 2003	Latissimus dorsi transfer for external rotation weakness of the shoulder in obstetric brachial plexus palsy	Journal Of Hand Surgery-British And European Volume	28B	5	487	490	28	1.22
62	Saleem, 1998	Compartment syndrome in a free fibula osteocutaneons flap donor site	British Journal Of Plastic Surgery	51	5	405	407	28	1
63	Morait, 2019	Attitudes and acceptance of the Saudi population toward cosmetic surgeries in Riyadh, Saudi Arabia	Journal Of Family Medicine And Primary Care	8	5	1685	1690	27	3.86
64	Al-Qattan, 2013	Update on Embryology of the Upper Limb	Journal Of Hand Surgery-American Volume	38A	9	1835	1844	27	2.08
65	Al-Qattan, 2002	Juxta-epiphyseal fractures of the base of the proximal phalanx of the fingers in children and adolescents	Journal Of Hand Surgery-British And European Volume	27B	1	24	30	27	1.13
66	Patrocínio, 2014	Evaluation of Lateral Crural Steal in Nasal Tip Surgery	Jama Facial Plastic Surgery	16	6	400	404	26	2.17
67	Al-Qattan, 2013	Preaxial Polydactyly of the Upper Limb Viewed as a Spectrum of Severity of Embryonic Events	Annals Of Plastic Surgery	71	1	118	124	26	2
68	Al-Qattan, 1997	Congenital palmar nail syndrome	Journal Of Hand Surgery-British And European Volume	22B	5	674	675	26	0.9
69	Samargandi, 2018	Antibiotic Irrigation of Pocket for Implant-Based Breast Augmentation to Prevent Capsular Contracture: A Systematic Review	Plastic Surgery	26	2	110	119	25	3.13
70	Siclovan, 2008	Advantages and outcomes in subfascial breast augmentation: A two-year review of experience	Aesthetic Plastic Surgery	32	3	426	431	25	1.39
71	Marouf, 2021	Complications of Body Contouring Surgery in Postbariatric Patients: A Systematic Review and Meta-Analysis	Aesthetic Plastic Surgery	45	6	2810	2820	24	4.8
72	Baez-Jurado, 2017	Conditioned Medium of Human Adipose Mesenchymal Stem Cells Increases Wound Closure and Protects Human Astrocytes Following Scratch Assay In Vitro	Molecular Neurobiology	55	6	5377	5392	24	3
73	Turkmani, 2017	New Classification System for Tear Trough Deformity	Dermatologic Surgery	43	6	836	840	24	2.67

(Continued.)

Table 1. Continued.

#	Study ID	Title	Journal	Volume	Issue	Beginning Page	Ending Page	Total Citations	Average per Year
74	Al-Qattan, 2006	Phalangeal neck fractures in adults	Journal Of Hand Surgery-British And European Volume	31B	5	484	488	24	1.2
75	Rahman, 1999	Outbreak of hand injuries during Hajj festivities in Saudi Arabia	Annals Of Plastic Surgery	43	2	154	155	24	0.89
76	Al-Qattan, 2007	Augmentation of the nasal dorsum with autogenous costal cartilage using the Edge-on technique	Annals Of Plastic Surgery	59	6	642	644	23	1.21
77	Al-Qattan, 2006	Metacarpal shaft fractures of the fingers: Treatment with interosseous loop wire fixation and immediate postoperative finger mobilisation in a wrist splint	Journal Of Hand Surgery-British And European Volume	31B	4	377	382	23	1.15
78	Al-Qattan, 2005	Vicryl Rapide＜SUP＞®＜/SUP＞ versus Vicryl＜SUP＞®＜/SUP＞ suture in skin closure of the hand in children:: A randomized prospective study	Journal Of Hand Surgery-British And European Volume	30B	1	90	91	23	1.1
79	Al-Qattan, 1998	Ischaemia-reperfusion injury - Implications for the hand surgeon	Journal Of Hand Surgery-British And European Volume	23B	5	570	573	23	0.82
80	Bafaqueeh, 1999	Open rhinoplasty: Columellar scar analysis in an Arabian population	Plastic And Reconstructive Surgery	102	4	1226	1228	23	0.82
81	Mortada, 2019	Perception of Plastic Surgery and the Role of Media Among Medical Students: Cross-Sectional Study	Interactive Journal Of Medical Research	8	2			22	3.14
82	Al-Thunyan, 2009	Ambulatory Cleft Lip Repair	Plastic And Reconstructive Surgery	124	6	2048	2053	22	1.29
83	Malaker, 2004	Treatment of earlobe keloids using the cobalt 60 teletherapy unit	Annals Of Plastic Surgery	52	6	602	604	22	1
84	Pitkanen, 2000	Immediate coverage of exposed, denuded cranial bone with split-thickness skin grafts	Annals Of Plastic Surgery	45	2	118	121	22	0.85
85	Al-Qattan, 1999	Nonunion following subcapital (neck) fractures of the proximal phalanx of the thumb in children	Journal Of Hand Surgery-British And European Volume	24B	6	693	698	22	0.81
86	Obeid, 2022	The prognostic value of concurrent phrenic nerve palsy in newborn children with Erb's palsy	Journal Of Hand Surgery-British And European Volume	23B	2	225	225	22	0.79
87	ElAbd, 2020	The Use of Social Media and Its Influence on Undergoing Rhinoplasty	Plastic And Reconstructive Surgery-Global Open	10	6			21	5.25
88	Al-Qattan, 2012	Body Contouring Surgery Improves Weight Loss after Bariatric Surgery: A Systematic Review and Meta-Analysis	Aesthetic Plastic Surgery	45	3	1064	1075	21	3.5
89	Al-Qattan, 2007	Anthropometry of the Saudi Arabian Nose	Journal Of Craniofacial Surgery	23	3	821	824	21	1.5
90	Al-Qattan, 2007	Long oblique/spiral mid-shaft metacarpal fractures of the fingers: Treatment with cerclage wire fixation and immediate post-operative finger mobilisation in a wrist splint	Journal Of Hand Surgery-European Volume	32E	6	637	640	21	1.11
91	Al-Qattan, 2003	Classification of secondary shoulder deformities in obstetric brachial plexus palsy	Journal Of Hand Surgery-British And European Volume	28B	5	483	486	21	0.91

(Continued.)

Table 1. Continued.

#	Study ID	Title	Journal	Volume	Issue	Beginning Page	Ending Page	Total Citations	Average per Year
92	Al-Qattan, 1998	Cosman (Question mark) ear: Congenital auricular cleft between the fifth and sixth hillocks	Plastic And Reconstructive Surgery	102	2	439	441	21	0.75
93	Mortada, 2022	Ocular Complications Post-Cosmetic Periocular Hyaluronic Acid Injections: A Systematic Review	Aesthetic Plastic Surgery	46	2	760	773	20	5
94	Alessa & Bloom, 2020	Microneedling Options for Skin Rejuvenation, Including Non-temperature-controlled Fractional Microneedle Radiofrequency Treatments	Facial Plastic Surgery Clinics Of North America	28	1	1	+	20	3.33
95	Mrad, 2017	Analyzing the Cost of Autogenous Cranioplasty Versus Custom-Made Patient-Specific Alloplastic Cranioplasty	Journal Of Craniofacial Surgery	28	5	1260	1263	20	2.22
96	Al-Qattan, 2009	THE BIFID MEDIAN NERVE RE-VISITED	Journal Of Hand Surgery-European Volume	34E	2	212	214	20	1.18
97	Al-Qattan & Al-Khawashki, 2002	The beggar's hand and the unshakable hand in children with total obstetric brachial plexus palsy	Plastic And Reconstructive Surgery	109	6	1947	1952	20	0.83
98	Al-Qattan, 2001	The adipofascial turnover flap for coverage of the exposed distal interphalangeal joint of the fingers and interphalangeal joint of the thumb	Journal Of Hand Surgery-American Volume	26A	6	1116	1119	20	0.8
99	Mrad, 2017	Predictors of Complications after Breast Reconstruction Surgery: A Systematic Review and Meta-analysis	Plastic And Reconstructive Surgery-Global Open	10	12			19	4.75
100	Alshomer, 2022	Low-Cost Desktop-Based Three-Dimensional-Printed Patient-Specific Craniofacial Models in Surgical Counseling, Consent Taking, and Education of Parent of Craniosynostosis Patients: A Comparison With Conventional Visual Explanation Modalities	Journal Of Craniofacial Surgery	30	6	1652	1656	19	2.71

activity and publication trends across different decades. Among the 100 most-cited plastic surgery publications from Saudi Arabia, M. M. Al-Qattan was the most prolific first author, contributing to 52 articles. The next most frequent contributors were Sami E. Alharethy, Osama A. Samargandi, and Hatan Mortada, each authoring 2 articles. The most frequently represented institution among the top 100 most-cited plastic surgery articles from Saudi Arabia was King Saud University, contributing to 59 publications when combining all naming variants. Other notable contributors included King Faisal Specialist Hospital with 4 articles and King Abdulaziz University with 3 articles. Of the 92 analyzed articles, 21 (22.8%) reported international collaboration. The most frequent partner countries were the United States and Canada, each contributing to 4 articles. Other collaborating countries included Germany, Turkey, South Korea, and Egypt. The most commonly cited collaborative institutions were Harvard Medical School and the University of Toronto. Fig. 3 demonstrates that collaborations are concentrated with North American partners, particularly the United States and Canada, while links with regional institutions remain sparse, indicating potential to strengthen intra-regional networks. The number of authors per article ranged from 1 to 50, with a mean of 3.43 and a median of 2. The most common authorship pattern was single-author publications, accounting for 36 articles. Fig. 4 illustrates these keyword clusters, highlighting hand and peripheral nerve surgery as central themes, while aesthetic and craniofacial surgery appear as smaller but distinct clusters. This distribution reflects both local clinical

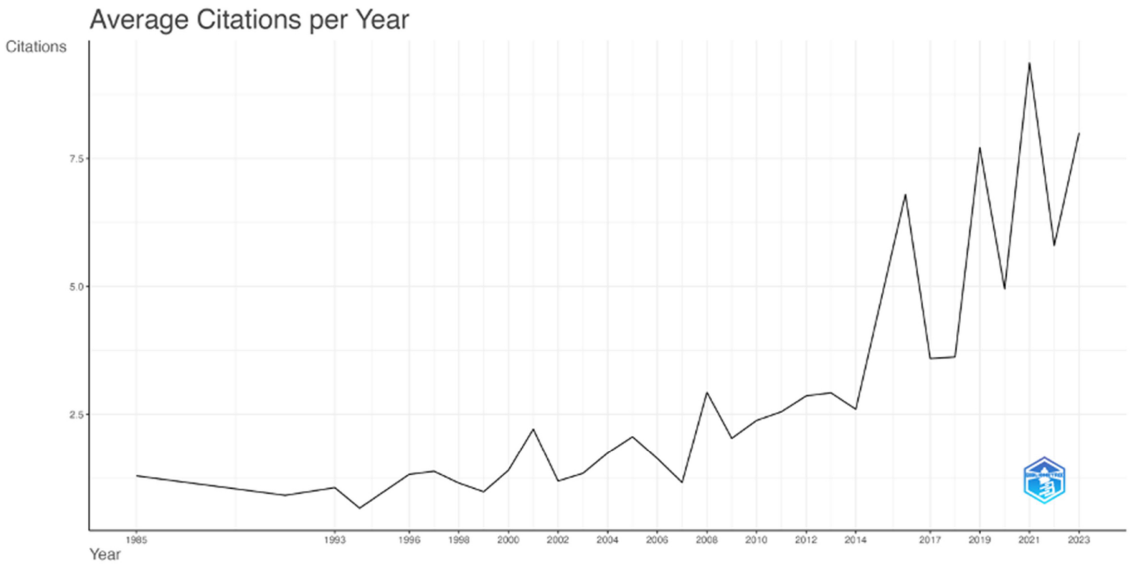

Fig. 2. Average citation distribution per year.

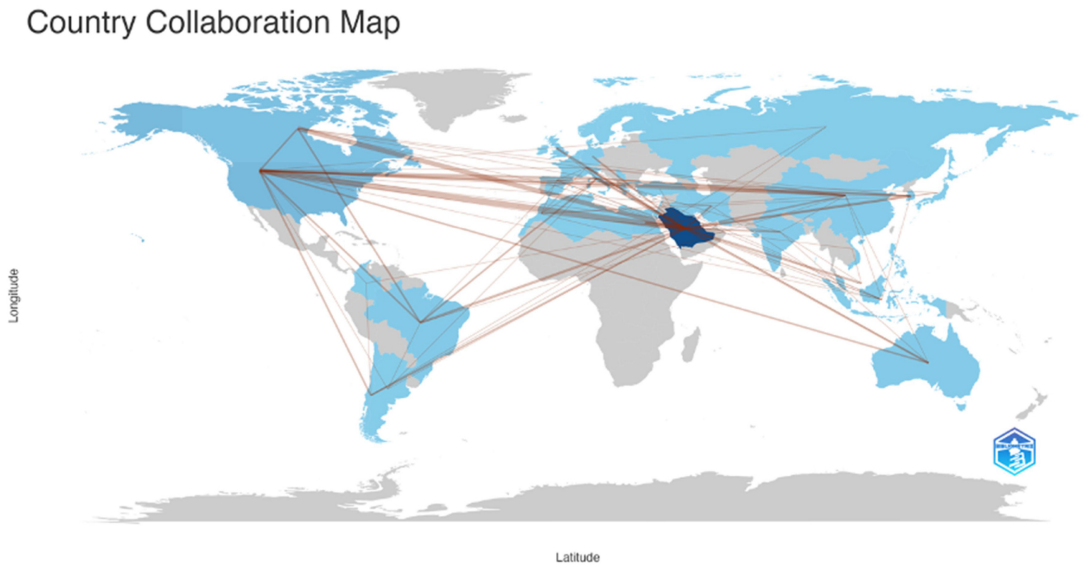

Fig. 3. Country collaboration map.

priorities and emerging areas of interest. As shown in Fig. 5, hand and peripheral nerve topics occupy central, well-developed areas of the thematic map. In contrast, aesthetic and craniofacial topics fall into developing or niche zones, suggesting opportunities for future expansion and higher-quality studies.

Most publishing authors in Saudi Arabia

From a total of 1,013 plastic surgery–related publications affiliated with Saudi institutions, Dr. Mohammad M. Al-Qattan was by far the most productive contributor, with 218 publications (21.5%). He was followed by Dr. Hatan Mortada with 77 publications (7.6%), while both Dr. Abdullah A. Al Qurashi and Dr. Abdullah E. Kattan contributed 25 publications each (2.5%). Other frequent contributors included Dr. Mohamed Amir Mrad (24, 2.4%), Dr. Osama Samargandi (21, 2.1%), and Dr. Khalid Arab (20, 2.0%).

Journals, study characteristics, research topics

The most frequent journal among the top 100 most-cited plastic surgery articles from Saudi Arabia was the Journal of Hand Surgery - British and European Volume, which published 22 articles. This

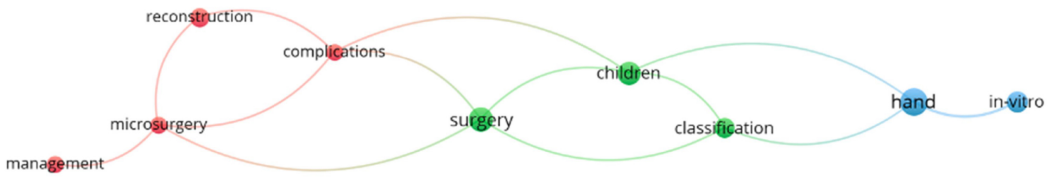

Fig. 4. Keyword co-occurrence network.

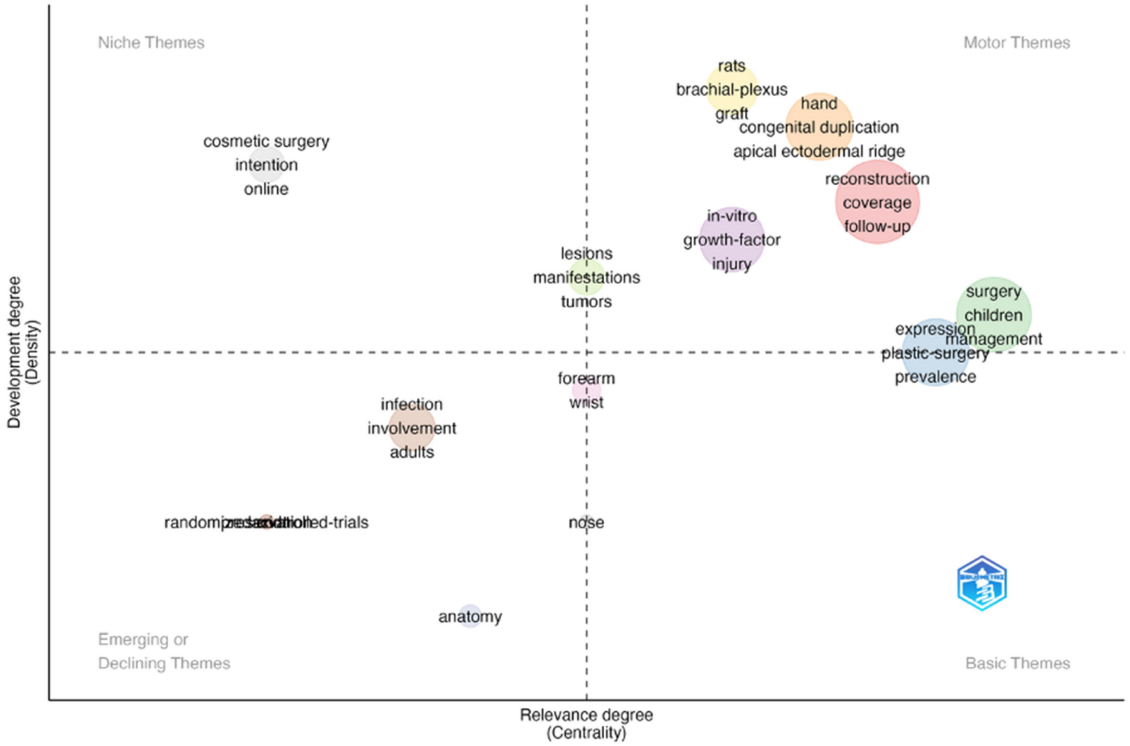

Fig. 5. Thematic map of research topics.

was followed by the Journal of Hand Surgery - American Volume (11 articles), Annals of Plastic Surgery (10 articles), and Plastic and Reconstructive Surgery (8 articles). The British Journal of Plastic Surgery also featured prominently, contributing 6 articles. The mean impact factor of the journals publishing the top 100 most-cited Saudi plastic surgery articles was 2.49, with a median of 2.0. The lowest reported impact factor was 0.8, while the highest reached 5.9 (*Anesthesia and Analgesia*). Four journals were not listed in Journal Citation Reports 2023/2024. Among the 99 analyzable articles, 77 (77.8%) were published in non–open access journals, while 19 (19.2%) appeared in open access venues. The most common study design was the retrospective cohort study (15 articles), followed by cross-sectional studies and case series (10 articles each). Case reports and narrative reviews were each represented in 9 articles. The majority of articles focused on Hand Surgery (36 articles), followed by Peripheral Nerve Surgery (14), Aesthetic Surgery (12), Reconstructive Surgery (8), and Craniofacial Surgery (8).

Funding sources & level of evidence

Funding information was not reported in 87 out of 99 articles (87.9%). Only 7 studies (7.1%) explicitly stated that no funding was received. A total of 5 studies (5.0%) reported support from King Saud University, including its affiliated research centers. Based on OCEBM classification, most studies were classified as Level IV (49 articles, 49%), followed by Level I (31 articles, 31%) and Level III (13 articles, 13%). Only 2 studies (2%) reached Level II, and 4 studies (4%) were categorized as Level V. One study was deemed not applicable due to its laboratory-based design.

Discussion

This bibliometric analysis highlights the development of plastic surgery research in Saudi Arabia from 1990 to 2025, marked by a substantial rise in output and increased thematic diversity. A total of 1013 publications were identified, accumulating

over 7900 citations, with a marked increase in productivity after 2000. This growth reflects national investments in research infrastructure and academic development, aligning with broader initiatives such as Vision 2030 [18].

A prominent finding was the concentration of scholarly output among a small group of authors. Dr. Mohammad M. Al-Qattan alone contributed over 20% of all publications within the analyzed Saudi-affiliated plastic surgery literature and was first author on 52 of the top 100 most-cited articles, a pattern consistent with other specialized fields where a few individuals significantly influence research direction [19, 20]. Institutionally, King Saud University dominated the landscape, contributing nearly 60% of the most-cited articles, indicating its leading role in national academic productivity [21]. In contrast, other major institutions had lower representation, pointing to opportunities for broader participation. The most frequently addressed topic was hand surgery, comprising 36% of the top-cited articles. Other key areas included peripheral nerve repair, craniofacial surgery, and aesthetic procedures, reflecting both clinical need and local expertise [22].

The average citation count of the top 100 articles was 39.3, with a range from 19 to 283. While a few publications achieved high international impact—such as the study by Hu et al., which linked bacterial biofilm formation to breast implant–associated anaplastic large-cell lymphoma (BIA-ALCL) [23]—most articles received moderate citation attention. International collaboration was identified in only 22.8% of cases, predominantly with institutions in the United States and Canada. Greater emphasis on cross-border partnerships could improve research quality and visibility [24]. The methodological quality of most studies was low, with the majority being retrospective cohorts or case series, corresponding to Level IV evidence under OCEBM standards. Only 31% qualified as Level I evidence, highlighting the pressing need for prospective designs and randomized trials to strengthen clinical relevance [25, 26]. Reliance on Level IV evidence restricts causal inference and undermines the development of robust clinical guidelines. Moving forward, efforts should focus on multicenter prospective cohorts, pragmatic randomized trials when feasible, protocol registration, and standardized outcome reporting. Such approaches would elevate the evidence base and improve the translation of research findings into patient care.

A major concern was the lack of transparency in funding disclosures. Among the top-cited articles, 87% failed to report funding information, and only 5% acknowledged institutional support, typically from King Saud University. Transparent reporting is essential to minimize bias and maintain credibility, as emphasized in global research guidelines [27, 28]. The study by Hu et al. [23], which incorporated 16S rRNA sequencing to identify bacterial biofilm on implants, has significantly influenced international understanding and clinical guidelines surrounding BIA-ALCL [29, 30].

Despite encouraging progress, limitations persist. A high proportion of single-author articles, limited collaboration, and reliance on lower levels of evidence suggest the need for greater research integration and training [31]. Additional studies have also pointed to media influence, burnout among residents, and limited methodological training as factors affecting research output [32–36]. Addressing these issues through improved research education, funding transparency, and collaborative networks could significantly strengthen the field.

Looking forward, Saudi Arabia's plastic surgery research community should prioritize multicenter collaborations, high-quality study designs, and greater emphasis on ethical and funding transparency. These steps will help align national research practices with international standards and enhance the global impact of future studies. Given the very high proportion of articles without funding disclosures, journals and authors in the region should adopt a mandatory funding statement policy. This should include either a clear description of financial support and the funder's role, or a declaration of 'no funding.' Such standardization would improve transparency, reduce potential bias, and align Saudi plastic surgery research with international publishing norms.

In conclusion, this bibliometric analysis provides a comprehensive overview of plastic surgery research in Saudi Arabia from 1990 to 2025, highlighting a notable increase in publication output, institutional engagement, and thematic diversity. The field remains heavily influenced by a small number of prolific authors and institutions, with hand surgery emerging as the most studied domain. Despite evidence of international collaboration and some high-impact contributions, the overall methodological rigor remains limited, with a predominance of lower-level evidence studies. To advance the impact and quality of plastic surgery research in the Kingdom, future efforts should focus on fostering multi-institutional and international collaborations, increasing the adoption of prospective and higher-evidence study designs, and promoting transparency in funding and ethical reporting. These improvements will help position Saudi Arabia as a more prominent and credible contributor to the global plastic surgery literature.

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References

1. Liechty AE, Sherpa JR, Trejo JS, French MM, Kneib CJ, Cho DY, *et al.* Globalization of *Plastic and Reconstructive Surgery*: A Continent, Country, and State-Level Analysis of Publications. Plast Reconstr Surg Glob Open. 2020;8(11):e3202. Published 2020 Nov 25.
2. Donthu N, Kumar S, Mukherjee D, Pandey N, Lim WM. How to conduct a bibliometric analysis: An overview and guidelines. Journal of business research. 2021 Sep 1;133:285–96.
3. Bai L, Chen K. A Bibliometric Analysis of the Articles Published in the Aesthetic Plastic Surgery Journal (1976–2023). Aesthetic Plast Surg. 2025;49(6):1784–1796.
4. Ramakrishnan J, Sankar GR, Thavamani K. Literature of aesthetic plastic surgery: A bibliometric study. Asian Journal of Information Science and Technology. 2022 Apr 26;12(1):8–17.
5. Mahon NA, Joyce CW. A bibliometric analysis of the 50 most cited papers in cleft lip and palate. J plast surg Hand surg. 2015 Jan 2;49(1):52–8.
6. Rymer BC, Choa RM. A worldwide bibliometric analysis of published literature in plastic and reconstructive surgery. J Plast, Reconstr Aesthet Surg. 2015 Sep 1;68(9):1304–8.
7. Sinha Y, Iqbal FM, Spence JN, Richard B. A bibliometric analysis of the 100 most-cited articles in rhinoplasty. Plast Reconstr Surg Glob Open. 2016 Jul 1;4(7):e820.
8. Muslu Ü. The evolution of breast reduction publications: a bibliometric analysis. Aesthetic plast surg. 2018 Jun;42:679–91.
9. Alhithlool AW, Al Qurashi AA, Halawani IR, Alkhonizy SW, AlBattal NZ, Alkhwildi LA, *et al.* Top 50 highly cited publications in facelift surgery: a 50-year bibliometric analysis review. Aesthetic Plast Surg. 2024 Feb;48(3):312–23.
10. Almarghoub MA, Al-Qattan MM. Publications from Saudi Arabia in Plastic Surgery in the Recent Five Years. Plast Reconstr Surg Glob Open. 2019;7(9):e2404. Published 2019 Sep.
11. Latif R. Medical and biomedical research productivity from the Kingdom of Saudi Arabia (2008–2012). J Family Community Med. 2015;22(1):25–30. doi:10.4103/2230-8229.149583.
12. Montazeri A, Mohammadi S, M Hesari P, Ghaemi M, Riazi H, Sheikhi-Mobarakeh Z. Preliminary guideline for reporting bibliometric reviews of the biomedical literature (BIBLIO): a minimum requirements. Syst Rev. 2023;12(1):239. Published 2023 Dec 15. doi:10.1186/s13643-023-02410-2.
13. Falagas ME, Pitsouni EI, Malietzis GA, Pappas G. Comparison of PubMed, Scopus, Web of Science, and Google Scholar: strengths and weaknesses. FASEB J. 2008;22(2):338–342. doi:10.1096/fj.07-9492LSF.
14. Mongeon P, Paul-Hus A. The journal coverage of Web of Science and Scopus: a comparative analysis. Scientometrics. 2016 Jan;106:213–28.
15. Van Eck NJ, Waltman L. Software survey: VOSviewer, a computer program for bibliometric mapping. Scientometrics. 2010;84(2):523–538. doi:10.1007/s11192-009-0146-3.
16. Aria M, Cuccurullo C. bibliometrix: An R-tool for comprehensive science mapping analysis. J of informetrics. 2017 Nov 1;11(4):959–75.
17. Oxford Centre for Evidence-Based Medicine. Levels of Evidence (March 2009). Centre for Evidence-Based Medicine. Published March 2009. Accessed June 2, 2025. https://www.cebm.ox.ac.uk/resources/levels-of-evidence/oxford-centre-for-evidence-based-medicine-levels-of-evidence-march-2009.
18. Al-Asmari AK, Khan AQ, Al-Shahrani H, Al-Zahrani SA. Epidemiology of breast cancer in Saudi Arabia: A retrospective analysis. Saudi J Biol Sci. 2017;24(6):1254–1263. doi:10.1016/j.sjbs.2016.01.002.
19. Al-Qattan MM. Magnetic resonance imaging in the diagnosis of glomus tumours of the hand. J Hand Surg Br. 2005;30(5):535–540. doi:10.1016/j.jhsb.2005.05.013.
20. Al-Qattan MM. A modified technique for harvesting the reverse sural artery flap from the upper part of the leg: Inclusion of a gastrocnemius muscle cuff around the sural pedicle. Ann Plast Surg. 2001;47(3):269–274. doi:10.1097/00000637-200109000-00009.
21. Alharbi Z, Othman A, Alhazmi A. Conventional vs. micro-fat harvesting: How fat harvesting technique affects tissue-engineering approaches using adipose tissue-derived stem/stromal cells. J Plast Reconstr Aesthet Surg. 2013;66(9):1271–1278. doi:10.1016/j.bjps.2013.04.034.
22. Al-Qattan MM. Giant cell tumours of tendon sheath: Classification and recurrence rate. J Hand Surg Br. 2001;26(1):72–75. doi:10.1054/jhsb.2000.0457.
23. Hu H, Johani K, Almatroudi A, Vickery K, Natta BV, Kadin ME, *et al.* Bacterial biofilm infection detected in breast implant–associated anaplastic large-cell lymphoma. Plast Reconstr Surg. 2016;137(6):1659–1669. doi:10.1097/PRS.0000000000002117.
24. Walker JN, Hanson BM, Pinkner CL, Simar SR, Pinkner JS, Parikh R, *et al.* Insights into the microbiome of breast implants and periprosthetic tissue in breast implant–associated anaplastic large cell lymphoma. Sci Rep. 2019;9:10393. doi:10.1038/s41598-019-46656-5.
25. Tashkandi T. The surgical management of high-grade gynecomastia. Ann Plast Surg. 2004;53(1):17–20. doi:10.1097/01.sap.0000122882.71049.d6.
26. Alasseri NA, Alasraj A, Alsaif H, Almarghoub MA, *et al.* Patient-specific implants for maxillofacial defects: Challenges and solutions. Maxillofac Plast Reconstr Surg. 2020;42(1):7. doi:10.1186/s40902-020-00254-w.
27. Deva AK, Adams WP Jr, Vickery K. The role of bacterial biofilms in device-associated infection. Plast Reconstr Surg. 2013;132(5):1319–1328. doi:10.1097/PRS.0b013e3182a3a4b5.
28. U.S. Food and Drug Administration. FDA requests recall of Allergan textured breast implants and tissue expanders. Published July 24, 2019. Accessed June 2, 2025. https://www.fda.gov/news-events/press-announcements/fda-requests-recall-allergan-textured-breast-implants-and-tissue-expanders.
29. Tevis SE, Hunt KK, Miranda RN, Lange C, Butler CE, Clemens MW. Differences in human leukocyte antigen expression

between breast implant–associated anaplastic large cell lymphoma patients and the general population. Aesthet Surg J. 2019;39(10):1065–1070. doi:10.1093/asj/sjz113.
30. Mempin M, Hu H, Vickery K, Kadon ME, Prince HM, Kouttab N, *et al.* Gram-negative bacterial lipopolysaccharide promotes tumor cell proliferation in breast implant–associated anaplastic large-cell lymphoma. Cancers (Basel). 2021;13(20):5298. doi:10.3390/cancers13205298.
31. Mortada H, Alqahtani YA, Seraj HZ, Albishi WK, Aljaaly HA. Perception of plastic surgery and the role of media among medical students: Cross-sectional study. Interact J Med Res. 2019;8(2):e12999. doi:10.2196/12999.
32. Almarghoub MA, Al-Qattan MM. Publications from Saudi Arabia in Plastic Surgery in the Recent Five Years. Plast Reconstr Surg Glob Open. 2019;7(9):e2404. doi:10.1097/GOX.0000000000002404.
33. Arab A, Barasain O, Alkhayyal J, Alshiha L, Barasain R, Alessa R, *et al.* Influence of social media on the decision to undergo a cosmetic procedure. Plast Reconstr Surg Glob Open. 2019;7(8):e2309. doi:10.1097/GOX.0000000000002309.
34. Alotaibi AS. Demographic and cultural differences in the acceptance and pursuit of cosmetic surgery: A systematic literature review. Plast Reconstr Surg Glob Open. 2021;9(3):e3471. doi:10.1097/GOX.0000000000003471.
35. Obeid A, Clarke HM, Curtis CG. The prognostic value of concurrent phrenic nerve palsy in newborn children with Erb's palsy. J Hand Surg Br. 1998 Apr;23(2):225. DOI:10.1016/s0266-7681(98)80179-4.
36. Aldrees TM, Hassouneh B, Alabdulkarim A, Asad L, Alqaryan S, Aljohani E, *et al.* Burnout among plastic surgery residents: National survey in Saudi Arabia. Saudi Med J. 2017;38(8):832–836. doi:10.15537/smj.2017.8.20324.