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Racial Disparities in Plastic Surgery Outcomes: A Systematic Literature Review and Meta-Analysis

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Background: Racial disparities in surgical outcomes have been shown to lead to subpar results in various patients. Variability and contradictions in the current literature highlight the need for a crucial evaluation of the matter in studies focusing on plastic and reconstructive surgery. Investigating the matter is a pivotal step toward effective guidelines that mitigate factors contributing to racial disparities in outcomes and improve our perception of a patient-centered health-care system. The study aimed to identify whether racial disparities exist in plastic and reconstructive surgery procedures.

Methods: Systematic review of the literature as per the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines was performed to find relevant articles assessing the impact of race on surgical outcomes. PubMed, Embase, MEDLINE, and Cochrane library were screened by both authors, and relevant articles were identified. Prevalence of complications were extracted from included studies, and odds ratio (OR) with 95% confidence interval (CI) was calculated and grouped for a statistical analysis.

Results: Meta-analysis of 13 studies, with a mean of 8059 patients per study, demonstrated a pooled OR of 1.21 (95% CI: 1.00–1.46), indicating an insignificant association between non-White race and postoperative complications. Subanalysis comparing African American patients to White patients (10 studies) showed an OR of 1.36 (95% CI: 1.06–1.74), signifying a statistically significant risk for African Americans. No publication bias was observed, but substantial heterogeneity (73% and 79%) suggested varied study factors influencing outcomes.

Conclusions: Racial disparities exist in plastic and reconstructive outcomes. Physicians and medical staff should focus on patients' sociodemographic background, accessibility to care, support cycles, and language proficiency, while determining the surgical plan and postoperative care. *(Plast Reconstr Surg Glob Open 2024; 12:e6220; doi: 10.1097/GOX.0000000000006220; Published online 9 October 2024.)*

INTRODUCTION

Equity and equality in care are growing concerns for all physicians and medical personnel.[1] Disparities in outcomes have been reported in numerous studies, and present a severe issue with life-threatening implications to marginalized communities. The first required step in resolving these disparities and diminishing their implications on the well-being and care of patients is to identify the contributing factors.

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Review of the published literature demonstrated concrete evidence of difference in clinical and patient-reported outcomes between White and non-White patients. Patients of non-White ethnicities experience adverse events, mortality, hospital readmission, and prolonged hospitalizations at higher rates.[2–5]

Numerous contributing factors were hypothesized to contribute to these differences in outcomes, and the pathogenesis is likely multifactorial and intertwined. Current literature most commonly refers to differences in access to medical care, socioeconomic status, and medical comorbidities as the driving factors.[6]

By understanding the multifactorial background that leads to the racial disparities of medical outcomes, proposed mitigation strategies focus on increasing the access to care, improving communication between the patients and medical staff, and cultural competency training. Although various strategies have been implemented, an

Disclosure statements are at the end of this article, following the correspondence information.

optimal approach has not yet been identified and further research is required to develop the most effective solution.[7]

Plastic and reconstructive surgery is a diverse field attending to a heterogeneous population of patients. In an attempt to provide quality care to all patients undergoing plastic or reconstructive surgery, determining the presence and magnitude of racial disparities is required for optimal outcomes.

The purpose of this meta-analysis and systematic literature review was to determine whether the outcomes of plastic and reconstructive surgery suffer from racial disparities. In addition, we sought to identify potential factors contributing to the situation, possible mitigation strategies, and trends over time.

Takeaways

Question: Do racial and ethnic disparities exist in plastic and reconstructive surgery, and what is their magnitude?

Methods: Systematic literature review and meta analyses of current literature has been conducted. Analysis showed a near significant association between non-White race and postoperative complications. Subanalysis comparing African American patients to White patients demonstrated a higher and statistically significant risk for African Americans.

Conclusion: Racial disparities exist in the outcomes of plastic surgery procedures.

PATIENTS AND METHODS

The study was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses recommendations.[8–10]

The search strategy, article selection, and analysis focused on whether non-White patients undergoing plastic reconstructive or aesthetic surgery, compared with White patients, experience, at a greater rate, 30-day complications.

SEARCH STRATEGY

The databases PubMed, Embase, Cochrane Library, and LILACS were searched (inception to May 3, 2023) for articles reporting plastic and reconstructive surgical outcomes stratified by race or ethnicity. No language restriction was applied. A PRISMA diagram depicting the search and review process, can be seen in Figure 1.

ELIGIBILITY AND INCLUSION/EXCLUSION CRITERIA

Included studies were randomized controlled trials, clinical trials, observational cohort studies, or case studies describing adverse events in patients after plastic and reconstructive surgery. Case reports and studies describing a population of pregnant women or animal models were excluded. Studies were included if the primary or secondary outcomes were postoperative adverse events, and data were stratified according to patient race/ethnicity. Studies depicting the data in the form of a graph with no numerical values were excluded.

ARTICLE SELECTION

The titles and abstracts of all records were screened independently and in duplicate by both the authors (R.S. and Y.W.). Articles found eligibile by initial inspection were retrieved in full. Studies with no full text available were excluded. Relevant studies were reviewed independently and in duplicate by the above-mentioned authors to ensure fulfillment of the studies inclusion criteria. The snowballing method, which includes screening the reference list of included studies to identify additional suitable studies, was implemented to widen the research database.

Studies were included in the statistical analysis only when both authors concurred on the study's eligibility. Disagreements were resolved through discussion until consensus was reached. In cases of overlapping data, the study with adjusted data or a larger patient population was selected.

DATA EXTRACTION

Both the authors extracted the agreed upon data individually and in duplicate using a standardized extraction form. Discrepancies in final data and disagreements were resolved using discussion and collaborative review of the data. Study characteristics, patient demographics, and surgical outcomes were extracted from each of the studies deemed relevant.

ASSESSMENT OF RISK OF BIAS

Both authors assessed the risk of bias (RoB) of the included studies independently and in duplicate using the ROBINS-I tool.[10] Disagreements over RoB were resolved by consensus after verbal discussions (Fig. 2).

OUTCOMES

The main study outcome was the odds ratio (OR) of postoperative 30-day complications. In instances when studies described separate OR for minor complications and major complications, the OR for major complications was preferred.

Length of stay was defined as length of hospital stay after the primary surgery. Length of readmission for revision surgery or management of sequelae complications was not extracted from the studies.

STATISTICAL ANALYSIS

Statistical analysis was performed using Review Manager (RevMan), version 5.4 (Nordic Cochrane Centre, The Cochrane Collaboration 2020, Copenhagen Denmark) and R software (R Core Team 2013, R Foundation for Statistical Computing, Vienna, Austria, URL (http://www.R-project.org/.) with the package meta.[11]

For adjusted analyses, the generic inverse variance method was used to pool estimates and standard errors, as suggested by the official published Cochrane guidelines

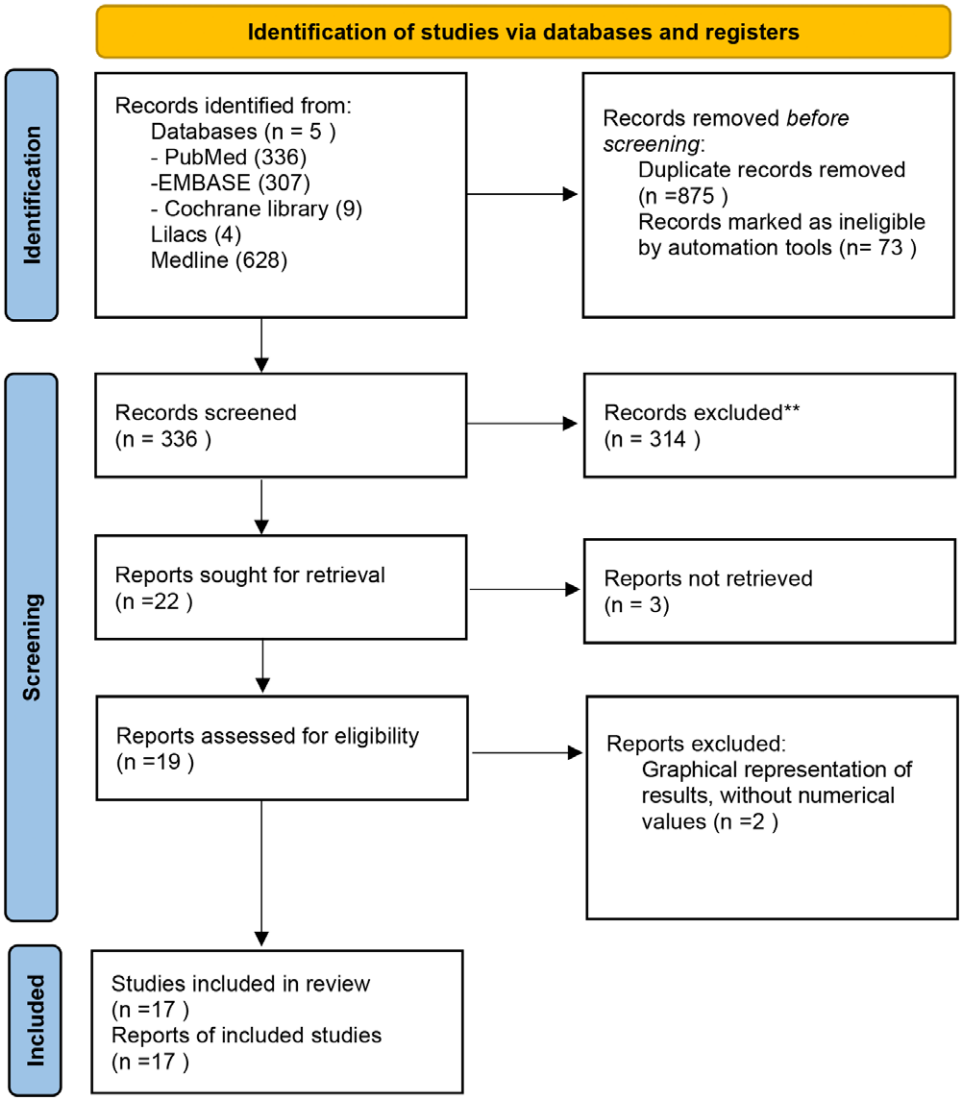

Fig. 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses diagram depicting the search and identification strategy presented in our research.

for meta-analysis conduction.[12,13] The results were reported as ORs with their 95% confidence intervals (CIs) for dichotomous outcomes. ORs and CIs were transformed to natural log and SE. Random effects models were used for all analyses performed despite the high heterogeneity found in the analysis.[14]

Forest plots and funnel plots were created based on the statistical analyses performed. Sensitivity analysis was planned based on possible outliers identified by the generated funnel plots. Publication bias was additionally used to graphically assess and inspect for potential publication bias in analyzed studies.

Re-planned subgroups analyses were performed to study possible heterogeneity stemming from racial definitions. Initial analysis grouped all non-White patients into a single category and conducted the analysis of a dichotomous variable (white/non-White). Sensitivity analysis was performed on a set of subgroup studies evaluating the complication rates solely of African American patients when compared with White patients. We did not conduct a subgroup analysis based on the various studies' timeframes, as the majority of studies were conducted in overlapping or partially overlapping timeframes, with no substantial outliers.

All *P* values presented were two-tailed, unless specified otherwise. Results were considered statistically significant if the *P* value was smaller than 0.05. Statistical heterogeneity, describing variance between studies, was evaluated by visual inspection of forest plots and the I^2 statistic.[15]

RESULTS

A total of 13 studies were included in the analysis, with a mean number of 8059 patients per study. The demographic characteristics of patients in the analyzed studies, as well as outcomes measures, are represented in Tables 1 and 2.

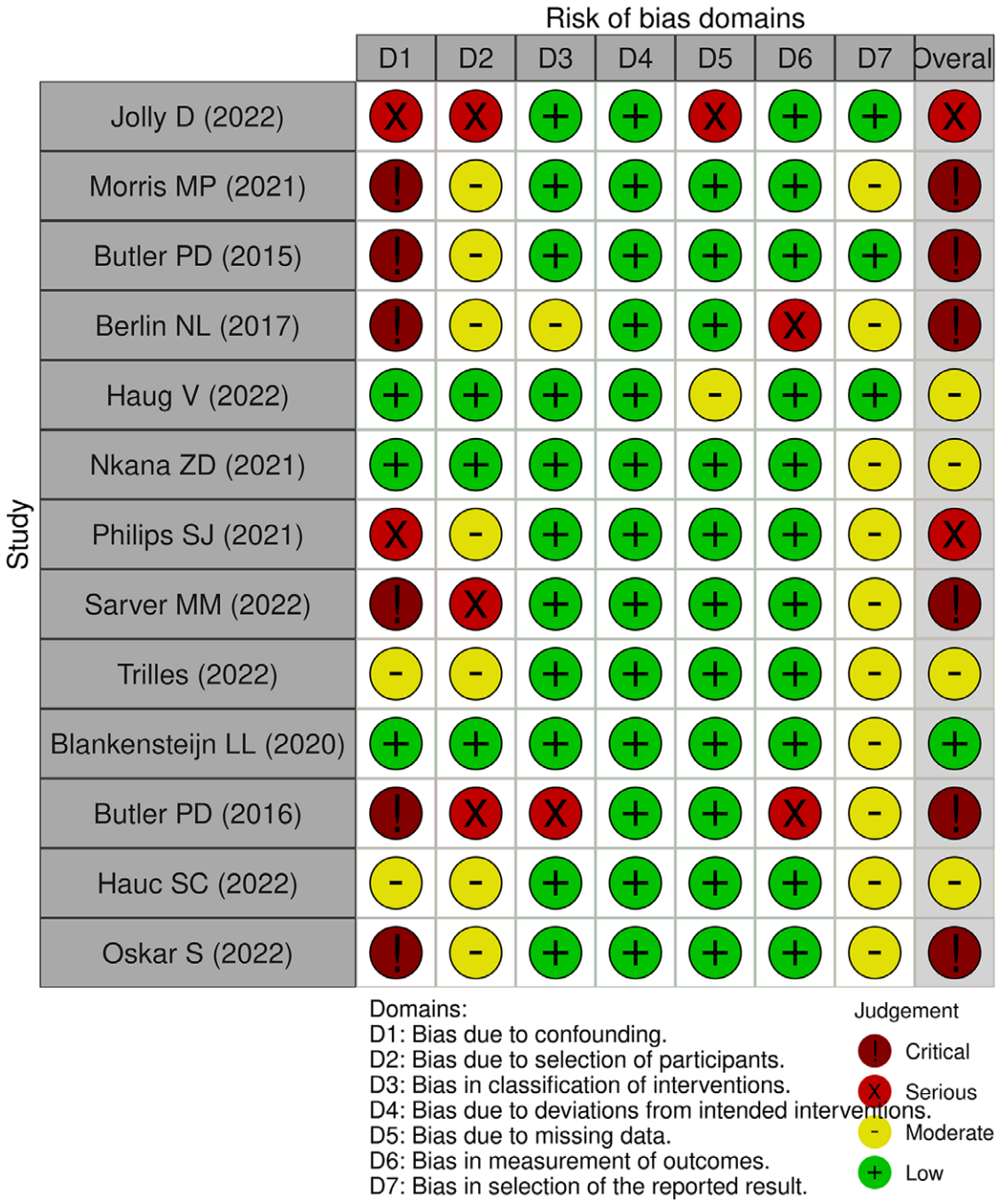

Fig. 2. ROB assessment of studies included in the meta-analysis.

The pooled OR was found to be 1.21, with a 95% CI ranging from 1.00 to 1.46 (Fig. 3). This result indicates a statistically insignificant association between race and postoperative outcomes, despite a slightly higher risk observed among certain racial groups compared with others.

In the subanalysis focusing specifically on African American patients versus White patients, 10 studies were included. The analysis revealed an OR of 1.36, with a 95% CI ranging from 1.06 to 1.74 (Fig. 4). This finding suggests a higher risk of adverse postoperative outcomes for African American patients compared with White patients, and the association was found to be statistically significant.

In assessing potential publication bias, the funnel plot and Egger test were used. The analysis showed no evidence of publication bias (Fig. 5), indicating that the studies included in the meta-analysis were likely representative of the overall body of literature on the topic.

Furthermore, the I^2 test indicated a substantial heterogeneity of 73% and 79%, accordingly, among the studies,

Table 1. Demographical Characteristics of All Included Studies in the Meta-analysis

	Author	No. Authors	Institution	Country	Subject	Measurement	Study Nature	Database	Period	No. Patients	Adjusted
1	Jolly et al	3	Harvard	USA	Gender-affirming chest surgery	30-day outcomes	Retrospective cohort study	ACS NSQIP	2008–2019	2505	Yes, (BMI/HTN/smoking/DM)
2	Hauc et al	10	Yale	USA	Melanoma resection and reconstruction	Length of stay	Retrospective cohort study	National Inpatient Sample	2010–2015	2904	No
3	Morris et al	6	Upen	USA	Reduction Mammaplasty	Complications	Retrospective cohort study	University of Pennsylvania Health System	2015–2020	115	No
4	Butler [16]	7	Upen	USA	Breast reconstruction	Complications	Retrospective cohort study	University of Pennsylvania Health System	2005–2011	838	No
5	Oskar et al	11	Memorial Sloan Kettering	USA	Breast reconstruction	Patient-reported outcomes, complications	Retrospective cohort study	Memorial Sloan Kettering Database	2010–2017	404	No
6	Berlin et al	7	University of Michigan	USA	Breast reconstruction	Outcomes	Retrospective cohort study	Mastectomy Reconstruction Outcomes Consortium	2012–2015	2703	Yes (age/BMI/income/education/smoking/DM procedure)
7	Haug et al	12	Harvard	USA	Breast reduction	30-day outcomes	Retrospective cohort study	ACS NSQIP	2005–2018	14,374	No
8	Butler et al[16]	8	Upen	USA	IBR	30-day outcomes	Retrospective cohort study	ACS NSQIP	2005–2011	16,150	Yes
9	Nkana et al	7	University of Wisconsin	USA	Breast reconstruction	Complications	Retrospective cohort study	University of Wisconsin, School of Medicine and Public health	2009–2020	192	Propensity
10	Philips et al	6	Yale	USA	Craniomaxillofacial bone lesions	Complications LOS	Retrospective cohort study	ACS NSQIP	2012–2018	372	Yes
11	Sarver et al[1]	11	Duke	USA	Breast Reconstruction	Outcomes	Retrospective cohort study	National Inpatient Sample	2012–2016	22,931	Yes
12	Blankensteijn et al	6	Harvard	USA	Breast reconstruction	Complications	Retrospective cohort study	ACS NSQIP	2008–2016	51,362	Yes (reconstruction type, age, BMI, COPD, HTN, DM, smoking, steroids, operating time)
13	Trilles et al	8	NYU	USA	Gender-affirming surgery	Complications	Retrospective cohort study	ACS NSQIP	2010–2018	2308	Yes (gender, BMI, smoking status, type of surgery performed, and hypertension)

Table 2. Race/Ethnicity Representation of Patients in Included Studies, Represented As Number (%) of Total Cohort Size

		American Indian/Alaska	Black	Pacific Islander/Hawaii	White	Hispanic	Asian	Unknown (Includes "Other," "Mixed")
1	Jolly et al	8 (0.3%)	351 (14%)	7 (0.28%)	1409 (52%)	N/A	101 (4%)	629 (25%)
2	Hauc et al	39 (1.48%)	66 (2.5%)	N/A	2391 (90.60%)	116 (4.4%)	20 (0.76%)	N/A
3	Morris MP et al	N/A	60 (52.2%)	N/A	47 (40.9%)	N/A	N/A	2 (1.74%)
4	Butler PD et al[16]	N/A	138 (16.5%)	N/A	654 (78%)	N/A	N/A	46 (5.5%)
5	Oskar S et al	N/A	63 (15.6%)	N/A	259 (64.1%)	N/A	N/A	82 (20.3%)
6	Berlin et al	N/A	158 (5.9%)	N/A	2244 (83%)	148 (5.5%)	N/A	153 (5.7%)
7	Haug et al	N/A	N/A	N/A	7185 (50%)	N/A	N/A	N/A
8	Butler et al[16]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9	Nkana	N/A	N/A	N/A	144 (75%)	N/A	N/A	N/A
10	Philips	N/A	40 (10.8%)	N/A	200 (53.8%)	35 (9.4%)	36 (9.7%)	61 (16.4%)
11	Sarver[1]	N/A	3201 (14.0%)	N/A	19,730 (86%)	N/A	N/A	N/A
12	Blankensteijn	N/A	5135	N/A	43,864	N/A	2033	330
13	Trilles [4]	N/A	419	N/A	1780	N/A	109	N/A

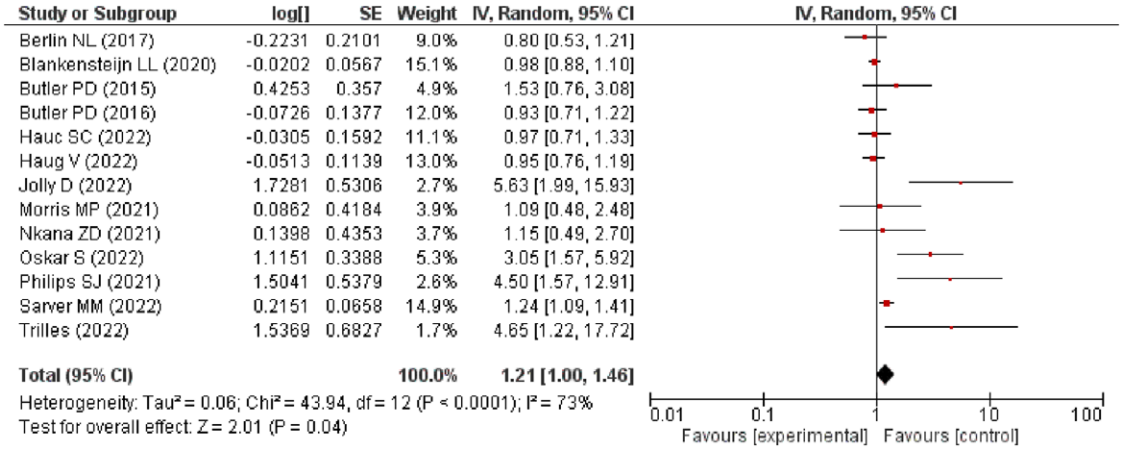

Fig. 3. Forest plot demonstrating the risk for complication in non-White patients compared with White patients.

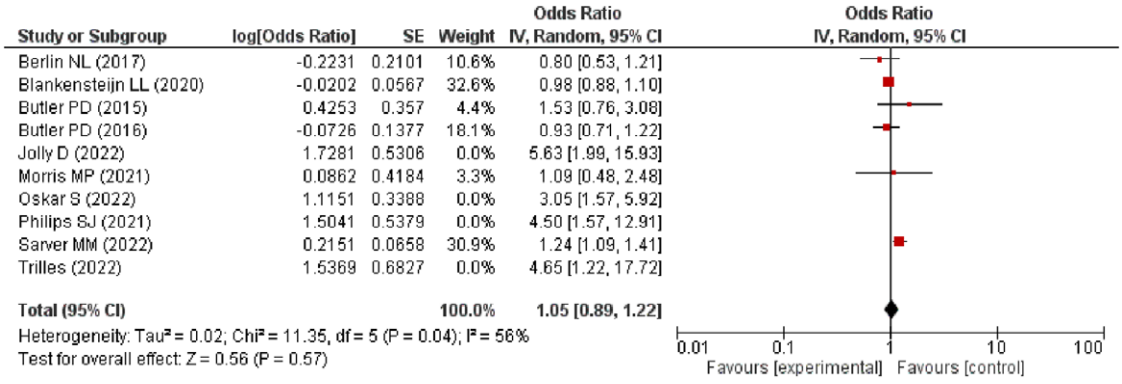

Fig. 4. Forest plot demonstrating the risk for complication in African American patients compared with White patients.

suggesting that variations in study design, patient populations, and other factors may have contributed to the observed differences in outcomes across the studies.

DISCUSSION

In this meta-analysis, we conducted a comprehensive examination of racial disparities in the outcomes of plastic surgery procedures. Our findings revealed an OR of 1.21 with a 95% CI ranging from 1.00 to 1.46, indicating a slightly higher likelihood of adverse events in non-White patients compared with White patients. The substantial heterogeneity observed among the included studies suggests variability in methodologies and patient populations, necessitating a careful interpretation of the

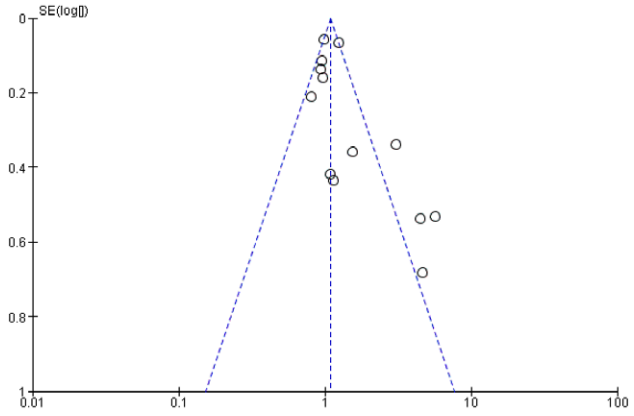

Fig. 5. Funnel plot demonstrating the risk for potential bias in included studies.

results. A subanalysis focusing specifically on African American patients, and their outcomes compared with White patients, found a larger and statistically significant difference between the groups, and warrants further investigations.

Adverse events in the postoperative period are of utmost importance in the surgical field in general, and in plastic surgery especially. In addition to the potential of life-threatening complications, worsening preexisting conditions and the need for revision procedures that carry additional risk, it can most certainly negatively impact patient satisfaction from the surgical results.

A majority of studies included in this meta-analysis based their conclusion on findings that stem from analyses of national databases. Therefore, the findings are less likely to suffer from a selection bias that could potentially result from trends in local health-care accessibility among patients of various ethnic and cultural backgrounds. However, socioeconomic determinants of health are expected to play a vital role in interpretation of the results. The impact of socioeconomic determinants of health on patient outcomes has been widely recognized in the medical fields, and played a major role in the advancement of patient-centered care.[17,18]

Recognition of the impact of socioeconomic status on life expectancy and medical outcomes, has instigated international debate on health-care competency to take care of marginalized communities. Unstable socioeconomic conditions that manifest with lower median incomes, higher rates of unemployment, unequal pay for the same job and employment in low paying jobs, are more commonly seen in historically marginalized and underserved racial/ethnic communities.[19]

Limited English proficiency has been recognized as an important factor in studies analyzing access to care and intervention outcomes in multi-ethnic and racial countries. Caballero et al[20] found that Hispanic ethnicity is independently associated with reduced likelihood of neuroaxial labor analgesia utilization in a large cohort of obstetric patients in a tertiary care center in the United States. However, when the authors controlled their results for preferred spoken language, they found that the Hispanic ethnicity is no longer significantly associated with the outcome. Similarly, a national database analysis revealed that not speaking English well or at all is negatively associated with breast cancer screening in an adjusted multivariate model.[21]

Although limited English proficiency is a significant factor that must be considered in all discussions of racial disparities, it is only a single aspect of a multifaceted problem. Limited English proficiency plays a role in limiting employment opportunities, which results in unstable socioeconomic conditions and insufficient insurance coverage.[19]

Due to the heterogeneous patient population in the plastic surgery clinic, socioeconomic status should be analyzed in the preoperative consultation to determine whether potential constraints exist that can impair adherence to postoperative care. Financial burdens and unstable employment can lead to premature mobilization and return to work; lack of transportation can hinder arrival to follow-up appointments and nursing care. Recognition of these factors in the preoperative setting can help the surgeon tailor the procedure and the after-care to the patient's abilities and needs, and in turn improve outcomes and satisfaction.[22–24]

Cultural competence refers to the ability of the medical staff to correctly understand the needs, wishes and beliefs of various cultures, and appropriately adapt their behavior in the clinical setting to best suit their needs. In the surgical field, under-representation of various cultural backgrounds in the department's staff can impair the staff's cultural competence and results in decreased pre- and postoperative patient satisfaction, timely recognition of complications, and willingness to reach out to the medical professionals for help. Several endeavors have been shown to be effective in increasing the cultural competence of medical staff, most notably the incorporation of a racially diverse staff, lectures and seminars on cultural differences, and required adaptations. These, in turn, can decrease the implicit bias toward non-White patients and improve surgical outcomes and patient satisfaction.[16]

Previous studies examining racial disparities in postoperative outcomes of breast reconstruction procedures have reported decreased preoperative and postoperative satisfaction among African American patients, compared with White patients.[25] Potential contributing factors include access to health-care professionals with emphasis on density of plastic surgeons per population, health-care literacy, and familiarity with cultural beliefs and characteristics.

Additionally, several studies evaluated the association between the clinical state of patients and the risk for adverse events. Despite consistent evidence of increased rate of comorbidities among African American patients compared with White patients, there is inconclusive evidence on its impact on the rate of postoperative complications. Mets et al[25] conducted a retrospective cohort analyzing all breast reconstruction procedures conducted in a single institution over a 5-year period. The authors found that African American and Hispanic patients, compared with other patients, presented with higher

comorbidity burdens, prior radiation and new-adjuvant chemotherapy, and postoperative complication rates. On the contrary, Nkana et al[26] found that in their institution, no racial disparities were found in regard to postoperative outcomes. In our meta-analysis, African American patients experienced a clinically and statistically significant increase in risk for postoperative complications compared with White patients. This finding accumulates the knowledge on the matter and demonstrates the need for further measures to fix observed disparities. Due to inconsistent documentation and reporting of race/ethnicity of various racial backgrounds, we were unable to conduct additional analyses that could have shed more light on communities also highly affected by racial disparities. Further research is required to draw meaningful conclusions on the matter and develop further the world-wide patient-centered care in the field of plastic reconstructive and aesthetic surgery.

Although this meta-analysis provides valuable insights, it is essential to acknowledge its limitations. The limited number of studies focusing on racial disparities in plastic surgery outcomes, especially for specific racial groups, may affect the overall findings. Further research with larger and more diverse samples is needed to validate and expand upon these findings. Additionally, the great variability in definition of complications in the studies could impair the analysis of the results. Currently, developments in the field of artificial intelligence are constantly being introduced and implemented in research. Web-scraping algorithms allow for aggregation of a great quantity of data to a single comprehensive database.[27–29] The use of such methods possesses the ability to partially mitigate the limitations we discussed in our study and create an international network of data, easily accessible worldwide.

Although our research dives into the association between race and adverse events in plastic surgery, it is important to emphasize that the findings illustrate an association and do not imply causality. Ascertaining a causal relationship in a multifaceted problem is difficult, and careful interpretation of the presented results is needed.[30,31]

Future studies should also explore other potential confounding variables that were not accounted for in the included studies, such as comorbidities, smoking status, and surgical technique variations, to better understand the relationship between race and postoperative complications in each specific expertise of plastic surgery.

In conclusion, this meta-analysis highlights racial disparities in postoperative complications following plastic surgery procedures. Non-White patients were found to be at an increased risk compared with White patients, with the effect being significantly larger when focusing the comparison on African American patients compared with White patients.

Addressing racial disparities in plastic surgery outcomes requires a multifaceted approach, encompassing efforts to reduce socioeconomic barriers, promote cultural competence among health-care providers, and further investigate genetic factors contributing to differential outcomes. The recent emphasis on the importance of health policy research stems from the understanding that recognizing factors negatively impacting nationalities and communities can only be achieved through careful examination of national databases and properly designed quasi-experimental research. We hope that our study will play a role in raising the attention for recognition of racial disparities in plastic surgery outcomes.[32] By recognizing and addressing these disparities, we can strive for equitable and high-quality care for all patients, regardless of their racial background. It is imperative for the plastic surgery community to embrace a commitment to fairness and inclusivity to improve patient outcomes and strengthen the field as a whole.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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