

Diversity Versus Efficiency in Surgical Practice: Making Practical Sense of Complicated Science

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Variability is said to be the enemy of quality, and many medical pundits have deplored variability in practice as wasteful of health care dollars. Eliminating such waste was the theme of Harvard Business School Professor Michael Porter's keynote presentation at Anesthesiology 2016, in which he called for the creation of "focused factories" to improve the efficiency of perioperative care.

Yet one of the reasons for variability of process is variability in need. There are >10,000 Current Procedural Terminology codes for surgical procedures today, mapping to >1000 different anesthesia codes. Our patients come in many flavors and require many different procedures. Because the average anesthesiologist in America covers about 1000 procedures a year, it is hard to imagine that any individual can be truly experienced at more than a small fraction of them. The same applies to the teams we work with and the hospitals we work in. So how do we assess and focus experience?

This issue of *Anesthesia & Analgesia* includes an article from the formidable academic team of Dexter et al,¹ analyzing the diversity of procedures done in a large subset of US hospitals. While the statistical methodology is intense enough to glaze the eyes of casual readers, the conclusions provide an important description of US surgical practice. In particular, this work establishes terminology, methodology, and results that should profoundly influence our future thinking about the size and scope of hospital-based surgery.

The authors studied major inpatient surgeries, defined as at least 8 anesthesia base units and at least a 4-day average length of stay nationally. The measure of surgical case diversity used, the inverse of the Herfindahl index, is simply explained as the number of procedures the hospital commonly performs. A previous publication on this topic showed that a typical large teaching hospital performed nearly 5000 major inpatient surgeries in a year, clustered in 274 codes.² Seventy-eight of these procedures were

commonly performed. By comparison, a small nonteaching hospital in the same state performed just 97 major inpatient surgeries, under 5 different codes. Only 2 of these procedures were commonly performed.

To expand these findings to the national level, the authors used the 2013 Nationwide Readmissions Database, maintained by the Agency for Healthcare Research and Quality. The 1981 hospitals included were from 21 states and represented about half of the US population. The study included 996,303 major inpatient surgeries across 465 International Classification of Diseases, ninth edition, surgical codes. The most common single procedure was "single internal mammary-coronary artery bypass," which accounted for 7.5% of all the major procedures. The 1981 hospitals studied were divided into urban versus rural, teaching versus nonteaching, and small-, medium-, and large-bed capacity. The authors calculated the diversity of procedures for each facility and provided simple comparisons of diversity across the hospitals studied. Despite the complicated, dense, and very precise terminology, what emerges is a description of common surgical practice, which tells us something important about American hospitals.

The authors found that larger hospitals had a greater diversity of procedures performed than smaller hospitals, and that teaching hospitals showed greater diversity than nonteaching hospitals. Rural hospitals, of any size, had a lower diversity of procedures performed than urban hospitals, likely reflecting the movement of rural patients toward urban areas when a complex procedure is needed. Fifty percent of hospitals commonly performed fewer than 10 different procedures. Among the 170 large, urban, teaching hospitals included in the study, diversity varied widely; while the median different procedures commonly performed was 40, the interquartile range was almost 20. Some large hospitals really are focused factories, concentrating their expertise on only a few procedures; other large hospitals represent the safety net, with a much broader base of experience.

These findings are predictable to most anesthesiologists. More interesting, however, is the implications for efficiency in health care. As the authors note in their introduction, increased diversity of common procedures correlates with decreased efficiency of practice. Anesthesiologists in more diverse settings are less able to predict blood utilization, less accurate at predicting case time, and less able to predict long-running cases. Simply put: large, diverse, teaching hospitals are less efficient than smaller, more focused

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facilities. It costs them more time and money to perform similar procedures. Why, then, do we need them? Because diversity is beneficial!

In the biological sense, diversity makes species more resistant to environmental change. Species with tightly focused genetics and narrow evolutionary niches are at great risk from natural disasters, whereas species with a wide range of genetic variation (and geography) are more likely to survive.³ The same might well be true of hospitals, especially in today's rapidly evolving health care environment.

Diversity is also a recruitment tool. We might hypothesize that a more diverse roster of cases would help to attract a more flexible staff and help to maintain their engagement. Diversity is clearly beneficial to patients with unusual diseases or the need for a one-off surgical procedure. Given the well-established link between experience with a surgical procedure—surgeon and hospital volume—and clinical outcome, patients with unusual problems should search, in general, for hospitals with high diversity. Whereas patients with common needs will likely be fine at the closest convenient surgical factory.

As a society, it seems clear that we need both kinds of facilities. Focused factories are necessary because they make the most efficient use of our health care dollars in service to the majority of patients. Diverse teaching hospitals are necessary because they will be able to deal with unusual patients and cases, and will more quickly adapt to changes in national need. It is even possible, as Dexter et al¹ hint, that there is a niche for hospitals that “specialize” in diversity. One of the more important passages in their discussion notes that rare cases, as a whole, offer higher contribution margins than common cases. Given a modicum of external support (eg, Medicare payments for resident staff), large, diverse university hospitals can be financially self-sufficient. Rather than trying to build hyperefficient systems for performing singular common procedures, such hospitals can focus on building a flexible infrastructure, including staff, to cope with anything that comes their way. And once this skill is developed, it can be marketed.

There is empirical evidence that such a strategy can work. High-end trauma care is a subspecialty of surgery and anesthesia that likely benefits from diverse experience and capabilities because patients can present with any combination of comorbidities and anatomic injury. A series of papers from one of the nation's busiest trauma centers demonstrates both operational efficiency (shortened length of stay and low readmission rate)⁴ and high-quality outcomes.⁵ Not published, because it is harder to quantify, is the impact of such a trauma center on its neighbors. Other

hospitals nearby, relieved of the burden of preserving resources and expertise for uncommon trauma presentations, can instead focus on efficiency in their elective surgical population. In theory, the entire system benefits. And, indeed, the need to balance capability for unusual patients and cases against the financial benefits of focus on a smaller case mix is one of the major drivers of the health care system agglomeration today. Smart anesthesiologists will follow the evolution of hospitals into systems by themselves evolving from small groups based in single centers to larger groups spread across multiple facilities, with an emphasis on putting their skills at triage and system optimization to work.

One unanswered question is how many hospitals, and at what level of diversity, produce the optimal result for the United States as a nation? And how should these hospitals be distributed? Although Dexter et al¹ cannot provide a direct answer, they do at least document that diverse hospitals are out there now. And they provide a methodology for identifying them, determining their realm of expertise, and comparing them with others. Health care policy makers and administrators of large hospital systems should take note of this work and its implications. The ability to identify and foster diversity will be just as important to the strength of American health care as the ability to enhance efficiency for routine patients and cases. ■■

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