

Editorial Commentary: Volume and Outcome: 100 Years of Perspective on Value From E.A. Codman to M.E. Porter



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Abstract: Outcome is the numerator for the value equation, with the denominator being cost; measurement of each is essential to determine the most effective care. With regard to both total shoulder arthroplasty and rotator cuff repair, outcomes of low (vs high) volume providers are associated with longer hospital stay, longer length of operating room time, increased hospital complications, and cost. This suggests that volume thresholds are a key to providing greater value. However, this effect can be modified through systematic efforts to measure outcome and thus improve. To quote Codman, "To effect improvement, the first step is to admit and record the lack of perfection. The next step is to analyze the causes of failure and to determine whether these causes are controllable." Thus, although volume most certainly plays a role in determining outcomes and cost, the more important principle is to measure outcomes and improve with such measurement.

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Weinheimer, Smuin, and Dhawan are to be congratulated for their timely article, "Patient outcomes as a function of shoulder surgeon volume: A systematic review,"¹ focusing on the effect of surgeon volume when considering outcomes and costs of treatment for arthroscopic rotator cuff repair (RCR) and total shoulder arthroplasty (TSA). Several academic institutions have recently adopted volume restrictions on surgeons in the areas of bariatric surgery, lung cancer surgery, esophagus surgery, and joint replacement.²⁻⁵ In light of this, consideration of this paper should rightfully be made in the broader context of Codman's concepts of "the end result" and the importance of measurement (Fig 1) and its effect on outcome and cost.^{6,7} Moreover, Porter et al.⁸⁻¹⁰ have proposed that outcome is the numerator for the value equation, with the denominator being cost; measurement of each is essential to determine the most effective care.

In a systematic review over a 26-year period of studies considering TSA and RCR, the authors identified 10 studies. Seven studies evaluated 88,740 patients who underwent shoulder arthroplasty, whereas 3

studies evaluated rotator cuff repair with 63,535 patients. Criteria for minimum low volume thresholds were set at 12 rotator cuff repairs per year and 5 arthroplasty cases per year. In both procedures, these low-volume thresholds were associated with longer hospital stay, longer length of operating room time, increased hospital complications, and cost. Thus, it is a clear conclusion that the value of such surgery is less than if higher volume surgeons perform the surgery. However, before we can conclude that volume thresholds are the key to providing better outcomes and thus value, it is important to look at the lessons from cardiothoracic surgery and other specialties.

In cardiothoracic surgery, Shahian¹¹⁻¹⁵ and others¹⁶⁻¹⁸ have shown that volume is most important in its influence on outcomes with less common and complex procedures such as valve replacement and less impactful in more common procedures such as coronary artery bypass graft. And even though a volume-to-outcome relationship exists, this effect can be modified through systematic efforts to measure and improve.^{8,16-24}

As the authors discussed, Hasan et al.²⁵ have demonstrated that most hip and knee surgery is performed by orthopedists who do a higher volume of cases, compared with shoulder arthroplasty. And although the orthopaedic literature²⁶⁻²⁹ has shown a volume relationship to outcomes in total hip

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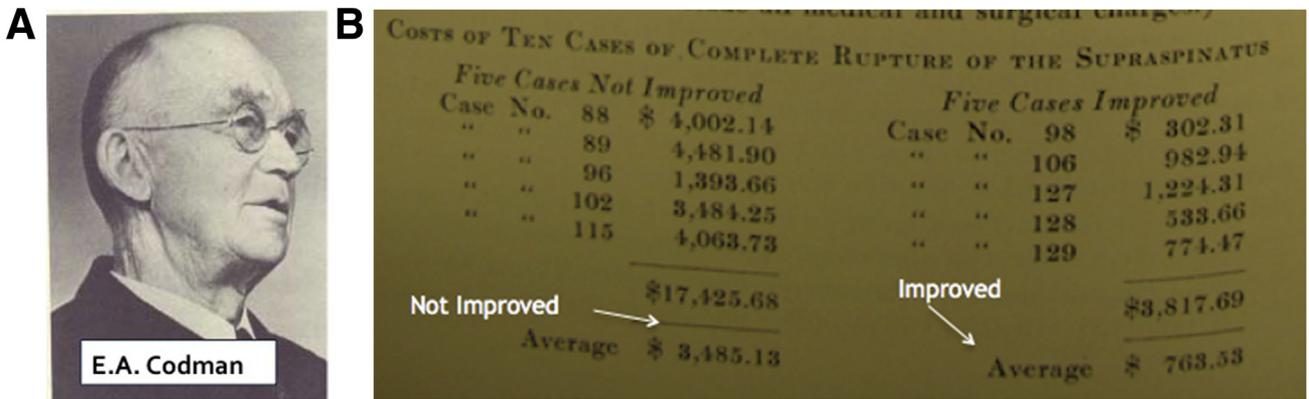


Fig 1. (A) E.A. Codman, the architect of the “end result” concept. (B) The cost of failure of rotator cuff repair as reported by Codman 100 years ago. From Codman EA. *The Shoulder* New York: Thomas Todd, 1934.⁶

arthroplasty and total knee arthroplasty, it is much weaker than with TSA and rotator cuff repair. This might be explained by the experience effect on performance described by Gladwell,³⁰ where experience of 10,000 hours is associated with excellence in the performance of sports and other activities.

In residency programs, the training and volume exposure in total hip arthroplasty and TKR is far greater than in TSA and RCR, so surgeons who graduate and then perform low volume in these procedures are likely to have worse outcomes than in the total hip replacement and TKR procedures they performed.³¹⁻³⁴

The Virtuous Circle of Value



Fig 2. The “Virtuous Circle of Value” and the effect of volume. Reprinted with permission from Michael E. Porter, Harvard Business School.

In the United States, where fee-for-service models reward the procedure rather than the outcome, financial motivation may be a contributing factor to low volume surgeons performing these operative procedures. The unavoidable reality is that this historical model of payment for service pays for the actual service and not the outcome. This potentially challenges the value of the care we deliver.⁸⁻¹⁰

Although orthopaedics has lagged behind cardiothoracic surgery in assessment of the impact of failure of surgery and application of standard benchmarks, more and more academic work is pointing out the implications of failure of TSA and RCR when it comes to delivering value.^{35,36}

Porter and Lee⁸ have discussed the role of volume and measurement of outcomes in providing value in health care. Porter and Kaplan have proposed a “Virtuous Circle of Value” based on volume of care (Fig 2). One important example of this is the Martini Klinik in Germany that specializes in prostatectomy for cancer.³⁷ Although their surgeons perform a higher volume of procedures than their comparators in the community, their structure is very important in delivering value. This clinic created “a hospital within a hospital” that integrates all elements of care, but most importantly, supports systematic measurement of outcomes to determine which surgeons are underperforming. In such cases, a proactive approach—including mentorship by better performing surgeons—leads to improved outcomes to the standard benchmark. With this approach, the Martini Klinik achieves dramatically lower complication rates than their comparators. Thus, volume is important, but ongoing critical measurement and a process to enact systematic improvement are likely more important.

Shahian¹¹ has written extensively in the computed tomography literature on this effect and has concluded that measurement of the entire process of care, from preoperative decision making to surgery and aftercare, can dramatically improve results of surgical care.

In his classic publication on Hospital Efficiency, Codman⁷ wrote:

To effect improvement, the first step is to admit and record the lack of perfection. The next step is to analyze the causes of failure and to determine whether these causes are controllable.

Thus, although volume most certainly plays a role in determining outcomes and cost, the more important principle is to measure outcomes and improve with such measurement.

Because health care moves to alternative payment models, this principle becomes even more important. The proposals for creation of insurance bundles in shoulder arthroplasty and rotator cuff repair have already begun. In these cases, management of risk and

outcomes becomes very important to delivery of value for all stakeholders in the care process. Johnson and Becker³⁸ showed this in their prescient publication in *Arthroscopy* in 1994. They proposed and delivered a warrantee on outcomes for arthroscopy and delivered an enhanced profit margin while providing the highest quality care and managing outcomes and cost. Twenty years later, we are faced with the same opportunities and such proposals are being made now.³⁹

In conclusion, as the authors point out, there is an association of volume with outcome; however, this effect is less in cases where orthopaedic residency training provides greater exposure, as with total hip and knee arthroplasty. In the case of total shoulder arthroplasty and rotator cuff repair, there is a much greater association. This has implications not only for patient outcome but also for hospital costs. Cardiothoracic surgery quality analysis demonstrates the same association of volume with outcomes in more complex and less frequent procedures; however, this can be mitigated through a dedicated approach to measurement, oversight, and mentorship. The Martini Klinik achieves consistently excellent outcomes in prostate cancer surgery through such a commitment to measurement to improve and then mentorship to achieve such improvement. In the case of total shoulder replacement and rotator cuff repair, these lessons would no doubt lead to improved outcomes and lower costs and fulfill the tenets of excellence embraced by both Codman’s end result approach and Porter’s value-based care.

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