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Managed care has begun to reshape many areas of health care practice, but anesthesia is not yet among them. The economics of anesthesia care are characterized by widespread inefficiency in the allocation of labor, and a unique market structure that poses special challenges to managed care influence. The potential for savings is great, perhaps as much as a one percent decrease in commercial health care costs. But these savings can only be realized if managed care organizations are able to restructure the incentives facing anesthesia professionals to promote innovation, cooperation, and shared benefits of efficiency improvements. Key words: *anesthesia, cost analysis, efficiency, labor, managed care, productivity*

The Anesthesia Market

In the late decades of the nineteenth century, the foundation for modern surgery was created with the development of anesthestic agents and techniques, together with a new understanding of the importance of sterile procedures.[1,2] Today, as then, the primary activity of anesthesia is administering drugs or gases to render patients insensitive to pain during and after surgery.[3]

Almost all anesthesia services in the United States are provided by physicians or nurses with advanced training in the field—anesthesiologists and certified registered nurse anesthetists (CRNAs). The numbers of practicing anesthesiologists and CRNAs are very similar: approximately 24,200 anesthesiologists,[4] and 23,800 CRNAs.[5] As of 1994, median anesthesiologist earnings were $244,600, or three times median CRNA earnings of $82,000.[6] For both professionals, incomes may vary significantly depending on experience, practice setting, and region of the country.

In many rural hospitals and in specialized outpatient surgical facilities such as eye, dental, or plastic surgery, CRNAs are the sole providers of anesthesia services. In urban hospitals anesthesiologists may be the sole anesthesia providers, but the most common practice arrangement is an "anesthesia care team" (ACT) involving both CRNAs and anesthesiologists.[7] In ACT settings, CRNAs are in constant attendance with the patient and perform the majority of anesthetic procedures, while anesthesiologists concurrently supervise the progress of from two to four cases and are personally involved at key stages, such as anesthesia induction and emergence.

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CRNA practice laws often refer to practicing "under the supervision" of the attending physician, and surgeons naturally work closely with the anesthesia staff. However, surgeons do not generally have comparable expertise to select anesthetic agents and to personally perform or direct anesthetic procedures (excepting local anesthesia). Accordingly, anesthesiologists and CRNAs generally assume primary responsibility for anesthesia outcomes whether in an ACT or independent practice setting.[8] For both types of anesthesia providers the overall safety and outcomes record is very good[9] and is reflected in declining malpractice insurance rates.[10,11]

Most anesthesiologists practice through professional corporations that have exclusive practice privileges at specific hospitals or surgical centers, which may or may not be formalized through facility contracts.[12] A relatively small number of anesthesiologists are salaried as hospital or clinic employees. By contrast, 42 percent of CRNAs are hospital or university employees; one-third are part of an anesthesiologist/CRNA group; and one-fifth are either self-employed, part of a CRNA-only or temporary service (locum tenens) group practice, or based at a clinic.[13]

Anesthesia services account for a significant share of total health care expenditures. For commercial group health insurance (employment-based), anesthesia services account for approximately 2.4 percent of total health care costs.[14] For Medicare, the percentage is approximately half as large, due mainly to much lower rates of reimbursement than commercial payers. Medicare also differs from commercial payers by reimbursing anesthesiologists and CRNAs at comparable levels.

Although beyond the scope of this article, anesthetic drugs, supplies, and equipment are also a significant part of anesthesia-related health care expenditures. The combined cost of anesthesia labor, drugs, supplies, and equipment has been estimated at three to five percent of total health care expenditures.[15] To put these costs in perspective, all U.S. health expenditures for home health care, durable medical equipment, and vision products combined represent three percent of the total, while expenditures for drugs and nondurable medical equipment are eight percent.[16]

Barriers to Competition

Many economists and health care analysts believe that unjustified limits on competition among various classes of health care providers are one of the primary sources of health care market failure. In describing the evolution of the division of health care labor in the 1920s and 1930s, Paul Starr writes: "Had medical care become a corporate enterprise, the medical care firm (even if run by doctors) would have had an incentive to seek greater flexibility in its use of personnel. It might have tried to substitute the cheaper labor of ancillary workers for physicians in many areas that physicians insisted on retaining."[17(p.225)]

While the precise degree to which anesthesiologists and CRNAs are substitutes is inherently controversial, there is widespread agreement in state licensing rules and anesthesia market studies[18] that the overlap in scope and quality of practice is substantial. Given the large gap in earnings, it seems reasonable to conclude that CRNAs are more cost-effective providers of anesthesia care. One might expect, therefore, that since managed care enterprises now have increasing influence in the health care market, they will aggressively explore opportunities to expand

Even highly integrated health plans have done little to restructure the allocation of labor in anesthesia.

CRNAs' role, while maintaining high standards of quality.

In fact, this has not yet occurred to any significant degree. Even highly integrated health plans, such as Kaiser Permanente of California, have done little to restructure the allocation of labor in anesthesia, despite having identified significant internal opportunities for improvement through increased use of CRNAs.[19] Why has managed care not done more to improve the efficiency of anesthesia services, and what are the barriers to doing so?

Evolution of the anesthesia labor market

In current discussions about expanding the role of advanced practice nurses (APNs), especially in primary care, a common topic is legal barriers APNs face in their permitted scope of practice, specifically in performing tasks that might otherwise be performed by physicians.[20,21] Compared to other APNs, CRNAs have already achieved substantial practice authority. Although CRNAs still face a variety of practice barriers in some facilities and health plans, they can and do serve as the exclusive provider for the full range of anesthesia services at hospitals and ambulatory surgical facilities, and receive direct reimbursement from Medicare and many health plans.

CRNAs' practice status arises from their evolution as "the original APNs." During the early stages of modern surgery development in the late nineteenth century, surgeons encountered a shortage of skilled and disciplined anesthetists. Anesthesia fees were negligible, and other specialties were more attractive to medical students. A solution was found by training religious order nurses to serve as anesthesia specialists. Nurse anesthetists contributed significantly to the early research in the field, and over time nurse anesthesia schools were established and CRNAs became the most common providers of anesthesia care.[22]

The demand for anesthesiologists and CRNAs is closely related. In most states, a supply of CRNAs per capita in excess of the national median coincides with a supply of anesthesiologists below the median, and conversely. A 1990 report by the U.S. Department of Health and Human Services noted that, "the substitutability of CRNAs for anesthesiologists is demonstrated in the geographic distribution of the two providers."[23(p.20)]

For most of this century, the demand for anesthesia professionals has exceeded supply, fueled by growth of the population and surgical capacity. In this environment, tensions between anesthesiologists and CRNAs over professional status and the division of labor have been mitigated by the common effects of a rising tide. There are abundant signs, however, that the tide has turned. While the long-term demand for anesthesia labor is expected to grow, the current supply appears to exceed the demand, particularly for anesthesiologists.

Only in recent years did the number of anesthesiologists approach the number of CRNAs. In 1967, there were still fewer than 8,000 practicing anesthesiologists compared with over 13,000 CRNAs.[24] Since 1967, the number of practicing CRNAs has increased 78 percent, while the number of practicing anesthesiologists has increased 208 percent.

Interest in anesthesiology has been fueled by increasing income levels, and its status as one of the highest-paid medical specialties. Anesthesiologist incomes have been enhanced by the widespread adoption of the ACT practice model, which allows anesthesiologists to bill for their role in multiple concurrent cases.

In recent years, however, anesthesiologist salaries have leveled off,[25] and the number of medical students entering anesthesiology residencies has dropped 55 percent since 1991.[26] The *Wall Street Journal* reported that one recent graduate had received only one full-time offer after six months of looking, and for less than half what other partners were making.[27] A recent study commissioned by the American Society of Anesthesiologists explored a number of alternative scenarios for predicting the future demand for anesthesiologists, including "physician-intensive" and "CRNA-intensive" scenarios, in recognition of the many "activities of CRNAs in which there is substantial overlap with anesthesiologists."[28(p.iv)] The study concluded that "the number of residents enrolled in four-year programs needed to meet future requirements will decrease under all scenarios."[29(p.xvi)] Under the CRNA-intensive scenario, the number of anesthesiologists now in practice exceeds the number of anesthesiologists projected to be required by almost two to one.

Given these findings, it is not surprising that overall tensions between CRNAs and anesthesiologists are growing. Relations between the respective professional associations are sufficiently frosty that formal dialogue of any type has been rare, due in part to anesthesiologists' long-standing insistence—rejected by CRNAs—that CRNAs accept the anesthesiologists' 1982 statement on the roles of anesthesiologists and CRNAs within ACTs.[30] Further adding to tensions are specific efforts by anesthesiologists to increase job opportunities at CRNAs' expense, such as

- Working to increase anesthesia practice opportunities for professionals who can practice only under anesthesiologist supervision, such as physician assistants and anesthesia technicians.[31] (CRNAs are not required to practice under anesthesiologist supervision.)
- Calling for the direct replacement of CRNAs by anesthesiologists. The treasurer of the American Society of Anesthesiologists recently wrote, "The simple fact is there are more than enough positions for every qualified resident; they exist in the [anesthesia] care team and are currently held by anesthetists [CRNAs]."[32(p.3)]
- And (according to a still-pending federal antitrust lawsuit filed by the Minnesota Association of Nurse Anesthetists) conspiring to eliminate CRNAs as lower-cost competitors.[33]

Role of hospitals in limiting efficiency improvements

Historically, hospitals have been strong supporters of CRNAs. It was the American Hospital Association, rather than the American Nurses Association, that came forward in 1931 to sponsor creation of the American Association of Nurse Anesthetists.[34] CRNAs have played a crucial role in allowing hospitals to meet increasing demand for surgery, and hospital employment remains most common for CRNAs. However, the changing economics of the health care market have tended to undermine some hospitals' allegiance to CRNAs, and the market forces

affecting hospitals have generally precluded them from being agents of change to promote efficiency in the anesthesia labor market.

With the increasing replacement of fee-for-service reimbursement with diagnosis related groups (DRGs), capitation, and other forms of fixed or bundled prices, hospitals' financial incentives have shifted from providing services to controlling costs. For many hospitals, CRNAs are among the highest-paid employees, and a primary candidate for cost containment scrutiny. To the extent that hospitals' managed care contracts do not fully reflect CRNA costs, and managed care contract negotiators do not fully appreciate that element of hospitals' cost structure, reducing CRNA "overhead" can provide hospitals with an opportunity to substantially improve their profit or surplus margin.

The most common way for hospitals to reduce CRNA overhead is by shifting CRNAs to independent contractor status, most often as subcontractors or employees of the anesthesiologist group. Since hospitals usually have no overall accountability for anesthesia costs, it does not affect their economic circumstances if total anesthesia costs rise through diminished use of CRNAs. Although hospitals provide the space, drugs, materials, and patients for anesthesiologists to practice, anesthesiologist charges are entirely separate from hospitals' billing stream and cost structure. (The same is true for independently billing CRNA groups.) Anesthesiologist groups, for their part, naturally seek to maximize their income and job security, and if given increased authority to control and direct use of the CRNA "resource," are likely to exercise it with this objective.[35] In other words, hospitals' efforts to cut costs in response to managed care pressures can have the effect of placing authority to decide anesthesiologist and CRNA allocations solely in the hands of anesthesiologists, who have a direct economic stake in the decision.

The federal Medicare program has taken greater interest in anesthesia costs than any other major health care purchaser.

Even in cases where a hospital may be considering increasing its use of CRNAs, the centrality of physicians to hospitals' economic well-being and governance makes it very difficult to upset the apple cart. A hospital's patients are referred or admitted by physicians; formal physician-hospital organizations are central to many hospitals' marketing efforts; hospitals' bylaws and medical staff standards systematically favor physicians over nonphysicians; and anesthesiologists are part of the community of physicians, while CRNAs are not. In hospitals that use ACTs, the anesthesia department is most often (although not always) headed by an anesthesiologist. In the environment of most hospitals, anesthesiologists have many advantages over CRNAs in their ability to limit competition, or to mitigate the impact of any changes in the division of labor that may affect anesthesiologists negatively.

Hospitals' incentives regarding the mix of anesthesia labor may change significantly if DRG or other bundled-service payment methods are revised to incorporate all anesthesia costs, including the costs of anesthesiologist services that are now billed independently. While some payers, including Medicare, have begun to experiment with such payment methods, they have yet to be adopted on a large scale.

Role of Medicare in limiting efficiency improvements

The federal Medicare program has taken greater interest in anesthesia costs than any other major health care purchaser. The U.S. General Accounting Office has issued a series of reports concluding that Medicare has overpaid for anesthesia services, and recommended a variety of cost-cutting steps that have led to changes in Medicare reimbursement policy.[36] While these steps have been effective in reducing Medicare anesthesia costs, their impact on the efficiency of the anesthesia labor market has been mixed.

Medicare's primary approach to anesthesia cost containment is aggressive price discounting. Whereas a health maintenance organization (HMO) or preferred provider organization (PPO) may seek anesthesia cost discounts of from 15 to 30 percent from billed charges, Medicare's mandated discounts are generally in the range of 60 to 70 percent. A recent study commissioned by the American Society of Anesthesiologists concluded that an anesthesiologist working exclusively on Medicare patients would earn a net income of $53,769, the lowest of any non–primary care specialty, and only 22 percent of the median income for all anesthesiologists.[37]

While low price levels have made Medicare business less financially rewarding to all anesthesia providers, other Medicare policies have had the effect of limiting opportunities to expand the use of lower-cost CRNAs.

TEFRA reimbursement standards

As part of the 1982 Tax Equity and Fiscal Responsibility Act (TEFRA), Pub. L. No. 97-248, Medicare instituted seven prerequisites for anesthesiologist "medical direction" billing in an ACT setting, including performing the preanesthesia evaluation, participating personally in the most demanding procedures, and remaining physically present and available for emergencies. These requirements were intended to curb the practice of anesthesiologists billing for medical direction despite minimal participation in a case.[38]

Prior to TEFRA, there had been no effective limit on the number of concurrent cases for which anesthesiologists could bill for providing medical direction and no definition for what constituted significant participation in a case. The TEFRA standards were intended to preclude payments to anesthesiologists for very limited or "phantom" services that add no significant value. They were not intended to define the clinically appropriate or most cost-effective roles for the members of an ACT nor have any studies been conducted to support such an interpretation.

Nevertheless, many anesthesiologists have advanced an interpretation of the TEFRA standards as quality guidelines and as an implicit federal government endorsement of anesthesiologists' role within ACTs. To the extent that anesthesiologists have been successful in advancing this interpretation with hospital administrators or other persons in positions to influence the design of anesthesia practice, the TEFRA standards have had the unintended effect of limiting exploration and assessment of alternative ACT models that may be superior in terms of clinical and efficiency outcomes.

ACT payment reform

More recently, the 1993 Omnibus Budget Reconciliation Act (OBRA) legislation instituted a phased-in reduction in the amount

Medicare will pay for medical direction in an ACT setting, and a fixed 50:50 split in the ACT fee between anesthesiologists and CRNAs. In the past, Medicare has paid more for cases in an ACT setting than for cases performed by an anesthesiologist or CRNA alone. Under OBRA, Medicare ACT reimbursement will be reduced from 120 percent of the fee for an anesthesiologist practicing alone in 1994, to 100 percent of the anesthesiologist-only fee in 1998. While these reforms will certainly lower Medicare costs, they create three problems for promoting the efficient use of labor:

1. They rigidly divide payment 50:50 between anesthesiologists and CRNAs, despite the fact that in many practice settings, especially those with three or four CRNAs for each anesthesiologist, CRNAs contribute substantially more labor.
2. They establish anesthesiologists doing cases solo as the reimbursement standard for all anesthesia delivery, irrespective of whether it is most efficient and appropriate to have ACTs, solo anesthesiologists, or solo CRNAs.
3. Paying no more for ACTs than solo practitioners implies that ACTs provide no added value in terms of patient care and removes the economic incentive to explore whether there are, in fact, options for using anesthesiologists and CRNAs together that are cost effective and quality enhancing.

Two-provider cases

Medicare's implicit skepticism about the value of ACTs is also evidenced by its policy with respect to cases where one anesthesiologist and one CRNA are both continually present. For such 1:1 cases, Medicare's general policy is to pay only for the anesthesiologist, on the broad presumption that it is not necessary to have multiple providers continually present. For CRNAs employed by hospitals, this means that such cases return no revenue to the hospital. And for CRNAs generally, this means that complex cases for which a 1:1 ratio may be clinically appropriate are not economically feasible, at least for Medicare patients. As part of the negotiations over the 1996 federal budget, Medicare has agreed to reform its 1:1 policy to split fees between anesthesiologists and CRNAs as they do for other ACT cases. For now, however, Medicare payments in 1:1 cases continue to flow only to anesthesiologists.

Medicare has instituted some changes that enhance CRNAs' market position. Medicare allows CRNAs to bill directly for their services, a precedent that has helped to persuade some health plans to follow suit. By paying anesthesiologists and CRNAs at the same level for most services, Medicare reinforces the overall parity and substitutability of the two classes of providers. But on the whole, Medicare's approach to anesthesia cost containment may be characterized as "brute force fee cutting," without becoming particularly involved in "where the chips fall" or in reengineering how care is actually delivered. While Medicare's TEFRA and OBRA reforms have successfully lowered anesthesia costs, they appear also to have had the unintended effect of reinforcing anesthesiologists' role and limiting the incentives and flexibility for exploring new divisions of labor.

Limited impact from managed care in promoting efficiency improvements

As with Medicare, HMOs and other managed care organizations would benefit di-

rectly from reducing anesthesia costs while maintaining or enhancing the quality of care. But few managed care organizations have advanced beyond relatively modest fee discounting in influencing the anesthesia market or have made substantive efforts to evaluate and redesign the anesthesia production function. Why is it that managed care organizations have not made greater efforts to determine the optimal allocation of anesthesia personnel? The answer lies in the following five factors:

1. Anesthesia is "packaged" with the hospital contracting decision.
2. Anesthesia efficiency is a complicated area to attempt to improve.
3. Anesthesia billing methods are confusing and create inappropriate incentives.
4. There has been little competitive pressure to improve anesthesia efficiency.
5. There has been little research into how to improve anesthesia efficiency.

Anesthesia is "packaged" with the hospital contracting decision

The two things any HMO or PPO must have in their provider networks are hospitals and primary care physicians, and it is these contracts that typically receive the greatest attention. Health plans must ensure adequate geographic coverage of their service area and inclusion of the hospitals most used by the plan's physicians. Health plans may have greater flexibility and leverage in contracting with non–primary care physicians—except for physicians who have exclusive practice rights at specific hospitals, such as anesthesiologists.

Once a health plan has decided to contract with a hospital, the facility's preexisting arrangements for anesthesia care are automatically part of the "package." Under these circumstances, the health plan has very limited leverage for negotiating favorable terms with the established anesthesiologist group, or for advancing proposals for alternative and potentially more cost-effective anesthesia practice models. In most cases, health plans are likely to be content with negotiating some degree of discount, while deferring to hospitals their established role of determining anesthesia practice arrangements. Given that hospitals are not directly accountable for anesthesiologist costs, they are unlikely to aggressively seek out more efficient arrangements without strong incentives and involvement from the health plans.

Anesthesia efficiency is a complicated area to attempt to improve

It is natural for health plans to seek out savings that are relatively easy to achieve before moving on to more challenging areas. For example, health plans have been very aggressive in reducing unnecessary hospital days, for which specific incentives can be readily targeted, yielding substantial savings in total health care expenditures.[39] By contrast, anesthesia is a complicated area, providers are often well entrenched and resistant to change, and there are no "easy pickings" in terms of managed care savings.

The degree of difficulty does not necessarily change with the degree of vertical integration. Health plans that own or exert substantial market control over their hospitals and clinics, such as staff model HMOs, may face many of the same issues of a physician-dominated organizational culture as hospitals. Replacing physicians with APNs or other less expensive providers may be efficient, but may lead to widespread dissatisfaction and resistance among the health plan's

community of physicians. At the other end of the integration continuum, health plans that command only a fraction of the market share at any given hospital cannot reasonably challenge a hospital to redesign itself to their specifications—even assuming the health plan knew enough about anesthesia to want to do so.

Anesthesia billing methods are confusing and create inappropriate incentives

A third factor limiting the influence of managed care in anesthesia is confusion and inappropriate incentives associated with anesthesia billing methods. Fee-for-service anesthesia is billed on the basis of a unique methodology that measures total units per case, including time units and base units. Time units reflect the duration of the procedure and are usually charged at the rate of one time unit for each 15 minutes. Base units reflect the complexity of the surgical procedure and may range from 3 or 4 for simple procedures, to 20 or more for highly complex procedures.

One shortcoming of this system is that although surgical complexity is certainly related to anesthesia complexity, other factors such as the patient's health may be better predictors of anesthesia complexity and required resources.[40–42] For example, a complex procedure performed on a healthy patient may require less demanding anesthesia services than a simpler procedure performed on a patient in poor health. Base units defined only in terms of surgical complexity have significant shortcomings as a mechanism for appropriately reimbursing anesthesia services.

Another shortcoming of the complex anesthesia billing methodology is the difficulty of recognizing the separate contributions of anesthesiologists and CRNAs in ACT settings. Medicare recognizes the two provider classes and, except for 1:1 cases, will pay each provider separately for the units associated with a particular case. Commercial health plans, by contrast, will rarely "pay twice" for anesthesia by reimbursing separate bills from anesthesiologists and CRNAs (or from hospitals on CRNAs' behalf) associated with the same case, taking the view that once they've paid one anesthesia bill, they should not have to face another one. This is not a problem for anesthesiologists and CRNAs practicing as sole anesthesia providers for a given facility or case, but can be a serious problem for ACT practitioners.

If CRNAs are working as anesthesiologists' employees or subcontractors, the anesthesiologists' bill will cover the CRNAs. In regions of the country where this is common, unit billing rates tend to be higher to reflect the combined anesthesiologist/CRNA cost structure. In areas where CRNAs are more likely to be hospital employees, however, there is no single bill that incorporates both anesthesiologist and CRNA costs. Because anesthesiologists bill separately from hospitals and for anesthesia services only, they generally bill more quickly and effectively. Health plans will reimburse the first-arriving anesthesiologist bill, but not a separate and later-arriving CRNA bill.

Because of health plan resistance, rather than billing for CRNA services on a fee-for-service basis, hospitals may seek to recover their CRNA costs through managed care fees on a DRG, per diem, or other bundled-service basis. This approach may not work, however, with indemnity carriers who must be billed on a fee-for-service basis. And by

placing less emphasis on aggressive fee-for-service billing for CRNA services, hospitals are also likely to recover less from Medicare or other government programs that do accept separate CRNA bills. The overall impact of this billing environment is difficulty for hospitals in recovering CRNA costs and a further impetus to remove CRNAs from the hospital payroll, even if the result is a net increase in total anesthesia costs.

There has been little competitive pressure to improve anesthesia efficiency

A fourth factor limiting the influence of managed care in anesthesia is the simple fact that, to date, there is little direct competition to do so. Once one HMO in a market area begins to lower its premiums by reducing the average hospital stay, other HMOs must follow suit or risk becoming uncompetitive. But if all health plans are allowing hospital stays of the same duration as 20 years ago, there is much less urgency for any health plan to worry about lengths of stay. Anesthesia efficiency today is much like lengths of stay 20 years ago—the potential for improvement is there, but remains largely uninvestigated.

If this is to change, competitive pressure may have to be consciously applied from the outside by health care purchasers. The impact of Medicare has already been discussed. Other potential sources of pressure are large employers and multiemployer purchasing coalitions. Through the use of health plan report cards and targeted contractual incentives, some purchasers are becoming more aggressive and sophisticated in pressuring health plans to improve performance in certain areas. Anesthesia is not yet among these, however. Even the radical approach adopted in the recent request for proposal by the Twin Cities Buyers Health Care Action Group, with its goal of replacing traditional HMOs with new "care systems" dedicated to innovation and quality improvement, offers few degrees of freedom for care systems that may be inclined to innovate in the area of anesthesia efficiency.[43]

There has been little research into how to improve anesthesia

And last but not least, there is the problem of inadequate research into how the efficiency of anesthesia may be improved. A recent survey of the anesthesia literature found that "only 2% of clinical investigations and 1% of scientific abstracts included any useful cost information."[44(p.840)] Almost all anesthesia research literature that addresses costs is limited to the evaluation of specific anesthetic drugs, agents, and supplies.[45] While these costs are significant and an area where substantial improvement could occur, anesthesia labor is the area of greatest potential gain.[46–48]

Managed care organizations have begun to closely evaluate practice pattern variations in areas such as elective surgery, diagnostic procedures, and the treatment of specific conditions. The study of variations provides a basis for investigating whether certain providers may be providing more or less care than is appropriate, and for developing guidelines to assist providers to treat patients as effectively and efficiently as possible. In its own way, anesthesia delivery, and the ACTs in particular, exhibit just as much practice variation as elective surgeries, and with equally significant cost implications, but have not received comparable managed care attention.

Despite the prevalence of ACTs, there is

no consistent standard or model of ACT structure and function. From region to region, and from hospital to hospital within specific communities, there is wide variation in ACT division of labor, the roles and responsibilities of anesthesiologists and CRNAs, and CRNAs' permitted scope of practice. In Hospital A, the overall ratio of anesthesiologists to CRNAs may be 1:4, with CRNAs involved in all cases and accorded a broad scope of practice including regional anesthesia, invasive monitoring lines, and other complex procedures. Hospital B in the same city and with similar patients may have a 1:2 ratio, with anesthesiologists handling many cases on their own and CRNAs highly restricted in the types of procedures they may perform. These types of variations are a function of the unique culture and history of each facility, rather than any clinical or empirical rationale.

The following few studies that have examined anesthesia labor efficiencies have two things in common: (1) they indicate a potential for substantial efficiency improvements through increased use of CRNAs, with no dimunition of quality or outcomes; and (2) they have not been implemented.

Cromwell and Rosenbach (1990)[49] studied anesthesiologist productivity and concluded that anesthesiologists are much more productive when delegating tasks to CRNAs than in performing cases alone, and that such delegation "could save society approximately $500 million in anesthesiologist costs, even allowing for an increase in nurse anesthetists."[50(p.159)] They also concluded that "the main source of inefficiency stems from paying the anesthesiologist three times what a CRNA earns, even though they perform most tasks equally well."[51(p.169)]

Kaiser Permanente (1995)[52] conducted an internal study of operating room best practices in their West Coast operations, including anesthesia labor. They concluded that (1) "The cost of MD direction can be reduced by spreading it over more operating rooms."[53(p.96)] (2) "A 1:4 ratio is more cost effective than a 1:2 or 1:3 ratio. We found no evidence that the 1:4 ratio is associated with unexpected adverse outcomes."[54(p.99)] (3) "If CRNAs are credentialed to perform invasive monitoring, fiberoptic bronchoscopy, and intraoperative Transesophageal Echocardiography (TEEE), opportunities [should be] provided CRNAs to utilize these skills."[55(p.101)] Despite the high degree of control over anesthesia Kaiser could presumably exert as a highly integrated system, the study found tremendous variation in anesthesia staffing—with costs ranging from 62 percent above the "guideline," or recommended level, to 26 percent below. Due in part to anesthesiologist resistance, this study has not yet had a major impact on anesthesia labor allocations within the Kaiser system.

Fassett and Calmes (1995)[56] reported on a study conducted in 1992 of a 370-bed public teaching hospital to examine how one ACT functions, anesthesiologists' and CRNAs' roles within the ACT, variations in the perceived value of anesthesiologist medical direction, and practice modifications that could lower costs. They found that (1) "Anesthesiologists and nurse anesthetists in this study agreed in their perceptions that more than 70% of these cases did not need medical direction."[57(p.117)] (2) "Excessive medical direction may be contributing to the higher costs of ACTs. Revision of medical direction guidelines, focusing on patient and operative factors, are recommended to preserve the

ACT as a practice option, while making it more cost effective."[58(p.117)]

Stein (1994)[59] reported on a trial of alternative levels of medical direction, building on the Fassett and Calmes findings. Patients in a control group were treated using standard facility staffing patterns, primarily one anesthesiologist for two CRNAs following the TEFRA guidelines for anesthesiologist participation. Patients in the study group were prospectively assigned to three groups according to the expected need for medical direction. Group A cases were handled by CRNAs alone. Group B cases were handled by CRNAs following a nominal preoperative consultation with an anesthesiologist, not including patient examination by the anesthesiologist, and no further anesthesiologist involvement. Group C cases were handled on a traditional ACT basis in conformance with TEFRA guidelines. The study found no differences in outcomes between the control and study groups, but significantly lower costs from following the study group guidelines—48 percent lower costs for Group A cases and 36 percent lower costs for Group B.

Except as noted, the findings of these studies into potential improvements in the efficient allocation of anesthesia labor have not been implemented or made the subject of further study in any other hospitals or managed care systems.

Potential for Gains in Efficiency

What division of labor would an efficient market produce between two classes of providers with substantially overlapping capabilities, where one earns approximately three times more than the other? It would use the less costly providers to the greatest possible extent, and concentrate use of the more costly provider on those cases and roles where the benefits of the higher cost are cost effective and clinically proven. What might this look like as applied to anesthesia care, and how would it affect costs?

What division of labor would an efficient market produce between two classes of providers with substantially overlapping capabilities, where one earns approximately three times more than the other?

Using a hypothetical urban hospital, the following series of tables illustrates the impact on anesthesia labor costs using alternative divisions of labor among anesthesiologists and CRNAs. The analysis could be extended to address additional complexities of staffing requirements and other types of health care staff who may be part of the division of labor under certain circumstances (e.g., registered nurses, anesthesia assistants or technicians, and supervisory staff). However, such features would add considerably to the model's complexity, and their absence should not detract from the model's purpose of illustrating in general terms the potential for savings from efficiency improvements.

Table 1 contains basic assumptions about the hypothetical urban hospital, including the volume of cases requiring anesthesia, the costs and productivity of anesthesia labor, and the anesthesia billing environment. Tables 2 and 3 allocate the case volume at the hospital to three categories that vary according to the need for medical direction, based on the criteria used in the Stein study.[60] Table 4 shows the

Table 1. Basic assumptions, hypothetical urban community hospital

	Assumptions	Amount	Per
Business volume	Billing volume in cases	10,000	Year
	Billing volume in base/time units	125,000	Year
	Average units per case	12.5	Case
Labor and office costs	Anesthesiologist median salary	$244,600	Year
	CRNA median salary	$82,000	Year
	Cost of benefits, overhead taxes	20%	Salary
	Anesthesiologist—total cost of labor	$293,520	Year
	CRNA—total cost of labor	$98,400	Year
	Office overhead costs	$4.00	Unit
Labor productivity	Anesthesiologist/CRNA work days/year	230	Year
	Anesthesiologist/CRNA type A cases/day	3.5	Day
	Anesthesiologist/CRNA type B cases/day	2.5	Day
	Anesthesiologist/CRNA type C cases/day	1.5	Day
Billing environment	Gross charges	$57.50	Unit
	Avg. discount across all payers	35%	Unit
	Avg. net charges	$37.38	Unit

number of anesthesiologists and CRNAs required for the three case categories under a variety of staffing options, from anesthesiologist only to CRNA only. Table 5 evaluates the total cost for anesthesia labor across the staffing scenarios from Table 3. Table 6 shows the impact of the staffing scenarios in terms of anesthesiologist and CRNA earnings, and the potential impact on the fee-for-service unit price for anesthesia services.

Basic assumptions

The hospital depicted in Table 1 handles 10,000 cases per year, representing a total of 125,000 billable anesthesia "units" (base + time), or an average of 12.5 units per case. The model assumes anesthesiologist and CRNA earnings are at the median level, an additional 20 percent for benefits and payroll taxes, and $4 per unit allocated for the overhead costs of operating the anesthesia professionals' business office. The model assumes equivalent productivity for anesthesiologists and CRNAs based on 230 work days per year, and that the number of cases that can be handled per day decreases as case complexity increases. The billing environment is based on a gross charge level of $57.50 per unit, an average discount of 35 percent—with commercial payers at 15 to 30 percent, Medicare and Medicaid at over 60 percent, and a modest bad debt allowance—resulting in average net charges of $37.38 per unit. Any of these assumptions can be altered to more accurately portray the circumstances of a specific hospital, but large changes would be necessary to change the model's basic conclusions as depicted in Tables 5 and 6.

Table 2 provides further detail on the breakdown of surgical case types from less to more complex, based on the previously dis-

Table 2. Case categories according to the need for two anesthesia professionals

Case type	Need for two anesthesia professionals	Factor #1: Patient risk	Factor #2: Patient age	Factor #3: Airway status	Factor #4: Surgical complexity	Factor #5: Vital signs	Factor #6: Time since food/drink	Factor #7: Trauma
A	No need established	ASA score = 1 or 2	12 to 70	Normal	6 or fewer base units	Normal	6+ hours	Would not include trauma
B	Limited prior consultation may be beneficial	ASA score = 3	5 to 80	Variant	7–9 base units	Abnormal but stable	5 or fewer hours	Would include trauma
C	Anesthesia care team may be beneficial	ASA score = 4 or 5	Under 5, over 80	Abnormal	10 or more base units	Abnormal and unstable	5 or fewer hours	Includes all major trauma

cussed approach reported in the Stein and Fassett and Calmes studies. This approach assigns patients to one of three categories based on the expected need for the involvement of two or more anesthesia professionals, including consultation, direction, and two pairs of hands. Category "A" cases are least complex and, according to the study findings, do not require two anesthesia professionals. Indicators for category A cases include the following: overall good health, neither very young nor very old, normal airway status, a relatively simple surgical procedure, normal vital signs, at least six hours since food or drink, and no trauma. At the other extreme, indicators for category C cases include one or more of the following factors: poor patient health, very young or very old, abnormal airway status, a complex surgical procedure, abnormal and unstable vital signs, five or fewer hours since food or drink, and major trauma. Table 3 assigns the 10,000 cases in our hypothetical hospital to category A, B, or C based on the results reported in the Stein study.

Alternative divisions of labor

Table 4 explores alternative divisions of labor for handling the cases in the hypothetical hospital, ranging from anesthesiologist only to CRNA only, and various anesthesia care team models—the full spectrum of possible divisions of labor. For each model, required full-time equivalents (FTEs) are calculated based on the Table 1 case capacity estimates.

Model A depicts a practice based on anesthesiologists exclusively. Models B and C depict a staffing pattern in which there is one anesthesiologist for each CRNA—model B has one anesthesiologist and one CRNA on

Table 3. Allocation of cases

Case type	Need for two anesthesia professionals	Facility case volume (%)	No. of facility cases/year	Avg. total units/case	No. of facility units/year
A	No need established	34%	3,400	8.5	28,890
B	Limited prior consultation may be beneficial	47%	4,700	12.0	56,400
C	Anesthesia care team may be beneficial	19%	1,900	20.9	39,710
	Totals	100%	10,000	12.5	125,000

every case, and model C assumes a 1:2 or 1:3 ratio on simpler cases, with anesthesiologists handling the most complex cases alone. Although models B and C have the same overall staffing ratio, model C requires far fewer total personnel. Models D and E both show an overall division of labor with two CRNAs for each anesthesiologist—model D on a straight 1:2 ratio for all cases, and model E with anesthesiologists performing some cases alone. Model E may be the closest to the average of ACT practice nationally.

The remaining models are more CRNA intensive. Models F and G reflect actual practice at some hospitals and are based on anesthesiologist to CRNA ratios for all cases of 1:3 and 1:4, respectively. Model H depicts a more CRNA-intensive practice, following the need for limited anesthesiologist consultation or assistance in less complex cases indicated in the Stein and Fasset and Calmes studies. Model I depicts a practice based on CRNAs exclusively, a model in use at many rural hospitals and specialty surgery centers for plastic surgery, dental surgery, and eye surgery. These types of surgeries are less likely than inpatient care to be fully covered by insurance and are therefore more price sensitive.

Potential savings

Tables 5 and 6 illustrate the economic impact, and potential for savings, inherent in the alternative divisions of labor. Table 5 shows salary and benefit costs, based on the prevailing earnings levels and benefit costs for anesthesiologists and CRNAs. Compared to model A, the anesthesiologist-only practice, all other models require more total FTEs, but still cost less—except for the model B (straight 1:1 ratio). Models F, G, H, and I, with ratios of 1:3 or greater, cost 67 percent, 59 percent, 46 percent, and 34 percent, respectively, of the anesthesiologist-only model.

Table 6 brings all of the preceding tables together to show the impact on the economics of an anesthesia practice, including (1) annual revenue case type, (2) office overhead costs, (3) CRNA salary and benefits, (4) anesthesiologist salary and benefits, (5) the net profit or loss at prevailing prices, and (6) the percentage price change necessary to break even. A different result is shown for each of the nine divisions of labor depicted in Table 4. A positive percentage in the "net profit or loss" column means that prices would have to be increased to cover overhead costs and main-

Table 4. Division of labor

Model A—Anesthesiologist-only practice

Case type	CRNA FTEs/case	Anesthesiologist FTEs/case	CRNAs/ anesthesiologist	Required CRNAs	Required anesthesiologists	Total required personnel
A	0.00	1.00	0.0	0.0	4.2	4.2
B	0.00	1.00	0.0	0.0	8.2	8.2
C	0.00	1.00	0.0	0.0	5.5	5.5
Totals			0.0	0.0	17.9	17.9

Model B—2.0 Anesthesia professionals for every case

Case type	CRNA FTEs/case	Anesthesiologist FTEs/case	CRNAs/ anesthesiologist	Required CRNAs	Required anesthesiologists	Total required personnel
A	1.00	1.00	1.0	4.2	4.2	8.4
B	1.00	1.00	1.0	8.2	8.2	16.3
C	1.00	1.00	1.0	5.5	5.5	11.0
Totals			1.0	17.9	17.9	35.8

Model C—Avg. 1:1 ratio, some anesthesiologist-only cases

Case type	CRNA FTEs/case	Anesthesiologist FTEs/case	CRNAs/ anesthesiologist	Required CRNAs	Required anesthesiologists	Total required personnel
A	1.00	0.33	3.0	4.2	1.4	5.6
B	1.00	0.50	2.0	8.2	4.1	12.3
C	0.00	1.00	0.0	0.0	5.5	5.5
Totals			1.1	12.4	11.0	23.4

Model D—1.5 Anesthesia professionals for every case

Case type	CRNA FTEs/case	Anesthesiologist FTEs/case	CRNAs/ anesthesiologist	Required CRNAs	Required anesthesiologists	Total required personnel
A	1.00	0.50	2.0	4.2	2.1	6.3
B	1.00	0.50	2.0	8.2	4.1	12.3
C	1.00	0.50	2.0	5.5	2.8	8.3
Totals			2.0	17.9	9.0	26.9

Model E—Avg. 1:2 ratio, some anesthesiologist-only cases

Case type	CRNA FTEs/case	Anesthesiologist FTEs/case	CRNAs/ anesthesiologist	Required CRNAs	Required anesthesiologists	Total required personnel
A	1.00	0.25	4.0	4.2	1.1	5.3
B	1.00	0.25	4.0	8.2	2.0	10.2
C	0.80	1.00	0.8	4.4	5.5	9.9
Totals			2.0	16.8	8.6	25.4

(*continues*)

Table 4. continued

Model F—1.33 Anesthesia professionals for every case

Case type	CRNA FTEs/case	Anesthesiologist FTEs/case	CRNAs/ anesthesiologist	Required CRNAs	Required anesthesiologists	Total required personnel
A	1.00	0.33	3.0	4.2	1.4	5.6
B	1.00	0.33	3.0	8.2	2.7	10.9
C	1.00	0.33	3.0	5.5	1.8	7.3
Totals			3.0	17.9	5.9	23.8

Model G—1.25 Anesthesia professionals for every case

Case type	CRNA FTEs/case	Anesthesiologist FTEs/case	CRNAs/ anesthesiologist	Required CRNAs	Required anesthesiologists	Total required personnel
A	1.00	0.25	4.0	4.2	1.1	5.3
B	1.00	0.25	4.0	8.2	2.0	10.2
C	1.00	0.25	4.0	5.5	1.4	6.9
Totals			4.0	17.9	4.5	22.4

Model H—CRNA-intensive care team, based on California study findings

Case type	CRNA FTEs/case	Anesthesiologist FTEs/case	CRNAs/ anesthesiologist	Required CRNAs	Required anesthesiologists	Total required personnel
A	1.00	0.00	—	4.2	0.0	4.2
B	1.00	0.10	10.0	8.2	0.8	9.0
C	1.00	0.25	4.0	5.5	1.4	6.9
Totals			8.2	17.9	2.2	20.1

Model I—CRNA-only practice

Case type	CRNA FTEs/case	Anesthesiologist FTEs/case	CRNAs/ anesthesiologist	Required CRNAs	Required anesthesiologists	Total required personnel
A	1.00	0.00	—	4.2	0.0	4.2
B	1.00	0.00	—	8.2	0.0	8.2
C	1.00	0.00	—	5.5	0.0	5.5
Totals			—	17.9	0.0	17.9

tain prevailing CRNA and anesthesiologist salary levels. A negative percentage means that prices could be decreased without falling below prevailing salary levels.

In the marketplace, of course, anesthesiologists and CRNAs are not free to charge any price they wish in order to "hold earning levels constant." A price increase may not be accepted

Table 5. Salary costs associated with alternative divisions of labor

Model	Required professionals			Personnel costs (in $ millions)			Total as % of Model A
	CRNAs	Anesthesiologists	Total	CRNAs	Anesthesiologists	Total	
Model A—Anesthesiologist-only practice	0.0	17.9	17.9	$0.00	$5.26	$5.26	100%
Model B—2.0 anesthesia professionals for every case	17.9	17.9	35.8	$1.76	$5.26	$7.02	134%
Model C—Avg. 1:1 ratio, some anesthesiologist-only cases	12.4	11.0	23.4	$1.22	$3.23	$4.45	85%
Model D—1.5 anesthesia professionals for every case	17.9	9.0	26.9	$1.76	$2.63	$4.39	84%
Model E—Avg. 1:2 ratio, some anesthesiologist-only cases	16.8	8.6	25.4	$1.65	$2.53	$4.18	80%
Model F—1.33 anesthesia professionals for every case	17.9	5.9	23.8	$1.76	$1.73	$3.50	67%
Model G—1.25 anesthesia professionals for every case	17.9	4.5	22.4	$1.76	$1.31	$3.08	59%
Model H—CRNA-intensive care team, based on California study findings	17.9	2.2	20.1	$1.76	$0.64	$2.41	46%
Model I—CRNA-only practice	17.9	0.0	17.9	$1.76	$0.00	$1.76	34%

by health care purchasers, in which case anesthesia professionals would need to reduce earnings or overhead costs to break even. On the other hand, a potential price decrease does not automatically mean that a health plan will receive the full decrease. This will only occur if the market is sufficiently competitive, and the health plan understands the internal economics of anesthesia sufficiently to negotiate a contract that passes along all or most of the savings. To the extent this does not occur, the owners of the anesthesia practice will be able to retain higher earnings.

In each model, the annual revenue and office overhead costs are the same, giving our hypothetical practice approximately $4.2 million to meet the costs of anesthesia professional labor. In model E, the practice setting that may be closest to "typical" for urban community hospitals, no price change

Table 6. Impact on practice economics from alternative divisions of labor

Model A—Anesthesiologist-only practice

Case type	Annual revenue by case type	Office overhead costs	CRNA salary and benefits	Anesthesiologist salary and benefits	Profit or loss	Price change need to break even
A	$1,079,756	$115,559	$0	$1,239,712	($275,515)	26%
B	$2,107,950	$225,600	$0	$2,399,207	($516,857)	25%
C	$1,484,161	$158,840	$0	$1,616,487	($291,166)	20%
Totals	$4,671,868	$499,999	$0	$5,255,406	($1,083,537)	23%

Model B—2.0 Anesthesia professionals for every case

Case type	Annual revenue by case type	Office overhead costs	CRNA salary and benefits	Anesthesiologist salary and benefits	Profit or loss	Price change need to break even
A	$1,079,756	$115,559	$415,602	$1,239,712	($691,117)	64%
B	$2,107,950	$225,600	$804,313	$2,399,207	($1,321,170)	63%
C	$1,484,161	$158,840	$541,913	$1,616,487	($833,079)	56%
Totals	$4,671,868	$499,999	$1,761,829	$5,255,406	($2,845,366)	61%

Model C—Avg. 1:1 ratio, some anesthesiologist-only cases

Case type	Annual revenue by case type	Office overhead costs	CRNA salary and benefits	Anesthesiologist salary and benefits	Profit or loss	Price change need to break even
A	$1,079,756	$115,559	$415,602	$409,105	$139,490	-13%
B	$2,107,950	$225,600	$804,313	$1,199,603	($121,567)	6%
C	$1,484,161	$158,840	$0	$1,616,487	($291,166)	20%
Totals	$4,671,868	$499,999	$1,219,916	$3,225,195	($273,243)	6%

Model D—1.5 Anesthesia professionals for every case

Case type	Annual revenue by case type	Office overhead costs	CRNA salary and benefits	Anesthesiologist salary and benefits	Profit or loss	Price change need to break even
A	$1,079,756	$115,559	$415,602	$619,856	($71,261)	7%
B	$2,107,950	$225,600	$804,313	$1,199,603	($121,567)	6%
C	$1,484,161	$158,840	$541,913	$808,243	($24,835)	2%
Totals	$4,671,868	$499,999	$1,761,829	$2,627,703	($217,663)	5%

Model E—Avg. 1:2 ratio, some anesthesiologist-only cases

Case type	Annual revenue by case type	Office overhead costs	CRNA salary and benefits	Anesthesiologist salary and benefits	Profit or loss	Price change need to break even
A	$1,079,756	$115,559	$415,602	$309,928	$238,667	-22%
B	$2,107,950	$225,600	$804,313	$599,802	$478,235	-23%
C	$1,484,161	$158,840	$433,530	$1,616,487	($724,696)	49%
Totals	$4,671,868	$499,999	$1,653,446	$2,526,217	($7,794)	0%

Table 6. continued

Model F—1.33 Anesthesia professionals for every case

Case type	Annual revenue by case type	Office overhead costs	CRNA salary and benefits	Anesthesiologist salary and benefits	Profit or loss	Price change need to break even
A	$1,079,756	$115,559	$415,602	$409,105	$139,490	-13%
B	$2,107,950	$225,600	$804,313	$791,738	$286,299	-14%
C	$1,484,161	$158,840	$541,913	$533,441	$249,968	-17%
Totals	$4,671,868	$499,999	$1,761,829	$1,734,284	$675,756	-14%

Model G—1.25 Anesthesia professionals for every case

Case type	Annual revenue by case type	Office overhead costs	CRNA salary and benefits	Anesthesiologist salary and benefits	Profit or loss	Price change need to break even
A	$1,079,756	$115,559	$415,602	$309,928	$238,667	-22%
B	$2,107,950	$225,600	$804,313	$599,802	$478,235	-23%
C	$1,484,161	$158,840	$541,913	$404,122	$379,286	-26%
Totals	$4,671,868	$499,999	$1,761,829	$1,313,851	$1,096,188	-23%

Model H—CRNA-intensive care team, based on California study findings

Case type	Annual revenue by case type	Office overhead costs	CRNA salary and benefits	Anesthesiologist salary and benefits	Profit or loss	Price change need to break even
A	$1,079,756	$115,559	$415,602	$0	$548,595	-51%
B	$2,107,950	$225,600	$804,313	$239,921	$838,116	-40%
C	$1,484,161	$158,840	$541,913	$404,122	$379,286	-26%
Totals	$4,671,868	$499,999	$1,761,829	$644,042	$1,765,997	-38%

Model I— CRNA-only practice

Case type	Annual revenue by case type	Office overhead costs	CRNA salary and benefits	Anesthesiologist salary and benefits	Profit or loss	Price change need to break even
A	$1,079,756	$115,559	$415,602	$0	$548,595	-51%
B	$2,107,950	$225,600	$804,313	$0	$1,078,037	-51%
C	$1,484,161	$158,840	$541,913	$0	$783,408	-53%
Totals	$4,671,868	$499,999	$1,761,829	$0	$2,410,040	-52%

is needed for the practice to break even. The practice earns a profit on the simpler cases (types A and B) handled on a 1:4 basis, which is offset by a loss on the more complex cases handled as 1:1 or anesthesiologist only.

In models A, B, C, and D, a price increase would be necessary to break even. For model D, where all cases are handled on a 1:2 basis, a modest five percent increase would suffice to maintain earnings at the median levels, and model C requires only a six percent increase. Model A, the anesthesiologist-only practice,

would require a substantial and probably untenable 23 percent price increase to maintain earning levels. Model B, with two professionals for every case, clearly cannot work since it requires a 61 percent increase.

Models F, G, H, and I allow room for a price decrease or to maintain current prices and return higher earnings to the practice owners. For model F, where all cases are handled on a 1:3 basis, prices could be decreased 14 percent. Model G, with straight 1:4 ratios as recommended by the Kaiser study, allows for a 23 percent decrease. Model H, based on the Stein and Fassett and Calmes studies, yields a 38 percent decrease. And if a CRNA-only practice were feasible in our hypothetical hospital, as depicted in model I, prices could be reduced by more than one-half (52 percent) without going below the median earning levels.

Anesthesia services account for an estimated 2.4 percent of total health care costs for commercial group health insurance. If model E is closest to today's norm and the basis for that 2.4 percent, what would it mean to a health care purchaser to move to model F, G, H, or I? If an employer's average health care costs per employee per year are $3,500,[61] 2.4 percent represents $84 per employee. Moving to model F would save $12 per employee or 0.3 percent of total health care costs, model G saves $19 per employee or 0.5 percent, model H saves $32 or 0.9 percent, and model I saves $44 or 1.2 percent. For an employer with 100 employees, model H (for example) would mean a $3,200 annual health insurance savings, or almost 1 percent. A large employer with 100,000 employees, such as a *Fortune 500* company or large government agency, would save $3.2 million annually.

The Challenge to Managed Care

The goal of managed care organizations with respect to anesthesia services should be to provide high quality care as efficiently as possible. Unique features of the market for anesthesia labor have prevented managed care from reshaping anesthesia practice. The challenge to managed care is to overcome these barriers and to create an anesthesia practice structure with incentives and opportunities for both providers to work together, to pool their energies and creativity toward a common end.

Some health plans have begun some modest restructuring of anesthesia incentives, such as contracting for anesthesia services on a capitation basis. While this may be a step in the right direction, it does not necessarily change incentives appropriately or enough. If capitation is limited to anesthesiologist costs, it does not capture the full anesthesia "production function" including CRNAs and, ideally, incentives for efficient use of anesthetic agents, drugs, and supplies. If the capitation amount is based strictly on what has been paid in the past, perhaps modestly discounted, it tends to lock in historical inefficiencies rather than promote new and more efficient models. And if capitation includes anesthesiologists and CRNAs, but anesthesiologists are able to "call the shots" in terms of the division of labor because they are the sole business owners and decision makers, they will still manage the business to maximize anesthesiologist earnings and job security, not anesthesia labor efficiency.

What might a new anesthesia practice model look like? First, it should contain incentives for anesthesia providers to (1) use supplies, drugs, and equipment efficiently; (2)

recognize the impacts of anesthesia practice methods in terms of patient recovery time, patient satisfaction, and other "beyond the operating room" factors; and (3) improve the coordination and teamwork of anesthesia with other operating room and hospital functions.

Next, a new anesthesia practice model should contain incentives for good outcomes, high quality, and a high degree of teamwork and collegiality among anesthesia professionals. If anesthesiologists and CRNAs do not see each other as partners with a shared incentive to improve the practice, whether as employees or as owners together, they may instead see each other primarily as competitors engaged in a "zero sum game." While recognizing anesthesiologists' and CRNAs' distinct skills and capabilities, a new practice model should allow both to participate equally in the benefits, risks, and management of the anesthesia practice, to the extent that they wish to do so.

Finally, a new anesthesia practice model must contain incentives for the efficient use of labor. To the extent that this may result in decreased demand for one type of provider and increased demand for another, methods should be developed to allow adjustments to be made as fairly and gradually as possible, while maintaining progress toward the efficiency goals.

• • •

The incentive for managed care to make progress toward a new and better anesthesia practice model is money. Whichever health plan "figures it out" first in its market area could gain a price advantage over its competitors of as much as a full percentage point—enough to tip the balance in some marketing situations. Achieving that percentage point will be difficult, and require a much greater level of attention and sophistication than managed care has shown for anesthesia in the past. But then, most of the "easy" savings, such as reducing inpatient lengths of stay, have already been taken.

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