



Value-based shoulder surgery: practicing outcomes-driven, cost-conscious care

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Background: Pathology of the shoulder contributes significantly to the increasing burden of musculoskeletal disease. Currently, there exists high variability in the nature and quality of shoulder care, and outcomes and cost reporting are not uniform. Value-based practice aims to simultaneously maximize outcomes and minimize costs for given disease processes.

Methods: The current state of the shoulder care literature was examined with regards to cost and outcomes data, initiatives in streamlining care delivery, and evidence-based practice improvements. This was synthesized with value-based care theory to propose new avenues to improve shoulder care in the future.

Conclusion: The treatment of shoulder disorders is ideal for the value-based model but has been slow to adopt its principles thus far. We can begin to advance value-based practices through (1) the universal reporting of outcomes and costs, (2) integrating shoulder care across provider specialties, and (3) critically analyzing data to formulate best practices.

Level of evidence: Narrative Review.

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Health care in the United States (US) is on an alarming trajectory. Rising costs, variations in care delivery and quality, inconsistent access to care, fragmentation, and lack of coverage for many have frustrated patients, caregivers, and policymakers alike. With continued advances in technology and an aging population, health care costs are rising unsustainably. Currently, these costs make up 17% of the national gross domestic product (GDP) and are expected to rise to 20% by the year 2020.¹⁵ Estimates project that health care expenditures will nearly double, from \$2.5 trillion in 2009 to \$4.6 trillion in 2020, with a 70% increase in per capita spending during that time.

The role of musculoskeletal disease in this cost burden is substantial. Musculoskeletal disorders are the leading cause of disability in the United States, with more than 107 million adults (approximately 50% of the adult population) having suffered from a chronic musculoskeletal health condition for longer than 3 months in 2005. The direct cost of treating musculoskeletal conditions in 2006 was \$576 billion, or 4.5% of the GDP.^{3,15} Shoulder disorders, in particular, play a significant role in this burden. In 2008, 18.9 million adults (8.2% of the US adult population) reported chronic shoulder pain.³ The shoulder was the second most common joint for which patients experienced chronic pain, just behind the knee. Studies highlight the importance of considering the direct and indirect costs (ie, missed work) associated with shoulder pathology and indicate that a relatively small number of patients may be responsible for a large proportion of those costs.^{45,62} In

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2000, the direct cost of treating shoulder pain was estimated at \$7 billion.⁴⁵

With rising costs and the long-term sustainability of the US health care system in question, a great deal of interest has emerged in the application of competitive strategies and value-based principles to health care. Such principles have successfully fueled other economic markets for years but have been slow to incorporate into health care. This is likely due to a combination of the increasing complexity of the health care system, resistance from providers to incorporate large-scale practice changes, a lack of universal or uniform reimbursement systems across multiple disciplines, and a general unwillingness to consider health care as a commodity that is subject to competitive forces.

Value, as applied to health care, can generally be defined as a gain in benefits (patient survival, health outcomes, satisfaction, etc) over the costs expended (direct and indirect) in providing care. Many health care economists argue that by shifting attention away from cost containment or service restriction and toward optimizing value (improving outcomes for less cost), patients will enjoy excellent outcomes that are achieved efficiently and in a sustainable manner.

Orthopedic surgery is well suited for such reformed thinking given the high (and increasing) prevalence of musculoskeletal disease, the elective nature of most procedures, the high costs of surgeries and implants, the long rehabilitation process, and the significant impact on quality of life associated with good outcomes. Leading orthopedic surgeons have begun to examine and incorporate these ideals in a variety of ways, as highlighted in a recent symposium in *Clinical Orthopaedics and Related Research* on value-based health care.¹⁰

Shoulder surgeons have expressed a great deal of interest in providing value for patients with shoulder disease. The American Shoulder and Elbow Surgeons (ASES) recently incorporated a Value-Based Shoulder/Elbow Care Committee charged with advancing shoulder and elbow care through value-based principles. In addition, the ASES recently rewrote its bylaws to stress the importance of developing evidence-based appropriate-use criteria for common shoulder pathologies to maximize patient outcomes and decrease related costs.

Currently, however, large-scale outcomes studies on shoulder disease are few and far between, and variations in practice exist at all levels of the care delivery chain. Although the number of cost studies in shoulder surgery is increasing, the quality has overall been lacking.³⁸

The aim of this article is to define and explore value-based care practices as well as examine the ways that value-based principles have already been applied to modern shoulder care. We explore further avenues to improve patient outcomes, decrease costs, streamline the care delivery process, and promote collaboration amongst members of the health care team.

Value-based care explained

Value, according to expert health care economists Porter and Teisberg,⁵⁵ is defined as patient health outcomes achieved per dollars of cost expended in a given care cycle. Essential to a value-based system are 3 simple principles⁵⁶:

1. Contrary to traditional definitions of “value,” Porter and Teisberg *shift the importance of value away from the system and toward the health care consumer, the patient*. Success is not measured by increased net hospital revenues, insurance subscription rates, office visits, or number of procedures performed by a provider; rather, increased value signifies improved patient outcomes at decreased overall costs.
2. *Care should be organized around specific medical conditions and their entire cycle of care*. In shoulder disease, this would include using shoulder-focused care teams and substratifying care delivery around global diagnoses (ie, instability, rotator cuff tears, arthritis). Outcomes and costs would be defined and measured around these conditions as a whole, not in relation to specific interventions or procedures. Care teams with expertise in particular shoulder conditions, or what Porter and Teisberg^{51,55} called integrated practice units (IPUs), would collaborate to yield optimal outcomes for the entirety of a given disease process. For example, a patient with shoulder instability would be initially seen and evaluated by a specialized team of care providers (orthopedic surgeon, physical therapist, nurse) who would organize and synthesize treatment based on the patient’s age, athletic status, comorbid conditions, and underlying diagnosis. All facets of the care delivery system would be recorded and analyzed based on global diagnoses.
3. Finally, *the universal measurement and reporting of results is emphasized*. Results include long-term outcome and cost data, as well as patient characteristics, comorbid conditions, and any information relevant to a specific condition over an entire care cycle. Such measurement and reporting is the cornerstone of value-based health care. Without robust data, it is impossible to determine what care processes are the most valuable for patients, including which treatments are the most and least beneficial to pain and longevity, which interventions are the most costly, and which have the highest and lowest complication rates.⁵⁶ With the continuous evaluation of outcomes and costs, best practices will be established and encouraged, procedures with poor outcomes will be abandoned, and costs will be minimized. This will benefit the patient and health care delivery chain alike.

In value-based care theory, using these principles would increase competition, efficiency, and transparency in the health care delivery process, and patients would be empowered with knowledge to seek the best care at the lowest

price. The current system of zero-sum competition would transition to positive-sum competition. In *zero-sum competition*, net value is constant and participants within a system compete to divide this amongst themselves. For example, restricting costly services to a patient may increase value for an insurance company while decreasing value for a patient. The overall value within the system is unchanged—the insurance company gains what the patient loses. *Positive-sum competition*, on the other hand, generates increasing levels of net value, and all parties involved enjoy increased value.^{15,51} For example, allowing patients access to services that are proven to improve outcomes will benefit patient health outcomes, lead to overall cost savings in the long-term, and lead to increased market share for the insurance company involved. All parties involved enjoy net increases in value.

Why shoulder?

Shoulder disorders are well suited for treatment through a value-based care delivery model. As established above, the burden of shoulder disease is high and contributes to a relatively large portion of the health care GDP. The number of common procedures performed on the shoulder is also rising substantially. During the 10-year period between 1996 and 2006, the volume of rotator cuff repairs in the United States increased by 141%, to 98 repairs per 100,000 capita in 2006.^{3,18} Similarly, the number of shoulder arthroplasties performed in the United States rose dramatically by 250%, from 2000 to 2008, with approximately 27,000 total shoulder arthroplasties and 20,000 hemiarthroplasties performed in 2008.^{3,35} In addition to high prevalence, shoulder disorders can be easily categorized into discrete medical conditions (ie, rotator cuff pathology, instability, adhesive capsulitis, arthritis, fractures, etc). This facilitates the organization of care around a number of unique pathologic conditions that can be studied longitudinally. These conditions usually have shorter and more finite care cycles compared with other medical conditions such as diabetes, hypertension, and kidney disease.

Shoulder disorders have historically been managed by multiple specialized care providers operating independently of one another, each with a unique contribution to the care cycle. In addition, there is substantial variability in the management of common shoulder conditions amongst these providers. Some patients, for example, receive more physical therapy or advanced imaging than others, and costs can vary a great deal based on provider preference. The ability to integrate all providers (ie, surgeons, physiatrists, primary care physicians, anesthesiologists, therapists, social workers, support staff, etc), streamline care practices, and facilitate communication and collaboration fits the value paradigm. A variety of value-based models for care delivery exist today in general orthopedics and in spine

care, which share many fundamental similarities to shoulder care. These have been wildly successful in improving patient outcomes, reducing costs, and streamlining care processes.^{30,45,53,55,62} For example, the Spine Center at Dartmouth-Hitchcock Medical Center in Lebanon, NH, USA, has incorporated interdisciplinary collaborative practice with thorough outcomes and cost analysis. Since its founding in 1997, the Spine Center (and clinical trials spearheaded by its leadership) has revolutionized spine care, improved patient outcomes, reduced unnecessary costs, and advanced the field.^{30,66}

Finally, outcomes reporting and cost-effectiveness research in the care of shoulder disorders are far from universal, comprehensive, or transparent. Most of the reports on outcomes and costs in shoulder care are supplied by a minority of providers. Although important, these studies may not be entirely representative of care trends being practiced by most shoulder care providers in the United States. By adopting a large-scale value-based system, providers are incentivized to report outcomes and costs throughout all levels, and best practices can be more readily established by using comprehensive and representative data.

The complexity of outcomes reporting

E.A. Codman, one of the founding fathers of shoulder surgery, was ostracized by his colleagues at the Massachusetts General Hospital in the early 1900s for his controversial ideas on measuring and publicly reporting the “End Result” of treatments for his patients.^{10,11,48} Codman was not only the first physician to suggest that outcomes should be rigorously studied but was also the first to actually do so.^{38,41} He established what he called the “End Result Hospital,” a care facility that was entirely transparent about its outcomes as well as its errors in diagnosis and treatment.

Codman used “End Result Cards” to keep track of each patient he cared for, and updated these cards yearly to record vital information such as diagnosis, treatment, and outcomes. He believed that “it is the duty of every hospital to establish a follow-up system, so that as far as possible the result of every case will be available at all times for investigation by members of the staff, the trustees, or administration, or by other authorized investigators or statisticians.”^{41,55} In the 100 or so years since making this statement, such universal measuring and reporting of outcomes has yet to gain favor in most fields of medicine, including orthopedics, and shoulder care in particular.

Although conceptually ideal, universal public reporting of outcomes is a complex issue. A variety of performance metrics, such as structural, process, outcomes, patient experience, and efficiency metrics, can be reported.^{42,56} These metrics can be difficult to standardize across locations, measurement can be costly and tedious, and

risk-adjustment to account for patient health differences can be complex and cumbersome. In addition, with fears of outcome transparency, providers may shift practices to a disproportionate number of healthier patients to maximize outcomes for fear of inadequate risk adjustment.^{56,67}

A variety of initiatives are currently underway where orthopedic surgeons have become involved in promoting the public reporting of data. Among these are public reporting of adverse events facilitated by the U.S. Food and Drug Administration's MedWatch program⁴⁷ as well as the Centers for Medicare & Medicaid Services-sponsored Physician Quality Reporting System, a voluntary program allowing health care providers to report information to Medicare regarding the quality of care they provide to those with certain conditions.¹⁴ Other national hospital-based initiatives are in place to measure a variety of basic outcomes (ie, infections, mortality, etc) and performance metrics (length of stay, administration of perioperative antibiotics, etc). However, criticisms have been made regarding the way in which hospital administrative claims data may not accurately reflect the clinical record, as well as the questionable applicability of certain process measures used as surrogates for true outcomes.⁴²

Many published large-scale analyses in orthopedics have used common quality indicators, such as mortality, readmission rates, reoperations, and postoperative complications, to determine the efficacy of certain interventions. However, orthopedic procedures are diverse in etiology, indications, and results. Analysis of these basic metrics is important, but outcomes and efficacy of particular orthopedic interventions may not be adequately assessed with these metrics given the unique nature of the services provided.³⁴

Widely accepted in other nations across the globe, orthopedic surgical registries provide information repositories for a variety of interventions unique to orthopedic surgery. Registries in shoulder arthroplasty have been established at local and national levels. The Mayo Clinic registry has recorded all shoulder arthroplasties performed there since 1976,^{46,60} and Finland began recording all shoulder arthroplasties performed in that nation since 1980.⁵⁷ Since then, a variety of other nations have followed suit, including Australia, Denmark, New Zealand, Norway, Sweden, and the United Kingdom (UK).⁵⁷

Registries can provide comprehensive implant survival and select outcomes data from widely diverse patients populations. Although the primary focus for most registries is implant survival (and thus narrow in scope from an outcomes perspective), many national registries record and report a variety of outcomes scores. For example, the UK and New Zealand arthroplasty registries measure the Oxford Shoulder Score at points preoperatively and postoperatively, the Danish and Swedish registries calculate the Western Ontario Osteoarthritis of the Shoulder index, and other registries calculate a variety of scores such as the EuroQol-5D and Disabilities of the Arm, Shoulder, and

Hand.⁵⁷ Using information from these registries, surgeons have been able to provide comprehensive long-term outcomes that can be generalized to the average hospital and surgeon and to prospectively identify reasons for failure or complications.

Norway has developed a number of registries for other nonarthroplasty orthopedic procedures, including anterior cruciate ligament surgery,^{26,27} hip fracture surgery,^{23,24} and shoulder instability surgery.⁹ Although young compared with arthroplasty registries, there is great potential to provide comprehensive data on these (and other) conditions that can guide treatment on a large-scale level.

Naturally, there are limitations in establishing, maintaining, and using data from national registries. Registries require a great deal of organization, documentation, and funding, and often cannot be successfully maintained without national (and often governmental) oversight.³⁷ Registry data are also observational, subject to variability in reporting, lack comprehensive outcomes measurement, and may be subject to confounding variables.

Without administrative and financial support from national or governmental organizations, many independent providers believe that large-scale outcomes collection is expensive, disruptive, cumbersome, and may present security or privacy risks.²⁵ Some solutions have been proposed, including hand-held touch screen computers that collect validated instrument tools at time points during the care period. The ideal system would be safe, efficient, cost-effective, and easy for patients and surgeons to use.^{5,6}

Finally, there is considerable variability amongst outcome measures used in studies on shoulder disorders. Upwards of 30 shoulder outcome measures have been described, and many of these may be specific to particular shoulder conditions.⁶⁹ Researchers have difficulty agreeing on the most useful measures across institutions, and this is further compounded in large-scale outcomes databases. In addition to validated health outcome measures, patient-centered outcomes have been measured and stressed in a variety of research studies.^{8,20,21} These include outcomes that focus on the patient and family experience during a care episode. Although critics argue that these are not proper surrogates for improved health measures, proponents of value-based care highlight patient experience and satisfaction as key components in care delivery outcomes.

Outcomes reporting in shoulder disorders—the future

Despite barriers to universal outcomes reporting, a variety of solutions exist that can help move shoulder care toward a true value-based system. Granted, these solutions are neither simple nor inexpensive and challenge a variety of conventional dogmas in current practice.

As originally proposed by Codman, we believe that outcomes should be universal and transparent. This

movement should be fueled and facilitated by leadership in national subspecialty societies and supported by government and industry, much like registries elsewhere. Health care providers and specialty societies, not governmental agencies and regulatory bodies, should determine which outcome measures and conditions should be highlighted. Shoulder care providers would be encouraged to measure and report outcomes for all patients and assess these numbers in real time. Providers should feel free to report without fear of retribution and critically analyze their own outcomes compared with national averages. Comorbid conditions would be recorded and used to adjust for variations in outcome, with the understanding that the process may take time to refine.

Small-scale outcomes from community providers could be pooled to formulate large-scale data repositories with the help of tablet computers and user-friendly software. In time, outcomes at various levels would be released publicly and analyzed for trends and variations, leading to meaningful adjustments in care practices that would benefit patients. These data, as with all registry or large-scale outcomes data, would be analyzed and adjusted for response rates, individual provider sample sizes, and patient-specific risks or comorbid conditions, and pooled or subcategorized depending on the analysis desired.

This is far from impossible and has been done to a smaller degree in a variety of practices throughout the United States.^{30,46,49} With the help of specialty leadership societies, such as the ASES, Arthroscopy Association of North America, and the American Orthopaedic Society for Sports Medicine, and under the guidance of the American Academy of Orthopaedic Surgeons (AAOS), large-scale provider-based efforts can overcome the above boundaries.

The cost conundrum—cost studies in shoulder disorders

Outcomes in isolation, however, constitute only half of the value equation. To maximize value, shoulder care providers must also measure and account for the costs of particular interventions. The term *cost* describes not only the cost of particular implants, surgical time, and physician and hospital fees, but also the cost of postoperative rehabilitation, costs of complications and their sequelae, and costs for missed work. Cost, as defined by Porter and Teisberg,⁵⁵ is all-inclusive and spans the length of a particular medical condition, including surgical and nonsurgical interventions. These data can be difficult to obtain and to do so requires expansion beyond traditional boundaries.

A variety of methods exist to synthesize cost and outcomes data to determine the relative cost-utility or cost-effectiveness of a procedure.⁵⁸ Unlike joint-specific outcome indices, cost-utility and cost-effectiveness studies use generalized, overall health-related quality of life

outcome measures to compare various treatment interventions.⁴⁰ Historically, the use of such studies in shoulder care has been minimal. Kuye et al³⁸ determined that the number of economic evaluations in shoulder disorders has been increasing at a rapid rate, with greater than 50% of the economic evaluations reported between 2005 and 2010. They note, however, that the quality of these newer studies is still limited and that the state of the literature is poor. The need for cost-effectiveness studies in shoulder pathology using robust outcomes and cost data is clear, and the contributions of such data in supporting reimbursement decisions made by public and private payors are essential.

Cost studies on shoulder disorders in the United States have predominantly focused on rotator cuff pathology and shoulder arthroplasties due to their relatively large prevalence. Twelve years ago, Cordasco et al¹⁹ detailed the success of open rotator cuff repair as an outpatient procedure, highlighting a 43% cost savings and high patient satisfaction. Data on procedure costs were sparse and limited to hospital fees, and no validated outcome scores were used. A variety of studies have been published since then analyzing the costs of rotator cuff repair. Vitale et al⁶³ examined the cost-utility of rotator cuff repairs compared with observation by relating costs to quality-adjusted life-years (QALYs), a standardized utility measure. Cost-effectiveness ratios after rotator cuff repair were measured at \$3091.90 per QALY using the European Quality-of-Life measure, and thus deemed highly cost-effective. Rotator cuff repair compared favorably with other interventions such as total hip replacement, medical therapy for hypertension, and hemodialysis.

Cost analyses have also compared a variety of factors involved within rotator cuff repair, including open vs arthroscopic repair and single-row vs double-row repair. Churchill and Ghorai¹⁶ used a statewide database to compare costs of mini-open and arthroscopic rotator cuff repairs at low-volume, intermediate-volume, and high-volume centers. The authors determined that mini-open repair was less expensive than all-arthroscopic repair, and that high-volume surgical centers cost significantly more than low-volume and intermediate-volume centers. However, this study did not control for tear size, patient comorbidities, revision surgery, or case complexity. As previously discussed, without a comprehensive data set, drawing meaningful conclusions when comparing these groups is difficult due to possible confounding factors.

Adla et al⁴ compared outcomes and cost in open and arthroscopic rotator cuff repair for 30 patients and determined that there were no significant differences in functional scores between the groups at follow-up. The incremental cost of each arthroscopic rotator cuff repair was \$1248.75, making this a less “cost-effective” procedure. However, standardized health outcome measures were not used to judge the results, and therefore, comparisons cannot be effectively made on the procedure’s true “cost-effectiveness.”

Finally, Genuario et al²² constructed a decision-analytic model to compare the cost-effectiveness of single-row and

double-row arthroscopic rotator cuff repair and determined that double-row repair was not cost-effective for any size rotator cuff tear. They noted that their input data were derived from historical literature and might be subject to bias and that their model only accounted for 2-year outcomes after these procedures.

Similar analyses have been undertaken for total shoulder arthroplasty (TSA) and reverse total shoulder arthroplasty (RSA). Mather et al⁴³ performed a cost-utility analysis comparing hemiarthroplasty with TSA in the treatment of glenohumeral osteoarthritis. They determined that TSA resulted in a higher number of average QALYs at a lower cost compared with hemiarthroplasty. TSA had a cost-effectiveness ratio of \$957 per QALY, surpassing even that of rotator cuff repair. Comparing RSA with hemiarthroplasty in the treatment of rotator cuff tear arthropathy, Coe et al¹⁷ determined that RSA was a cost-effective procedure. However, this was true only with a limited complication rate and was highly sensitive to implant price and dependent on the particular health utility gained from the operation. They concluded that a larger data set using head-to-head comparisons (as in a shoulder arthroplasty registry) was necessary to make a formal determination of large-scale cost-effectiveness.

Cost studies have also been undertaken for adhesive capsulitis,^{13,61} although a recent systematic review and cost-effectiveness analysis of available literature determined that limited clinical evidence exists on the cost-effectiveness of various treatment modalities in adhesive capsulitis. The authors noted that high-quality primary research is required to make any further determinations of efficacy.⁴⁴ Data are similarly sparse regarding the cost-effectiveness for treatments in shoulder instability.^{7,38,64}

Despite the shortcomings of these studies, a good deal of progress has been made in beginning to quantify the costs associated with treating shoulder disorders. There are multiple procedures that can be highly cost-effective in the treatment of various shoulder pathologies. Indeed, with a more robust data set on costs and outcomes of various treatment options, providers can continue to better judge the utility of particular interventions against one another.

Generalized vs specialized care—the debate

Implicit within value-based care theory is the idea that providers who offer the best value to patients (better outcomes at decreased costs) will attract more patients and therefore gain a greater “share in the market” for that particular condition. For instance, surgeons who provide superior value in shoulder arthroplasty will be rewarded with more patients seeking arthroplasties, and those patients will similarly be rewarded with better outcomes. Naturally, this phenomenon would lead to a field where providers become subspecialized in areas where they are truly superior and less involved in areas where

their outcomes are suboptimal. This has already taken place to a degree in orthopedic surgery, where subspecialists (ie, hand, arthroplasty, spine, etc) have become more commonplace, particularly in larger urban areas. It would not be far fetched to imagine a field where shoulder surgeons, in particular, became even further subspecialized with the variety of shoulder conditions described previously (ie, rotator cuff, arthritis, fractures, etc.).

Although the principles behind these scenarios are second nature to competitive strategists, support for such ideas is less than uniform in medicine. For example, ideas like shopping around for a surgeon with the best-reported outcomes, accommodating practices to fit standards that are constantly being updated and advanced, or ultra-specialization in a field that seems to constantly narrow its scope of practice, may very well seem to some like the ideas of a heretic in an ivory tower. Given the way shoulder care is currently structured (typically by multiple independent practitioners, a fee-for-service model between multiple service providers, and a paucity of outcomes-reporting requirements), there may be a great deal of resistance toward implementing the practice of value-based care in shoulder surgery.

However, these ideas are geared toward a universal goal that all care providers can agree on: *improving value for the patient*. Research in all fields of medicine has shown that physicians with more experience in a given procedure or with a particular condition have better outcomes at less cost. The same holds true for interdisciplinary and collaborative care.³⁶ Shoulder care is by no means an exception.

For common shoulder procedures, surgeons and centers with more experience and volume have improved outcomes, lower complication rates, and lower costs. In the case of rotator cuff repair, variation in indicators such as length of stay and operative time can largely be explained by surgeon practice patterns (ie, volume),²⁸ where low-volume surgeons are more likely to experience longer-than-normal mean operating room times and their patients experience longer lengths of stay.³³ Lower surgeon volume is also an independent risk factor for revision rotator cuff repair.⁵⁹

Similar results hold true for shoulder arthroplasty. Jain et al³² determined that for primary glenohumeral osteoarthritis, surgeons with lower shoulder arthroplasty case volumes and providers practicing in low-volume hospitals were more likely to perform a hemiarthroplasty vs TSA, which is a less cost-effective but technically less challenging procedure. Mortality rates, risk-adjusted rates for postoperative complications, lengths of stay, and hospital costs were also higher with low-volume surgeons and centers compared with high-volume surgeons and centers.^{29,31} Jain et al³¹ determined that centers performing fewer than 5 TSA procedures per year had an increase of nearly 250% in the rate of complications compared with centers performing 10 or more. When low-volume and high-volume surgeons were compared, there was, on

average, a 40% increase in the complication rate, but this did not reach statistical significance. In a multivariate outcomes analysis, Hammond et al²⁹ found a statistically significant increase in risk of complications when low-volume surgeons were compared with high-volume surgeons.

Data from these volume studies, as in other studies mentioned previously, are limited by the retrospective nature and origins from hospital admissions and billing records. Although critics purport the need for prospective, more comprehensive data to further substantiate these claims, these studies do provide evidence that increased provider and hospital experience can improve value for patients to some degree.

The assumption that valuable care can only be provided by those with the highest level of experience in high-volume centers, however, may undermine the role of independent care providers practicing in rural areas to diverse patient populations.³⁶ In fact, a substantial portion of musculoskeletal care in the United States currently takes place outside of high-volume centers.

According to Porter and Teisberg,^{51,55} value-based care can be facilitated by combining collective experience between providers in a variety of fields into IPU. These IPUs aim to provide integrated, high-quality care using a team of specialized health care providers from different fields in the treatment of specific medical conditions. In shoulder care, this could involve a team of providers, including a shoulder surgeon, physiatrist, physical therapist, musculoskeletal radiologist, specialized regional anesthesia provider, care coordinator, and a nursing supervisor, operating in conjunction to become experts in treating patients with a variety of shoulder pathology. Ideally, these providers would be located near one another to facilitate communication and collaboration, as well as convenience for the patient.

IPUs have become successful in orthopedic surgery, boasting high patient and provider satisfaction rates, improved outcomes, and decreased costs.^{30,52-55} However, IPUs can be difficult to organize, may require interdepartmental funding and shifting in location space, and may require a degree of restructuring outside of the comfort zones of providers and administrators. Such large-scale reorganization requires a great deal of coordination, cooperation, and patience, and may be physically impossible in some locations due to geographic constraints.

As reimbursement plans increasingly shift toward bundled payment models, collaborative care through IPUs may provide substantial value not only to the patient but also to providers. Increasing collaboration between support staff will maximize provider efficiency, improve outcomes, and minimize costly complications. Provider satisfaction would also improve. For example, shoulder surgeons would be able to spend more relative time operating, less time relaying complex postoperative therapy regimens to inexperienced physical therapists, and less time

coordinating multidisciplinary approaches to complex problems (with the help of care coordinators). Patient expectations would be tempered with realistic and transparent outcomes for a variety of conditions. Net value would increase for all parties involved in a positive-sum fashion.

IPUs may indeed provide the most sustainable form of practice for providers who are becoming increasingly cost-conscious.

Assessing value and establishing best practice

The ability to synthesize and transform available results into best care practices is essential to value-based care practice. Comprehensive data will have little utility if it cannot be used properly in an organized, cost-effective manner. Large-scale, prospective observational data are lacking in a great variety of shoulder pathologies and could be extremely helpful in determining best practices. This has been highlighted by controversy surrounding the recently published AAOS clinical practice guidelines on the management of rotator cuff disease.⁵⁰ Of the 25 guidelines identified, 15 were characterized as having inconclusive evidence to make a definitive recommendation one way or another. The authors cite a paucity of high-level evidence in guiding evidence-based treatment guidelines and recommend that higher-quality research, such as randomized prospective clinical trials, be performed. Critics cite the methodology of formulating these guidelines was too narrow along with concerns that certain randomized surgical trials might be impractical and unethical.^{39,68}

Comparative effectiveness research (CER) offers an additional avenue to pursue information on best practices and proves less restrictive than the process of evidence-based clinical practice guidelines. CER, as defined by the AAOS, “refers to the evaluation of the relative (clinical) effectiveness, safety, and cost of two or more medical services, drugs, devices, therapies, or procedures used to treat the same condition.”¹ CER allows for a more global approach to determine the efficacy of a particular treatment for a condition and integrates a variety of forms of clinical and cost data. The AAOS believes CER is an extremely valuable supplement to using evidence-based data interpretation in guiding clinical practice guidelines. In fact, the AAOS wishes for a more radical, concerted effort between the AAOS, government, patients, and specialty societies to allow CER to make real changes in clinical management, because there is no evidence that evidence-based guidelines have done so in the past.^{1,65}

Use of the appropriate use criteria methodology can also provide substantial benefits in situations where evidence-based guidelines may fall short. These criteria are formulated by combining evidence-based information with the clinical expertise of physicians in a particular field “to improve patient care and obtain the best outcomes while

considering the subtleties and distinctions necessary in making clinical decisions.”¹ Criteria are formulated using a structured process called the RAND/UCLA Appropriateness Method, with the goal of answering questions on what the best treatment options may be in particular clinical scenarios based on available literature and clinical expertise.¹² By synthesizing available information, clinicians are able to help determine best practices for certain conditions. Plans are currently underway to supplement the AAOS rotator cuff clinical practice guidelines with an appropriate use criteria analysis.²

By using and combining these methods of translating clinical data into practice, care can become more uniform and efficient. With the proper data infrastructure, willingness of providers to contribute results, and collaborative efforts amongst specialties, shoulder care can be propelled forward as a prime example of value-based care in the 21st century.

Conclusion

Health care costs continue to rise unsustainably, and we must determine a way to improve outcomes at a lower cost, thereby providing value. Shoulder care is an ideal model for conversion into a value-based system. By instituting the universal reporting of outcomes and costs, providers can begin to make essential decisions on the appropriate ways to treat various pathologic conditions in the shoulder. Combining efforts into integrated practice units can increase efficiency and profitability as well as improve patient convenience, outcomes, and satisfaction. We must look toward national organizations and their leadership for guidance on the practicalities of instituting a value-based system.

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