Will Volume-Based Referral Strategies Reduce Costs Or Just Save Lives?

Although these strategies are promising, policymakers must keep an eye out for adverse market effects and new costs to the health system.

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ABSTRACT: Although recent policy initiatives aimed at concentrating selected surgical procedures in high-volume hospitals may reduce mortality, their economic implications have not been considered fully. From the hospital perspective, the primary effect of these policies will be to redistribute surgical profits to bigger centers. From the payer perspective, prices paid for procedures will likely increase in some geographic areas. From the societal perspective, how these policies will affect the true cost of providing surgical care is uncertain, but use of discretionary procedures will likely increase. For these reasons, the primary argument for volume-based referral strategies should be improving quality, not reducing costs.

FOR MANY ELECTIVE BUT HIGH-RISK surgical procedures, high-volume hospitals have much lower operative mortality rates than low-volume centers have.[1] Volume-outcome relationships have been remarkably consistent over time and across studies. In one recent structured literature review of mortality with forty different surgical procedures, 123 of 128 analyses (96 percent) noted lower mortality at high-volume hospitals, in most cases statistically significant.[2]

Although volume-outcome relationships have been long recognized, efforts to use surgical volume as a lever for improving quality are only now beginning to gain momentum. Some volume-based referral strategies are consumer-oriented, focused on getting information to patients. For example, both the media and several large advocacy groups (such as www.healthscope.org) are emphasizing the importance of volume with different procedures and providing patients with information about volume at hospitals near them.[3] Other volume-based referral strategies are regulatory in nature, including efforts by individual states to incorporate volume standards in certificate-of-need applications for new surgical centers.[4]

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The most prominent effort to steer patients to high-volume hospitals is payer-based. The nonprofit Leapfrog Group, a coalition of more than 100 Fortune 500 employers and public-sector purchasers, is emphasizing volume standards for coronary artery bypass graft (CABG) surgery, coronary angioplasty, carotid endarterectomy, abdominal aortic aneurysm repair, and esophagectomy.[5]

Although these efforts may reduce surgical mortality, the economic implications of volume-based referral strategies have not been fully considered. Here we consider economic effects from three different perspectives: (1) Hospital perspective: Surgery is a well-known profit center at most hospitals. How would redistributing surgical caseload affect the bottom lines of high-volume hospitals gaining patients, and low-volume hospitals losing market share? (2) Payer perspective: Concentrating selected procedures among a smaller number of providers may reduce competition among hospitals. Will insurers have to pay more for surgery? (3) Societal perspective: Volume-based referral strategies could influence both the unit cost of providing a given surgical procedure and the total number of procedures performed. Will the net cost of delivering surgical care rise or fall?

Of course, answers to these questions will depend in part on details of the specific strategy employed. In this paper, however, we consider more generally the economic effects of any policy whose result is for a larger proportion of surgical procedures to occur in high-volume hospitals.

The Hospital Perspective: Winners And Losers

Volume-based referral strategies will redistribute surgical revenues. In general, surgery is a hospital profit center: The costs of delivering procedures are lower than the average reimbursements hospitals receive for providing them. Thus, referral (high-volume) hospitals would increase caseloads and net revenues, while referring (low-volume) hospitals would lose market share and revenue.

To evaluate potential gains and losses from the hospital perspective, we estimated average hospital profits with four surgical procedures (all targeted by the Leapfrog Group), using data from a cross-section of New England hospitals.[6] For each of the four procedures, average hospital reimbursements greatly exceed costs (Exhibit 1). Average profits ranged from $3,200 for elective abdominal aortic aneurysm repair to $6,840 for CABG surgery.

From the perspective of individual hospitals, the financial implications of volume-based initiatives depend on the number of cases they gain or lose. For example, a hospital giving up three esophagectomies a year would sustain a loss of less than $20,000. However, financial redistributions for more common procedures could be much larger: A hospital giving up 100 CABG procedures a year would experience a net loss of $684,000.

Of course, these estimates are intended for illustrative purposes. Hospital costs and average reimbursements vary widely. Overall, however, we are likely overestimating true costs: The marginal costs of providing these services are likely to be

EXHIBIT 1
Average Hospital Profit (Per Patient) For Four Different Procedures In A Sample Of New England Hospitals, 2000

Procedure	Average cost of providing procedure	Average reimbursement	Average profit
Coronary artery bypass graft surgery	$21,450	$28,290	$6,840
Carotid endarterectomy	4,950	8,450	3,500
Elective AAA repair	38,130	41,330	3,200
Esophageal cancer	41,490	47,110	5,620

SOURCE: J.D. Birkmeyer, C.M. Birkmeyer, and J.S. Skinner, "Economic Implications of the Leapfrog Safety Standards," www.leapfroggroup.org (6 May 2002).

NOTES: Average ("fully loaded") costs estimated from a sample of New England hospitals and patients undergoing procedures in 2000. Average hospital reimbursements based on national data provided by the MEDSTAT Group. AAA is abdominal aortic aneurysm.

much lower than the fully loaded costs used in our estimates, particularly with small or moderate changes in hospital caseloads. Thus, our analysis likely underestimates the distributional impact of volume-based referral strategies.

Payer Perspective: Will Hospitals Charge More For Surgery?

In general, how much hospitals charge (and get reimbursed) depends in part on their real costs of providing a given procedure. However, prices are also strongly influenced by the relative negotiating positions of providers and payers in local markets. Negotiating strength is in turn related to the number of high-volume providers competing for market share in a given area.

In rural or small metropolitan areas, volume-based referral strategies could result in having only one provider of high-volume services. This reduction will result in monopolistic market power for providers in these settings. Previous studies have documented higher prices for hospital-based care in more concentrated hospital markets.[7] In metropolitan areas where several large hospitals compete for market share, volume-based referral strategies may actually strengthen the negotiating position of payers. High-volume hospitals may be loath to lose contracts that allow them to remain designated referral centers for different procedures or conditions and thus be willing to accept lower prices to maintain volume (as observed commonly in the early days of managed care).

Societal Perspective: More Efficient Care Or Just More Procedures?

From a societal perspective, it is most important to consider how volume-based referral strategies might influence the true costs of delivering surgical care, not how they are distributed between hospitals and payers. The true cost associated with a given surgical procedure is the product of two variables: the unit cost (resources required to provide one operation) and the total number of procedures

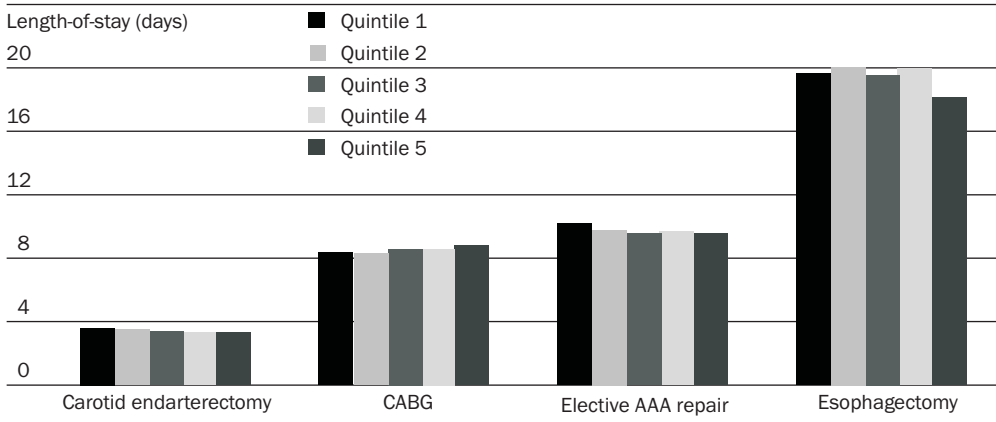
performed. Volume-based referral strategies could affect both variables in several ways, some increasing, others decreasing total costs.

■ **Unit costs.** Many assume that volume-based referral strategies will reduce unit costs by two main mechanisms: (1) better "economies of scale" in providing resource-intensive services, and (2) decreased hospital use as a result of improvements in quality. Economies of scale—diluting fixed costs over a greater number of procedures—may be particularly important for some operations.[8] For example, with cardiac surgery, a minimum number of cardiopulmonary bypass machines or perfusionists are required, regardless of whether a hospital performs two per week or two per day (100 versus 500 annually). Most operations, however, do not involve such procedure-specific fixed costs. Thus, savings related to improved economies of scale may be relatively small.

Unit costs for surgical procedures also could fall if volume-based referral strategies resulted in reduced hospital use—shorter lengths-of-stay or reduced readmission rates after surgery. Hospital use could decline if high-volume hospitals had lower complication rates after surgery. Hospital use, particularly length-of-stay, could also decline to the extent that hospitals with higher volumes are better positioned to implement standardized protocols for postoperative care.

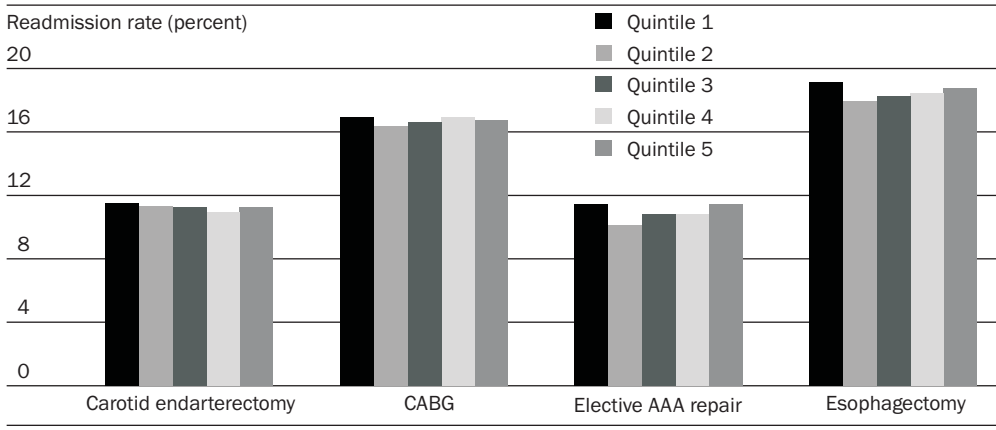
Although clinically plausible, however, current evidence does not indicate that higher-volume hospitals do in fact achieve shorter lengths-of-stay or lower readmission rates with most procedures. We examined hospital use using the 1994–1999 national Medicare database.[9] Exhibits 2 and 3 compare lengths-of-stay and readmission rates across volumes for each of the four operations targeted by the Leapfrog Group. Volumes vary by operation but are presented in the exhibits as

EXHIBIT 2
Mean (Post-Procedure) Length-Of-Stay For Four Different Surgical Operations, Based On Data From The National Medicare Population, 1994–1999



SOURCE: Data presented by P.P. Goodney and colleagues, Dartmouth-Hitchcock Medical Center, at the annual meeting of the Society of University Surgeons, Honolulu, Hawaii, 6 February 2002.
NOTES: Actual volumes of procedures vary by operation but are shown here as standardized quintiles. Quintile 1 reflects the lowest hospital volume. CABG is coronary artery bypass graft. AAA is abdominal aortic aneurysm.

EXHIBIT 3
Thirty-Day Readmission Rates For Four Different Surgical Procedures, Based On Data From The National Medicare Population, 1994–1999



SOURCE: Data presented by P.P. Goodney and colleagues, Dartmouth-Hitchcock Medical Center, at the annual meeting of the Society of University Surgeons, Honolulu, Hawaii, 6 February 2002.
NOTES: Actual volumes of procedures vary by operation but are shown here as standardized quintiles. Quintile 1 reflects the lowest hospital volume. CABG is coronary artery bypass graft. AAA is abdominal aortic aneurysm.

standardized quintiles. As shown in the exhibits, volume was not related to either length-of-stay or readmission rates in any of the four operations. Volume was also not consistently related to hospital use across a wider range of cardiovascular and cancer procedures (data not shown).[10]

There are several reasons why volume-based referral strategies could actually increase the unit costs of surgical procedures. Increasing procedure volume at high-volume centers would require adding capacity (operating rooms and beds) at some facilities, a one-time cost that could increase the (amortized) average cost of procedures. These costs would not be offset by a corresponding decline in fixed costs at hospitals losing surgical volume, at least in the short term.

Referral centers also would need to increase staff, including surgeons, anesthesiologists, operating room staff, nurses, and other support staff involved in postoperative care. Ultimately, these staffing needs would be met by workforce reductions at hospitals losing surgical caseload. However, there would be friction costs related to workforce redistribution.

There would be obvious administrative costs associated with transferring medical information between referring and referral hospitals. Some degree of duplicate evaluation and testing would also occur. Before decisions are made to refer for surgery, patients will often undergo specialist evaluation locally, a service duplicated at the referral center. Many diagnostic tests already performed at outside facilities (such as electrocardiograms and computed tomography, or CT, scans) would be repeated after patients were referred to high-volume centers.

Finally, volume-based referral strategies would concentrate more care at teaching hospitals, which tend to deliver care more expensively than do smaller,

nonteaching hospitals.[11] Although similar data are not available for most surgical procedures, one study noted that Medicare hospital reimbursements for hip fracture, stroke, and congestive heart failure were approximately $1,000–$2,000 higher for major teaching hospitals than for other types of hospitals.[12]

■ **Number of procedures performed.** The total number of procedures performed may be a more important determinant of total costs than of unit costs. To the extent that high volume may be associated with higher-quality diagnostic practices or patient selection, or both, volume-based referral strategies could avert some unnecessary procedures (such as major resections in patients with incurable cancer). These strategies also could reduce the use of procedures by reducing surgical capacity—that is, closing some surgical centers. For some conditions, patients are more likely to undergo a procedure at the hospital where they initially present for treatment.[13] However, although current policy initiatives may be successful to some degree in redistributing cases between low- and high-volume centers, none are likely to result in closure of surgical centers.

Volume-based referral strategies are more likely to increase the total number of procedures performed. Emphasis on procedure volume as a quality indicator creates obvious incentives for hospitals to increase the number of procedures they perform. Intentionally or not, surgeons could respond to volume pressures by lowering their threshold for intervention. Many procedures are performed for discretionary clinical conditions, such as lifestyle-limiting coronary artery disease, small abdominal aortic aneurysms, and asymptomatic carotid stenosis. Because of the subjective nature of clinical decision making for such conditions, the use of surgery could be increased considerably without the use of overtly "inappropriate" or "unnecessary" procedures.[14]

The total number of procedures performed could increase for subtler reasons. In exploring reasons for regional variation in rates of carotid endarterectomy, Mark Chassin has noted that regions with the highest utilization rates tend to be dominated by a small number of high-volume providers.[15] He postulates that such (high-volume) surgeons were more "enthusiastic" about recommending carotid endarterectomy. Thus, efforts to concentrate selected procedures in high-volume hospitals may be directing patients to surgeons who are most prone to recommend discretionary procedures.

Conclusions And Policy Implications

Volume-based referral strategies may have several important economic effects. From the hospital perspective, these strategies will redistribute surgical revenue, creating financial winners (high-volume hospitals) and losers (lower-volume centers). From the payer perspective, reduced competition among providers may result in increased prices in many, but not all, areas. Finally, volume-based referral strategies should not be expected to greatly reduce direct health care costs. In the absence of quantitative information about different costs and savings, it is impos-

"The dollar value associated with lives saved by volume-based referral strategies could be substantial."

sible to calculate a bottom line. However, by creating incentives for hospitals to do more cases and concentrating care in the hands of surgical "enthusiasts," volume-based referral strategies could greatly increase the use of discretionary procedures.

The economic implications of volume-based referral policies would depend on details of the specific strategy employed. For example, health plans deciding to contract with the single highest-volume provider might pay more for surgery than if they simply dropped the lowest-volume hospitals. Obviously, the economic effects of any given policy would be proportional to the number of patients moved to high-volume centers. Thus, a regional patient education effort would have much less effect than a (hypothetical) decision by the Centers for Medicare and Medicaid Services (CMS) to limit reimbursement to high-volume hospitals for selected procedures. Strategies focusing on relatively rare cancer resections (such as esophagectomy) would have much less impact than would those focusing on CABG.

This paper did not consider explicitly the indirect (nonhealth) savings associated with improving patient outcomes. Previous analyses suggest that concentrating selected procedures in high-volume hospitals could save thousands of U.S. lives each year.[16] As implied by our large investment in health care, U.S. society places a great deal of economic value on health and saving lives. Although difficult to quantify, the dollar value associated with lives saved by volume-based referral strategies could be substantial. In one analysis by the Leapfrog Group (which assumed each life-year saved was worth $50,000), lives saved by concentrating five procedures in high-volume hospitals could be worth $1 billion annually in the United States.[17]

Volume-based referral strategies may a good place to start in efforts to improve surgical quality. Such policies may be relatively easy to implement and monitor, have intuitive appeal to patients, and may greatly reduce overall mortality for some procedures. As these policies are implemented, however, it will be important to watch for adverse market effects and new costs to the health care system. In particular, we will need to watch for unnecessary costs in the referral process and signs that the threshold for surgical intervention is falling.

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NOTES

1. See, for example, H.S. Luft, J.P. Bunker, and A.C. Enthoven, "Should Operations Be Regionalized? The Empirical Relation between Surgical Volume and Mortality," *New England Journal of Medicine* 301, no. 25 (1979): 1364–1369; and C.B. Begg et al., "Impact of Hospital Volume on Operative Mortality for Major Cancer Surgery," *Journal of the American Medical Association* 280, no. 20 (1998): 1747–1751.
2. See R.A. Dudley et al., "Selective Referral to High-Volume Jospitals: Estimating Potentially Avoidable Deaths," *Journal of the American Medical Association* 283, no. 9 (2000): 1159–1166.
3. See A. Comarow, "Higher Volume, Fewer Deaths," *U.S. News and World Report*, 17 July 2000, 68–70; and L. Marsa, "Not Every Hospital Is Created Equal," *Los Angeles Times*, 25 September 2000.
4. See J. Arnold and D. Mendelson, "Evaluation of the Pennsylvania Certificate of Need Program" (Falls Church, Va.: Lewin-ICF, 1992).
5. See www.leapfroggroup.org.
6. We identified patients admitted in the year 2000 (based on their appropriate diagnosis codes) and obtained estimates of average "fully loaded" costs using a ratio of cost/charge accounting process. These cost estimates include not only the marginal costs associated with providing the procedure itself but also those associated with all aspects of hospital operation (such as physical plant depreciation, administration, and so on). These costs therefore include both the direct and indirect costs of care. For hospital reimbursements, we used estimates provided by the MEDSTAT Group, based on data from hospitals nationwide, and, where available, information from the New England hospitals for which costs were estimated. For details, see www.leapfroggroup.org.
7. See R.A. Connor, R.D. Feldman, and B.E. Dowd, "The Effects of Market Concentration and Horizontal Mergers on Hospital Costs and Prices," *Journal of the Economics of Business* 5, no. 2 (1998): 159–180; J. Simpson and R. Shin, "Do Nonprofit Hospitals Exercise Market Power?" *International Journal of the Economics of Business* 5, no. 2 (1998): 141–157; and E.B. Keeler, G. Melnick, and J. Zwanziger, "The Changing Effects of Competition on Non-Profit and For-Profit Hospital Pricing Behavior," *Journal of Health Economics* 18, no. 1 (1999): 69–86.
8. See S.A. Finkler, "Cost Effectiveness of Regionalization—Further Results for Heart Surgery," *Health Services Research* 16, no. 3 (1981): 325–333.
9. For details on the patient populations used for this analysis, see J.D. Birkmeyer et al., "Hospital Volume and Surgical Mortality in the United States," *New England Journal of Medicine* 346, no. 15 (2002): 1128–1137.
10. Data presented by P.P. Goodney and colleagues, Dartmouth-Hitchcock Medical Center, at the annual meeting of the Society of University Surgeons, Honolulu, Hawaii, 6 February 2002.
11. See F.A. Sloan, R.D. Feldman, and B. Steinwald, "Effects of Teaching on Hospital Costs," *Journal of Health Economics* 2, no. 1 (1983): 1–28; and L.I. Iezzoni et al., "Illness Severity and Costs of Admissions at Teaching and Nonteaching Hospitals," *Journal of the American Medical Association* 264, no. 11 (1990): 1426–1431.
12. See D.H. Taylor Jr., D.J. Whellan, and F.A. Sloan, "Effects of Admission to a Teaching Hospital on the Cost and Quality of Care for Medicare Beneficiaries," *New England Journal of Medicine* 340, no. 4 (1999): 293–299.
13. J. Blustein, "High-Technology Cardiac Procedures: The Impact of Service Availability on Service Use in New York State," *Journal of the American Medical Association* 270, no. 3 (1993): 344–349.
14. See L.L. Leape et al., "Does Inappropriate Use Explain Small-Area Variations in the Use of Health Care Services?" *Journal of the American Medical Association* 263, no. 5 (1990): 669–672; and M.R. Chassin et al., "Does Inappropriate Use Explain Geographic Variations in the Use of Health Care Services? A Study of Three Procedures," *Journal of the American Medical Association* 258, no. 18 (1987): 2533–2537.
15. See M.R. Chassin, "Explaining Geographic Variations: The Enthusiasm Hypothesis," *Medical Care* 31, no. 5 (Supplement 1993): YS37–YS44.
16. See J.D. Birkmeyer, F.L. Lucas, and D.E. Wennberg, "Potential Benefits of Regionalizing Major Surgery for Medicare Patients," *Effective Clinical Practice* 2, no. 6 (1999): 277–283; and J.D. Birkmeyer et al., "Leapfrog Safety Standards: Potential Benefits of Universal Adoption," www.leapfroggroup.org/PressEvent/birkmeyer.pdf (6 May 2002).
17. See J.D. Birkmeyer, C.M. Birkmeyer, and J.S. Skinner, "Economic Implications of the Leapfrog Safety Standards," www.leapfroggroup.org/toolkit/LF.Costs.Final.pdf (6 May 2002).