Evidence-Based Performance Measures for Autologous Breast Reconstruction: An American Society of Plastic Surgeons Quality Performance Measure Set

Aamir Siddiqui, M.D.
Cristiane Ueno, M.D.
Jayant Agarwal, M.D.
Edward I. Chang, M.D.
Minas Chrysopoulo, M.D.
Caryn Davidson, M.A.
Dana Khuthaila, M.D.
Michele A. Manahan, M.D.
Evan Matros, M.D.
Lisa A. Newman, M.D., M.P.H.
Michael Newman, M.D.
Michelle Sowden, D.O.
Oren Tessler, M.D.
Eric Whitacre, M.D.
Bernard T. Lee, M.D., M.B.A., M.P.H.

Detroit, Mich.; Morgantown, W.Va.; Salt Lake City, Utah; Houston and San Antonio, Texas; Arlington Heights, Ill.; New York, N.Y.; Baltimore, Md.; Torrance, Calif.; Burlington, Vt.; New Orleans, La.; Tucson, Ariz.; and Boston, Mass.

Summary: The American Society of Plastic Surgeons commissioned the Autologous Breast Reconstruction Performance Measure Development Work Group to identify and draft quality measures for the care of patients undergoing autologous breast reconstruction and other breast reconstruction surgery. Four outcome measures and one process measure were identified. Outcomes include patient satisfaction with information for all breast reconstruction, a subscale of the BREAST-Q, and the length of stay, operative time, and rate of blood transfusion for autologous blood transfusion. The process measure looks at coordination of care around managing the breast reconstruction patient's care, with the physician coordinating the ongoing care, be it an oncologist, radiologist, other specialist, or primary care physician. All measures in this report were approved by the American Society of Plastic Surgeons Quality and Performance Measures Work Group and the American Society of Plastic Surgeons Executive Committee. The Work Group recommends the use of these measures for quality initiatives, continuing medical education, maintenance of certification, American Society of Plastic Surgeons' Qualified Clinical Data Registry reporting, and national quality-reporting programs. (*Plast. Reconstr. Surg.* 145: 284e, 2020.)

The American Society of Plastic Surgeons is the largest plastic surgery specialty organization in the world. It represents almost 95 percent of all board-certified plastic surgeons in the United States. The mission of the American Society of Plastic Surgeons is to advance quality care to plastic surgery patients by encouraging high standards of training, ethics, physician practice, and research in plastic surgery. To further this goal, the American Society of Plastic Surgeons is committed to developing scientifically sound and evidence-based performance measures for plastic surgeons. These performance measurements are designed to provide physicians with parameters that represent standards for acceptable clinical practice. The Autologous Breast Reconstruction Performance Measurement Work Group was commissioned by the American Society of Plastic Surgeons to supplement work already done in this area.[1] The goal of the Autologous Breast

From Henry Ford Hospital; West Virginia University; University of Utah Health; M. D. Anderson Cancer Center; PRMA Plastic Surgery; the American Society of Plastic Surgeons; Central Park South Plastic Surgery; Johns Hopkins University School of Medicine; Memorial Sloan Kettering Cancer Center; South Bay Plastic Surgeons; the University of Vermont; LSU Health Sciences Center; the Breast Center of Southern Arizona; and Beth Israel Deaconess Medical Center, Harvard Medical School.
Received for publication April 30, 2019; accepted August 16, 2019.

DOI: 10.1097/PRS.0000000000006478

Disclosure: *Dr. Siddiqui is a consultant for Smith & Nephew, Inc. Dr. Chrysopoulo is a consultant for Mentor and is the founder of the Breast Advocate App and InviCible Scars. The remaining authors have no financial interests to disclose.*

AMERICAN SOCIETY OF PLASTIC SURGEONS
Official Peer-Reviewed Publication from the AMERICAN SOCIETY OF PLASTIC SURGEONS.

Reconstruction Performance Measures Work Group was to identify and draft quality measures for the care of patients undergoing autologous breast reconstruction. All work groups tasked by the American Society of Plastic Surgeons are charged with developing measures that reflect rigorous clinical evidence, patient-centered outcomes, and specific areas of focused performance improvement. In addition, the hope is that each measure supports and is linked to one of the Institute of Medicine's six core aims for health quality improvement: safety, efficacy, patient-centered, timeliness, efficiency, and equitability.[2]

The mission of the Work Group was to apply the rigorous structure and methodology developed by the American Society of Plastic Surgeons to look at the current clinical landscape, peer-reviewed science, and patient perspective for autologous breast reconstruction. Based on this, the group developed quality performance measures that most represent safe surgical technique, reproducible clinical and patient-centered outcomes, equitable use of resources, and maximization of patient safety.

Scope and Intended Users

The American Society of Plastic Surgeons encourages the use of these measures by plastic surgeons and other health professionals. These performance measures are developed to impact quality improvement, continuing medical education, maintenance of certification, and regional and national quality reporting programs. These measures can be used for both individual and system-level quality improvement. These measures can support better outcomes for autologous breast reconstruction patients, with the understanding that, over time, measures may need to be revisited and updated.

These performance measures are not to be considered clinical guidelines and do not establish a standard of medical care. Guidelines for autologous breast reconstruction have been previously examined through American Society of Plastic Surgeons task forces and their recommendations published.[3] The goal of the performance measures is not intended to establish fixed protocols, but rather to serve as metrics by which health care providers or facilities can assess their own performance. They may also serve as a benchmark against national databases. Patient care and treatment should always be based on the clinician's independent medical judgment, given the individual patient's clinical circumstances.

Autologous Breast Reconstruction in the Literature

Autologous breast reconstruction after mastectomy is a wide and expanding field of practice. There are both pedicle and free tissue options. Free tissue options encompass a very large category, including musculocutaneous and fasciocutaneous options and a variety of donor sites throughout the body. Autologous free fat grafting is also a recognized surgical technique. It is clear that, as time goes on, more options will be added. Further permutations include unilateral and bilateral reconstruction, the use of biological matrix materials, and ever-changing additional procedures for treating malignancies. The staged nature of the surgery also adds a variety of revision techniques. In general, it is difficult to categorize autologous breast reconstruction into any finite number of categories. This also makes it difficult to judge outcomes, either by preoperative workup, decision-making, strengths of a particular facility or surgeon, role of the breast cancer surgeon, or number of intermediate steps. Clinical outcomes can include surgical morbidity, complications, and patient-reported satisfaction.

The importance and role of breast reconstruction after mastectomy appear to be relatively conclusive. Early reconstruction appears to be associated with higher patient satisfaction compared with patients with no reconstruction.[4] There is some research to support autologous tissue reconstruction as providing the highest level of satisfaction for women undergoing surgery for breast cancer.[5,6] There is literature to support improved outcome in many spectrums, including emotional, physical, psychosocial, and sexual, as a result of breast reconstruction.[7] Present-day literature does suggest that breast reconstruction, and specifically autologous reconstruction, may be the most durable long-term option for many women.

The utility and importance of performing autologous breast reconstruction are well established in the literature and clinical practice. Because these operations are performed under varying clinical scenarios, both within the United States and abroad, it does present a challenge to develop a singular picture of how these operations should be performed. The clinical and professional demands on a solo practitioner performing autologous breast reconstruction in a small community are much different than those of a physician employed in a large academic center with access to multiple surgical staff and many ancillary services. The Autologous Breast Reconstruction Performance Measures Work Group was concerned that these measures be used primarily for educational and not punitive purpose by regulatory bodies. Stringent measures may prevent those early in their training from taking on these cases or providing the best option for patients. In contrast, measures that could be considered as "low bar" would be of no benefit to anyone and compromise

the integrity of the process. The Work Group therefore walked the line between these parameters in an effort to provide measures that were equitable and robust but not overreaching and still grounded on sound science and evidence-based literature.

Although there is a great deal of literature on the topic of autologous breast reconstruction, the diversity of outcomes reported makes it difficult to come up with a coherent picture with respect to performance measure development. Surgical technique has specific nuance that can be different among practitioners and groups. Publications on this subject can therefore be difficult to compare. There can be publication bias, especially with respect to complications. Finally, techniques continue to improve and publications from years ago may not be relevant or carry the same complications compared to the present. There can be variability with respect to patient selection, as some groups may accept a higher body mass index for their patient population than others because of where they practice. These changes in standard protocol may result in changes in morbidity and recovery time, making it difficult to compare two different studies.

The Autologous Breast Reconstruction Performance Measures Work Group elected to focus on issues that were more overarching and applicable to all types of autologous reconstruction. The goal was to focus on issues that most surgeons would agree are important and represent true measures of clinical outcome. The measure group followed a rigorous development process that included a multidisciplinary work group, management of conflict of interest, and patient input. The process can be found on our performance measures web page (https://www.plasticsurgery.org/documents/medical-professionals/quality-resources/Standardized-Measure-Development-Process-External.pdf). Our focus was therefore on preoperative evaluation and patient engagement, intraoperative complications, and patient-centered outcomes.

METHODS

American Society of Plastic Surgeons members were invited to apply to the Work Group by means of Society e-mail communication. All applicants were required to submit an online conflict-of-interest disclosure form for membership consideration. Members of the American Society of Plastic Surgeons Quality and Performance Measurement Committee reviewed and selected Work Group members to ensure a diverse representation of U.S. regions, practice type (i.e., large multispecialty group practice, small group practice, solo practice, and academic practice), experience in clinical research, and evidence-based medicine expertise. Three stakeholder organizations, including the American Society of Breast Surgeons, the American Society of Clinical Oncology, and the American College of Surgeons were also invited to participate in the measure development process. Each organization nominated one member from their respective organization to serve on the Work Group.

The technical specifications drafted for this performance measurement set were drafted as registry specifications, because many American Society of Plastic Surgeons members are in solo and small group practices and have not yet implemented electronic health records. Electronic health record specifications have also been developed for implementation in the American Society of Plastic Surgeons Qualified Clinical Data Registry. For performance measure exceptions, the American Society of Plastic Surgeons uses the PCPI exception criteria, which are divided by medical and patient/nonmedical reasons.[8]

Clinical Evidence Base

Performance measure development is a part of the American Society of Plastic Surgeons evidence-based medicine initiative. Ideally, clinical practice guidelines serve as the foundation for the development of performance measures. However, systematic literature reviews and individual publications also support the Breast Reconstruction Performance Measures. A number of clinical practice guidelines have been developed for the treatment of postmastectomy breast cancer patients. These provide recommendations for the treatment and management of the phases of treatment for this patient population. The Work Group also used data from the American Society of Plastic Surgeons Tracking Operations and Outcomes for Plastic Surgeons database and the American College of Surgeons National Surgical Quality Improvement Program. The Tracking Operations and Outcomes for Plastic Surgeons is a national database that tracks plastic surgery procedures and outcomes. The National Surgical Quality Improvement Program is a nationally validated, risk-adjusted, outcomes-based program to measure and improve the quality of surgical care.

Quality Measures

All narrative measure components can be found in Tables 1 through 5.[9–44] The full measure specifications including CPT codes are available at: https://www.plasticsurgery.org/for-medical-professionals/quality/asps-performance-measures; it is imperative that the specifications are followed for proper reporting.

Aamir Siddiqui, M.D.
American Society of Plastic Surgeons
444 East Algonquin Avenue
Arlington Heights, Ill. 60005
cdavidson@plasticsurgery.org

Table 1. Measure 1: Coordination of Care for Patients Undergoing Breast Reconstruction

	Measure Information
Measure description	Percentage of female patients aged 18 years and older with genetic susceptibility to malignant neoplasm of the breast, current diagnosis or history of breast cancer AND breast reconstruction with or without a tissue expander or implant who had documentation of coordinated care* prior to their procedure
Measure components	
Numerator statement	Patients who had documentation of coordinated care* before their procedure.
Denominator statement	All female patients aged 18 yr and older with genetic susceptibility to malignant neoplasm of the breast, current diagnosis or history of breast cancer, and breast reconstruction.
Denominator exceptions	None.
Supporting guideline	The following evidence statements are quoted *verbatim* from the referenced position statement: **The policy paper (The Patient-Centered Medical Home Neighbor: The Interface of the Patient-Centered Medical Home with Specialty/Subspecialty Practices. A Position Paper of the American College of Physicians[9]) of the American College of Physicians makes the following specific recommendations:** **1. The ACP recognizes the importance of collaboration with specialty and subspecialty practices to achieve the goal of improved care integration and coordination within the PCMH care delivery model.** **2. The ACP approves the following definition of a PCMH-N as it pertains to specialty and subspecialty practices. A specialty/subspecialty practice recognized as a PCMH-N engages in processes that:** • Ensure effective communication, coordination, and integration with PCMH practices in a bidirectional manner to provide high-quality and efficient care. • Ensure appropriate and timely consultations and referrals that complement the aims of the PCMH practice. • Ensure the efficient, appropriate, and effective flow of necessary patient and care information. • Effectively guide determination of responsibility in comanagement situations. • Support patient-centered care, enhanced care access, and high levels of care quality and safety. • Support the PCMH practice as the provider of whole-person primary care to the patient and as having overall responsibility for ensuring the coordination and integration of the care provided by all involved physicians and other health care professionals. **3. The ACP approves the following framework to categorize interactions between PCMH and PCMH-N practices. The clinical interactions between the PCMH and the PCMH-N can take the following forms:** • Preconsultation exchange—intended to expedite/prioritize care, or clarify need for a referral. • Formal consultation—to deal with a discrete question/procedure. • Comanagement: • Comanagement with shared management for the disease. • Comanagement with principal care for the disease. • Comanagement with principal care of the patient for a consuming illness for a limited period. • Transfer of patient to specialty PCMH for the entirety of care. **4. The ACP approves the following aspirational guiding principles for the development-of-care coordination agreements between PCMH and PCMH-N practices.** • A care coordination agreement will define the types of referral, consultation, and comanagement arrangements available. • The care coordination agreement will specify who is accountable for which processes and outcomes of care within (any of) the referral, consultation, or comanagement arrangements. • The care coordination agreement will specify the content of a patient transition record/core data set, which travels with the patient in all referral, consultation, and comanagement arrangements. • The care coordination agreement will define expectations regarding the information content requirements, and the frequency and timeliness of information flow within the referral process. This is a bidirectional process reflecting the needs and preferences of both the referring and consulting physician or other health care professional. • The care coordination agreement will specify how secondary referrals are to be handled. • The care coordination agreement will maintain a patient-centered approach, including consideration of patient/family choices, ensuring explanation/clarification of reasons for referral, and subsequent diagnostic or treatment plan and responsibilities of each party, including the patient/family. • The care coordination agreement will address situations of self-referral by the patient to a PCMH-N practice. • The care coordination agreement will clarify in-patient processes, including notification of admission, secondary referrals, data exchange, and transitions into and out of the hospital. • The care coordination agreement will contain language emphasizing that in the event of emergencies or other circumstances in which contact with the PCMH cannot be practicably performed, the specialty/ subspecialty practice may act urgently to secure appropriate medical care for the patient. • Care coordination agreements will include: • A mechanism for regular review of the terms of the care coordination agreement by the PCMH and specialty/subspecialty practice. • A mechanism for the PCMH and specialty/subspecialty practices to periodically evaluate each other's cooperation with the terms of the care coordination agreement, and the overall quality of care being provided through their joint efforts.

(*Continued*)

Table 1. (*Continued*)

	Measure Information
Measure importance	
Rationale/opportunity for improvement	Communication among all medical team members is important to optimize outcomes for patients with breast cancer seeking breast reconstruction. A 2016 study by Milucky et al.[10] looked at communication between medical oncologists and plastic surgeons. Both plastic surgeons and medical oncologists had substantial knowledge deficits, which can have important implications for the timeliness of chemotherapy initiation.[10] Several care coordination models have looked at collaboration with subspecialists. The goal of the PCMH model is to promote integrated, coordinated care throughout the health care system; however, it recognizes that the effectiveness of the PCMH care model to achieve this goal is dependent on the cooperation of the many subspecialists, specialists, and other health care entities (e.g., hospitals, nursing homes) involved in patient care. The success of the PCMH model depends on the availability of a "hospitable and high-performing medical neighborhood" that aligns their processes with the critical elements of the PCMH. The PSH is another model gaining traction. Conceptually, the PSH model aims to reduce variability in perioperative care given that variability increases the likelihood for errors and complications. One way in which this variability can be reduced is through ensuring continuity of care and treating the entire perioperative episode of care as one continuum rather than discrete preoperative, intraoperative, postoperative, and postdischarge episodes.[11] Gap in care: Milucky et al.[10] found that medical oncologists did not strongly consider whether a patient had undergone breast reconstruction when planning chemotherapy, and plastic surgeons did not strongly consider the likelihood of adjuvant chemotherapy when planning immediate breast reconstruction. Plastic surgeons reported knowing the likelihood of chemotherapy for a patient undergoing reconstruction 62% of the time. For patients without complications, both specialties reported communicating a few times. For patients with complications, the frequency of communication was increased. Based on other studies, we can assume that a similar knowledge gap exists between plastic surgeons and other specialists or primary care physicians managing the care of patients with breast cancer.[12,13] It is well described that timely diagnosis is paramount to ensure optimal outcome in breast cancer care.[14,15] Thus, an understanding of coordination of care is critical to improve quality of treatment and practices regarding posttreatment care.[16]
Measure designation	
Measure purpose	Quality improvement; accountability
Type of measure	Process
Care setting	Inpatient or surgical center, ambulatory care
Data source	Medical record

ACP, American College of Physicians; PCMH, Patient-Centered Medical Home; PCMH-N, Patient-Centered Medical Home Neighbor; PSH, Perioperative Surgical Home.
*Documentation of coordinated care = documentation of a formal care coordination agreement as defined by the Patient-Centered Medical Home Neighbor; *or* documentation of discussion with physician currently managing care or referring physician (oncologist, radiologist, other specialist, or primary care physician).

Table 2. Measure 2: Performance on Patient Satisfaction Questionnaire

	Measure Information
Measure description	Percentage of patients aged 18 years and older who had breast reconstruction who reported a score of 65 or higher on the BREAST-Q Satisfaction with Information scale, within 120 days of the procedure. This measure is reported as three rates stratified by procedure: •Reporting criterion 1: Implant breast reconstruction procedures •Reporting criterion 2: Autologous breast reconstruction procedures •Reporting criterion 3: Total rate: all breast reconstruction procedures
Measure components	
Numerator statement	Patients who reported a score of 65 or higher on the BREAST-Q satisfaction with information scale, within 120 days of the procedure.
Denominator statement	All patients aged 18 yr and older who underwent breast reconstruction.
Denominator exceptions	Patient refusal to complete the survey.
Supporting guideline	The following evidence statements are quoted *verbatim* from the referenced clinical guidelines: **4.2.1. Based on little or no systematic empirical evidence, it is the consensus of the Work Group that clinicians may treat patients undergoing mastectomy and autologous breast reconstruction with either surgical technique (pedicled TRAM flap or DIEP flap) because there was no differences in patient satisfaction noted. However, it was found that the level of patient satisfaction is high for both procedures.** **Level IV Evidence** **Recommendation Grade: D** **ASPS ABR Guideline (2017)**[3]
Measure importance	
Rationale/opportunity for improvement	PROMs, wherein the patient's perception of his or her outcomes is quantified, have become increasingly important as the surgical community attempts to curb health care costs and move past traditional outcome measures such as morbidity and mortality. In plastic surgery, patient-centered outcomes data are of particular importance, as the majority of operative interventions aim to improve appearance, function, and/or quality of life. One important advantage (among many) is that use of the BREAST-Q provides researchers with the ability to quantify and compare patient perspectives, which is essential to demonstrate the value of potentially more time-intensive or costly reconstructive options, such as free-tissue flap–based reconstruction.[17,18] In a 2014 critical study of unilateral immediate breast reconstruction using the patient-reported outcomes instrument BREAST-Q, patients undergoing MAFBR had higher scores in psychosocial and sexual well-being, satisfaction with outcome, breast, information, and plastic surgeon when compared with patients who underwent staged EIBR. For patients eligible for both MAFBR and EIBR, MAFBR is associated with higher levels of satisfaction and quality of life.[19] Cohen et al.[20] reported the results of a 5-year, prospective, multicenter cohort study involving 11 centers in the United States and Canada where patients enrolled in the study completed a series of questionnaires with the aims of evaluating health-related quality-of-life outcomes and patient satisfaction after breast reconstruction. Among 2093 recruited patients, 1534 completed the BREAST-Q satisfaction with care scales questionnaire (73.3%). The lowest scores were for the satisfaction with information scale when compared to other satisfaction with care scales: satisfaction with information (72.8 ± 17.7), surgeon (89.49 ± 16.0), medical team (92.3 ± 16.4), and office staff (95.5 ± 12.0). Studies have shown that expectations are an important predictor of health outcomes. The primary goal of breast reconstruction is to improve body image and fulfill patients' expectations regarding their breast appearance after surgery. Understanding of patients' expectations can assist in the education and consent processes and in perioperative and postoperative compliance.[20,21] Furthermore, patient satisfaction questionnaires can provide measurements of how well patients feel that they were informed about their surgery.[17,22] One standard deviation below the mean score for satisfaction with information is 55 (73 – 18 = 55); 10% above is 65, so we are using this as our cut-point for defining satisfaction with information. This is further justified because 0.5 SD is 9 (which we would consider to be a "minimally important clinical difference," and we are setting 10 as "meaningful change." Understanding women's reasons for wanting or not wanting breast reconstruction can assist clinicians to help women make choices most aligned with their individual values and needs.[23] Patients undergoing breast reconstruction as opposed to only mastectomy generally reported higher satisfaction rates with the surgical outcome.[24,25] The literature on the use of patient satisfaction tools is almost exclusively in research settings. It is believed that use of these tools in real practice is minimal. Increasing the use of these tools will be an important first step in gaining real world data.
Measure designation	
Measure purpose	Quality improvement; accountability
Type of measure	Outcome
Care setting	Inpatient or surgical center, ambulatory care
Data source	Administrative data; medical record
Measure guidance	Only procedures performed from January 1–August 31 of the reporting period will be considered for this measure, to allow for collection of the patient satisfaction scale within 120 days following the breast reconstruction procedure. Breast reconstruction procedures performed from September 1–December 31 are excluded from the initial population.

TRAM, transverse rectus abdominis musculocutaneous; DIEP, deep inferior epigastric perforator; ASPS, American Society of Plastic Surgeons; ABR, autologous breast reconstruction; PROMs, patient-reported outcome measures; MAFBR, microsurgical abdominal flap breast reconstruction; EIBR, expander-implant breast reconstruction.

Table 3. Measure 3: Length of Stay following Autologous Breast Reconstruction

	Measure Information
Measure description	Percentage of female patients aged 18 years and older who had breast reconstruction via autologous reconstruction (not including latissimus flap) with or without a tissue expander or implant who were discharged from the hospital by the end of postoperative day 4.
Measure components	
Numerator statement	Patients who were discharged from the hospital within 4 days of the initial procedure.
Denominator statement	All female patients aged 18 yr and older who had breast reconstruction by means of autologous reconstruction (not including latissimus flap) with or without a tissue expander or implant.
Denominator exclusions	Patients who had an unplanned second operation within the same hospital stay (this exclusion is included, as there is another ASPS measure tracking unplanned return to the OR).
Denominator exceptions	Patient/nonmedical reason exception for delays in discharge outside the physician's control, such as lack of support at home, disposition delay.
Supporting evidence	The following evidence statements are quoted from relevant studies: Length of stay is a widely accepted marker for health care quality, and possible reduction measures include earlier subspecialist consultation, preoperative counseling regarding the anticipated length of stay, and the wider adoption of a formal multidisciplinary, clinical pathway.[26] Prolonged length of stay was defined as a length of stay greater than or equal to the 75th percentile, the top quartile of postoperative hospitalization duration. For patients undergoing breast reconstruction with free tissue transfer, 5 days marked the 75th percentile. The 75th percentile also represents the benchmark grouping for length-of-stay calculations in the majority of published series using the American College of Surgeons National Surgical Quality Improvement Program database.[26] Billig et al.[27] conducted a nationwide analysis for cost variation for autologous free flap patients and found that the median length of stay was 4 days across the country. The median represents the 50th percentile, so this is where we are setting our marker for improvement. Operative time, especially when exceeding 12 hr in duration, was the most predictive of prolonged length of stay in both study groups (breast reconstruction and non–breast reconstruction with free tissue transfer).[26]
Measure importance	
Rationale/opportunity for improvement	In today's health care climate of limited resources and rising cost, it is important that clinicians evaluate the quality of health care delivery in the framework of reconstructive surgery. Hospital beds represent a fixed resource in almost universal demand, and thus length of hospital stay exerts considerable influence on health care resource allocation and use.[26,28,29] Length of stay is a widely accepted marker for health care quality, and possible reduction measures include earlier subspecialist consultation, preoperative counseling regarding the anticipated length of stay, and the wider adoption of a formal multidisciplinary, clinical pathway. These coordinated, multidisciplinary, clinical pathways, or "fast-track protocols," deliver a goal-directed approach to patient management that entails appropriate procedure selection, intraoperative management, and postoperative care.[28,30,31] Numerous studies have established their efficacy at reducing length of stay and total costs across a variety of major surgical procedures such as esophagectomy, aneurysm repair, and colon resections.[26] Gap in care: The median length of stay in a nationwide study was 4 days. Thus, 50% of patients were discharged by 4 days and 50% were not.[27]
Measure designation	
Measure purpose	Quality improvement; accountability
Type of measure	Outcome
Care setting	Inpatient
Data source	Administrative data; medical record

Table 4. Measure 4: Operative Time for Autologous Breast Reconstruction

	Measure Information
Measure description	Percentage of female patients aged 18 years and older who had unilateral breast reconstruction via autologous free tissue reconstruction with or without a tissue expander or implant whose operative time* did not exceed 8 hours.
Measure components	
Numerator statement	Patients whose operative time* did not exceed 8 hr.
Denominator statement	All female patients aged 18 yr and older who had unilateral breast reconstruction by means of autologous free tissue reconstruction with or without a tissue expander or implant.
Denominator exceptions	None.
Supporting evidence	Operative time, especially when exceeding 12 hr in duration, was the most predictive of prolonged length of stay in both study groups (breast reconstruction and non–breast reconstruction with free tissue transfer). Operative time, defined as the duration between first incision and wound closure, was categorized as follows: <4 hr, 4 to <8 hr, 8 to <12 hr, and ≥12 hr.[26] Prolonged operative time is associated with higher postoperative complications and higher costs.[30,32–34] Cases whose operative times were >604 min in length had twice the rate of reoperation compared to cases that were <372 min in length (8.85% vs. 17.08%, respectively).[35] After controlling for other variables, cases whose operative time was greater than or equal to the 75th percentile (625.5 min) were twice as likely to experience flap failure.[36]
Measure importance	
Rationale/opportunity for improvement	Prolonged operative time has been found to be a significant predictor of flap failure and reoperation. Cases whose operative times were >604 min in length had twice the rate of reoperation compared to cases that were <372 min in length.[35] After controlling for other variables, cases whose operative time was greater than or equal to the 75th percentile (625.5 min) were twice as likely to experience flap failure.[36] Most of the studies did not control for unilateral vs. bilateral reconstruction, nor did they differentiate reconstruction with or without concurrent mastectomy or situations where difficult clinical situations arise necessitating increased length of surgery and inherent value judgment (i.e. longer time in the OR/hospital might be worth it to the patient if the other choice is no breast reconstruction). Consensus of the Work Group was to limit this measure to unilateral free flap reconstruction, and thus the metric of 10 hr was originally decided after significant consideration. On consultation with CMS, the 75th percentile was found to not show enough differentiation and they asked that the measure be changed to the 50th percentile or 8 hr. Gap in care: 50% of relevant cases in the NSQIP database had operative time greater than 8 hr.[35]
Measure designation	
Measure purpose	Quality improvement; accountability
Type of measure	Outcome
Care setting	Inpatient
Data source	Administrative data; medical record

OR, operating room; CMS, Centers for Medicare & Medicaid Services; NSQIP, National Surgical Quality Improvement Program.
*Definition of operative time: the NSQIP collects only full operative time, defined as the duration between first incision and wound closure.

Table 5. Measure 5: Rate of Blood Transfusion for Patients Undergoing Autologous Breast Reconstruction

	Measure Information
Measure description	Percentage of female patients aged 18 years and older who had breast reconstruction via autologous reconstruction (not including latissimus flap) tissue flap with or without a tissue expander or implant who received blood or blood product transfusion during hospitalization (inverse measure, lower score = better performance).
Measure components	
Numerator statement	Patients who received blood or blood product transfusion during hospitalization.
Denominator statement	All female patients aged 18 yr and older who had breast reconstruction by means of autologous reconstruction (not including latissimus flap) with or without a tissue expander or implant.
Denominator exclusions	Patients who had an unplanned second operation within the same hospital stay (this exclusion is included, as there is another ASPS measure tracking unplanned return to the OR).
Denominator exceptions	Medical exception for patients with known bleeding disorders.
Supporting evidence	The following evidence statements are quoted from relevant studies: A NSQIP review of free flap patients found that increased anesthesia time correlates with increased postoperative transfusions in these patients. As a result, limiting blood loss and avoiding prolonged anesthesia times should be goals for the microvascular surgeon.[37] Moreover, studies have shown that blood transfusions are associated with increased morbidity complications and cost.[38] As a result, comprehensive preoperative evaluation of risk factors, limiting blood loss, and avoiding prolonged anesthesia times should be goals for the microvascular surgeon.
Measure importance	
Rationale/opportunity for improvement	In an NSQIP analysis of free tissue transfer patients, IOT was significantly associated with higher rates of overall complications, medical complications, postoperative transfusion, and reoperation. However, IOT was not associated with surgical complications or free flap loss.[39] A prospective review of all patients undergoing breast reconstruction receiving blood transfusions found that transfusions were independently associated with higher rates of medical complications. A significantly lower rate of medical complications was observed when a restrictive transfusion (HgB level, <7 g/dl) was administered ($p = 0.04$).[38,40] A cost analysis demonstrated that each blood transfusion was independently associated with an added $1500 in total cost.[38] A retrospective review of women undergoing DIEP flap breast reconstruction found that bilateral reconstruction and length of surgery were the only factors to significantly increase the risk of perioperative blood transfusion. Patients receiving blood transfusions had an increased risk of experiencing a postoperative complication.[41] Patients should have a thorough preoperative evaluation including review of identifiable risks factors and counseling regarding the risks of intraoperative/postoperative need for blood transfusion.[42] Implementation of ERAS has shown a decrease in hospital stay with shorter recovery times and a decrease in complications, flap loss, and readmissions. Oh et al.[30] showed a statistically significant decrease in hospital costs and need for blood transfusions in patients that participated in ERAS protocols. Gap in care: Transfusion rates in DIEP flap procedures range from 9.1[43] to 18.8%.[41] Fischer et al. found the rate of blood transfusion for all autologous breast reconstructions to be 8.2%,[38] and Al-Benna and Rajgarhia[44] found the postoperative transfusion rate across all elective breast reconstructions to be similar, at 8%.
Measure designation	
Measure purpose	Quality improvement; accountability
Type of measure	Outcome
Care setting	Inpatient
Data source	Administrative data; medical record

ASPS, American Society of Plastic Surgeons; OR, operating room; NSQIP, National Surgical Quality Improvement Program; IOT, intraoperative transfusion; HgB, hemoglobin B; DIEP, deep inferior epigastric perforator; ERAS, enhanced recovery after surgery.
*Full measure specifications including CPT codes available at: https://www.plasticsurgery.org/for-medical-professionals/quality/asps-performance-measures.

ACKNOWLEDGMENTS

The work group is indebted to the patient representatives that participated in the process: Evelyn Calip and Caroline Morton. Other nonvoting participants included Akhil Seth, M.D., Olivia Ho, M.D., and David Song, M.D.

REFERENCES

1. Manahan MA, Wooden WA, Becker SM, et al. Evidence-based performance measures: Quality metrics for the care of patients undergoing breast reconstruction. *Plast Reconstr Surg.* 2017;140:775e–781e.
2. Institute of Medicine. *Crossing the Quality Chasm.* Washington, DC: National Academy Press; 2001.
3. Lee BT, Agarwal JP, Ascherman JA, et al. Evidence-based clinical practice guideline: Autologous breast reconstruction with DIEP or pedicled TRAM abdominal flaps. *Plast Reconstr Surg.* 2017;140:651e–664e.
4. Alderman AK, Hawley ST, Morrow M, et al. Receipt of delayed breast reconstruction after mastectomy: Do women revisit the decision? *Ann Surg Oncol.* 2011;18:1748–1756.

5. Atisha DM, Rushing CN, Samsa GP, et al. A national snapshot of satisfaction with breast cancer procedures. *Ann Surg Oncol.* 2015;22:361–369.
6. Yueh JH, Slavin SA, Adesiyun T, et al. Patient satisfaction in postmastectomy breast reconstruction: A comparative evaluation of DIEP, TRAM, latissimus flap, and implant techniques. *Plast Reconstr Surg.* 2010;125:1585–1595.
7. Eltahir Y, Werners LL, Dreise MM, et al. Quality-of-life outcomes between mastectomy alone and breast reconstruction: Comparison of patient-reported BREAST-Q and other health-related quality-of-life measures. *Plast Reconstr Surg.* 2013;132:201e–209e.
8. PCPI. Specification and categorization of measure exceptions. Available at: https://cdn.ymaws.com/www.thepcpi.org/resource/resmgr/pcpi-exceptions-framework.pdf.
9. American College of Physicians. The patient-centered medical home neighbor: The interface of the patient-centered medical home with specialty/subspecialty practices. Philadelphia: American College of Physicians; 2010. Available at: https://www.acponline.org/system/files/documents/advocacy/current_policy_papers/assets/pcmh_neighbors.pdf.
10. Milucky JL, Deal AM, Anders C, Wu R, McNally RS, Lee CN. Coordination of care for breast reconstruction patients: A provider survey. *Clin Breast Cancer* 2017;17:e59–e64.
11. Kain ZN, Vakharia S, Garson L, et al. The perioperative surgical home as a future perioperative practice model. *Anesth Analg.* 2014;118:1126–1130.
12. Runowicz CD, Leach CR, Henry NL, et al. American Cancer Society/American Society of Clinical Oncology Breast Cancer Survivorship Care Guideline. *J Clin Oncol.* 2016;34:611–635.
13. Lee M, Reinertsen E, McClure E, et al. Surgeon motivations behind the timing of breast reconstruction in patients requiring postmastectomy radiation therapy. *J Plast Reconstr Aesthet Surg.* 2015;68:1536–1542.
14. Bakker DA, Fitch MI, Gray R, Reed E, Bennett J. Patient-health care provider communication during chemotherapy treatment: The perspectives of women with breast cancer. *Patient Educ Couns.* 2001;43:61–71.
15. Golshan M, Losk K, Kadish S, et al. Understanding process-of-care delays in surgical treatment of breast cancer at a comprehensive cancer center. *Breast Cancer Res Treat.* 2014;148:125–133.
16. Virgo KS, Lerro CC, Klabunde CN, Earle C, Ganz PA. Barriers to breast and colorectal cancer survivorship care: Perceptions of primary care physicians and medical oncologists in the United States. *J Clin Oncol.* 2013;31:2322–2336.
17. Cohen WA, Mundy LR, Ballard TN, et al. The BREAST-Q in surgical research: A review of the literature 2009-2015. *J Plast Reconstr Aesthet Surg.* 2016;69:149–162.
18. Ho AL, Klassen AF, Cano S, Scott AM, Pusic AL. Optimizing patient-centered care in breast reconstruction: The importance of preoperative information and patient-physician communication. *Plast Reconstr Surg.* 2013;132:212e–220e.
19. Liu C, Zhuang Y, Momeni A, et al. Quality of life and patient satisfaction after microsurgical abdominal flap versus staged expander/implant breast reconstruction: A critical study of unilateral immediate breast reconstruction using patient-reported outcomes instrument BREAST-Q. *Breast Cancer Res Treat.* 2014;146:117–126.
20. Cohen WA, Ballard TN, Hamill JB, et al. Understanding and optimizing the patient experience in breast reconstruction. *Ann Plast Surg.* 2016;77:237–241.
21. Ashraf AA, Colakoglu S, Nguyen JT, et al. Patient involvement in the decision-making process improves satisfaction and quality of life in postmastectomy breast reconstruction. *J Surg Res.* 2013;184:665–670.
22. Pusic AL, Klassen AF, Snell L, et al. Measuring and managing patient expectations for breast reconstruction: Impact on quality of life and patient satisfaction. *Expert Rev Pharmacoecon Outcomes Res.* 2012;12:149–158.
23. Flitcroft K, Brennan M, Spillane A. Making decisions about breast reconstruction: A systematic review of patient-reported factors influencing choice. *Qual Life Res.* 2017;26:2287–2319.
24. Zhong T, Hu J, Bagher S, et al. A comparison of psychological response, body image, sexuality, and quality of life between immediate and delayed autologous tissue breast reconstruction: A prospective long-term outcome study. *Plast Reconstr Surg.* 2016;138:772–780.
25. Aguiar IC, Veiga DF, Marques TF, Novo NF, Sabino Neto M, Ferreira LM. Patient-reported outcomes measured by BREAST-Q after implant-based breast reconstruction: A cross-sectional controlled study in Brazilian patients. *Breast* 2017;31:22–25.
26. Offodile AC II, Aherrera A, Guo L. Risk factors associated with prolonged postoperative stay following free tissue transfer: An analysis of 2425 patients from the American College of Surgeons National Surgical Quality Improvement Program database. *Plast Reconstr Surg.* 2014;134:1323–1332.
27. Billig JI, Lu Y, Momoh AO, Chung KC. A nationwide analysis of cost variation for autologous free flap breast reconstruction. *JAMA Surg.* 2017;152:1039–1047.
28. Bonde CT, Khorasani H, Elberg J, Kehlet H. Perioperative optimization of autologous breast reconstruction. *Plast Reconstr Surg.* 2016;137:411–414.
29. Temple-Oberle C, Shea-Budgell MA, Tan M, et al.; ERAS Society. Consensus review of optimal perioperative care in breast reconstruction: Enhanced Recovery after Surgery (ERAS) Society recommendations. *Plast Reconstr Surg.* 2017;139:1056e–1071e.
30. Oh C, Moriarty J, Borah BJ, et al. Cost analysis of enhanced recovery after surgery in microvascular breast reconstruction. *J Plast Reconstr Aesthet Surg.* 2018;71:819–826.
31. Batdorf NJ, Lemaine V, Lovely JK, et al. Enhanced recovery after surgery in microvascular breast reconstruction. *J Plast Reconstr Aesthet Surg.* 2015;68:395–402.
32. Chu MW, Barr JS, Hill JB, Weichman KE, Karp NS, Levine JP. Late-start days increase total operative time in microvascular breast reconstruction. *J Reconstr Microsurg.* 2015;31:401–406.
33. Duraes EF, Schwarz G, Durand P, et al. Complications following abdominal-based free flap breast reconstruction: Is a 30 days complication rate representative? *Aesthetic Plast Surg.* 2015;39:694–699.
34. Hultman CS, Kim S, Lee CN, et al. Implementation and analysis of a lean six sigma program in microsurgery to improve operative throughput in perforator flap breast reconstruction. *Ann Plast Surg.* 2016;76(Suppl 4):S352–S356.
35. Kwok AC, Agarwal JP. Unplanned reoperations after microvascular free tissue transfer: An analysis of 2,244 patients using the American College of Surgeons National Surgical Quality Improvement Program database. *Microsurgery* 2017;37:184–189.
36. Wong AK, Joanna Nguyen T, Peric M, et al. Analysis of risk factors associated with microvascular free flap failure using a multi-institutional database. *Microsurgery* 2015;35:6–12.
37. Kim BD, Ver Halen JP, Grant DW, Kim JY. Anesthesia duration as an independent risk factor for postoperative complications in free flap surgery: A review of 1,305 surgical cases. *J Reconstr Microsurg.* 2014;30:217–226.
38. Fischer JP, Nelson JA, Sieber B, et al. Transfusions in autologous breast reconstructions: An analysis of

risk factors, complications, and cost. *Ann Plast Surg.* 2014;72:566–571.
39. Kim BD, Ver Halen JP, Mlodinow AS, Kim JY. Intraoperative transfusion of packed red blood cells in microvascular free tissue transfer patients: Assessment of 30-day morbidity using the NSQIP dataset. *J Reconstr Microsurg.* 2014;30:103–114.
40. O'Neill AC, Barandun M, Cha J, Zhong T, Hofer SO. Restrictive use of perioperative blood transfusion does not increase complication rates in microvascular breast reconstruction. *J Plast Reconstr Aesthet Surg.* 2016;69:1092–1096.
41. Appleton SE, Ngan A, Kent B, Morris SF. Risk factors influencing transfusion rates in DIEP flap breast reconstruction. *Plast Reconstr Surg.* 2011;127:1773–1782.
42. Ting J, Rozen WM, Le Roux CM, Ashton MW, Garcia-Tutor E. Predictors of blood transfusion in deep inferior epigastric artery perforator flap breast reconstruction. *J Reconstr Microsurg.* 2011;27:233–238.
43. Lymperopoulos NS, Sofos S, Constantinides J, Koshy O, Graham K. Blood loss and transfusion rates in DIEP flap breast reconstruction: Introducing a new predictor. *J Plast Reconstr Aesthet Surg.* 2013;66:1659–1664.
44. Al-Benna S, Rajgarhia P. Blood transfusion requirements in elective breast reconstruction surgery. *Breast* 2010;19:475–478.