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Process measures such as surgical technique are not easily quantified but need attention to improve the quality of surgical oncology care.

Quality of Care in Surgical Oncology

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Background: High-quality health care is safe, effective, efficient, timely, patient-centered, and equitable. A current focus on quality assessment and improvement in oncology care, specifically in surgical oncology, is aimed toward providing optimal health services that consistently fulfill these elements for cancer patients.

Methods: In surgical oncology, outcomes have historically focused on perioperative morbidity and mortality. To assess care metrics in the United States, we review structural and process measures of quality care in surgical oncology.

Results: Most quality metrics in surgical oncology pertain to structural measures of care such as accreditation, procedure volumes, provider specialization, and multidisciplinary teams. Process measures, such as surgical technique, are also important but are not easily quantified.

Conclusions: Policy implications of quality metrics in surgical oncology include formal regionalization of care, changes in payment structures, and public reporting. More comprehensive assessments of outcomes are gaining traction in the field of surgical oncology; this shift in focus to the patient's perspective will enhance the quality of care delivered by surgical oncologists.

Introduction

The provision of high-quality health care is a key element of cancer care. Despite the increasing interest in improving the quality of health care, studies have shown great variation in the quality and appropriateness of care delivered to patients.^{1,2} For example, in a project by the National Initiative for Cancer Care Quality, Malin et al² found that 86% of breast cancer patients and 78% of colorectal cancer patients received recommended cancer care.² In its landmark study, *Crossing the Quality Chasm*, the Institute of Medicine (IOM)

defined quality health care as that which is safe, effective, efficient, timely, patient-centered, and equitable.³ Under ideal conditions, each of these components of quality care would be achieved. However, challenges persist in the effort to provide high-quality care to all cancer patients.⁴ Currently, there is a great focus on quality assessment and improvement in oncology care, specifically in surgical oncology.

Donabedian's conceptual framework for quality of care evaluates the relationships between structure, process, and outcomes of the health care delivery system.⁵ Through this model, we can attempt to understand the drivers of quality in surgical oncology and envision comprehensive quality improvement initiatives. Structure describes the care environment, including the availability and use of resources by providers in order to deliver care to patients. Process of care describes what providers do to or for a patient. Outcomes capture the results of what happens to a patient or population during the course of care. A simple example relating the Donabedian model to surgical

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oncology involves a patient with breast cancer who needs to undergo a sentinel lymph node biopsy. In this example, structural elements of importance may include whether or not the care is delivered at an accredited cancer center, whether multidisciplinary teams are in place to facilitate the necessary steps across the continuum of care, whether different specialists are available (eg, surgical oncologist, radiologist, pathologist) and may include the physical characteristics of the hospital. The primary process measures in this example would be the performance of the sentinel lymph node biopsy and the pathologic evaluation of the lymph nodes. These structural and process measures can have an important impact on outcomes; the outcomes of interest in this example include accuracy of staging, treatment decisions, and mortality.

Quality measurement in surgical oncology has traditionally centered on structural components of the health care system. In discussing quality metrics, it is important to acknowledge that our definitions of quality are often based on the convenience of what components can be measured, which hopefully serve as a proxy for quality. This is a potential pitfall of many quality metrics. While associations can be clearly stated, determining the finer levels of cause and effect of quality remains difficult. Structural measures of quality are likely proxies for underlying processes or components of care that are more directly responsible for the predicted associations. A number of structural measures with potential importance in surgical oncology are accreditation, procedure volume, surgeon specialization, and multidisciplinary teams. An additional measure that is important to consider is the process measure of surgical skill or technique, which is difficult to quantify and is influenced by multiple providers in addition to the surgeon.

In this paper, we briefly review the history of the quality movement in the United States with a focus on surgery and surgical oncology. We then discuss each of the quality measures mentioned above: accreditation, procedure volume, provider specialization, multidisciplinary teams, and surgical technique. To provide an overview of these topics, we searched the literature for articles on surgery, oncology, and quality, as well as topics concerning surgical oncology: accreditation, procedure volume, surgeon specialization, multidisciplinary teams, and surgical skill or technique. Articles that provided comprehensive literature reviews received preference and, in some instances, sentinel articles were identified and reviewed. Additionally, our knowledge of and experience with certain programs including accreditation bodies and professional organizations directed focus to Web sites and materials by these programs.

Also included is a discussion of the major potential policy implication of these quality measures: regionalization of care. Regionalization of care has many limitations and potential unintended consequences regarding distribution of resources, provider availability, and patient preferences, to name a few. If we can better

understand the structures and processes that directly improve quality of care, we may be able to implement these across care settings and thus negate the need for regionalization. Outcomes measures are not directly addressed in this paper but are discussed in the context of the previously mentioned quality metrics. In surgical oncology, outcomes have historically focused on perioperative morbidity and mortality. More comprehensive assessments of outcomes are gaining traction in the field of surgical oncology, including consideration of long-term mortality rates and patient-reported outcomes such as quality of life and functional status. This shift in focus to the patient's perspective will enhance the quality of care delivered by surgical oncologists.

The Quality Movement in American Medicine

Formal interest in quality of care began over a century ago. In the second half of the 1800s, the American Medical Association (AMA) called for the standardization of medical education as an initial foray into the realm of quality assurance. In 1908, the AMA's Council on Medical Education enlisted the aid of the Carnegie Foundation to perform a thorough review of all medical schools and hospitals.⁶ This led to the now infamous Flexner Report⁷ published in 1910, which exposed the poor conditions of hospitals and medical schools throughout the United States. This report revealed significant variation in quality of care and education. As a result, further efforts were put in place to support institutions that adopted the educational norms put forth by the AMA and Flexner, while support diminished for programs that did not adopt the new standards.⁸ The AMA and Flexner's early collaborations are often referred to as the birth of medical education; their efforts were aimed at improving the quality of the health care profession by standardization of education.

In the same year that the Flexner report was published, Ernest Codman, MD, was waging his own battle to improve the quality of care in American hospitals. Codman was a surgeon at Massachusetts General Hospital who encouraged his colleagues to track their outcomes in an effort to assess the quality and effectiveness of care provided. While his efforts were shunned by many, his work ultimately contributed to the founding of the American College of Surgeons (ACS) and, specifically to the early quality improvement initiatives by the ACS. In 1917, the ACS set forth standards for hospitals relating to staffing structure, staff licensure and credentialing, integrity of the medical record and clinical laboratories, among others. The Hospital Standardization Program evolved over the years into what we now know as the Joint Commission for the Accreditation of Healthcare Organizations (JCAHO).⁸

Numerous groups are now involved in quality measurement efforts, including the Centers for Medicaid and Medicare Services (CMS), the Agency for Healthcare Reporting and Quality (AHRQ), the National Quality Forum (NQF), the National Comprehensive Cancer Network (NCCN), licensing bodies, major payers, health

care professional organizations, hospitals and health care systems, and consumer advocacy groups. While a full listing of each organization and a discussion of its role in quality improvement are beyond the scope of this paper, a few additional developments in surgical quality of care warrant mention.

As early as the 1920s, the ACS began to organize around the issue of quality care in surgical oncology. The ACS Commission on Cancer (ACS-CoC) was established in 1922 as an association of professional societies focused on improving cancer care through prevention, research, and education, and by setting standards of care and monitoring comprehensive care.^{8,9} The ACS-CoC accredits hospitals as ACS-CoC-designated cancer centers based on meeting a set of standards that aim to ensure the potential for high-quality cancer care and also create an atmosphere of quality improvement. As an example, one standard to be met for accreditation requires the cancer center to perform at least two quality improvement studies per year. There are roughly 40 standards, including availability of specialists, services, and facilities.¹⁰ The ACS-CoC is the only cancer center-accrediting body with a surgical foundation. Accreditation also serves to ensure high-quality data, which is a necessary step in measuring quality and studying outcomes in cancer care. The ACS-CoC partnered with the American Cancer Society in 1989 to develop the National Cancer Database (NCDB), which is a comprehensive dataset containing over 20 million records from hospital cancer registries in the United States and Puerto Rico. This dataset has been used to evaluate outcomes, assess trends in cancer care, develop quality indicator benchmarks, and provide evidence for a number of quality initiatives.¹⁰⁻¹²

Additional developments in the realm of surgical quality of care in the late 1980s-1990s took place at the US Department of Veterans Affairs (VA). The VA had come under significant scrutiny for its high mortality rates, ultimately leading to Congressional action. Congress passed law 99-166 mandating comprehensive reporting of surgical outcomes, taking into account both risk adjustment and comparisons with the private sector. The VA National Surgical Quality Improvement Program (NSQIP) was born out of this congressional mandate. The VA NSQIP is a well-studied, validated model for consistent evaluation of quality of surgical care over time.¹³ Thorough patient level data are collected prospectively, allowing for risk adjustment of outcomes. Outcomes are reported back to participating institutions on a biannual basis such that institutions can further improve their care. The ACS adopted the NSQIP methodology to develop the ACS NSQIP in the early 2000s.

Measures of Quality in Surgical Oncology Accreditation

Accreditation and certification programs focus on the delivery of high-quality cancer care by setting standards, analyzing outcomes, and ensuring that quality benchmarks are met. The National Cancer Institute

(NCI) and the ACS-CoC evaluate institutions for accreditation as cancer centers.

The NCI designates appropriate institutions as NCI cancer centers or NCI comprehensive cancer centers. Accreditation as an NCI cancer center includes a detailed review of structural elements. For example, the NCI's most recent guidelines for designation as a cancer center include six key elements for consideration. Among these are structural elements such as the facility's physical design and layout, its organizational structure including administrative duties, methods for information sharing and collaboration, organizational status including role within the larger institution, reporting structures, advisory boards, and leadership structure. As discussed previously, the ACS-CoC also reviews health care systems and identifies designated CoC cancer centers based on a thorough review of both structures and processes of care.^{9,10}

In addition to these overarching programs that accredit cancer centers, disease-based programs can now also receive designation as programs of excellence. The American College of Surgeons has led the way in these efforts. In 2008, the National Accreditation Program for Breast Centers was created based on patient and payer demand for accredited programs whose outcomes meet or exceed national benchmarks.¹⁴ This program seeks to improve quality across the range of heterogeneous practice models currently in existence.

Accreditation and certification bodies perform thorough evaluations of cancer programs before designating them as cancer centers. It is intuitive that the comprehensive structure of care needed to meet accreditation standards would lead to improved quality of care. However, there is a paucity of research evaluating accreditation status and surgical quality. Much of the research evaluating hospital type with outcomes has focused on hospital ownership, teaching or academic status, or hospital volume. Further research to specifically address outcomes at accredited institutions could better illuminate the specific structural components of care that may be associated with improved outcomes.

Participation in accreditation programs does not guarantee high-quality care, but it demonstrates a commitment to such aims. As stated above, many accreditation programs specifically require quality improvement initiatives as part of their standards. Thus, it is our opinion that participation in such programs is a worthwhile endeavor as we strive to improve the overall cancer care at our facilities.

Volume-Outcomes Relationship

The relationship between procedure volume and outcomes has been studied for decades. Health care purchasers have begun to put considerable stock into the association between higher volume and better outcomes. Many studies have been published in the surgical oncology realm dealing with volume-outcomes relationships.¹⁵⁻²² A positive relationship between higher volume and better outcomes has been demonstrated

fairly consistently in complex surgical oncology cases such as pancreatectomy and esophagectomy.^{15-17,19,21} Volume is a proxy measure; in order to push the quality movement further, we must work to understand the specific attributes of high-volume centers that may be responsible for improved outcomes.

The volume-outcomes relationship was initially described by Luft et al²³ in 1979. In a study evaluating a wide range of surgical procedures, including cardiovascular surgery, cholecystectomy, and colectomy, they described a positive relationship between increased hospital procedure volume and improved outcomes. A large body of research has expanded on this theme, and some of these studies are discussed further herein.

Begg et al¹⁵ evaluated 5,103 patients 65 years of age and older who underwent either a pancreatectomy, esophagectomy, pneumonectomy, liver resection, or pelvic exenteration between 1984 and 1993 as identified through the Surveillance, Epidemiology and End Results (SEER)-Medicare linked database. Thirty-day mortality was evaluated in relation to hospital volume, adjusting for case mix. They found that mortality was significantly lower in patients cared for at a high-volume institution for all cases except for pneumonectomy.¹⁵

Birkmeyer et al¹⁶ have added a considerable amount to the volume-outcomes literature. In a well-known study, they evaluated patients through the Medicare claims database and nationwide inpatient sample who underwent cardiovascular procedures and eight cancer resections between 1994 and 1998. Striking differences were found in adjusted mortality rates between very low-volume hospitals and very high-volume hospitals for patients undergoing pancreatic resections, esophagectomy, and pneumonectomy. Smaller differences with a similar directional trend were seen for gastrectomy, cystectomy, colectomy, lobectomy, and nephrectomy.

Another study by Birkmeyer et al¹⁷ systematically addressed provider volume accounting for hospital volume and vice versa. In this study, they evaluated all patients ages 65 to 99 years from the nationwide inpatient sample and Medicare claims who underwent one of 14 cardiovascular or cancer surgeries. Cancer surgeries included pancreatic resection, esophagectomy, lung resection, and cystectomy. The outcome of interest was operative mortality (defined as death before discharge or within 30 days of index surgery). Low-volume surgeons had higher odds of operative mortality for all cancer procedures studied except pneumonectomy. Increased hospital volume was associated with decreased mortality from cystectomy, pneumonectomy, and pancreatic resection. They found that mortality from esophagectomy was higher for low-volume surgeons at high-volume hospitals compared with low-volume hospitals. For pancreatic resection, mortality was lower at high-volume hospitals compared with low-volume hospitals regardless of surgeon volume.

Halm et al¹⁹ performed an extensive review of the literature regarding operative volume and outcomes covering English language articles in MEDLINE between

1980 and 2000. Of the 135 articles they examined, the most consistent finding of improved mortality when comparing high- and low-volume hospitals in surgical oncology was in pancreatic and esophageal cancers.

The Leapfrog Group, a nonprofit consortium representing many public and private health care purchasers,²⁴ has published recommendations regarding hospital volume for certain high-risk, complex operations including pancreatectomy (≥ 11 cases per year) and esophagectomy (≥ 13 cases per year). There are no other surgical oncology procedures with specific Leapfrog criteria at this time.²⁵ Of note, Halm et al¹⁹ found that there was vast heterogeneity in definitions of volume as well as in the quality and techniques of risk adjustment in the research they reviewed. Of significant importance, however, they found that there was vast heterogeneity in definitions of volume as well as in the quality and techniques of risk adjustment in the research reviewed. There is little agreement in the literature regarding volume thresholds for most cancer surgeries. Thus, most volume-outcomes studies either evaluate volume as a continuous measure, use investigator-determined thresholds, or break up volume into percentages based on the distribution of their sample. Regardless of the technique, reviews such as those by Halm et al¹⁹ and Hillner et al²¹ suggest that the trend remains that higher volume is associated with improved mortality, particularly in relation to complex procedures. Most of the volume-outcomes work has focused on short-term outcomes. Recently, researchers have begun to address long-term outcomes with regard to volume and other quality measures.^{26,27}

Thus, while hospital volume has been shown in some cases to be associated with improved outcomes, particularly in complex surgical oncology cases, there is still much to be learned about what occurs at high-volume centers that drives this association. In a study by Schell et al,²⁸ operative outcomes of pancreatectomies were evaluated at a high-volume, major academic medical center and at all of its low-volume affiliate hospitals. They found comparable outcomes at all sites and attributed this to the ability of these affiliates to work together to import from the academic medical center expertise and care pathways necessary to result in good outcomes. Specifically, the low-volume centers often imported attending surgeons from the large academic medical center for specific operations and surgical residents familiar with care pathways rotated at all low-volume affiliate hospitals. This is one example of a local effort to understand the drivers of better outcomes and to implement the appropriate changes for the relevant hospital systems.

To impact the quality of care provided across care settings requires an understanding of the finer elements of the structures and processes of care that are directly responsible for the improved outcomes seen at centers with higher volumes. Our goal should be to advance the field of quality and to improve the care delivered to patients at both high- and low-volume centers.

Specialization

Efforts to get at the specific attributes of high-volume surgeons and hospitals that are responsible for better outcomes has led to a discussion regarding the role of provider specialization. It is generally accepted that specialty-trained surgeons have a greater understanding of disease processes.¹⁸ Unfortunately, defining specialization has been inconsistent in the literature.^{29,30} How should we define what makes a provider a specialist? Is specialization based on years of experience, number of cases performed, or fellowship training?³⁰

In a recent systematic review of the literature, Bilimoria et al²⁹ identified 27 research studies that evaluated the role of specialization on clinical outcomes in surgical oncology. While the majority of the articles they reviewed found a survival benefit or lower recurrence rate among patients treated by specialists, there was vast heterogeneity in study design, data sources, and specialist definition that limited the generalizability of the findings. Definitions of specialist included having American Board of Surgery certification, being fellowship trained, or having subspecialty board certification. Additionally, the role of expertise was reviewed in terms of years of operative experience, as measured by either years from medical school or years from residency. As there was wide variation in methodology, risk adjustment, and types of cancer studied, the authors recommended further studies to better understand the processes of care among specialty-trained, high-volume, or otherwise experienced surgeons that could be associated with improved outcomes.

More subspecialization has occurred as the surgical field has evolved. The majority of graduating residents go on to a clinical fellowship.²⁹ Among the subspecialties, many training pathways lead to involvement in surgical oncology. While there is distinct training in surgical oncology fellowships, other fellowships also train clinicians in the care of cancer, including surgical fellowships in endocrine, breast, cardiothoracic, hepatobiliary, colorectal cancers and transplantation. In discussing provider specialization, then, it is important to identify what it is about that specialty or training that might have an impact on outcomes.²⁹ Is it the familiarity with disease processes? Is it technical prowess or the experience of collaborating on multidisciplinary teams? These are important questions for patients with cancer who want to ensure that they are literally in the hands of a physician who can provide high-quality care. Given the heterogeneity in definitions of specialist in the literature and the broad range of diseases considered when discussing cancer care, the authors agree with Bilimoria et al²⁹ that further study is warranted to better define the essence of specialization that is associated with improved care.

Multidisciplinary Teams

Multidisciplinary teams have become widely accepted as critical to the success of cancer programs. Multidisciplinary teams in oncology include clinical oncolo-

gists, surgeons, radiologists, radiation oncologists, pathologists, anesthesiologists, nurse specialists, social workers, patient navigators, and research coordinators. A timely, appropriate transition from one phase of cancer care to the next is dependent upon both access to the necessary providers and accurate communication among providers. Highlighting this concept, Aiello Bowles et al³¹ performed semistructured interviews on an expert panel to evaluate barriers and facilitators important in realizing quality care in cancer. They found that the need for coordination across the continuum of cancer care was the major perceived barrier to achieving the six quality aims set forth by the IOM.

Although it is instinctive to suggest that multidisciplinary teams could facilitate such coordinated and evidence-based care, little research has been done to address these claims.^{32,33} The mere presence of all team members may be necessary but not sufficient for quality cancer care. What can we learn about team dynamics, communication skills, and creative team formation that might contribute to the growth of the quality movement in cancer care?

Studies that have investigated the impact of multidisciplinary teams on oncologic outcomes have been heterogeneous. Stephens et al³⁴ performed a retrospective study to evaluate the effect of multidisciplinary teams on clinical outcomes in esophageal cancer. They found lower operative mortality and higher 5-year survival rates in patients who were treated in a team environment from 1998 to 2003 compared with a control cohort of patients treated by independent surgeons from 1991 to 1997. Limitations of this study included the small sample size and potential unmeasured effects such as changes in secular trends or neoadjuvant therapy regimens across time periods. Other studies from the United Kingdom have suggested improved processes of care, such as appropriate staging of disease, and improved survival associated with multidisciplinary team models in ovarian cancer, non-small cell lung cancer, and head and neck cancers.³⁵ Houssami et al³³ performed a systematic review of the literature in 2006 to evaluate the effect of multidisciplinary teams on clinical outcomes in breast cancer care where multidisciplinary teams have long been widely accepted as a pinnacle of quality. In their review, they found little evidence to support an association between multidisciplinary teams and better outcomes. Although one typically thinks of multidisciplinary teams as housed in the same care environment, this is not always possible, particularly in rural and underserved areas. Davison et al³⁶ recently evaluated the effect of multidisciplinary team meetings in lung cancer conducted through the use of telemedicine in the United Kingdom. Though the study was small, they demonstrated an increase in cancer resection rate of 30% and a decrease in mean time from first clinic visit to operative intervention from 69 to 54 days.

These studies are intriguing despite the limitations in methodology and sample size. It is possible that multidisciplinary teams foster better communication between

specialists, which may result in more appropriate coordinated care. In addition to communication skills, the importance of shared responsibility and accountability among team members cannot be overstated.^{32,37-39} We live in a system that is increasingly moving toward pay for performance, benchmarking, and public reporting. While many of these initiatives grew out of an interest in quality care, they are simplistic when implemented at the individual provider level. When each provider is critical at its stage across the continuum of care, and each stage impacts the outcome of interest, which provider gets the credit, or the blame, on a performance measure?

Clearly there is much to be learned about enhancing the functionality of multidisciplinary teams with the goal of improving overall quality. The effect of multidisciplinary teams on clinical outcomes as well as considerations of how to measure a team's success warrant further systematic study. Additionally, creative solutions to provide equitable access to high-quality care including multidisciplinary teams, such as the use of telemedicine mentioned above, should continue to be sought.

Surgical Technique

A surgeon's knowledge and skill are influential across the continuum of surgical oncology care including initial patient selection, adequacy of staging, operative resection, and follow-up for recurrence. Objectifying the surgeon's actions, particularly within the operating room, into quality metrics has proven more difficult than the structural measures discussed previously. There are countless small acts that occur within the operating room that have the potential to affect a patient's outcome. Quality measurement aims to capture the most influential of these actions, ideally in a way that can lead to learning and quality improvement. As with other quality metrics, we are limited to those that can be measured effectively. Consequently, the challenge remains to identify quality metrics that are not just exercises in measurement, but rather genuinely serve as proxies of high-quality care. In attempting to drill down further to identify specific quality indicators of surgical technique, some metrics have been developed such as nodal harvest, use of sentinel node biopsy, and extent of resection. The relationship specifically addressing surgical technique and quality in surgical oncology has been most studied in breast, gastric, colon, and rectal cancers. Of these, national policy has been established for process measures only in colon cancer.^{40,41}

A number of studies have evaluated the relationship between number of lymph nodes sampled during colectomy for colon cancer and mortality. In a systematic review of the literature, Chang et al⁴² evaluated 17 studies on lymph node status in colorectal cancer. They found that, despite the heterogeneity in study designs, an increased number of resected lymph nodes was associated with decreased mortality. The ACS-CoC has collaborated with the American Society of Clinical Oncology (ASCO) and the National Comprehensive

Cancer Network (NCCN) to establish quality measures in colon cancer. They recommended that at least 12 lymph nodes be examined in a colectomy specimen for colon cancer. The National Quality Forum adopted this measure in April 2007 as a measure of hospital quality.^{40,41} A number of payers have additionally adopted these quality measures to incorporate into their pay for performance programs in surgical oncology.^{32,42,43}

In rectal cancer, much of the focus has been on extent of resection. Ridgway and Darzi⁴⁴ performed a systematic review of the literature on rectal cancer treated by total mesorectal excision (TME). In 1982, Heald et al⁴⁵ described TME, which involves the en bloc resection of rectal mesentery including blood supply and lymphatic drainage. Ridgway and Darzi⁴⁴ noted that the initial reports of recurrence with TME were zero at 2 years. In the 13 studies they reviewed from 1982 through 2002, they found highly reproducible results with an average of approximately a 4% recurrence rate at 5 years. TME is an example of a surgical technique that has an impact on patient outcomes. However, challenges persist in operationalizing such a process to a hard measure of quality.

Gastric cancer provides another example where extent of resection may be associated with survival differences. It has been postulated that the more extensive resections performed in Japan, including more extensive lymph node dissection, is responsible for improved survival among Japanese cohorts compared with western populations. In a review of the literature regarding quality assurance in surgical oncology, Landheer et al⁴⁶ discussed two multicenter clinical trials that compared the two standard resections in gastric cancer (D1, D2) and found no survival benefit to the extended lymph node dissection. Such studies have highlighted that operative technique continues to vary widely. This situation is similar to TME in rectal cancer; it is a significant challenge to try to objectify quality by specific operative technique.

Quality of care pertaining to breast cancer care has been studied extensively. Nodal status, which arguably is the most important prognostic indicator in breast cancer, as well as preoperative evaluation and type of surgery have all been implicated in quality assessments of surgical breast cancer care. While a large body of work evaluated the rates of axillary lymph node dissections,^{21,46} the advent of sentinel lymph node dissection (SLND) has changed the focus of quality assurance. It has been suggested that preoperative needle biopsy and SLND could be indicators of quality in breast cancer care. However, neither is systematically collected in the major national cancer databases. In an effort to better understand the value of surgical process measures in breast cancer care, the American Society of Breast Surgeons has undertaken a pilot program to track process measures and outcomes. The initiative focuses on preoperative needle biopsy prior to open biopsy, orientation of the surgical specimen, and verification that an image-guided target was surgically removed.

The pilot program, Mastery of Breast Surgery, collects physician-reported data on these quality measures with periodic feedback as part of a continuous quality improvement initiative.⁴⁷

Process measures are not perfect quality indicators, however. For example, questions have been raised as to the utility of using the number of lymph nodes in colorectal cancer as a quality metric. Wong et al⁴³ used SEER-Medicare data to evaluate trends in number of lymph nodes sampled among patients aged 65 to 99 years undergoing colon cancer resections. They found that there was no long-term survival difference among patients with higher lymph node counts than those with lower lymph node counts after adjusting for patient and provider characteristics. The authors found that regardless of the number of lymph nodes sampled, the average number of positive lymph nodes was consistent across hospitals. The potential processes that can account for these differences, including surgeon technique, patient body habitus, tumor biology, and pathologist technique, have been discussed by Wong et al⁴³ and others.⁴²

Additionally, we have seen in each of the process measures discussed here in the context of surgical skill that the surgeon is not an isolated care provider. In colorectal cancer, the NQF quality measure is actually at the hospital level rather than the surgeon level. This is an implicit recognition that nodal status requires the surgeon to remove the lymph nodes and the pathologist to evaluate and verify the presence of those nodes, as well as the state of disease in the nodes. Similarly, discussion of SLND in breast cancer cannot take place without consideration of the multidisciplinary team necessary to perform a SLND, including the surgeon, radiologist, nuclear medicine team, and pathologist. The issue of benchmarking quality in nodal sampling highlights the important distinction between systems level and patient/provider-level quality assessment. For example, a patient may have received high-quality cancer care but might not have the “appropriate” sample of lymph nodes removed due to patient factors, ie, the patient did not have the required number of lymph nodes. Despite the fact that the benchmark was not met at an individual level, the care should not necessarily be deemed subpar. These benchmarks serve to evaluate and identify systems of care that are routinely outside the limits considered appropriate for quality care delivery.

Policy Implications of Quality Measures in Surgical Oncology

Structure-outcomes measures in surgical oncology range from broad systems assessments, such as accreditation and volume, to assessments of individual providers, such as specialty training. Most discussions of the volume-outcomes association implicitly state that this relationship is a proxy for underlying structures and processes of care that ultimately impact outcomes.^{17,19,27} The same might be said for other struc-

ture-outcomes relationships, as we discussed earlier. Despite the understanding that structural measures are often blunt proxies, they (particularly volume and accreditation status) have been adopted as quality metrics with significant policy implications.

Regionalization of care has been proposed in response to the association between volume or accreditation and outcomes. This can be implemented in a number of ways. State governments have the power to regionalize certain services in a systematic fashion as has been done with trauma, neonatal intensive care units, and transplant centers. Purchasers of health care (namely large insurance companies and business groups) have begun to use volume in their contracting decisions, essentially encouraging referrals to high-volume providers and/or institutions.¹⁸ It has been suggested that hospital administrators place restrictions on providers' scope of practice in cases where provider volume is suggested to be related to outcomes.¹⁷ Finally, some have advocated the inclusion of individual provider volumes and hospital volumes on new report cards. Such public reporting may implicitly lead to regionalized care by altering purchaser and patient treatment decisions.^{18,25}

Despite the push to turn structure-outcomes research into action through such policies, this may be an overly simplistic approach. Regionalization may not be the one-size-fits-all solution it is sometimes touted to be. Successful examples of regionalization were mentioned above, including trauma centers and neonatal intensive care units. However, these systems are unique in that their infrastructure is not limited to the hospital or ward alone, but rather includes a comprehensive system of communication and transportation between providers and centers. There is no unified cancer care system in the United States. Regionalization would require restructuring many components of our current health care delivery systems, which could lead to new imbalance in available resources at specialty centers and at other institutions.⁴⁸ Specialty providers are an important resource to consider, as well; it is possible that regionalizing specialized care could exacerbate existing health care disparities.^{49,50} Another potential unintended consequences of regionalization may be poorer patient-reported outcomes secondary to patient burden of travel, inconveniences, and dislike of being away from home and from one's social support system.

Conclusions

This article discussed a brief history of the quality movement and has given a broad overview of research related to quality measures as they pertain to surgical oncology. Current quality metrics are limited to those components of the health care system that can be easily measured. As we have shown, accreditation, hospital and provider volume, surgeon specialization, and multidisciplinary teams are considered structural measures in the Donabedian model that have been used in the evaluation of quality of surgical oncology. Even among

these measures, definitions within each metric vary widely as has been shown with regard to volume cut-offs and to specialist descriptions. Another important area of quality assessment in surgical oncology is the process measure of surgical technique. As discussed, surgical expertise, technique, or skill is difficult to define, let alone measure. However, we must endeavor to better understand the detailed qualities of a surgical oncologist or a health care system that are directly responsible for high-quality cancer care.

Going forward, surgical oncologists could focus on a few key areas in an effort to improve the cancer care delivered to patients.⁵¹ Although this review addressed structural and intraoperative process measures, there are equally important processes in surgical oncology that occur before and after surgery. In the preoperative setting, for example, such processes include taking a thorough history, performing a complete physical examination, appropriately discussing neoadjuvant therapy, referring to other members of the multidisciplinary team, and adequately discussing management options with patients such as potential complications, prognosis, and expected postoperative functional status. Processes of care that are important in the postoperative setting include prevention of iatrogenic complications, comprehensive discharge planning, coordination of further care within the multidisciplinary team, and follow-up care. As the population ages and our medical and technical abilities continue to advance, we must be open to the discovery and development of new structures and processes of care that will be critical to the provision of high-quality surgical oncology care.

In addition to the innumerable actions surgeons can take to impact patient care, they must also know their own limits. As we have discussed, there are currently many pathways in surgical specialty training; expertise in a given area may not translate to expertise in another area of surgical oncology. As we strive to improve the quality of cancer care for all patients, we must refine our ability to define and promote the expertise that all patients deserve. It is imperative that surgeons remain involved in quality assurance efforts. For example, the assessment of outcomes is changing rapidly from a traditionally strict focus on morbidity and mortality to a broader focus that includes patient-reported outcomes and long-term survival. Surgeons should record and review their own outcomes. This will not only enhance our discussions with individual patients but also inform our understanding of the drivers of quality overall, possibly leading to innovative quality improvement initiatives.

Perhaps nothing will be more important in influencing our capacity to provide high-quality cancer care in the future than our ability to work together on teams. Cancer care is increasingly complex and multidisciplinary. Our ability to communicate with one another and to shepherd our patients through the continuum of cancer care is critical to the provision of efficient, stage-appropriate, patient-centered care.

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