ORIGINAL ARTICLE

Breast

Quality Measures in Postmastectomy Breast Reconstruction: Identifying Metrics to Improve Care

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Background: Specific measures tailored to the properties of individual procedures will ensure the appropriate evaluation of quality. Because postmastectomy breast reconstruction (PMBR) is becoming increasingly common, a review of the literature is timely to identify potential breast reconstruction–specific measures that can be applied by institutions and national healthcare organizations to improve quality.

Methods: We searched PubMed and Embase for studies examining the quality of care for patients undergoing PMBR. Data extracted from the articles include basic study characteristics, the number of quality metrics, type of quality metric (defined by Donabedian model), and the domain of quality (defined by the National Academy of Medicine).

Results: A total of 2,158 articles were identified in the initial search, and 440 studies were included for data extraction. The most common type of quality measure was outcome measures (91%), and the least common measure was structure measures (1%). The most common metrics were operative time (41%), hospital type (28%), and aspects of the patient–provider interactions (20%). Additionally, we found that timeliness and equity were least common among the 6 National Academy of Medicine domains.

Conclusions: We identified metrics utilized in the PMBR, some of which can be further investigated through high-level evidence studies and incorporated into policy. Because many factors influence surgical outcomes and breast reconstruction is driven by patient preferences, an inclusion of structure, process, and outcome metrics will help improve care for this patient population. Moreover, nonpunitive initiatives, specifically quality collaboratives, may provide an avenue to improve care quality without compromising patient safety. *(Plast Reconstr Surg Glob Open 2020;8:e2630; doi: 10.1097/GOX.0000000000002630; Published online 25 February 2020.)*

INTRODUCTION

Healthcare costs in the United States exceed those of other high-income countries, with national health expenditures of 18% of the national gross domestic product.[1] The United States ranked lowest among 11 high-income countries by the Commonwealth Fund in terms of healthcare performance.[2] Consequently, both private and public payers have developed a number of initiatives to promote the transition from fee-for-service to value-based payment models.[3–5] For instance, the Centers for Medicare & Medicaid Services (CMS) developed the Hospital-Acquired Condition Reduction Program to penalize hospitals with higher rates of hospital-acquired conditions.[6] The development of comprehensive quality metrics becomes vital as the United States transitions toward value-based care. Specifically, measures tailored to the unique properties of individual procedures will ensure the appropriate evaluation of healthcare quality.

The Donabedian framework is the most common conceptual model used to describe the components of

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healthcare that influence value. According to this model developed by Donabedian[7,8] in 1966, healthcare quality can be organized into structure, process, and outcome metrics. Although outcome metrics have been considered the standard for measuring surgical quality,[9,10] process and structure metrics should not be neglected.[11] Measuring outcomes requires an extensive amount of resources and may not always be representative of high-quality care. A good outcome is influenced by several factors, some of which healthcare professionals are not able to control. For example, a patient who smokes may experience a higher risk of wound complications. An investigation of the types of quality studied in the plastic surgery literature will help shed light on current measures used to evaluate care and provide guidance for the establishment of other metrics.

Quality assessment for plastic surgery procedures is unique because it traditionally depends on subjective evaluation, such as cosmetic appearance, rather than quantitative measures. Although the evaluation of outcomes through patient-reported questionnaires is extremely valuable, it is also resource-intensive, time-consuming, and can be influenced by several factors that may not be controlled from a healthcare standpoint. Additionally, given the nature of breast reconstruction, there is a wide range of patient preferences and shared decision-making that guide treatment,[12,13] which could be examined using an established process metric. Thus, given the confounding variables that may influence surgical outcomes and the patient-driven nature of this reconstructive procedure, inclusion of quality using structure, process, and outcome measures is warranted to maximize the quality of care for this patient population.

Researchers have investigated the measures used to evaluate care for different types of medical care.[14,15] For example, Brett et al[14] conducted a systematic review of the solid organ transplant literature to identify and characterize quality metrics in the literature. The authors found that more than half of the quality metrics found were outcome measures with poorly defined definitions. We used similar methodology to conduct a review of a commonly performed plastic surgery procedure—postmastectomy breast reconstruction (PMBR). The rate of breast reconstruction following mastectomy increased 62% from 2009 to 2014 alone.[16] Given the growing utilization of PMBR, a systematic review of the literature on quality is warranted because it will shed light on other potential breast reconstruction–specific measures that can be utilized by national surgical organizations, public organizations, or individual medical institutions to evaluate the quality of care. A review was previously conducted by Nazerali et al[17] to identify the established quality measures used for breast reconstruction. Although the authors found only 5 established breast reconstruction–specific candidate quality measures, they did not include non-established metrics which can be further studied through high-level investigations and implemented into policy.[17]

The establishment of quality metrics for plastic surgery procedures, such as PMBR, will help improve patient outcomes and the patient experience. In this study, we perform a systematic review to identify the quality measures utilized in the PMBR literature according to the Donabedian model. We hypothesize that most of the quality metrics identified will be outcome measures.

METHODS

Search Criteria

We searched PubMed and Embase for primary research articles investigating the surgical quality of care for patients undergoing PMBR. The search was performed in January 2019. The complete search algorithm is provided in **Supplemental Digital Content 1** (**see table, Supplemental Digital Content 1**, which displays the inclusion and exclusion criteria, http://links.lww.com/PRSGO/B301). This study was considered nonregulated by the Institutional Review Board at our institution.

Inclusion and Exclusion Criteria

The inclusion and exclusion criteria are outlined in **Supplemental Digital Content 2** (**see table, Supplemental Digital Content 2**, which displays the search algorithm, http://links.lww.com/PRSGO/B302). We included primary research articles published from January 2007 to January 2019. The search was limited to articles published within the past 12 years to gain a current perspective on quality for patients undergoing PMBR. We included only articles written in English to avoid potential misinterpretations caused by translation. Furthermore, we excluded all review articles, discussions, or perspective articles. We included articles that reported on breast reconstruction for patients with a prior breast cancer diagnosis. Articles reporting on the process, structure, or outcome of care provided to patients who received posttraumatic reconstruction or reconstruction on male patients were excluded. Additionally, studies reporting solely on patients receiving prophylactic care were excluded from the study cohort. We removed these articles to maintain the homogeneity of our sample because the metrics for patients undergoing breast reconstruction after a cancer diagnosis may differ from that of a patient receiving a mastectomy for prophylactic care. Furthermore, we excluded articles if they reported solely on the radiologic or oncologic experiences of patients because our focus was on the surgical aspect of care.

Title and Abstract Screening

One member of the research team reviewed the title and abstracts for all articles obtained from the initial search. An additional member of the research team spot-checked 10% of the articles assessed. The interrater reliability for the spot-check was approximately 92%. All disagreements were reviewed collaboratively, and a list of ways to improve the assessment of inclusion was created. This list was then used by the initial reviewer to improve screening. After the completion of the title and abstract review, full-text articles were obtained and uploaded to an online systematic review program.

Data Extraction

The variables collected included basic study characteristics, clinical characteristics, number of quality metrics, type of quality metrics, domain of quality, and indication
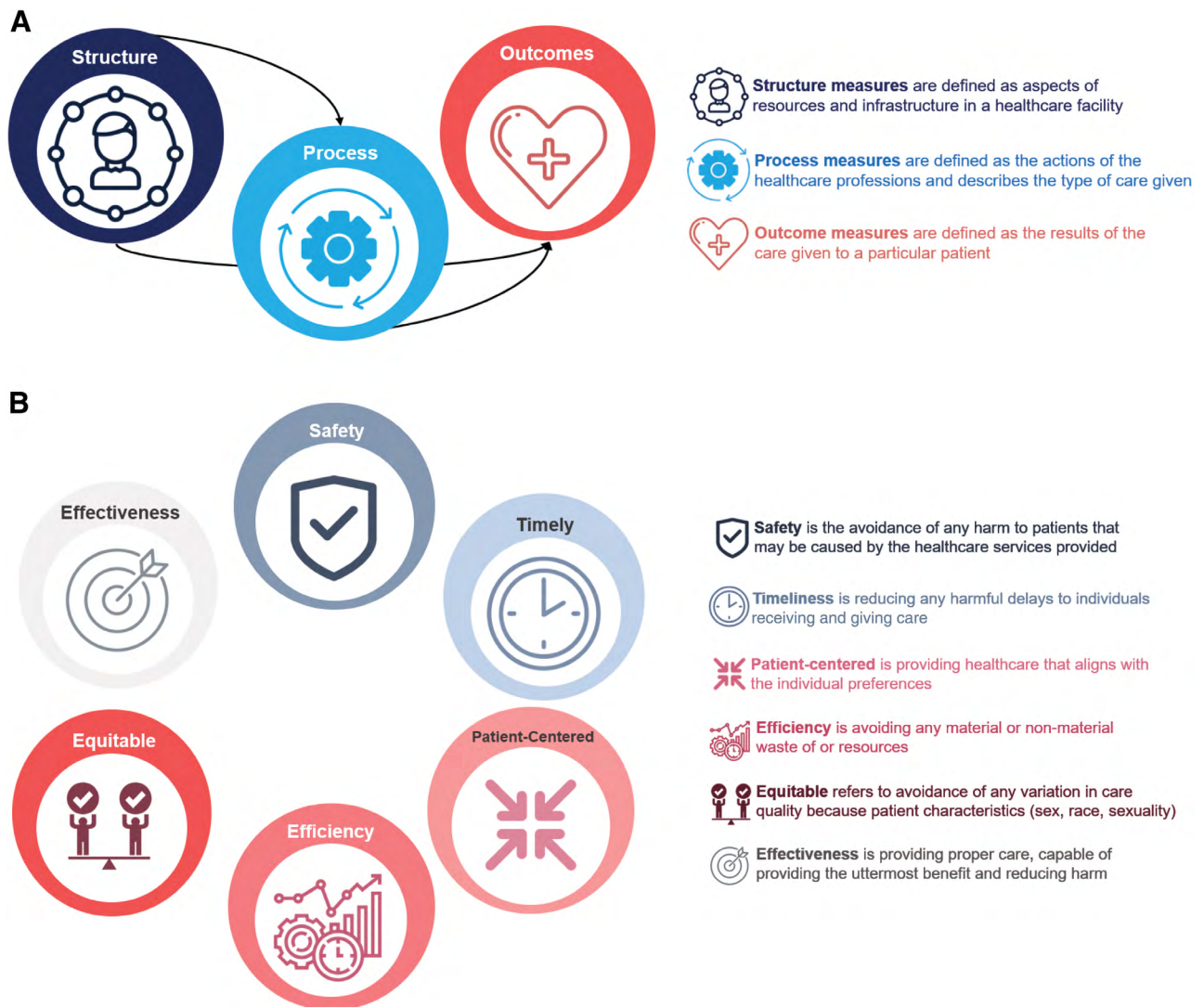
Fig. 1. Quality assessment. A, Donabedian classification of quality metric type. B, National Academy of Medicine Classification of Quality Metric Domain.

of whether the metric was established. We categorized the "type" of quality according to both the Donabedian classification (Fig. 1A) and the "domain" of quality according to the classification developed by the National Academy of Medicine (Fig. 1B).[7,8,18] Quality was classified using the categorizations by Donabedian and the National Academy of Medicine (previously named the Institute of Medicine) because both are used by the CMS and will provide a comprehensive summary of quality metrics in PMBR.

All the reviewers were trained by a senior member of the research team to ensure that they all had the same baseline understanding of quality metrics as it pertains to surgery. The training was done using high-impact systematic reviews, textbook chapters, and online resources. A total of 4 individual reviewers extracted data from the articles included in the final study cohort. A key was created for data extraction to ensure consistency of ambiguous metrics. Additionally, a senior member of the research team spot-checked 25% of articles included in the final

study cohort and only minor discrepancies were found. The disagreements were reviewed collaboratively and resolved within the research team. After the discussion, a list of ways to improve data extraction was created and slight modifications were made to improve consistency. If there were disagreements about whether or not a specific metric would be considered a quality metric, we consulted the scientific literature. For example, we categorized operative time as a process metric because recent research indicates that it may be indicative of care quality.[19,20]

Statistical Analysis

We used "DistillerSR," an online systematic review program, to extract data from the articles included in the final study cohort. All calculations were performed using "Microsoft Excel." Additionally, we report our analysis in conjunction with the applicable Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Moreover, this systematic review was registered

using the International Prospective Register of Systematic Reviews (PROSPERO) registry (ID = CRD42019126064).

RESULTS

Characteristics of Included Studies

We retrieved 2,158 articles in the initial search. A total of 440 remained after an application of our inclusion and exclusion criteria (Fig. 2). The most common study types were retrospective reviews (48%) and prospective cohort studies (33%). Most studies investigated immediate (47%) or both immediate and delayed reconstruction (41%). The included articles investigated various breast reconstruction techniques including implant-based (34%), autologous (26%), or mixed reconstruction (36%). Furthermore, the studies included in our final sample reflected the experiences of researchers in various parts of the world. The basic characteristics of the included studies and their respective patient cohort are presented in Table 1.

Types of Quality Metrics

The average number of quality metrics per study was 4 (SD, ±2.6). Outcomes were the most common measure (91%), and structure measures were the least common (1%) (Fig. 3A). On average, each study included 0.1 (SD, ±0.3) structure measures, 0.3 (SD, ±0.5) process measures, and 3.6 (SD, ±2.6) outcome measures. The most common structure measures included hospital type (28%), specialty training (16%), hospital volume (12%), and surgical volume (12%) (Fig. 4). Operative time (41%), patient–provider interactions (20%), perioperative care (11%), and the time between operations (8%) were the most common process measures studied (Fig. 5). The most common outcome measures were complications (20%), reoperation rate (9%), satisfaction with breasts and surgical outcome (9%), and physical well-being (8%) (Fig. 6). **Supplemental Digital Contents 3–5** provide the definitions and examples of the structure, process, and outcome metrics included in the analysis (see **table, Supplemental Digital Content 3**, which displays description and examples of structure metrics assessed, http://links.lww.com/PRSGO/B303) (see **table, Supplemental Digital Content 4**, which displays description and examples of process metrics assessed, http://links.lww.com/PRSGO/B304) (**see table, Supplemental Digital Content 5**, which displays description and examples of outcome metrics assessed, http://links.lww.com/PRSGO/B305).
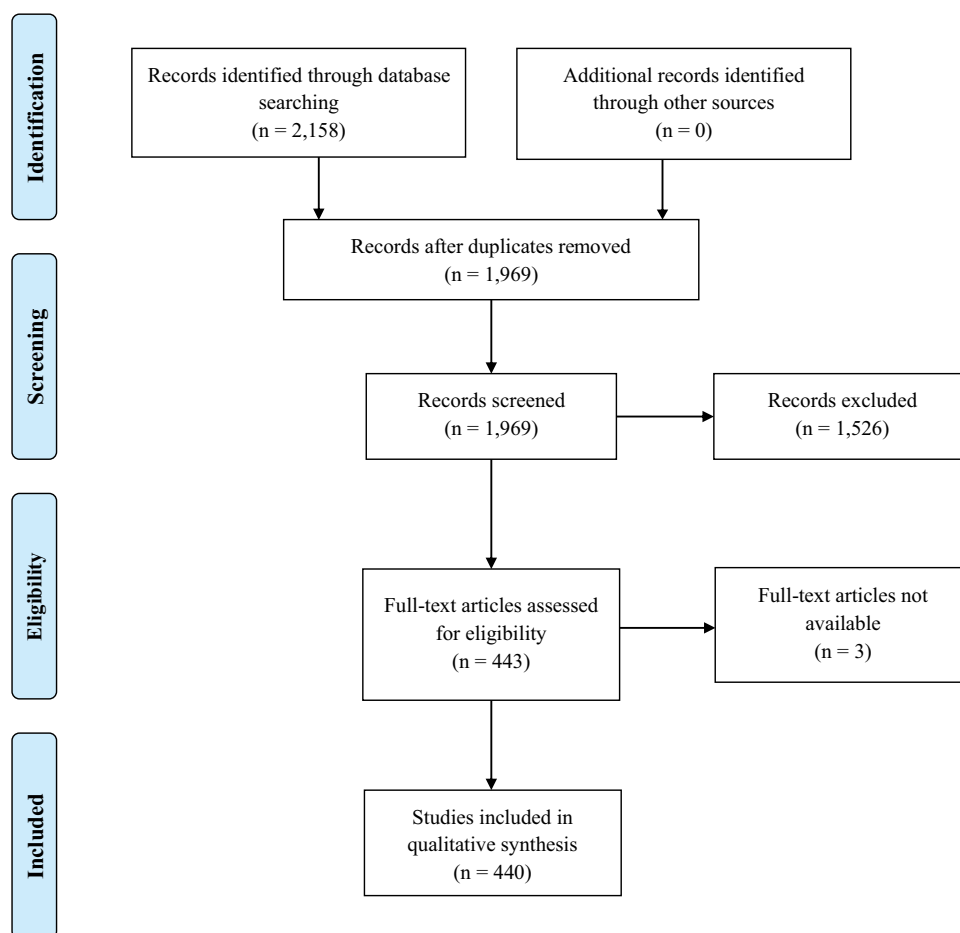

Fig. 2. Flowchart of study cohort.

Table 1. Characteristics of Included Studies

	N (%)
Study type	
Retrospective review	211 (48)
Prospective cohort	145 (33)
Retrospective database	65 (15)
Randomized control trial	12 (3)
Mixed methods/qualitative	5 (1)
Not specified	2 (0)
Timing of reconstruction	
Immediate	205 (47)
Both	180 (41)
Delayed	13 (3)
Not specified	42 (9)
Type of reconstruction	
Mixed reconstruction	160 (36)
Implant/expander-based	147 (34)
Autologous tissue	114 (26)
Not specified	19 (4)
Patient sample	
11–50	99 (23)
51–100	74 (17)
101–300	133 (30)
301–1,000	71 (16)
1,000+	63 (14)
Country of study	
United States	193 (44)
United Kingdom	33 (8)
Italy	22 (5)
Canada	13 (3)
Korea	13 (3)
Australia	12 (3)
France	12 (3)
The Netherlands	12 (3)
China	11 (2)
Other	98 (22)
Multiple	19 (4)
Not specified	2 (0)

Domains of Quality

Of the 440 studies included for data extraction, 302 (69%) studies examined quality in >1 domain. The most common domains of quality examined were safety (37%) and effectiveness (36%), whereas the least common domains of quality were timeliness (1%) and equitability (2%) (Fig. 3B).

Established Metrics

A total of 153 (35%) articles studied healthcare measures based on established metrics. Established quality metrics include validated outcome questionnaires (93%), metrics proposed based on other existing quality measures (4%), or metrics defined by national healthcare organizations (3%). Validated outcome questionnaires included the BREAST-Q, the European Organization for Research and Treatment of Cancer Quality of Life of Cancer Patients (EORTC QLQ-C30), The Short Form (36) Health Survey (SF-36), EORTC QLQ Breast (BR-23), among others. Some authors of the included studies modified metrics defined by other organizations. For example, an analysis of emergency department visits for patients after PMBR relied on existing CMS readmission metrics and were modified to establish relevance for breast cancer surgery.[21] Additionally, some studies examined quality in terms of existing metrics and recommendations. For instance, an analysis of the timeliness for breast cancer care was performed using international timeliness recommendations for breast cancer care by national organizations around the world.[22] The authors examined the impact of treatment and operative choice on number of days between surgical consultation and operation date.

DISCUSSION

Our study found that in the PMBR research literature, outcome measures were the most common measure and structure was the least common measure. Additionally, we found that few studies examined the timeliness and equitability of PMBR. Researchers may focus future research on investigating structure and process measures that can be used to identify quality after PMBR. Furthermore, the identified list of potential quality metrics can be utilized to drive future research. The development of quality measures for PMBR should focus on all types and domains,
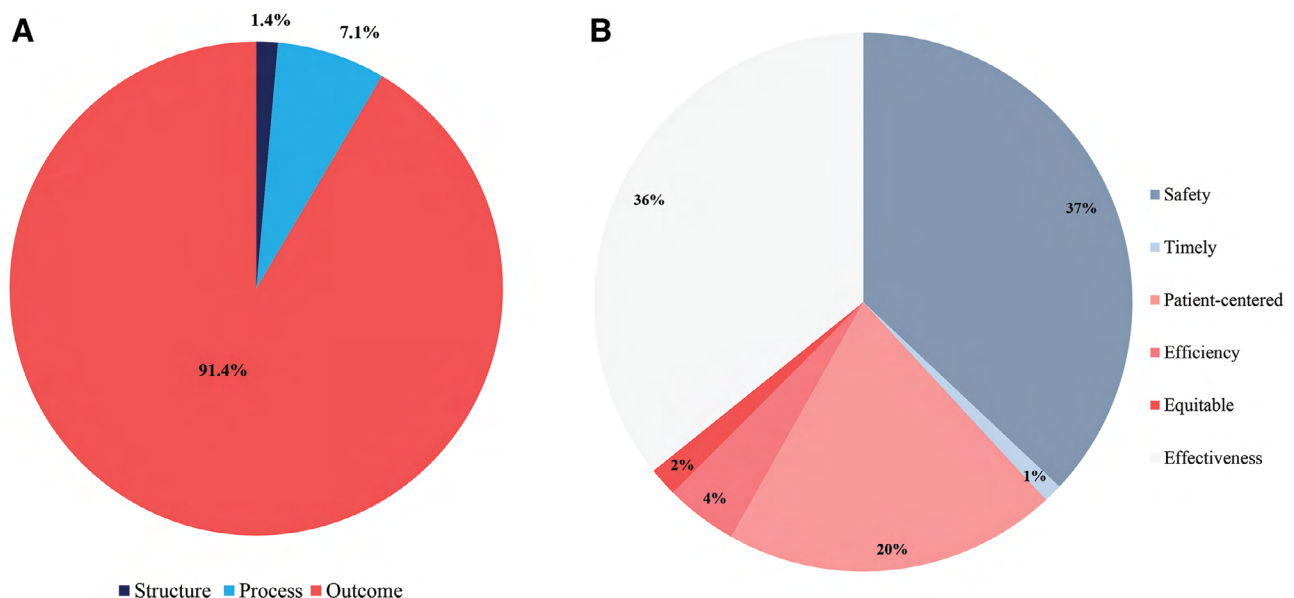
Fig. 3. Quality assessment of included studies. A, Types of quality metrics in included studies. B, Domain of quality measures in included studies. Some studies examined >1 domain of quality.
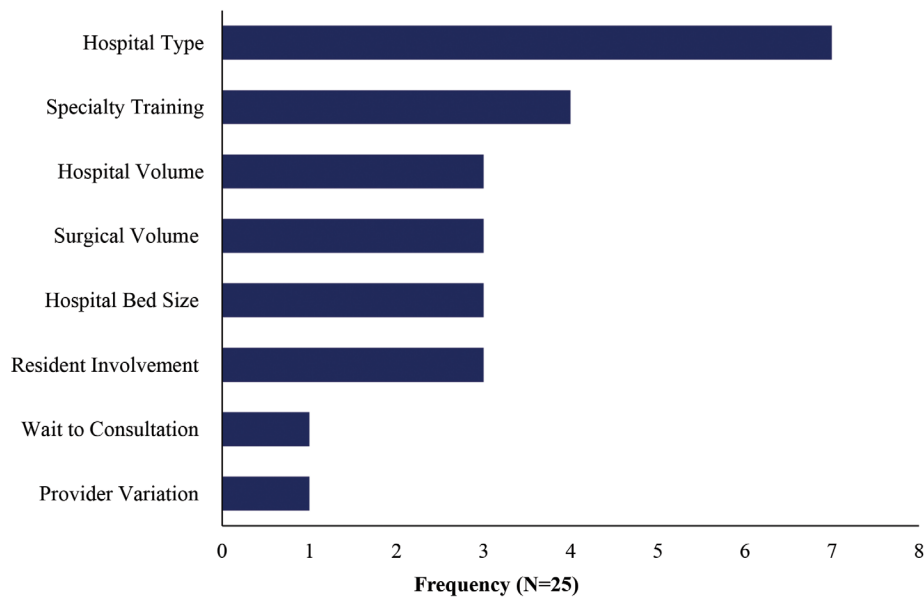
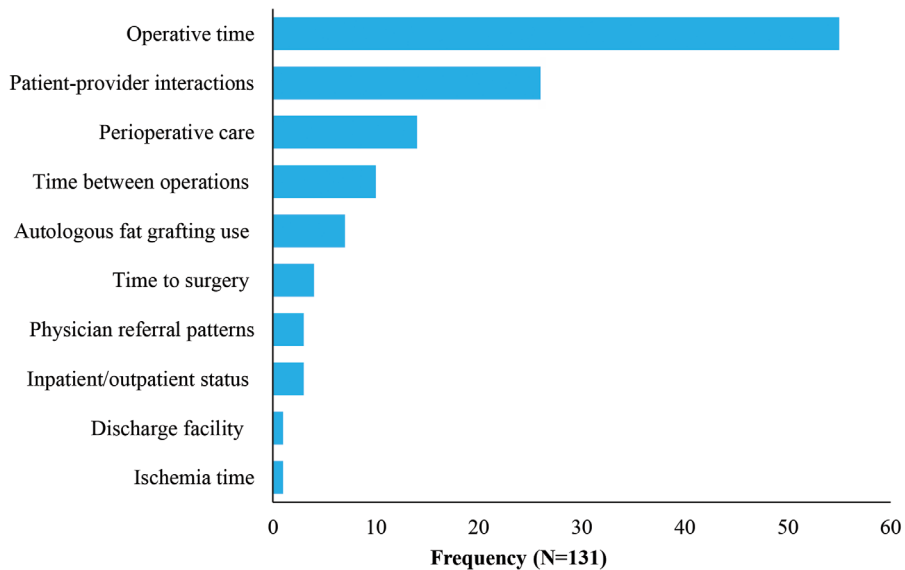**Fig. 4.** Frequency of structure metrics.

Fig. 5. Frequency of process metrics.

as defined by the Donabedian model and the National Academy of Medicine.

An increasing number of articles in the plastic surgery literature are examining care equity.[12,23,24] For example, Morrison et al[24] performed an analysis of the Accredited Council for Graduate Medical Education–accredited plastic surgery and urology programs to determine the degree to which plastic surgery and urology trainees are prepared to treat transgender patients. Further research investigating the extent to which plastic surgeons are prepared to treat patients of different socioeconomic status, sexualities, and ethnicities may provide policymakers with guidance regarding the development of a quality metric focused on cultural competency training. Because patient preference is important in the decision to undergo breast reconstruction,[25] cultural competency metrics may aid in the improvement of patient counseling for various breast reconstruction procedures.

The National Strategy for Quality Improvement in Healthcare was created by the Agency for Healthcare Research and Quality in 2011 to help define and guide healthcare quality improvement initiatives. The main priorities included (1) making healthcare more patient-centered, reliable, accessible, and safe; (2) addressing the various determinants of health to help improve population health; and (3) reducing the cost of quality care.[26] This process requires a coordination of efforts by clinicians, researchers, and policymakers to properly translate recent evidence into policy. The establishment of quality metrics in surgery requires extensive efforts from researchers and policymakers. Researchers must continually identify care utilizing structure, process, and
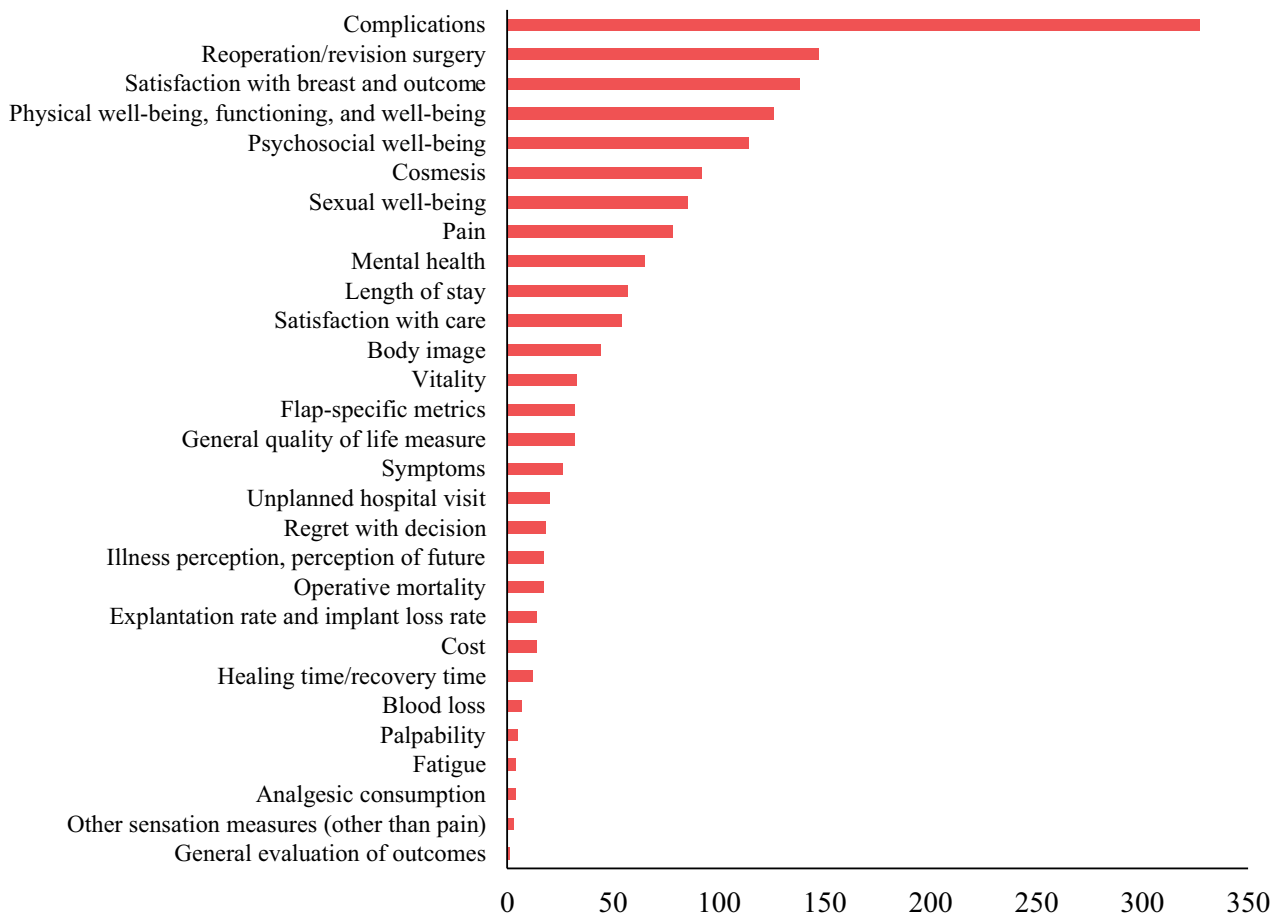
Fig. 6. Frequency of outcome metrics.

outcome measures. Consequently, policymakers can implement initiatives to evaluate care quality using the various metrics examined in the literature. Established metrics must be continually evaluated to ensure the measures are a proxy for high-quality care.

Patient care may be compromised if the policy aimed at measuring quality using specific metrics is not carefully crafted. The Hospital Readmissions Reduction Program (HRRP) was developed by the Patient Protection and Affordable Care Act to reduce healthcare costs associated with unnecessary readmissions. Despite research depicting that the HRRP was successful in reducing readmissions,[27,28] researchers have identified potential unintended consequences.[29,30] Specifically, Fonarow et al[30] discuss the potential unintended consequence of increased mortality for patients with heart failure after the implementation of the HRRP. Researchers speculate that pressure to reduce unplanned readmissions may cause inappropriate emergency triage care, coercion of clinicians into readmission delays, and an increased use of observation stays without formal admission.[31] Despite the projected 2 billion dollars in cost savings prompted by the HRRP in only 5 years,[32] the potential harm caused by the program should be considered. It is imperative that quality measures for PMBR are robustly studied for all potential unintended consequences.

According to the Agency for Healthcare Research and Quality, quality measurement tools must be objective, based on scientific evidence, and not distort results.[33] Thus, high-quality studies are essential before the development of a robust quality metric into policy. Furthermore, nonpunitive collaborative initiatives may serve to improve quality without compromising patient safety.

Collaborative Quality Initiatives have become a popular method to measure and improve quality in various medical fields.[34–37] For example, the Michigan Surgical Quality Collaborative collects data on certain procedures and provides specific sites with data analysis, training, and best practice sharing to help reduce variation in care, improve care quality, and reduce costs. Estimates suggest that the Michigan Surgical Quality Collaborative could reduce payments associated with adverse outcomes by $20 million per year.[38] Similar collaboratives may serve as avenues to improve quality of care for patients undergoing PMBR. Participating sites can identify variation in care without receiving any type of penalty that could jeopardize patient care. The advancement of quality collaboratives for PMBR may focus on including the structure, process, and outcome measures identified in this review. Including comprehensive measures in all domains and types will maximize the improvements of such a quality collaborative. Additionally,

data registries for subspecialty surgical fields are becoming increasingly common.[39] Including robust variables in data registries that permit individuals to evaluate the structure, process, and outcomes of breast reconstruction will aid in the establishment of quality metrics for PMBR.

Plastic surgery researchers can further identify potential quality metrics for PMBR by identifying measures utilized in similar surgical fields and establishing relevance to breast reconstruction. For example, our research team recently conducted an analysis of unplanned emergency department visits 30 days after breast reconstruction procedures. This study was developed based off the HRRP program developed by the CMS.[21] Because complications after breast reconstruction are not always severe enough to warrant a readmission, a metric using emergency department visits is more relevant. Researchers and clinicians can identify potentially relevant metrics by examining recent policy developed by public and private organizations or meeting with institutional or governmental policymakers. Such research evidence will aid in the development of plastic surgery–specific quality metrics.

We recognize that this study has some limitations. A total of 4 reviewers extracted data for this study; however, all reviewers were trained on data extraction and a key was made to guide the reviewers on the data extraction for ambiguous measures. Additionally, a spot-check was performed on 25% of the articles included in the final study cohort and only minor changes were made. Various types of study designs were included because the purpose of this study was to summarize all the potential quality measures that can be used to evaluate care for patients undergoing PMBR. Moreover, we used an open and comprehensive search strategy to ensure we captured all established and nonestablished quality measures. We recognize that there is some subjective aspect of assigning quality measures. Nonetheless, we ensured that any ambiguous measures were discussed and resolved within the research team.

Quality metrics are becoming increasingly popular in this era of value-based care. Numerous public and private organizations are implementing policy to help evaluate patient care according to a set of predetermined metrics in various domains of quality. However, procedure-specific metrics in the field of plastic surgery are lacking. In this study, we found a paucity of structure and process metrics in the literature examining quality for patients undergoing PMBR. We identified a list of metrics that may be used in the development of institutional or national policy focused on improving care quality for patients undergoing PMBR. Furthermore, we found a lack of literature reporting on the timeliness and equitable domains of care, as defined by the National Academy of Medicine. Moreover, efforts from researchers to study the metrics identified in this study using high-level evidence, such as population-based analyses, will help improve the integration of such quality measures into policy.

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