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Revisiting Level of Evidence Ratings in Plastic Surgery: A Call to Action

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Abstract

Background: Evidence-based medicine underpins medical and surgical practice, with level of evidence (LOE) being a key aspect that allows clinicians and researchers to better discriminate the methodological context by which studies are conducted and appropriately interpret their conclusions, and more specifically the strength of their recommendations.

Objectives: The aim of this study was to reassess the LOE of articles published in plastic surgery journals.

Methods: To assess the overall LOE of publications from January 1 to December 31, 2021, a review of the following plastic surgery journals was performed: *Aesthetic Surgery Journal* (ASJ), *Annals of Plastic Surgery* (Annals), *Journal of Plastic Reconstructive and Aesthetic Surgery* (JRPAS), *Plastic and Reconstructive Surgery* (PRS), and *Plastic and Reconstructive Surgery Global Open* (PRS GO).

Results: Of 3698 PUBMED articles, 1649 original articles and systematic reviews were analyzed. The average LOE for each journal was: ASJ 3.02 ± 0.94, Annals 3.49 ± 0.62, JPRAS 3.33 ± 0.77, PRS 2.91 ± 0.77, and PRS GO 3.45 ± 0.70. The collective average LOE was 3.28 ± 0.78. Only 4.4% were LOE 1 and 7.3% were LOE 2. Compared to past studies, PRS showed a significant LOE improvement ($P = .0254$), while ASJ and JPRAS saw nonsignificant changes; Annals experienced a significant decrease ($P = .0092$).

Conclusions: ASJ and PRS showed the highest LOE among the journals analyzed. Despite this, low LOE studies remain prevalent in plastic surgery. This paper serves as a call to action for both researchers and academic journals to elevate the standard, offering several strategies to help improve the LOE in plastic surgery.

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Evidence-based medicine (EBM) is the systematic and judicious use of peer-reviewed evidence to guide clinical decision-making.[1-3] As with other disciplines, the field of plastic and reconstructive surgery has seen an increased emphasis on the importance of implementing EBM to guide clinical practice at most institutions, as well as in its curriculum.[4] Although several systems have been proposed over the years to classify studies by describing their levels of evidence (LOE), which are specifically based on their methodology, consensus holds that the Oxford Center for Evidence-Based Medicine (OCEBM) is

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Table 1. Description of Different Types of Studies and Their Levels of Evidence

Level of evidence	Description
1	Randomized controlled trials Systematic reviews and/or meta-analyses of randomized controlled trials
2	Prospective cohort studies Reviews of prospective cohort studies
3	Retrospective cohort studies Case-control studies Cross-sectional comparative studies Reviews of these types of studies
4	Case series Case reports Reviews of case series/reports
5[a]	Animal studies Nonclinical studies Expert opinions Letters to the editor Surgical techniques/editorials COVID-related papers Reviews that are not systematic reviews (eg, narrative, literature, scoping reviews, etc.)

[a]These papers were excluded from our analysis.

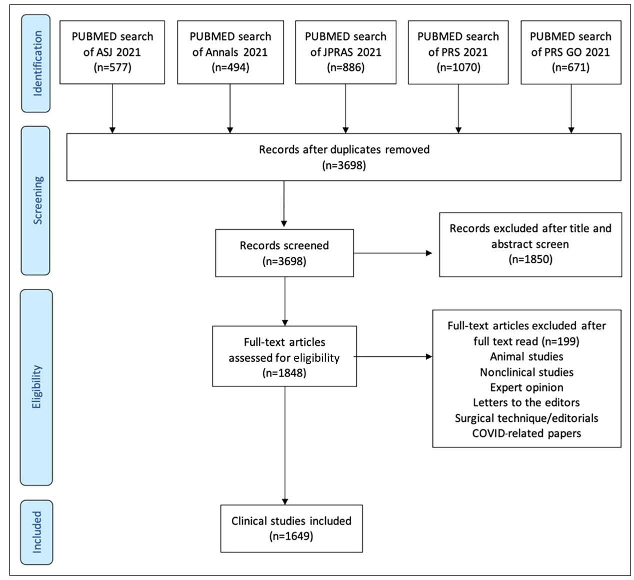

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram for screening and study inclusion. Annals, *Annals of Plastic Surgery*; ASJ, *Aesthetic Surgery Journal*; JRPAS, *Journal of Plastic Reconstructive and Aesthetic Surgery*; PRS, *Plastic and Reconstructive Surgery*; PRS GO, *Plastic and Reconstructive Surgery Global Open*.

the authority on EBM, with their latest guideline revisions coming in 2011.[5]

The field of plastic and reconstructive surgery is unique in its constant pursuit of innovation, making dedication to EBM of utmost importance in ensuring superior patient care. By encouraging higher standards in research and basing clinical decision-making on studies of higher LOE, the field will continue to extend the frontiers of knowledge and innovation.

The purpose of the present study was to determine the current LOE within the field of plastic surgery and to identify any temporal changes by comparing current studies to those published in the past years. The specific objectives of this study were to measure the LOE of publications in 5 major plastic surgery journals and compare their LOE with previous years.

METHODS

The PUBMED database (National Institutes of Health, Bethesda, MD) was electronically searched in August 2022 to retrieve all articles published in the following journals: *Aesthetic Surgery Journal* (ASJ), *Annals of Plastic Surgery* (Annals), *Journal of Plastic Reconstructive and Aesthetic Surgery* (JRPAS), *Plastic and Reconstructive Surgery* (PRS), and *Plastic and Reconstructive Surgery Global Open* (PRS GO). Two authors (J.C. and H.E.) independently reviewed all articles. Results were compared and disagreements were resolved through arbitration by the same authors. Systematic reviews that included papers with varying levels of evidence were categorized by the study of lowest level of evidence included. Nonclinical studies such as animal models, laboratory experiments, surgical techniques, editorials, letters to the editor, other types of reviews (ie, scoping reviews, narrative reviews, etc.), abstracts, or miscellaneous articles were excluded from the study. Articles related to COVID-19 were also excluded to make any comparison between the current data and previously published data more reliable.

Each paper included was classified based on the study's methodology in 1 of the following categories: (1) randomized controlled trials (RCTs), (2) systematic review or meta-analysis of RCTs, (3) prospective cohort studies, (4) retrospective cohort studies, (5) case-control studies, (6) cross-sectional studies, (7) case series, (8) case reports, (9) systematic reviews of non-RCTs. A modification of the OCEBM levels of evidence (Oxford level of evidence scale), as in previous similar studies, was utilized to determine the level of evidence of the included studies (Table 1). Moreover, each study's topic was classified as 1 of the following plastic surgery topics (subspeciality domains): breast reconstruction, craniofacial, cosmetics, experimental, general reconstruction, hand, pediatric (non-craniofacial), peripheral nerve, special topic/other.

Statistical Analysis

The weighted mean level of evidence of each journal was calculated by dividing the cumulative LOE scores for each

Table 2. Summary of Study Domains for ASJ, Annals, JPRAS, PRS, and PRS GO

	n (%)					
Domain of study	ASJ	Annals	JPRAS	PRS	PRS GO	Total
Breast reconstruction	44 (21.0)	66 (20.8)	110 (25.6)	62 (21.2)	81 (20.2)	363 (22.0)
Cosmetic	100 (47.6)	17 (5.4)	50 (11.7)	29 (9.9)	57 (14.2)	253 (15.3)
Craniofacial	31 (14.8)	73 (23.0)	66 (15.4)	61 (20.9)	56 (14.0)	287 (17.4)
Experimental	4 (1.9)	2 (0.6)	1 (0.2)	5 (1.7)	6 (1.5)	18 (1.1)
General reconstruction	6 (2.9)	83 (26.2)	116 (27.0)	39 (13.4)	94 (23.4)	338 (20.5)
Hand	0 (0.0)	19 (6.0)	19 (4.4)	14 (4.8)	23 (5.7)	75 (4.5)
Other	17 (8.1)	11 (3.5)	32 (7.5)	23 (7.9)	24 (6.0)	107 (6.5)
Pediatric (non-craniofacial)	0 (0.0)	9 (2.8)	5 (1.2)	12 (4.1)	9 (2.2)	35 (2.1)
Peripheral nerve	0 (0.0)	11 (3.5)	15 (3.5)	14 (4.8)	18 (4.5)	58 (3.5)
Special (education or financial)	8 (3.8)	26 (8.2)	15 (3.5)	33 (11.3)	33 (8.2)	115 (7.0)
Total	210	317	429	292	401	1649

Annals, *Annals of Plastic Surgery*; ASJ, *Aesthetic Surgery Journal*; JRPAS, *Journal of Plastic Reconstructive and Aesthetic Surgery*; PRS, *Plastic and Reconstructive Surgery*; PRS GO, *Plastic and Reconstructive Surgery Global Open*.

journal by the number of articles included. Standard deviations were calculated for each journal and presented with each weighted mean. Furthermore, one-way analysis of variance (ANOVA) and Kruskal-Wallis were performed to assess for significant differences in LOE between the 5 journals assessed, with the latter analysis accounting for the non-normal distribution of data. Tukey honestly significant difference (HSD) and Dunn's post hoc pairwise comparisons were also included as parametric and nonparametric analyses, respectively (Supplemental Table 1, available online at www.aestheticsurgeryjournal.com). The *t* test and Mann-Whitney-Wilcoxon were applied for longitudinal comparisons of the LOE between 2007 and 2021 for applicable journals. All statistical analyses were performed with SPSS 25.0 (IBM, Armonk, NY) and R Studio 4.2.2 (R Core Team, Vienna, Austria). A predetermined P value of <.05 was considered statistically significant.

RESULTS

The initial search on PUBMED identified 3698 articles (ASJ: 577, Annals: 494, JPRAS: 886, PRS: 1070, and PRS GO: 671). After title and abstract screening, 1850 articles were excluded. A total of 1848 articles (ASJ: 240, Annals: 332, JPRAS: 507, PRS: 327, and PRS GO: 442) underwent full text analysis, of which 199 did not meet the inclusion criteria. The final analysis was performed on 1649 clinical studies (ASJ: 210, Annals: 317, JPRAS: 429, PRS: 292, and PRS GO: 401) (Figure 1). The most common topic published was breast reconstruction ($n = 363/1649$; 22.0%) followed by general reconstruction ($n = 338/1649$; 20.5%), craniofacial surgery ($n = 287/1649$; 17.4%), and cosmetic surgery ($n = 253/1649$; 15.3%) (Table 2).

Across all 5 journals, the most common type of study design was case series ($n = 595$; 36.1%) followed by retrospective cohort ($n = 448$; 27.2%) and cross-sectional analysis ($n = 227$; 13.8%). Moreover, there were a total of 120 prospective cohort studies (7.3%); 66 RCTs (4.0%); 61 case control studies (3.7%); and 6 systematic reviews of RCTs (0.4%) (Table 3). The majority of included studies were either level 3 evidence (44.6%) or level 4 evidence (43.7%). Level 2 evidence comprised 7.3% of all included publications, and only 4.4% of all studies were level 1 evidence. The average LOE across all 5 journals was 3.28 ± 0.78 (Table 4).

A 1-way analysis of variance (ANOVA) demonstrated significant differences in average LOE across the 5 journals (ASJ 3.02 ± 0.94, PRS 2.91 ± 0.77, JPRAS 3.33 ± 0.77, PRS GO 3.45 ± 0.70, Annals 3.49 ± 0.62, $F = 35.5$, $P < .0001$). Post hoc Tukey HSD tests showed ASJ and PRS having a higher LOE than JPRAS ($P < .0001$), PRS GO ($P < .0001$), and Annals ($P < .0001$). There was no significant difference between ASJ and PRS ($P = .4883$). JPRAS was found to have a higher LOE than Annals ($P = .0238$) but not PRS GO ($P = .1150$). There was no statistical difference in the LOE between PRS GO and Annals ($P = .9511$) (see Appendix, available at www.aestheticsurgeryjournal.com).

The LOE of the journals investigated was also compared longitudinally (Table 4). Pairwise analysis in the overall LOE across PRS, JPRAS, ASJ, and Annals between 2007 and

Table 3. Distribution of Different Types of Study and Their Level of Evidence Across ASJ, Annals, JPRAS, PRS and PRS GO

Type of study	LOE	ASJ	Annals	JPRAS	PRS	PRS GO	Total (%)
RCT	1	20	5	18	16	7	67 (4.1)
SR of RCT	1	2	0	0	2	2	6 (0.4)
Cohort—Prospective	2	24	6	25	45	20	122 (7.4)
Case Control	3	3	15	20	7	16	64 (3.9)
Cohort—Retrospective	3	40	87	120	133	68	451 (27.3)
Cross-sectional	3	48	32	45	33	69	230 (13.9)
Case Report	4	2	18	5	2	99	130 (7.9)
Case Series	4	71	154	196	54	120	603 (36.6)
Total		210	317	429	292	401	1649

Table 4. Pairwise Comparison of Journal LOE in 2007 and 2021 With *t* Test and Mann-Whitney-Wilcoxon

	Average LOE		*P*	
Journal	2007	2021	*t* test	Mann-Whitney-Wilcoxon
ASJ	3.11 ± 0.85	3.02 ± 0.94	.5794	.7644
Annals	3.31 ± 0.78	3.49 ± 0.62	.0092	.03084
JPRAS	3.35 ± 0.88	3.33 ± 0.77	.7195	.2022
PRS	3.05 ± 0.69	2.91 ± 0.77	.0254	.04976
PRS GO	NA	3.45 ± 0.70	NA	NA
Total	NA	3.28 ± 0.78	NA	NA
Total without PRS GO	3.19 ± 0.78	3.22 ± 0.80	.4646	.2747
Total without Annals or PRS GO	3.16 ± 0.78	3.13 ± 0.83	.538	.9328

Annals, *Annals of Plastic Surgery*; ASJ, *Aesthetic Surgery Journal*; JRPAS, *Journal of Plastic Reconstructive and Aesthetic Surgery*; LOE, level of evidence; PRS, *Plastic and Reconstructive Surgery*; PRS GO, *Plastic and Reconstructive Surgery Global Open.*

2021 did not show a statistically significant improvement (3.19 ± 0.78 vs 3.22 ± 0.80, $P = .4646$). PRS GO was excluded from this analysis as no data were available from 2007, given that it was founded in 2013.[6] Of note, only PRS, JPRAS, and ASJ were in the top 5 journals according to H-index score, however there was also no statistically relevant improvement in LOE from 2007 to 2021 for this subgroup (3.16 ± 0.78 vs 3.13 ± 0.83, $P = .538$). Individually, PRS demonstrated a statistically significant improvement in the LOE (3.05 ± 0.69 vs 2.91 ± 0.77, $P < .0254$). ASJ (3.11 ± 0.85 vs 3.02 ± 0.94, $P = .5794$) and JPRAS (3.35 ± 0.88 vs 3.33 ± 0.77, $P = .7195$) also demonstrated improvements but they were not statistically significant, while Annals was found to have a significant decline in LOE between 2007 and 2021 (3.31 ± 0.78 vs 3.49 ± 0.62, $P = .0092$) (Figure 2).

DISCUSSION

The evolution of EBM in the field of plastic surgery is pivotal for enhancing patient outcomes and refining surgical techniques. Our analysis underscores a concerning observation: the level of evidence (LOE) in major plastic surgery journals has not seen a significant improvement over the years.

The current updated analysis shows that the average LOE in 2021 was 3.28 ± 0.78. Most studies included in the present analysis were level 3 or 4 evidence, while only a small fraction of the studies were level 1 or 2. PRS and ASJ were found to have the highest levels of evidence, over JPRAS, PRS GO, and Annals. Breast reconstruction was the most common domain of study across all 5 journals, however cosmetic surgery was by far the most common in ASJ.

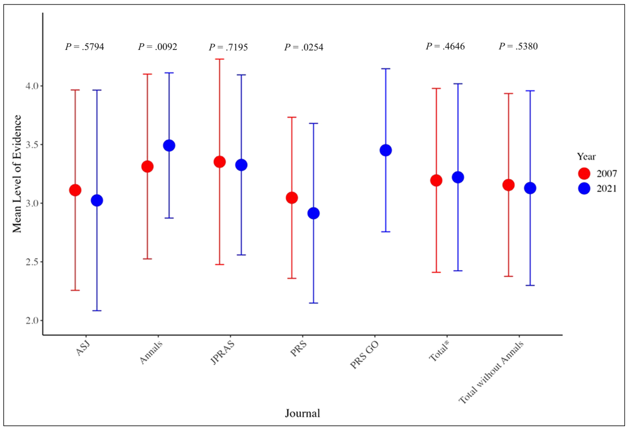

Figure 2. Comparison of average LOE in plastic surgery journals between 2007 and 2021. Red represents the year 2007 and blue represents the year 2021, the dots represent the mean LOE, and the tails represent standard deviation. Annals, *Annals of Plastic Surgery*; ASJ, *Aesthetic Surgery Journal*; JRPAS, *Journal of Plastic Reconstructive and Aesthetic Surgery*; PRS, *Plastic and Reconstructive Surgery*; PRS GO, *Plastic and Reconstructive Surgery Global Open*. *Includes ASJ, Annals of PS, JPRAS, PRS, and PRS GO.

A previous study by Sinno et al conducted a similar analysis of the major plastic surgery journals in 2007, consisting of PRS, ASJ, JPRAS and Annals.[6] There was no significant change in the overall LOE across the 4 journals between 2007 and 2021. A subgroup analysis of the 3 major journals (PRS, ASJ, and JPRAS) only, as defined by an H-index in the top 5 among plastic surgery journals, also showed no significant change in LOE among these journals between 2007 and 2021.

The predominance of lower LOE studies and its stagnancy over the years highlights an interesting phenomenon of the research domain in plastic surgery that needs to be further investigated. Higher LOE often provides stronger evidence to guide clinical decision-making and provide grounds for clinical guidelines.

Despite the value and benefits of using LOE to move in a direction of evidence-based medicine, it is not without its stipulations, especially as it pertains to its interpretation. It is exceedingly important to emphasize that LOE does not equate to quality or impact of research. For example, an RCT with poorly defined and/or executed methodology would be regarded as having a higher LOE than a well-designed retrospective cohort study. A recent study showed that many RCTs in plastic surgery, while having statistically significant results, suffer from a low fragility index.[7] Moreover, it is important to reiterate the value of case series and other study types with low LOEs. As Momeni et al note, there are many examples, such as the advent of microsurgery, techniques for limb transplantation, the introduction of craniofacial distraction osteogenesis, and the inception of vacuum-assisted wound closure, that were initially introduced through publication of low LOE studies.[8] Ormseth et al further emphasize the foundational role case reports can have by pointing out that innovations such as the DIEP flap, stemming from the seminal works of Koshima and Soeda, as well as by Allen and Treece, have now become the gold standard of autologous breast reconstruction.[9-11] McCarthy et al's landmark case report that delineated the potential of distraction osteogenesis for mandible lengthening has since been canonized as a cornerstone reference, profoundly influencing the trajectory of craniofacial reconstructive surgery as we know it today.[12] Although studies of lower LOE are cited less frequently overall, these studies demonstrate that lower LOE does not necessarily diminish the potential impact of the study, and they are often the first step to developing a hypothesis that prospective cohort studies and RCTs are based upon.[8,9,13] It is worth noting that the large proportion of lower LOE studies may suggest that the field has yet to identify the most important questions or how best to answer them, making it especially difficult to get adequate funding. Furthermore, the rarity of many conditions and the inherent creative and innovative nature of plastic and reconstructive surgery, which depend largely on patient-dependent protocols, make it difficult to design RCTs and prospective cohort studies, which require standardized treatment protocols.[6] Nonetheless, LOE is a useful metric that, at the very least, encourages awareness of evidence-based medicine.

Improving LOE can be achieved through several approaches, most of which are related to 1 of 2 factors—authors submitting studies with higher LOEs, and journals accepting works of higher LOEs. A study by Blum et al found an association between LOE and advanced academic degrees. The authors postulate that dedicated training in academia, ample resources, and collegial support is conducive to improving LOE.[14] With the growing inclusion of evidence-based medicine in medical curricula and emphasis being placed on quality over quantity by academic institutions, researchers should become increasingly aware of what constitutes meaningful research. From a practical standpoint, focusing efforts on prospective studies that utilize voluntary patient enrollment, designation of control groups with blinding and randomization where possible, predefined outcomes and follow-up intervals, all while upholding standards of ethical review boards, will see an increase in the number of levels 1 and 2 studies, with a simultaneous decrease in studies of lower LOEs.[6] From the perspective of the journals, we believe it is important to emphasize the importance of higher quality research. Given the increased volume of research being produced and the limited capacity of print publications, journals are certain to be more selective in the works they accept going forward. A study by Leal at al found that publications of higher LOE (systematic reviews and RCTs) were more than twice as likely than publications of lower LOE (cohort studies, case control studies, case series, and case reports) to be cited at least 10 times in the first 2 years after being published.[4] Higher LOE studies typically require more time and, in particular, financial resources—a known scarcity in the field. Despite this, Asserson and Janis found that the majority of the most-cited articles across plastic surgery journals had no funding.[15]

The present study was not without limitations. Conclusions about the overall trajectory are based on 2 sample years almost 15 years apart. A larger sample size may provide a more accurate picture of the overall pattern in the change of LOE over the years. Furthermore, only 5 plastic surgery journals were included in the analysis, and it would be interesting to assess the overall trajectory of other plastic surgery journals to see if the findings on the present 5 journals extend to the entire field. Finally, the type of clinical question posed by the investigated articles was not distinguished. In contrast to the original Oxford level of evidence scale that assessed the type of clinical question (eg, therapeutic vs prognostic), the modified form of the scale was applied for the present study.[16]

CONCLUSIONS

The trajectory of the LOE in major plastic surgery journals underscores an important juncture in the evolution of EBM within the field. The current study indicates that in 2021, PRS and ASJ exhibited the highest levels of evidence. While there remains a need for lower LOE studies, which often introduce innovative concepts, the imperative for higher LOE studies that provide the robust evidence essential for informed clinical decision-making cannot be understated. This transition can be facilitated through strategies like promoting the pursuit of higher academic qualifications, improving peer support, integrating the principles of EBM into medical curriculums, and focusing efforts on prospective studies.

Supplemental Material

This article contains supplemental material located online at www.aestheticsurgeryjournal.com.

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