

INPLASY

INPLASY202690098

doi: 10.37766/inplasy2026.9.0098

Received: 22 September 2026

Published: 23 September 2026

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Artificial Intelligence in Plastic and Reconstructive Surgery: Expanding the Frontiers of Practice or Just a Passing Trend? A Scoping Review

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ADMINISTRATIVE INFORMATION

Support - No support.**Review Stage at time of this submission** - Completed but not published.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY202690098**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 23 September 2026 and was last updated on 23 September 2026.

INTRODUCTION

Review question / Objective To systematically map and synthesise the emerging literature on artificial intelligence across plastic, reconstructive and aesthetic surgery.

To describe the clinical domains in which AI has been applied and the rigour with which it has been evaluated.

To trace publication trends from September 2016 to September 2026, with attention to the inflection that followed generative AI; and to identify significant gaps in the existing literature that should inform future empirical research, institutional policy and ethical governance relating to AI-assisted surgical practice and AI-assisted academic work.

Rationale Distinguishing genuine clinical progress from a rapid expansion in publication volume requires mapping the field as a whole — including what kinds of studies are being published, how

rigorously AI systems have been evaluated, and how the mix of study types has shifted since generative AI became available.

No existing review has mapped artificial intelligence across the full range of subspecialties within plastic, reconstructive and aesthetic surgery using a two-search design capable of capturing both the trend/bibliometric literature and the primary clinical evaluation literature.

Condition being studied This scoping review is not restricted to a single disease or condition. It maps artificial intelligence applications across the full range of conditions and procedures treated within plastic, reconstructive and aesthetic surgery — breast cancer reconstruction and lymphoedema, craniofacial and hand trauma or congenital anomalies, burn injury, microsurgical free-tissue transfer, and elective aesthetic procedures — wherever an AI, machine-learning, deep-learning or large-language-model application has been reported, evaluated or substantively discussed.

METHODS

Search strategy Two complementary database searches were run on 14 September 2026, covering the period from September 2016 to September 2026.

Search 1 applied a three-block Boolean (Alterms AND plastic-surgery terms AND trend terms) to Scopus, PubMed/MEDLINE, Web of Science, IEEE Xplore and the Cochrane Library, searched in title, abstract and keywords; it returned 3,408 records.

Search 2 retrieved original research with an AI term in the title from sixteen plastic-surgery and allied technical journals in PubMed (Plastic and Reconstructive Surgery and Global Open; Journal of Plastic, Reconstructive & Aesthetic Surgery; Aesthetic Plastic Surgery; Aesthetic Surgery Journal; Annals of Plastic Surgery; Journal of Craniofacial Surgery; Microsurgery; Journal of Reconstructive Microsurgery; Journal of Hand Surgery; Burns; Journal of Cranio-Maxillofacial Surgery; Facial Plastic Surgery; Heliyon; Applied System Innovation; and Medicina), with reviews, letters, comments and editorials excluded by publication type; it returned 421 records.

The two searches together identified 3,829 records.

Participant or population This review does not enrol patients directly. As this is a literature-mapping review rather than a review of patient-level data, the eligibility criterion functioning as 'population' is defined at the level of the publication concerning plastic, reconstructive, or aesthetic surgery, or any of its subspecialties (breast reconstruction and lymphedema, craniofacial and hand surgery, burn care, microsurgery, aesthetic surgery, surgical education and administration), in which an artificial intelligence application was reported, evaluated, or substantively discussed.

Intervention This scoping review does not evaluate a single clinical intervention. The "intervention" mapped across the included studies is a class of technologies — artificial intelligence systems, including machine-learning classifiers, deep-learning/computer-vision models and large language models (LLMs) — applied to tasks across plastic, reconstructive and aesthetic surgery, such as flap-perfusion monitoring, burn-depth assessment, craniomaxillofacial image segmentation, aesthetic outcome scoring, preoperative planning, and patient-facing chatbots. No single AI intervention was assessed against a comparator; the review maps the full range of AI applications reported in the literature, regardless of the specific technique used.

Comparator As this is a literature-mapping review rather than a comparative-effectiveness study, no single comparator is specified for the review as a whole.

Where an individual included study reports a comparator, it is charted at the level of that study—for example, an AI system evaluated against clinician judgement, a defined clinical or radiological reference standard, or an earlier non-AI method—rather than being treated as a fixed comparator applied uniformly across the review.

Study designs to be included All designs were eligible: algorithm development/validation (image-based AI), prediction-model studies, LLM/chatbot evaluations, reviews, bibliometric/landscape analyses, surveys, and other original research. No design was excluded a priori. For Search 2 only, the study also had to quantitatively evaluate an AI system against a defined reference standard. Case reports without a comparator, abstracts with no full text, and non-research types (books, errata, correspondence) were excluded.

Eligibility criteria Beyond the population, intervention, comparator and study-design criteria specified above, studies were required to have a retrievable title and abstract and to be published in English between September 2016 and September 2026.

Studies were additionally excluded, even where they matched the search terms, if they concerned facial-recognition or biometric-security applications rather than surgical practice; were veterinary or bench/preclinical science rather than clinical or human-subject work; or matched an artificial-intelligence search term coincidentally rather than substantively (for example, records about wildfire or combustion retrieved on the word "burn").

For Search 2 only, one further criterion applied: the study had to develop, validate or quantitatively evaluate an AI system on a clinical or surgical task against a defined reference standard.

Information sources Two complementary database searches were run on 14 September 2026, covering the ten-year window from September 2016 to September 2026.

Search 1 queried five databases — Scopus, PubMed/MEDLINE, Web of Science, IEEE Xplore and the Cochrane Library — searching title, abstract and keyword fields with a three-block Boolean combination of artificial-intelligence terms, plastic-surgery terms and trend-related terms. IEEE Xplore was included because a substantial share of the engineering literature on surgical AI is indexed there rather than in

biomedical databases. Search 1 returned 3,408 records: Scopus 1,120; PubMed/MEDLINE 606; Cochrane Library 323; IEEE Xplore 925; Web of Science 434.

Search 2 queried PubMed/MEDLINE only, searching the article title for an artificial-intelligence term, restricted to original research published in sixteen plastic-surgery and allied technical journals: Plastic and Reconstructive Surgery and Global Open; Journal of Plastic, Reconstructive & Aesthetic Surgery; Aesthetic Plastic Surgery; Aesthetic Surgery Journal; Annals of Plastic Surgery; Journal of Craniofacial Surgery; Microsurgery; Journal of Reconstructive Microsurgery; Journal of Hand Surgery; Burns; Journal of Cranio-Maxillofacial Surgery; Facial Plastic Surgery; Heliyon; Applied System Innovation; and Medicina. Reviews, letters, comments, and editorials were excluded by publication type. Search 2 returned 421 records.

Together, the two searches identified 3,829 records.

No grey literature, clinical-trial registries, or manual hand-searching of reference lists were used as additional information sources: the two searches were designed to be complementary rather than exhaustive across every possible source, since Search 1's trend-oriented Boolean and Search 2's journal-restricted, title-based design retrieve two largely non-overlapping segments of the literature.

Main outcome(s) This scoping review does not test a single, pre-specified outcome; outcomes were charted per study, as reported by that study's own authors.

The headline metric charted depended on study design: for image-based algorithm-development or diagnostic-support studies, most often a discrimination or agreement metric — accuracy, sensitivity, specificity, area under the receiver-operating-characteristic curve (AUC), or a segmentation-overlap measure such as the Dice coefficient; for prediction-model studies, discrimination (AUC, concordance index) and, where reported, calibration; for large-language-model or chatbot-evaluation studies, a quality or correctness score against expert or reference-standard judgement; for narrative, bibliometric or survey studies, no single quantitative outcome was extracted, and these were summarised descriptively instead.

Across all designs, this review offers a descriptive rather than a meta-analytic synthesis, mapping how AI systems were evaluated, on what task, against what reference standard, and with what reported performance, organised by domain.

Additional outcome(s) Beyond each study's own headline performance metric, this review charted a set of review-level outcomes rather than a second clinical endpoint per study: the number of included studies per calendar year (2016–2026); the shift in method composition—generative AI/large-language-model, deep-learning and classical machine-learning approaches—before and after the public release of conversational LLMs in November 2022, computed on the de-duplicated Search 1 date; the distribution of included studies across ten mutually exclusive clinical/technical domains; the distribution of studies by field of publication venue (plastic-surgery journals, computer-science/engineering journals, general medicine, and others) and by study design; and, where individual studies reported them, secondary study-level outcomes such as inter-rater or inter-method agreement, processing time, clinician or patient satisfaction, and cost or workflow-efficiency measures. Methodological quality was charted descriptively (MMAT, JBI critical-appraisal criteria, and CLAIM/STARD-AI reporting-completeness checks for image-based algorithm studies) but was not used as an inclusion filter.

Data management For each study we charted first author, year, journal, field of publication venue, identifiers, study design, AI method class, application domain and headline performance where reported. Data were recorded in a structured spreadsheet, provided in full as Supplementary Table S1 (247 rows, one per included study).

Quality assessment / Risk of bias analysis

Methodological characterisation was tiered: the Mixed Methods Appraisal Tool (MMAT) was applied to primary studies, JBI critical-appraisal criteria to evidence syntheses, and, for image-based algorithm studies, the Checklist for Artificial Intelligence in Medical Imaging (CLAIM) and STARD-AI were used descriptively as reporting-completeness references rather than as exclusion criteria.

Strategy of data synthesis Synthesis is narrative by domain, supported by counts. Each study was placed in one of ten mutually exclusive domains (aesthetic and facial analysis; preoperative planning; breast reconstruction and lymphoedema; burn and wound care; postoperative monitoring; generative AI and large language models; hand and peripheral nerve surgery; ethics and workforce; microsurgery and robotics; education and administration).

Two views of publication trends over time are reported: included studies per year and, on the de-duplicated Search 1 dataset, the shift in method

composition (generative AI/LLM, deep learning, and classical machine learning) before and after the public release of conversational LLMs in November 2022.

Subgroup analysis The review's a priori subgroup analysis is temporal: studies were split into two periods, September 2016–November 2022 and December 2022–September 2026, at the public release of conversational large language models, to test whether the mix of AI methods and the volume of publications changed after generative AI became widely available. This comparison was computed on the de-duplicated Search 1 dataset (2,557 records with an assignable year), because that dataset applied uniform retrieval across five databases and is large enough to be stable; the same period split is also applied descriptively to the 247 included studies, reported as counts per year.

Two further subgroups are reported descriptively rather than pooled statistically, given the narrative nature of the synthesis: by clinical/technical domain (ten mutually exclusive domains, from aesthetic and facial analysis to education and administration) and by study design (algorithm development/validation, prediction-model development/validation, LLM/chatbot evaluation, review, bibliometric/landscape analysis, survey/qualitative, and other original research). No effect-size pooling or meta-analytic subgroup testing was planned, since a scoping review maps the shape and extent of a literature rather than a pooled treatment effect; subgroup comparisons here are descriptive counts and proportions, not statistical tests.

Sensitivity analysis No formal sensitivity analysis was conducted, and none was appropriate given the design of this review.

A sensitivity analysis checks whether a summary result survives when specific studies, exclusion criteria, or quality thresholds are varied.

This scoping review does not generate such a summary result, but a narrative, descriptive map of the literature (counts of studies by domain, design, publication venue and year), so there is no summary statistic whose robustness needs re-testing.

Several methodological choices that could, in principle, be varied were instead made explicit and reported in the manuscript, so readers can judge their influence directly: (1) methodological quality (MMAT, JBI, CLAIM, STARD-AI) was charted descriptively rather than applied as an inclusion filter, so results are not sensitive to a quality cut-off that does not exist; (2) the temporal boundary used for the subgroup comparison (November 2022, the

public release of conversational large language models) is a fixed historical event rather than a data-driven cut-point, so it was not varied; (3) the two-search design was deliberately kept non-overlapping by construction, and the number of included studies contributed by each search (Search 1: 88; Search 2: 159) is reported, so a reader can judge how much the findings depend on either search alone.

Language restriction English-language publications only.

Country(ies) involved Romania.

Other relevant information This protocol was registered retrospectively, after data collection and analysis had substantially progressed. No amendments to the eligibility criteria or search strategy were made after the searches were run on 14 September 2026.

The search strategy retrieves two largely non-overlapping segments of the literature by design — a trend-orientated Boolean search across five databases and a journal-restricted, title-based search in PubMed — rather than a single exhaustive search of one database set; this trade-off is discussed in the manuscript's Methods and Limitations sections.

No meta-analysis was planned or performed, consistent with the scoping (mapping) rather than effect-estimating aim of the review.

The review received no external funding.

The authors declare no conflicts of interest.

This review synthesised published literature only; it involved no human participants, animals or identifiable data and required neither ethics approval nor consent.

The review's only planned subgroup comparison is temporal — studies published before versus after the November 2022 release of conversational large language models (2016–2022 vs 2023–2026); as the synthesis is narrative rather than quantitative, no sensitivity analysis was applicable.

Keywords artificial intelligence; machine learning; deep learning; large language models; plastic surgery; reconstructive surgery; scoping review; publication trends; flap monitoring; burn.

Dissemination plans Results will be disseminated through publication in a peer-reviewed journal (Medicina, MDPI), presented as a PRISMA-ScR flow diagram, a narrative synthesis organised by domain, summary tables and figures, and a full data-charting table (Supplementary Table S1) made available with the published article.

Contributions of each author

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