Assessing and Improving the Quality of Surgical Care in Rural America

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Amidst the many ideas, opinions, and debates currently swirling in the public forum on health care policy, the most consistent theme is the call for improvement in the quality of care. The Institute of Medicine articulated this theme in the publication *Crossing the Quality Chasm*, calling for health care that is safer, more effective, more efficient, more equitable, more patient-centered, and more timely.  

Efforts to improve the quality of health care represent the convergence of many interests: the patients’ interest in achieving the best possible health, the health care providers’ interest in their patients’ outcomes and in building successful practices in a competitive market, and the payers’ interest in avoiding the costs associated with poor health care. It is no surprise, therefore, that reform and improvement of the quality of health care has become a top national priority.

Efforts to understand and improve the quality of surgical care are not new, but have gained greater urgency as the quality of health care has assumed greater prominence in the public consciousness. In addition to the longstanding tradition of local peer review of surgical morbidity and mortality, there is a fast-growing body of articles reporting the results of research in surgical outcomes. At an institutional level, several significant and high-profile surgical quality initiatives have emerged in the last two decades, including the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP, developed initially in the Veterans Administration and then extrapolated to the public sector), the Leapfrog Group’s surgical care initiatives, Surgical Care Improvement Program (SCIP), the Michigan Plan, and the Surgical Care Outcomes Assessment Program.

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Although efforts to improve surgical quality are effectively addressing the conditions of larger urban and suburban hospitals, they are less easily applied to smaller hospitals, many of which are in rural areas of the United States. Already, there is public suspicion that small rural hospitals may not provide high-quality care. Small rural hospitals’ problems of public perception are further compounded when new surgical quality standards and programs seem beyond their reach.

This article describes some of the challenges related to applying surgical quality assessment and improvement initiatives to the practice of surgery in small rural hospitals. These challenges must be met because rural residents will continue to require the services of surgeons in rural hospitals, and the care that these surgeons provide must necessarily be of the highest possible quality. This article also presents approaches to addressing these challenges to stimulate dialog about surgical quality improvement in small rural hospitals.

**BARRIERS TO QUALITY ASSESSMENT OF RURAL SURGERY**

There are numerous barriers to the implementation of surgical quality assessment techniques and quality improvement measures in small rural hospitals. These include professional isolation, limited financial and other resources, low surgical volume, and differences between urban and rural populations.

**Professional Isolation**

Even before health care quality became a national priority and quality assessment and improvement achieved a higher level of sophistication, keeping a close watch to identify and prevent the repetition of surgical errors was a challenge in small rural hospitals. The traditional approach to surgical quality assessment and improvement is the surgical morbidity and mortality conference (M&M conference), a private meeting regularly convened by surgeons to review bad outcomes and identify what went wrong, what mistakes might have been made, and how similar outcomes might be avoided in the future. In a large urban hospital, this process involves many surgeons with extensive combined experience. In a small rural hospital, however, peer review is typically limited to very few surgeons (or even just one surgeon) and a few nonsurgeons. Thus even at the most basic level in rural hospitals, the effectiveness of quality assessment and improvement through peer review is hampered by a disadvantage of numbers.

Insofar as quality is also measured by the degree to which the latest and best technologies and techniques are applied in surgical practice, small rural hospitals function at a disadvantage. First, because some new technologies are very expensive, small rural hospitals are unable to invest the capital required to acquire them. For example, sentinel node biopsy for breast cancer requires special capabilities and equipment, and their purchase is difficult to justify given the small number of patients with breast cancer presenting annually at a small rural hospital. Secondly, because of limited surgical staffing in rural hospitals, it is difficult to arrange time away from work for continuing medical education, and this can result in slower dissemination of new techniques and practices. Although Kemp and colleagues\(^7\) reported that these barriers did not affect the time taken to adopt laparoscopic cholecystectomy, these challenges that are related to maintaining the state of the art in surgery are a core concern expressed by rural surgeons in forums addressing rural surgery practice.\(^8\)
The association between higher volume of procedures and better surgical outcomes has been demonstrated repeatedly in medical literature. Although this association has been questioned, the preponderance of statistical evidence supports the volume-outcome effect for many surgical procedures. The question is not whether the volume-outcome effect is real, but rather whether it is reasonable to use volume as a measure of quality and whether it is fair to use it as a justification for selective referral (regionalization).

A false interpretation of the volume-outcome effect is the assumption that what is observed in the aggregate also holds true for specific cases. In other words, it is incorrect to assume that because low-volume hospitals have higher overall mortality than high-volume hospitals, all low-volume hospitals produce worse outcomes. The only valid conclusion about individual hospitals that one can draw from the volume-outcome effect is that the odds of choosing a hospital with good outcomes are higher when one chooses a high-volume hospital. However, there are certainly poor-performing high-volume hospitals and high-performing low-volume hospitals.

Volume is an ineffective measure of quality in small rural hospitals because most rural hospitals perform low volumes of the surgical procedures for which the volume-outcome effect has been demonstrated. Because most rural hospitals perform relatively low volumes of surgical procedures, the whole range of surgical quality, from low to high, may be represented. This hypothesis is supported by an analysis of Medicare claims data that Meyers and the author made several years ago. The study compared mortality rates in rural versus urban hospitals in the United States for colectomy for cancer, a procedure for which there is a demonstrated, significant volume-outcome effect. The subjects for the study were drawn from all non-HMO Medicare claims for patients older than 65 years during a 6-year period (1994–1999). Urban and rural hospital designations were based on rural-urban commuting area (RUCA) codes developed by health services researchers at the University of Washington. Multiple logistic regression was used to describe the relationship between combined in-hospital and 30-day mortality and the rural/urban hospital location, controlling for patient and hospital characteristics.

In the complete cohort of hospitals, the authors observed the same significant volume-outcome effect that was reported in a previous Medicare-based study of colectomy mortality. However, the overall adjusted operative mortality in rural hospitals (6.7%; 95% confidence interval [CI], 6.4–7.0) was similar to that of urban hospitals (6.4%; 95% CI, 6.3–6.5), even though nearly 90% of rural hospitals were in the lowest 2 quintiles of hospital procedure volume (<57 colectomies/year) compared with only 28% of urban hospitals. When comparing adjusted operative mortality in the lowest 2 quintiles of hospital volume, it was found that mortality in the low-volume rural hospitals (6.6%; 95% CI, 6.3–6.9%) was significantly lower than mortality in urban hospitals with similar annual volume of procedures (7.2%; 95% CI, 7.0–7.4%).

In summary, nearly 90% of rural hospitals where colectomy for cancer is performed are low-volume hospitals, but their adjusted operative mortality is significantly lower than that of urban hospitals with similar procedure volume. Rural hospitals, although predominantly low volume, had an overall mortality rate that more closely resembled the overall mortality rate observed in the entire cohort of urban hospitals (Fig. 1). This finding may be explained by the presence of more low-volume high performers in the cohort of rural hospitals.
As volume is an ineffective standard for quality in rural hospitals (because most are low-volume hospitals), the obvious alternative approach to identify the better performing hospitals is the direct measurement of surgical outcomes. However, the tendency for rural hospitals to perform relatively low volumes of surgical procedures presents an impediment to this approach. The reason for this is the low statistical power resulting from the small number of procedures in rural hospitals. When the number of outcomes (eg, mortality) being measured is low, statistical comparisons result in wide confidence intervals. This makes outcomes-based quality comparisons across hospitals very difficult for most procedures. This statistical problem exists not only for rural hospitals but also for most urban hospitals across various procedures, as demonstrated in an elegant analysis by Dimick and colleagues published in 2004.

As a simple example, assume that during a given time period, procedures performed in a given region number 50,000, with 1500 deaths, yielding a benchmark mortality rate of 3%. Then assume that Hospital A during the same time period performed 46 procedures, with 4 deaths, yielding a mortality rate of 8%. Although this mortality rate would appear to be more than twice as high as the benchmark, conventional statistical comparison techniques (chi-square analysis) would suggest that the mortality rates are actually similar (no statistically significant difference). Now assume that Hospital B performed the same number of procedures as Hospital A, but with no deaths, yielding a mortality rate of 0%. Although Hospital B might consider these results exceptional, conventional statistical analysis again suggests no difference from the benchmark. As can be seen from this simple example, when bad outcomes are rare, outcomes-based quality assessment by conventional statistical methods is not adequate. Small rural hospitals with low surgical volumes are unable to distinguish themselves statistically as providing either superior or inferior quality of surgical care, based on analysis of outcomes.

**Rural-Urban Patient Mix Differences**

Largely on an anecdotal basis, it is believed that people who reside in rural areas are more prone to poor surgical outcomes because of comorbid medical conditions, more advanced disease, and socioeconomic factors. Although the protest “my patients are sicker” is a common complaint among providers faced with evidence of less-than-ideal surgical outcomes, it is certainly possible that regional population differences influence patient outcomes significantly. Although a small amount of research

![Fig. 1. Adjusted combined in-hospital and 30-day mortality after colectomy for cancer in Medicare (age>65 years) patients, 1994 to 1999. Black bars indicate urban hospital mortality across quintiles of hospital volume. Gray bars indicate mortality in low-volume rural hospitals (90% of all rural hospitals are in the 2 lowest quintiles).](image-url)
suggests that rural residents are not “sicker” on average, the demand that outcomes analysis take into consideration patient differences is widely accepted, and risk adjustment is now considered standard practice in outcomes research and assessments of quality of care.

Risk adjustment for patient differences presents 2 important problems for rural surgery. The first relates to the intrinsic limitations of performing risk adjustment. Accounting for differences in populations requires the ability to accurately measure those differences. Accuracy of measurement in turn depends on the fidelity of the processes put in place to collect risk information, which may be subject to human error or information bias. Also, lists of comorbid conditions do not perfectly reflect true risk (eg, 2 patients with the same diabetes diagnosis may present very different risks). When comparing large populations, these limitations are less important, as the biases can work in either direction and tend to regress to a population mean. In rural practice, however, volumes are lower and thus more subject to the effects of random variation. When the cohort is small, a few patients who are at a high level of risk that is not well-reflected in the list of patient factors assigned to them can more easily skew results despite statistical risk adjustment. The second problem with risk adjustment when comparing smaller populations with fewer adverse outcomes relates to statistical confidence. Although risk adjustment is important for comparing populations that differ in baseline risk, it also widens statistical confidence intervals and results in diminished ability to discriminate between rates of adverse outcomes across comparison groups, particularly when the comparison groups are small and adverse outcomes are rare.

Fairness

What is most disconcerting for rural surgeons hampered by low procedure volumes is the sense that despite awareness of its limitations as a measure of quality in the rural setting, procedure volume continues to be a component of quality assessment and payer policy. Ease of measurement ensures the inclusion of procedure volume in hospital quality assessments issued to consumers by popular third party entities such as HealthGrades. As another example, bariatric surgery is increasingly restricted to hospitals certified as centers of excellence, a category that requires a specific minimum in procedure volume. Even if superior quality of care were demonstrable through direct outcomes measurement, most rural surgeons who want to include bariatric surgery in their practices would be prevented from doing so because of volume requirements. Whether high quality can truly be achieved in the setting of low volume may be an open question, but there is little doubt that many rural surgeons consider such policies unfair.

APPROACHES TO QUALITY ASSESSMENT AND IMPROVEMENT IN RURAL SETTINGS

Quality assessment and improvement in rural settings requires approaches that take into account the lower procedure volumes typical of a small rural hospital. Although problems with many current approaches persist, there have been several positive developments in the assessment and improvement of surgical quality. First, there is a growing recognition that in addition to outcomes, better processes in surgical care must be identified and implemented to improve surgical quality. Second, there are growing efforts to create and develop multi-institutional consortiums focused on improving the quality of surgical care. These efforts pay greater attention to the specific conditions of rural practice. Third, there is increasing recognition that a surgical workforce shortage in rural areas contributes to professional isolation and
also bars access to surgical care, thereby diminishing the quality of care available to
rural residents. Finally, efforts to understand the concept of “appropriate care”
promise to improve quality in rural settings by helping surgeons understand who
should receive what operations in what setting.

Focus on Processes of Care

One of the most consistent criticisms of early quality improvement programs was their
overemphasis on outcomes. When the information gathered by a quality improvement
program simply identifies hospitals with poor outcomes, there is no clear path to
improvement. On the other hand, if processes of care (eg, appropriate use of antibi-
otics, use of appropriate technologies) are the metric by which quality is measured,
the quality assessment itself clearly points to the changes required to improve quality.

In rural settings where low procedure volume stymies efforts to assess quality based
on outcomes, quality is more appropriately assessed by determining the use of best
practices. This approach obviates the problem of inadequate statistical power, as
the benchmark for processes that should always be in place is 100% compliance.
Outcomes in low volume settings cannot be interpreted with confidence, but they
can be expected to reflect the benefits that a particular process of care has provided
in clinical trials.

Process-based quality assessment and improvement has in recent years begun to
gain momentum, notably with the development of SCIP and with proposed changes in
the ACS-NSQIP.\textsuperscript{19} SCIP is a widely accepted national quality improvement effort with
a clear emphasis on a short list of easily measurable and effective processes of care,
including prophylactic antibiotic use, appropriate hair removal technique, periopera-
tive β-blocker use, maintenance of postoperative normothermia, and prophylaxis
against deep venous thrombosis. The effort benefits from the partnership of private
and public entities with a shared interest in improving the quality of surgical care.
The ACS-NSQIP is a well-established and widely disseminated quality improvement
program that has traditionally based quality assessment on risk-adjusted outcomes.
Although this has been successful, there has been greater recognition in recent years
of the need to add measurement of processes of care to this program, both as a means
to assess hospital quality and a way to identify target areas for quality improvement.\textsuperscript{19}

Although the assessment of processes of care has clear theoretical advantages,
there are important practical limitations to this approach. Surgical care is complex
and difficult to separate into individual independent processes. There is a lack of
identifiable, scientifically based, universally accepted processes of care in surgery.
Nevertheless, assessment of process of care remains the most promising quality
assessment and improvement approach in low-volume rural settings. Unfortunately,
there are few process-based quality improvement efforts such as SCIP, and they
provide only a piecemeal approach to improving the quality of surgical care.

Quality Consortiums

Professional isolation in rural settings can be at least partially addressed by participa-
tion in consortiums focused on assessing and improving surgical quality. A successful
example of this approach to quality improvement is the Surgical Care Outcomes
Assessment Program (SCOAP).\textsuperscript{6} SCOAP is a physician-led, voluntary, collaborative
surgical quality program that aims to improve quality by reducing variations in
processes of care in the Washington State region. Although participant hospitals
are mostly larger urban and community hospitals, smaller hospitals meeting very
minimal volume requirements are also encouraged to participate. The advantages
of participation include the “surveillance and response” approach used by the
consortium, which provides valuable opportunities for external peer review and has the potential to diminish the challenges related to professional isolation in rural practice.

Participation in the ACS-NSQIP can provide similar benefits, but at present, the cost and resource commitment required to enroll in the ACS-NSQIP has been a barrier for small rural hospitals with limited resources. Fortunately, the ACS-NSQIP is undertaking measures to streamline the program and make it more accessible to smaller institutions with limited resources. There is also discussion in the American College of Surgeons of creating a “lite” version of the ACS-NSQIP tailored for small rural hospitals (Clifford Ko, Director of the Division of Research and Optimal Patient Care, American College of Surgeons, personal communication).

Workforce

There is a heightened awareness of the shortage of general surgeons in rural areas. The American College of Surgeons has played a key role in bringing invaluable political attention to the issue, and has made the rural workforce shortage a primary focus of its newly formed Health Policy Institute at the University of North Carolina. In response to these efforts (and the efforts of several other organizations concerned about physician workforce levels), the US Congress is presently considering legislation to address the barriers to increasing the workforce of physicians.

Although increasing the rural surgical workforce to provide rural residents with better access to surgical care is a laudable goal, simply increasing the overall number of trained general surgeons in the United States addresses this issue in the wrong way. The surgical workforce is unevenly distributed across the urban/rural spectrum, with lower overall surgeon-to-population ratios evident in most rural areas. If the approach to rectifying shortages in rural areas is to significantly increase the national supply of surgeons, it is inevitable that the most attractive health care markets will have to be supersaturated before rural areas get relief. Insofar as oversupply is associated with increased health care costs with no corresponding incremental improvement in quality, the cost-effectiveness of surgical care can be expected to diminish in more populated oversupplied areas before the benefits of improved access are realized in less-populated rural areas. The public interest would be better served by specific policy measures to address the shortages in deficit areas. These measures might include targeted incentives, such as loan cancellation for residency graduates choosing to practice in under-served locales, or graduated reimbursement rates favoring rural practice. Such measures would significantly diminish the number of additional surgeons required to address the needs of areas short of surgeons in the United States.

Appropriateness of Surgical Care

Appropriateness, which is increasingly acknowledged as an important component of surgical quality, has special relevance to rural surgery. Although appropriateness is frequently used in reference to decisions about who should get what operation, in a broader sense appropriateness also refers to who should provide the operation, and in what setting.

For some higher risk procedures (eg, bariatric surgery), payers have taken the initiative by setting standards for reimbursement of hospitals, which effectively limit the hospitals where these operations are performed. In contrast, rural general surgeons are reluctant to set explicit limits on the scope of practice, and hospitals are often liberal in granting privileges, as limiting surgical practice has the potential to diminish revenue. However, the high degree of variability in outcomes for specific procedures
across hospitals and surgeons suggests that some limits should exist. Even when an individual surgeon has the technical skill to perform a procedure well, the hospital setting can influence the eventual outcome substantially, as reported in a large study of pancreatic surgery that showed similar intraoperative morbidity rates in hospitals with very different rates of surgical mortality. Although most would agree that there should be at least some limits on the scope of surgical procedures performed in rural hospitals with limited resources, it remains unclear where those limits should be fixed. Although we know that there are de facto differences between rural and urban hospital case mixes, a more explicit evidence-based effort to define the appropriate scope of surgical practice in rural settings could add substantially to the quality of rural surgical care.

SUMMARY

The quality of surgical care in rural hospitals is important, as surgery remains a critical component of rural health care systems. Current models for surgical quality assessment and improvement largely reflect the characteristics of larger urban hospital settings, which include proximity to other providers for peer review, higher procedure volumes to accurately assess outcomes, and greater financial resources to acquire data collection systems and finance participation in regional or national quality improvement programs such as the ACS-NSQIP. Although rural surgeons and hospitals face numerous challenges in their efforts to demonstrate or improve the quality of their surgical practices, developments in surgical quality favor their increased participation in quality improvement initiatives.

REFERENCES

8. For the past 5 years, a forum for rural surgeons has been held at the Clinical Congress of the American College of Surgeons (ACS), sponsored by ACS Division of Member Services. A biannual Rural Surgery Symposium also provides an open forum for rural surgeons.


