Cost Effectiveness of Physician Anesthesia

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Introduction

The question of whether anesthesiologists are cost-effective providers of anesthesia services remains an open question in the minds of some of our medical colleagues, the allied health community, the political and regulatory class, and the public. There have been recent publications that claim that there is no difference in outcomes between anesthetics delivered by anesthesiologists versus those delivered by nurse anesthetists and since nurses are paid less than physicians that anesthesiologists are not cost-effective [1-3]. In a medical environment with rapidly narrowing margins, replacing physicians with nurses could be an attractive option to some medical facilities.

These studies are fatally flawed making use of incomplete billing data, not accounting for billing for nurse anesthesia services when anesthesiologists were present, no adjustment for large differences in work hours of physicians as compared to nurses, nor accounting for the complexity of cases and patients. Fortunately, we do have data that is more robust and appears to illuminate this issue more clearly.

Cost-Effectiveness of Physician Anesthesia From a Societal Perspective

In 2000, Silber and colleagues published a large study of over 200,000 patients and reported 30-day mortality and mortality following complications (failure-to-rescue) was lower when anesthesiologists directed the anesthetic. There were 2.5 fewer deaths/1,000 and 6.9 fewer failures-to-rescue per 1,000 patients, p<0.04 and p<0.01, respectively when anesthetics were either personally provided or medically directed by anesthesiologists [4]. In a later article, Silber reported that board certified anesthesiologist also had lower 30-day mortality and failure-to-rescue rates as compared to non-board certified anesthesiologist, further supporting the hypothesis that greater education and experience is associated with improved outcomes [5]. In primary care we find that physicians order few tests, particularly expensive imaging studies than advanced practice nurses [6]. We also see similar results in the nursing literature, comparing outcomes of nurses with bachelor’s degrees to those with only certificates [7].

When one considers that the Medicare System and the majority of other payers reimburse anesthesiologists at the same rate as nurse anesthetists and the costs associated with medical complications, it should be no surprise that anesthesiologists reduce net healthcare costs. In a study examining the cost-effectiveness of anesthesiologists, from a societal perspective, found that physician anesthesia reduced healthcare costs $4,410-$38,778 per life-year saved [8].

Even if one ignores the cost savings associated with avoiding perioperative complications and assumes that physicians and nurses do the same number of cases per year (i.e. ignoring the average work hours per week of each group) and base the economic analysis on salaries not payments, physician anesthesia remains cost-effective.

Physician salary $336,000/yr. – Nurse salary $170,000 = $166,000/yr. salary differential
If each group administers 1,000 anesthetics per year, the incremental cost for a physician anesthetic is $166. Assuming the extra live patient per 400 anesthetics with physician anesthesia will live only 10 additional years. Then the cost-effectiveness of physician anesthesia would be:

\[
\frac{($166/\text{case} \times 400 \text{ cases})}{10} = \frac{$6,640}{\text{life-year-saved}}
\]

If Silber was wrong, and the difference in outcome is reduce to only 1 additional life-saved per 1,000 anesthetics, then the calculation would be:

\[
\frac{($166/\text{case} \times 1,000 \text{ cases})}{10} = \frac{$16,600}{\text{life-year-saved}}
\]

In addition, if each group did only half as many cases per year, the cost differential would rise to $332 per case and the calculation would be:

\[
\frac{($332/\text{case} \times 1,000 \text{ cases})}{10} = \frac{$33,260}{\text{life-year-saved}}
\]

Finally, if one then goes on to assume that patients, on average, only live 5 additional years after surgery, then the calculation would be:

\[
\frac{($332/\text{case} \times 1,000 \text{ cases})}{5} = \frac{$66,600}{\text{life-year-saved}}
\]

Therefore, under the most adverse economic conditions, using only salary data, assuming physicians and nurses work the same hours and administer the same number of anesthetics, that Silber data was 2.5 times more favorable to physicians as compared to nurses, and that patient’s have a far lower life expectancy than observed. Under all these cumulative adverse conditions physician anesthesia would cost $66,000 / life-year-saved. This still compares favorably to other accepted medical interventions.

<table>
<thead>
<tr>
<th>Physician Anesthesia Based on Available Data ‡</th>
<th>(-$4,410) - (-$38,778)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adverse Assumptions</td>
<td>$6,640 – $66,400</td>
</tr>
<tr>
<td>CABG for left main disease *</td>
<td>$8,768</td>
</tr>
<tr>
<td>3-Drug Treatment for HIV§</td>
<td>$13,000 - $23,000</td>
</tr>
<tr>
<td>PAP Smear Screening*</td>
<td>$24,011</td>
</tr>
<tr>
<td>Breast Cancer Screening (55-65 yrs.)*</td>
<td>$41,008</td>
</tr>
<tr>
<td>Neonatal ICU (500-999 grams)*</td>
<td>$77,161</td>
</tr>
</tbody>
</table>

Cost of avoiding anesthesia-related mortality as compared to the cost, in U.S. dollars-per-life-year-saved of accepted medical interventions. ‡(8), * (9), § (10)

None-the less, as health care dollars become scarcer and demand for medical services increases
there will be temptation (and lobbying) to replace physician delivered anesthesia care with that of nurses. There is no disputing the fact that the salary for nurse anesthetists remain generally lower than that of physicians, even when one considers the difference in the average hours per week each provider spends delivering medical care. I believe that anesthesiologists are going to have to make a better case than just pointing to the improved patient outcomes, and it’s associated economic advantage, of physician anesthesia. Fortunately, there is more than ample evidence to support the broad cost-effectiveness of physician anesthesia.

Anesthesiologists as a Marker of the Quality of a Health Care Facility

When Silber reported his findings, he included the unadjusted outcomes data, comparing patient outcomes in facilities with undirected nurse anesthetists to facilities with anesthesiologists.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Undirected Rate (%)</th>
<th>Directed Rate (%)</th>
<th>Odds Ratio</th>
<th>95% Confidence Interval</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 23,101</td>
<td>n = 194,430</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>4.53</td>
<td>3.41</td>
<td>1.35</td>
<td>(1.26, 1.44)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Complication</td>
<td>47.87</td>
<td>41.15</td>
<td>1.31</td>
<td>(1.28, 1.35)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Failure to Rescue</td>
<td>9.32</td>
<td>8.18</td>
<td>1.15</td>
<td>(1.08, 1.24)</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

* Odds ratio denotes the odds of an outcome observed in the undirected group versus that of the directed group

The comprehensive and complex analysis that Silber presented was to adjust for patient and hospital characteristics in order to identify those differences in outcome, if any, that were directly attributable to the anesthesia care delivered by physicians and/or nurses. This is the standard methodology to identify such differences, but this methodology does not identify indirect impact on the quality of medical care found within a healthcare facility. The data above strongly suggests that facilities with anesthesiologists have far better outcomes than those that do not offer physician anesthesia. From the perspective of a patient, their family, or a referring physician it really doesn’t matter why a hospital provides a better quality of care, just that it does. The economic reality that higher quality care with fewer complications is also less expensive care is icing on the cake.

These results are further supported when one examines the U.S. News and World Report rating of health care facilities [11]. Every healthcare facility has anesthesiologists on their staff. While many of us have reservations regarding some of our hospital administrators, I think we can generally agree that most of them can count, and are focused on staying in business. It is no accident that anesthesiologists are part of the medical staff at all of these highly rated facilities and it appears clear that the reason for this is both the direct and indirect impact of
anesthesiologists on the quality of care delivered at these medical centers.

**The Indirect Impact of Anesthesiologists**

How can anesthesiologist impact the overall care of patients within a healthcare facility? Most of us can think of examples in our own practices where practice improvement projects have led to real improvements in the quality of care and have decreased the cost of delivering that care. In my practice, for example, for many years an internist would examine all patients scheduled for elective surgery. In an effort to increase access to these internists we opened a preoperative clinic staffed by anesthesiology. One of the many metrics that we used to evaluate this new clinic was preoperative testing. Six months after the opening of the preoperative clinic we found that orders for laboratory and diagnostic testing was reduced by almost 80%. We can find similar examples of system improvement in the scientific literature.

In a pair of studies examining preoperative consultations in more than 250,000 patients the authors reported that anesthesia consultations were associated with lower length of stay (8.17 days vs. 8.52 days, p<0.001) as compared to matched pairs of patients who did not receive preoperative consultations [12]. In contrast, medical consultation was associated with increased 30-day mortality (relative risk (RR) 1.16, 95% confidence interval (CI) 1.07-1.25), 1-year mortality (1.08, 1.04-1.12), length of stay (0.67 days, 0.59-0.76), preoperative testing and pharmacologic interventions as compared to matched pairs of patients who did not receive preoperative consultations [13]. When one considers that these two studies looked at the same population of surgical patients receiving preoperative medical care it’s reasonable to combine the results. In the net, it appears that moving preoperative services from internal medicine to anesthesiology will result in lower mortality, length-of-stay, and preoperative testing. These results are consistent with what we observed in my practice.

In a small study (n=100) examining perioperative care of patients receiving lower extremity total joint surgery, comparing the economic outcomes of those cared for using the Total Joint Clinical Pathway (TJCP) which consisted of preoperative analgesics, perioperative regional nerve block, and post operative IV and oral analgesics to conventional therapy [14]. Although this study used historic controls, the authors used matching criteria, which included age, sex, surgeon, procedure, and ASA physical status. As compared to conventional therapy, direct costs of TJCP patients were reduced by $1,999 (CI $584-$3,231, p<0.0004). Most of the cost saving was secondary to reductions in hospital-based costs.

At Dartmouth Medical Center, anesthesiologists examined the impact of continuous pulse oximetry in postoperative patients during their entire hospitalization [15]. The study design was to gather data for 11 months prior to and 10 months after implementation of a system of continuous pulse oximetry monitoring, where the patient’s RN would be paged when the oxygen saturation was less than 80% for longer than 30 seconds. As compared to preimplementation patients, rescue events decreased from 3.4 per 1,000 patient discharges (1.89-4.85) to 1.2 (0.53-1.88), p<0.01, transfers to the ICU decreased from 5.6 1,000 patient days (3.7-7.4) to 2.9 (1.4-4.3), p<0.02, and mortality decreased from 4 patients to 2 patients but did not achieve statistical significance. In a follow up study, the authors reported a decrease in
health care costs of $255 per patient for the implementation year and projected cost savings of $404 for the out years [16]. This translates into an annual savings of $817,000 with projected savings of $1,295,000 per year.

**Conclusion**

These and other studies demonstrate the broad value of anesthesiologists throughout the acute care environment. From both a societal and a medical center perspective anesthesiologists deliver high value, cost-effective medical care. Anesthetics delivered with anesthesiologists cost less secondary to decreased morbidity and mortality. Even if one assumes that outcomes are 2.5 times worse than reported by Silber and that cost and productivity assumptions are adverse to anesthesiologists, physician anesthesia remains cost-effective. Finally, when the impact of anesthesiologists is considered in the context of perioperative care, anesthesiologists have been shown to reduce length of stay, ICU admissions, rescue events, preoperative testing and net costs. There is a reason that the best hospitals in the United States uniformly utilize anesthesiologists, their bottom-line demands it.

**References**

14. Duncan CM, Long KH, et al. The Economic Implications of a Multimodal Analgesic
