

Calculating Institutional Support That Benefits Both the Anesthesia Group and Hospital

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Institutional support to anesthesia groups for clinical care is very common, particularly when compensation for certified registered nurse anesthetists and anesthesiology residents is considered. Poor contracts can reduce incentives for good operating room (OR) management. We show that two types of agreements for institutional support are rational, and that alternatives to those models increase profit for either the hospital or anesthesia group at the expense of the other. For both agreements, costs are based on survey data, not actual costs. Terms in equations are not recalculated regularly, thereby preventing undesirable incentives such as the anesthesia group profiting from reduced OR workload. Support is not based on hours worked late, because such an agreement would ignore the underutilized OR time sustained by the group. The support would create a disincentive to decision-making that would reduce overutilized OR time such as decreasing turnovers and starting add-on cases expeditiously. For groups with uncommonly low net collections, group profit is higher if the hospital provides support expected to assure a reasonable (fair) income for the group to recruit and retain members. For what is likely the majority of groups, with average net collections per anesthesia hour exceeding the hospital's compensation per scheduled hour, expected profit is higher if institutional support is payment at a reasonable rate (fair market value) for the expected incremental hours of underutilized OR time (i.e., nonbillable idle time) caused by the specialty-specific staffing (i.e., OR allocations). Such an agreement creates incentives whereby the hospital and anesthesia group both profit from increased OR workload and from more accurate specialty-specific staffing.

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Academic anesthesia departments in the United States negotiate an average of \$95,000 per anesthesiologist in institutional support.¹

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Consider the following agreement:

The anesthesia group will provide a minimum of six anesthesiologists covering weekdays from 7:00 AM to 3:00 PM. In addition, one anesthesiologist will provide coverage for emergency surgery between 3:00 PM and 7:00 AM and for twenty-four hours on weekends and holidays. In exchange, the group will be compensated at a monthly rate of \$215,000. The hospital shall be entitled to bill and collect for anesthesia professional services rendered to patients.

How should the anesthesia group and hospital have chosen 7:00 AM, 3:00 PM, \$215,000, and/or whether the group keeps the billed collections? Can such an agreement be reconciled with the results of scientific studies showing that anesthesia groups need financial support because of substantial underutilized operating room time (i.e., idle ORs) and/or overutilized OR time (i.e., OR time after the end of regularly scheduled hours)?²⁻⁶

Analysts performing the calculations of institutional support are referred to Refs. 2 and 7 for step-by-step instructions. The main purpose of our present article is to evaluate scientifically whether there is a correct answer to each question in the preceding

Table 1. Known Compensation for Operating Room (OR) Anesthesia

The anesthesia group receives institutional support from a hospital equaling
(total annual scheduled hours on workdays + total annual scheduled hours on weekends and holidays)
× (reasonable compensation per scheduled hour based on survey data)
– (net collections of the anesthesia group)

For example,

$$\begin{aligned} & [(250 \text{ workdays}) \times [8 \text{ ORs} \times 8 \text{ h} + 4 \text{ ORs} \times 11 \text{ h} + 1 \text{ OR} \times 24 \text{ h}] + [(365 - 250) \text{ other days}] \times [1 \text{ OR} \times 24 \text{ h}]) \\ & \times ([50\text{th percentile for compensation and expenses of a CRNA and } \frac{1}{2} \text{ time of an anesthesiologist, using} \\ & \text{ regional value from 2005 group survey and 3\% inflation rate}] \div [2000 \text{ scheduled clinical hours per year}]) \\ & - (2005 \text{ net collections of the anesthesia group for the 13 ORs}) \end{aligned}$$

“Net collections” refers to the difference of collections and practice expenses including billing costs, the compensation term is described in Section 2, and the scheduled hours are chosen using the methods described in Section 5. Secondary analyses confirm that support is minimally affected by turnover times, accuracy of case duration prediction, cancellations, trends in OR workload over time, etc.^{2,7}

Table 2. Compensation for Inefficient Use of Operating Rooms

The anesthesia group receives institutional support from a hospital equaling²
(expected annual incremental hours of inefficiently used OR time on workdays from staffing and case scheduling
+ expected annual incremental inefficient hours on weekends and holidays)
× (reasonable compensation per scheduled hour based on survey data)

For example,

$$\begin{aligned} & [(250 \text{ workdays}) \times [26 \text{ incremental inefficient hours sustained daily by the anesthesia group}] \\ & + [(365 - 250) \text{ other days}] \times [14 \text{ incremental inefficient hours sustained daily by the group}]) \\ & \times (50\text{th percentile for compensation and expenses of a CRNA and } \frac{1}{2} \text{ time of an anesthesiologist, using regional value} \\ & \text{ from 2005 group survey and 3\% inflation rate}) \div 2000 \text{ scheduled clinical hours per year),} \end{aligned}$$

subject to staffing as in Table 1:

$$[(250 \text{ workdays}) \times [8 \text{ ORs} \times 8 \text{ h} + 4 \text{ ORs} \times 11 \text{ h} + 1 \text{ OR} \times 24 \text{ h}] + [(365 - 250) \text{ other days}] \times [1 \text{ OR} \times 24 \text{ h}])$$

Terms are defined and methods of calculations are explained in Sections 4 through 6. Secondary analyses confirm that support is minimally affected by turnover times, case duration prediction, cancellations, trends in workload over time, etc.^{2,7}

paragraph. Concurrently, we evaluate whether prior review articles^{2,7} that have included step-by-step instructions for analyses of OR staffing are sufficient for the calculation of institutional support.

The approach that we take in our article is to propose two models for institutional support. One provides for “known compensation” (Table 1) and the other for “compensation for inefficient use” of OR time (Table 2). In Sections 2 to 4, we use examples to show that each possible alternative to any term in the two models results in an agreement that is less advantageous either to the anesthesia group or hospital. To simplify the examples, we refer to support provided by a hospital to an anesthesia group composed of anesthesiologists and Certified Registered Nurse Anesthetists (CRNAs). Of the academic departments in the United States, 96% have CRNAs.¹ However, the principles are the same for departments without CRNAs. Among training programs in the United States, 73% of the support comes from hospitals, with the remainder from other institutional sources such as health system, University, or medical group. For simplicity, we refer to support being from a “hospital.” Finally, “ORs” are considered for brevity, but the article considers all locations where procedures are performed and billed using American Society of Anesthesiologists’ Relative Value Guide (ASA RVG) time units.

For agreements of the “known compensation” type (Table 1), the anesthesia group receives a known

monthly compensation. The support compensates the group for low reimbursement per ASA RVG unit of work. Described in regulatory terms, the hospital provides sufficient payment to assure that the group makes a reasonable profit. Payment is made at a fair market rate for the availability of the anesthesia providers throughout the workday, adjusted for the group’s collections. An advantage to the anesthesia group is that its minimum income is highly predictable. Although the equation in Table 1 is written with the group retaining its collections, the agreement is effectively identical if the group provides services to the hospital and the hospital bills and collects for the services.

An agreement of the “compensation for inefficient use” type (Table 2) compensates the anesthesia group for its expected nonbillable OR time caused by inefficient OR management and case scheduling decision-making.² The hospital secures the availability of anesthesia providers to facilitate the growth of surgeons’ practices. The hospital is paying a reasonable (fair market) rate for the nonclinical time of anesthesia providers, limited to the component of the clinically idle time that is due to less than optimal scheduling practices. Such support is fundamentally the same as the hospital compensating the anesthesiologist who serves as the OR medical director for his or her time spent managing the OR rather than rendering reimbursable patient care. Sections 4 to 6 provide details about “inefficient” and

“efficiently used” OR time² and the incorporation of case scheduling into agreements. In Section 7, we show that most anesthesia groups likely have an expected higher profit with support of the “compensation for inefficient use” type (Table 2) versus the “known compensation” type (Table 1). The Discussion includes a review of studies about negotiating compensation and an opinion from ASA counsel about the legality of support.

2. Costs are Based on Survey Data, Not Estimated Costs

The equations in Tables 1 and 2 include the terms: “reasonable compensation per scheduled hour based on survey data.” A fair market value of anesthesia providers’ time (i.e., “reasonable compensation”) can be arrived at based on the opportunity cost of the providers’ time (i.e., based on surveys like Ref. 1). An alternative to the use of survey data would be to try to measure directly the costs of the anesthesia group. However, the allocation of costs to an empty OR is inherently arbitrary (i.e., there is no “right” way to do this). The examples below highlight that estimation will be disadvantageous either for the hospital or anesthesia group, depending on how the costs are estimated for partially empty OR time.

Example: A group pays its newly trained anesthesiologists at the 30th percentile of national compensation, while the partners’ compensation is at the 70th percentile. Although assignment decisions are made without regard to providers’ compensation, the partners are assigned more commonly to the relatively empty ORs. If the cost of the empty ORs were based on the actual compensation of the assigned providers, the group would benefit more from the agreement than if the cost was based on the average compensation, and *vice versa*. The allocation of costs to the relatively empty ORs is arbitrary.

Example: Cases are scheduled into all 13 ORs less often than 1 day every 2 weeks, and on that 1 day the 13th OR usually contains just one brief case. Cases start in each OR at 7 AM. The group schedules six anesthesiologists and 12 CRNAs daily. The anesthesiologist on-call usually sleeps several hours each night. He or she stays for 2 to 3 h the next morning in the rare situation that the OR nurses want to run the 13th OR. The allocation of costs for staffing that 13th OR is arbitrary. If the cost of an anesthesiologist for the day were attributed to the 13th OR, then the hospital would pay more than the group’s actual costs. If the 13th OR has to be staffed, but were excluded from cost calculations, then the anesthesia group’s costs would be underestimated. Section 3, below, shows that including only those hours used would not be a rational solution.

Example: By 12 noon, three ORs are finished. Colleagues relieve the Chair and her program director to work on the modified residency curriculum. They work until 7 PM. The allocation of costs for staffing those ORs is arbitrary (i.e., whose compensation is

used for the calculation). Whether time spent doing nonclinical activities is recorded and excluded from reimbursement is also arbitrary.

In the equations of Tables 1 and 2, survey data are used not only for compensation, but also to choose a value for individuals’ annual scheduled clinical hours. The latter is important, for example, because more than one CRNA is needed to staff each OR, as a result of the duration of the staffed workday relative to a 40-h workweek, vacations, meetings, sick time, etc. Some stakeholders may perceive that the example in the Tables of 2000 hours is too low or too high. The choice of a value that is modestly lower or higher is the same as choosing an appropriate compensation percentile to be larger or smaller, respectively. In contrast, the following example shows that the regular auditing of a group’s scheduled hours can be arbitrary and thus should not be used to calculate institutional support.

Example: The anesthesiologists use a rotating call system of 1st out, 2nd out, ..., 12th out, and the 13th “on-call.” Any one choice for the scheduled hours (e.g., 7:00 AM to 5:00 PM) to be used in an alternative set of equations would be arbitrary, because the group has no scheduled hours, just a process to achieve overall equal workload by rotating the assignments.

3. Terms in the Two Equations Should Not be Recalculated Frequently

The use of fixed values in the equations of Tables 1 and 2 aligns incentives for both the hospital and the anesthesia group to reduce staffing costs by modifying the specialty-specific staffing (i.e., OR allocations), when doing so will not reduce the growth in OR workload. The alternative is to frequently recalculate support (e.g., daily, monthly, or quarterly).^{2,8} Such recalculation would misalign incentives, because improvement in the matching of specialty-specific staffing to workload² would result in a corresponding reduction in support to the anesthesia group. The group cannot reduce its staffing costs as quickly, resulting in a reduction in profit. The situation could arise that the group practices at more than one facility and would shift its providers from the hospital to another facility where the collections per hour exceed the hospital’s support per hour. However, that eventuality would not be known when the agreement with the hospital is negotiated unless the group was planning to provide insufficient staffing at the better paying facility.

Suppose that an agreement of the “known compensation” type (Table 1) were used, but with support recalculated regularly. Annual growth in OR workload would increase the group’s collections without an increase in the number of ORs. Institutional support would then be reduced by an equal amount. Groups have higher costs per hour for full ORs versus underutilized OR time caused by the specialty-specific staffing and case scheduling, either because of fewer

opportunities for creative staff scheduling (see second example of Section 2 and Refs. 7, 9, and 10) or requirements for additional providers to complete essential nonclinical activities (see third example of Section 2 and third paragraph of Discussion). Consequently, growth in OR workload would *reduce* the group's profit. This modification of the agreement of type Table 1 would create a disincentive for the anesthesia group to increase OR workload, and would almost surely result in the group losing financially from investment to encourage caseload (e.g., working closely with hospital analysts as in Refs. 2–13). The lack of use of a fixed value agreement would misalign incentives with those of the hospital, for which growth in OR workload achieved without an increase in the number of staffed ORs or purchased capital equipment is almost always beneficial financially.^{11–13}

A hospital's objective in an agreement may be to offset the anesthesia group's costs in providing flexibility in case scheduling to surgeons, thereby facilitating growth. However, anesthesia groups can affect growth in many ways other than just being available (e.g., providing new services and being engaged in OR management). The effect of an agreement with support recalculated regularly would be that as the group makes subsequent business decisions that could result in growth versus no growth, those that result in growth would become less favorable financially to the group.

Suppose that an agreement of the "compensation for inefficient use" type (Table 2) were used, but with the inefficient hours of OR time recalculated regularly. In addition, suppose that the collections per hour of used OR time were less than the sum of the hourly support provided by the hospital and the marginal increase in costs from the OR time being used. Then, the group's profit would be reduced by a growth in OR workload. The group would have a disincentive for growth in OR workload. More importantly, consider those procedures and/or surgeons with anesthesia reimbursement per OR hour less than the hourly support. The group would have an incentive to *reduce* the workload of those procedures and/or surgeons. In other words, the group would be compensated more to be idle than by doing cases.

4. Agreements are Based both on Underutilized and Overutilized OR Time

The hours of inefficiently used OR time have two components. There are the hours of OR time from staff being present but neither caring for patients, setting up, nor cleaning up (i.e., "underutilized OR time"). There are also the hours of over-utilized OR time (e.g., hours beyond the specialty's scheduled workday because of cases taking longer than expected or because the cases were scheduled to facilitate growth of surgeons' practices).² The alternative to the agreements of Tables 1 and 2 would be to exclude underutilized or overutilized OR time.

Example: An anesthesiologist was assigned to an OR with planned staffing from 7 AM to 5 PM. She finished the only scheduled case in the OR at 11 AM. She started a 2.5-h elective add-on case at 4 PM, when the surgeon was available from his clinic. The OR had 5 h of underutilized OR time and 1.5 h of overutilized OR time. Had the cases been booked sequentially, there would have been 3.5 h of underutilized OR time. This example highlights the importance of considering both of underutilized and overutilized OR time.

Example: A hospital has two ORs staffed from 7:00 AM to 3:00 PM for cardiothoracic surgery. One day, one OR has cases from 7:00 AM to 1:30 PM and the other from 7:10 AM to 2:40 PM. The OR workload was 6.5 h in one OR and 7.5 h in the other OR.² There was a total of 2.0 h of underutilized OR time, 1.5 h in one OR and 0.5 h in the other. Based on the cardiothoracic surgeons choosing the day of surgery, changes to the specialty-specific staffing and case scheduling could not have prevented those 2.0 h of underutilized OR time.² There were 0.0 incremental hours of inefficiently used OR time caused by staffing and case scheduling.² Consequently, an agreement of type Table 2 would contain no future support based on that day. In contrast, an agreement of the type of Table 1 would compensate for the 2.0 h of underutilized OR time, to the advantage of the anesthesia group. However, the seeming advantage of the support for the 2.0 h would be balanced by the group losing its compensation (in excess of support) for the 14 h of OR workload.

This point is very important (see paragraph in Discussion on kickbacks). Because of uncertainty in case duration estimates and the greater expense of over-utilized versus underutilized OR time, the costs of the anesthesia group and hospital are reduced when the hours into which cases are scheduled results in some underutilized OR time.^{2,14} For example, suppose that a specialty consistently has 12.0 h of cases and turnovers each Friday and that 1.50 equals the relative cost of an hour of overutilized OR time to an hour of underutilized OR time. The cost of having two 8 h ORs each with 2.0 h of underutilized OR time would be substantially less than the cost of having one 8 h OR with 4.0 h of overutilized OR time. Thus, the 2.0 h of idle time in each OR would serve to reduce the staffing costs. There would be no compensation for the 2.0 h by an agreement of type Table 2, because this inefficiently used OR time was not caused by OR management and case scheduling.

Suppose that instead of support being based on the equations in Tables 1 or 2, an agreement was based only on the overutilized OR time. Because OR workload changes little from month to month,^{2,8,15,16} but overutilized OR time is highly sensitive to the specialty-specific staffing and case scheduling,² such an agreement would not be a fixed value but, rather, would be based on actual hours worked late each day. The next example expands upon Section 3 to show that there

could be disadvantageous impacts on the anesthesia group.

Example: An anesthesia group is paid for hours worked after 3:00 PM. The staffing planned for a specialty was three ORs from 7:00 AM to 3:00 PM. One surgeon performed cases from 7:00 AM to 4:00 PM, resulting in 1 h of overutilized OR time. The other two surgeons had cases from 7:00 AM to 12 noon and from 7:45 AM to 11:45 AM. The hours of inefficiently used OR time would have been less if the staffing planned for the specialty had been two ORs.² Nonetheless, the agreement is based only on overutilized OR time. Consequently, the anesthesia group sustained 7 h of unnecessary and uncompensated underutilized OR time and required an additional anesthesia provider to staff the third OR.

There could also be disadvantageous impacts on the hospital. When an anesthesia group receives support based on the hours of overutilized OR time, the group has a reduced incentive to promote OR management efforts to encourage anesthesia providers' and surgeons' timely arrivals and progress. The group has a reduced incentive to start add-on cases earlier in the day or to move cases from one OR to another to start earlier in the day. Provided the group adjusts its staff scheduling to maximize its profit,^{7,9,10} the group benefits financially from being inefficient (see next section). We show next that, in contrast, agreements as in Tables 1 and 2 have incentives for anesthesiologists to complete work quickly.

5. Case Scheduling Dictates that Incremental Inefficient Hours are Underutilized OR Time

The inefficiency of use of OR time is a weighted combination of the hours of underutilized OR time and hours of overutilized OR time.^{2,14} Therefore, the expected inefficiency of use of OR time is the same whether few hours of staffing are planned and there are many expected hours of overutilized OR time versus if many hours of staffing are planned and there are many expected hours of underutilized OR time.² The "many" will be different, because each hour of overutilized OR time is weighted to be more expensive than an hour of underutilized OR time. Nonetheless, there is no disadvantage to an anesthesia group for an agreement to be based on the incremental hours of underutilized OR time caused by specialty-specific staffing and case scheduling. When anesthesia staffing is based on long workdays and little expected overutilized OR time, the group is being paid for availability. More institutional support means more profit. For academic groups, more hours of underutilized OR time means more paid nonclinical time. Likewise, there is no disadvantage to the hospital, as then support conceptually matches that of the commonplace support of OR medical directors.

An agreement, based on staffing for long workdays, has the advantage of either ignoring case scheduling or mentioning it briefly. Such an agreement specifies a

sufficiently high percentile (e.g., 80%) of the hours of OR time used at each day of the week and time of the day that rarely will anesthesia providers work late. Methods for the calculations are in Refs. 7, 9, 10, and 15. Graphs of workload by specialty and time of the day are simple to explain to stakeholders.

A hospital can reduce its institutional support by basing it on staffing that minimizes the inefficiency of use of OR time for each specialty.^{2-5,17} As we recently reviewed, typically such staffing is closer to the 63rd percentile of OR workload.^{2,14} The anesthesia group should then include case scheduling in the contract, because case scheduling is not otherwise under its control and its providers will thus often work late without compensation. "OR allocations" and the "staffing" for a specialty are synonymous. Thus, sufficient wording is that "cases will not be scheduled to be performed in overutilized OR time unless allocated OR time is full or there is medical necessity."^{2,17,18} Rarely would all allocated OR time be full, because otherwise there would not be inefficient hours of OR time requiring hospital support. A necessary and sufficient condition about medical necessity for case scheduling is knowledge of the shortest time that each case can wait safely from the time of the injury (e.g., motor vehicle accident resulting in an open fracture).¹⁷ An agreement can specify that cases scheduled into overutilized OR time are reviewed promptly by a surgical services committee, based on the evidence-based medical literature, upon request of an affected surgeon, anesthesiologist, or nurse. Nevertheless, we reiterate that avoiding these issues by specifying scheduled hours as in the preceding paragraph is simpler.

A hospital may base its support on surgeons' block times (i.e., not based on actual workload, but that set by some committee). Then, it is important for both the hospital and anesthesia group that the hours of anesthesia staffing by specialty in the agreement be sufficient to prevent frequent disagreement with surgeons and limitations in patient care.²

Example: A 13 OR surgical suite has one trauma OR that is planned for 24 h and 12 ORs that are planned for elective scheduled cases. Surgeons are allocated block time in 8 h increments. The policy is that cases are to be scheduled into 8 h. However, the policy is ignored, such that on 20% of days there are 4 ORs in use for more than 11 h. Despite this, the hospital initially specifies in the agreement that the staffing for the 12 ORs is for 8 h, matching the block time. The anesthesia group explains that the hours of anesthesia staffing needs to be based on the surgeons' actual workload, not the official block time.

Since, in a simple agreement, the incremental inefficient hours of OR time will be underutilized OR time, it can be straightforward to describe a contract of the "compensation for inefficient use" type (Table 2). Provided that the calculations will be performed by analysts who understand the mathematical details,

both parties can describe the support as being proportional to the hours that anesthesia providers are required to be available to work but are expected to have no cases to staff.

Example: A hospital has substantial underutilized and overutilized OR time. One of the hospital's executives does not know the phrase "overutilized OR time" and seems uninterested in learning. The hospital's analyst concurs with the anesthesia group's recommended anesthesia staffing (i.e., numbers of ORs for specific hours), which they chose based on the calculations in the first paragraph of this section.⁷ The anesthesia Chair uses a simple example that does not require understanding OR management to explain why her department needs support. She refers to an outreach clinic with adequate billable work to support the salaries of two pediatricians daily. The clinic uses an open access system, whereby all patients are offered an appointment within one day of request (i.e., there are no queues). Nevertheless, the health system has mandated that three pediatricians be present daily. Rightfully, the health system should pay the salary for that third pediatrician, since he is being required to work, effectively, with no billing. The anesthesia department is asking for the same consideration. This is not compensation for most of the idle time, just the incremental component caused by how the staffing is planned and the appointments are made.

6. Calculation of the Incremental Hours of Inefficient OR Time

We recently reviewed the calculation of the incremental hours of inefficiently used OR time caused by how staffing was planned and cases were scheduled.² This section considers only additional points.

Example: A proposed agreement of type Table 2 has anesthesia staffing of 8 ORs for 8 h, 4 ORs for 11 h, and 1 OR for 24 h, totaling 132 h. Using the methods^{3,4} reviewed in Ref. 2, the forecasted mean daily expected hours of overutilized OR time is 7 h. If, instead, staffing were planned and cases were scheduled based on maximizing the efficiency of use of OR time,² staffing would be 4 ORs for 8 h, 5 ORs for 11 h, and 1 OR for 16 h, totaling 103 h. Emergency cases would, of course, still be done from 11 PM to 7 AM. The new estimated average overutilized OR time would be 9 h per day. A cost of 1.5 for each hour of overutilized OR time relative to each hour of allocated OR time is used. The incremental hours of inefficient OR time sustained by the anesthesia group equal 26 h per workday, where $26 = (132 - 103) + 1.5 \times (7 - 9)$.

When calculating the mean daily incremental hours of inefficiently used OR time, the OR allocations used should not be the surgeons' blocks. What matters for anesthesia staffing is the specialty-specific staffing (e.g., Cardiac, Pediatrics, and Neurological).² For non-elective (urgent) cases, a pseudo-specialty of "urgent" is created and allocated its own OR time. The value

calculated for those urgent cases is the incremental hours of anesthesia staffing required versus if the cases were performed sequentially in a few ORs during the workday.

There are only slight differences in hours of inefficiently used OR time calculated using OR information system, anesthesia information system, or anesthesia billing data.⁷ Thus, the anesthesia group and hospital can perform the calculations independently, and should arrive at virtually the same value. Equivalently, one party can do the calculation and reasonably rely on the other. There are no judgments to be made in the analyses that can substantively affect results. What is imperative is that the calculations are performed correctly using the raw data, as summarized in Ref. 2.

To use billing data, turnover times must be calculated. Generally, the billing company or office must be recording the OR in which each case is performed, because otherwise the turnover times are unknown. However, if there is usually just one anesthesia provider in each OR for the day, the turnover times can be calculated based on the provider. Either way, billing data are sufficient for analysis, because from Section 3, it is not the actual underutilized and overutilized OR time that is desired, just the future (expected) amount² based on the new staffing calculated⁷ as described in Section 5. Even if a hospital and/or anesthesia group were to recalculate the incremental hours of underutilized and overutilized OR time in retrospect, this would not be based on knowing "late rooms," but the specialty-specific staffing that should have been chosen based on the workload that was observed.^{2-5,8}

Finally, it has been suggested that the basis for institutional support be the difference between the adjusted utilization (i.e., the ratio of the underutilized OR time to the allocated time) and a specified target value (e.g., 75%).¹⁹ However, any such target value is an arbitrary choice. Calculations for an agreement of the "compensation for inefficient use" type (Table 2) effectively *determine* the target utilization for each specialty, based on minimizing the inefficiency of use of OR time. Selection of a "target utilization" that is larger or smaller than that calculated value would result in a financial advantage for the anesthesia group or hospital, respectively.

7. Choosing Between the Two Types of Agreements

Sections 2 through 6 demonstrated that for agreements of the types in Tables 1 and 2, there is only one value that needs to be negotiated: the percentile of survey data for institutional support.

The basis for institutional support differs between agreements. For an agreement of the "known compensation" type (Table 1), the group effectively provides services to the hospital and receives a fixed income, regardless of any growth in OR workload. Thus, the negotiated percentile generally provides a sufficient,

but just reasonable, profit to retain and recruit anesthesia providers to staff the contracted ORs. In contrast, for an agreement of the “compensation for inefficient use” type (Table 2), a hospital uses market data to judge a reasonable price to pay per hour for anesthesia providers during times that they are required to be available, but bill nothing, because of idle (underutilized) ORs caused by staffing and case scheduling. The average price would be expected to be close to the opportunity cost of anesthesia providers’ time.

This prediction is testable. Among U.S. academic departments, the average collections in 2005 were \$31 per ASA RVG unit and the ratio of the average institutional support to ASA RVG units averaged \$8.¹ The ratio of \$8 to the total of \$39 equals 20%. If the prediction were true, then an average of 20% of anesthesia providers’ time could have scheduled elsewhere. The value 20% is also the mean percentage increase in staffing costs caused by incremental hours of inefficiently used OR time from actual staffing and case scheduling ($n = 13$ academic hospitals, median was 17%, and the mean of the 11 U.S. hospitals was 19%).²⁻⁵

The expected profit of an anesthesia group differs between the two agreements. For agreements of the “known compensation” type (Table 1), the expected profit equals approximately:

- (A) institutional support for the incremental inefficient hours of OR time,
plus
- (B1) institutional support for the efficiently used OR time,
plus
- (C1) \$0 of the net collections,
plus
- (D) realized cost savings after the contract is signed,
minus
- (E) staffing costs.

There is institutional support both for (A) and (B1), because for agreements as in Table 1 the hospital pays for anesthesia coverage of all OR time. For an agreement of the “compensation for inefficient use” type (Table 2), the expected profit of the anesthesia group equals approximately:

- (A) institutional support for the incremental inefficient hours of OR time,
plus
- (B2) \$0 of institutional support for the efficiently used OR time,
plus
- (C2) net collections,
plus
- (D) realized cost savings after the contract is signed,
minus
- (E) staffing costs.

The C1 and B2 terms equal \$0. The (E) staffing costs term appears equally in both agreements, canceling regardless of which components are included (e.g., health and liability insurance). Thus, determination of which of the two agreements will result in the larger expected profit of the anesthesia group depends on the comparison between the (B1) institutional support for the efficiently used OR time and the (C2) net collections. For anesthesia groups in which providers are salaried (e.g., most academic medical centers), a “larger expected profit” will typically be just barely positive.¹

From Section 5, the incremental hours of inefficiently used OR time will be mostly underutilized OR time and the efficiently used OR time will be mostly billable anesthesia time. Thus, the anesthesia group should determine the highest compensation per scheduled hour that it can reasonably expect to negotiate as support without providing billing data. Compare that value to the group’s net collections per hour of billed anesthesia time. Unless the group expects to negotiate to be paid more per scheduled hour than the group collects per billed hour, the group has larger expected profit with an agreement of the “compensation for inefficient use” type (Table 2).

Example: A group expects that the most institutional support it could possibly negotiate is \$360,000 per anesthesiologist, corresponding to \$180 per scheduled hour. The group collects \$35 per ASA RVG unit. Billing costs are 4% of collections. At 7.2 ASA RVG units per billed hour,²⁰ collections average \$240 per hour, where $\$240 = \$35 \times (100\% - 4\%) \times 7.2$. Since \$240 exceeds \$180, the group negotiates an agreement of the “compensation for inefficient use” type (Table 2).

The following survey data show that most anesthesia groups probably fall into this category of a larger expected profit with an agreement of the “compensation for inefficient use” type (Table 2) instead of the “known compensation” type (Table 1). The average U.S. academic group collects \$31 per ASA RVG unit and its faculty bills 11,500 units per year.¹ The product equals \$365,000. Generally support exceeding this value minus billing costs would be needed for a group to achieve a higher expected profit from not retaining its collections.

During the interval when institutional support is being negotiated, the anesthesia group needs to make business decisions for recruitment of personnel. Suppose that there were many hours of underutilized OR time caused by inefficient staffing and case scheduling. The group would increase its profit by assuring that all surgical cases get done.^{2,21} However, the group would not be contracted to cover a certain number of ORs. Thus, the group’s profit would be increased by not recruiting to replace attrition, and surely not to expand. Such decision-making may create conditions wherein the hospital gains by paying just for the availability of anesthesia providers to facilitate growth

of surgeons' practices (i.e., as in Table 2), instead of also paying to assure a reasonable profit of one of its medical groups (i.e., as in Table 1). The reason is that the latter precedent could be disadvantageous for the hospital that must negotiate in the future not just with the anesthesia group, but with other medical groups (e.g., surgery for call coverage). Multiple physicians may reasonably interpret that the anesthesia group (labor) has successfully used a work slowdown to motivate the hospital (i.e., "the firm") to agree to a lucrative labor agreement based on the hospital assuring the group's profit.

DISCUSSION

In Sections 2 through 7, we showed that two types of agreements for institutional support of an anesthesia group's clinical activity are rational, and that alternatives to those two models are disadvantageous either to the hospital or anesthesia group. For both types of agreements, costs are based on survey data, not actual costs of the group, because otherwise there are challenges in the arbitrary allocation of costs and scheduled hours to the hospital. Terms in the equations are not recalculated regularly, because otherwise undesirable incentives can be created such as the anesthesia group benefiting from *reducing* OR workload. Compensation is not based on hours worked late, because doing so ignores the underutilized OR time sustained by the group, and also can create a disincentive to make decisions that reduce overutilized OR time such as decreasing turnovers and starting add-on cases promptly. Either sufficient anesthesia staffing should be planned that there is little to no overutilized OR time, or the agreement needs to specify that cases will only be scheduled into overutilized OR time if it is medically necessary (e.g., emergency case). For groups with uncommonly low net collections, profit would be higher for the group if the hospital provides support expected to assure a sufficiently reasonable profit to recruit and retain members. For the majority of groups with average net collections per anesthesia hour exceeding the hospital's compensation per scheduled hour, profit will be higher if paid at a reasonable rate for the expected idle time caused by the specified staffing and case scheduling (i.e., an agreement as in Table 2). On the other hand, agreements of the "known compensation" type (Table 1) provide a guaranteed minimum profit, reducing the group's risk.

Since most academic groups receive institutional support,¹ they already have compensation agreements in place. Many of these agreements likely differ from those of Tables 1 and 2. We suggest that anesthesia groups and hospitals with such agreements review each section of our article to identify the negative incentives in their agreements.

Agreements of the "compensation for inefficient use" type (Table 2) are typically based on the hospital

paying a reasonable (fair market) rate for the availability of anesthesia providers to facilitate growth of surgeons' practices. Just as the hospital provides compensation to the group for the hours of nonclinical service of the OR medical director, the same applies to the hours of the other anesthesia providers who are expected to be idle clinically. The hospital may choose to have the agreement stipulate that the supported time be spent assisting colleagues (e.g., to reduce turnover times), facilitating day of surgery managerial decision-making (e.g., add-on case scheduling), working to grow surgeons' practices (e.g., involvement in capital purchasing, finance, and block time allocations) and/or reducing costs (e.g., specialty-specific staffing, clinical pathways, and pharmacy programs). Typically, a few anesthesiologists or CRNAs would work with hospital analysts on such initiatives. An agreement may specify those individuals. For groups with all providers needed for first case of the day starts, cases would then have to be assigned based on the expected underutilized OR time going to those individuals.

An example of a reverse kickback covered by the U.S. federal anti-kickback law is an anesthesia group providing OR medical director services without compensation in exchange for the right to practice at the facility.²² The same may apply to an agreement providing no compensation for the incremental hours of inefficiently used anesthesia time caused by the specified staffing and resulting case scheduling (personal communication, Karin Bierstein, ASA Counsel, July 10, 2007). Furthermore, in a recent ASA newsletter,¹⁹ Ms. Bierstein wrote:

"... the facility that benefits from the ability of a group to provide personnel without delay should pay for what economists call the 'lost opportunity costs' ... The hourly cost of anesthesiologists, nurse anesthetists, and anesthesia assistants idled by inefficient management of the ORs ... is a sound basis for determining the fair market value to the hospital that demands excess anesthesia coverage ... Compensation for the fair market value of services ... is prohibited by neither the anti-kickback nor the self-referral laws. If occasioned by the hospital's utilization choices and calculated accordingly, the value of the underutilized or unused anesthesia staff time is an obvious basis for establishing the size of the compensation package that the group may seek and the hospital may offer."

Our article showed how to perform such calculations, incorporating the impact of both underutilized and overutilized OR time, the two components of the inefficient use of OR time.

As shown in Sections 2 through 6 and stated above at the top of Section 7, an important result of our article is that the agreements of Tables 1 and 2 contain only one value that should need to be negotiated: labor compensation based on percentiles of regional data. Based on this result, there may be additional insights

obtainable from studies of professional arbitrators^{23,24} and compensation executives.²⁵ Among arbitrators' salary decisions for which written explanations were provided, many listed one type of evidence as the "most important," "paramount," etc.²³ For 58% it was salary comparability and for 21% it was cost of living. The ability to pay was the next highest criterion, just 8%. Experimental studies with vignettes provide additional insight.^{24,25} Ranges of realistic values for present wages were from 96% to 102% of the actual national mean wage of workers in different industries.²⁴ These results suggest that an anesthesia group may want to focus its expectations for institutional support on 100% of the region's average for groups caring for comparable patients (i.e., the 50th percentile of survey data). There was only a small increase in wages when the financial health of a firm was strong versus a large decline when the financial health was weak.²⁴ Similarly, compensation executives' decisions on wage increases for computer programmers were unaffected by the average or strong relative financial strength of the corporation,²⁵ but reduced when the company was performing poorly.²⁵ Thus, perhaps an anesthesia group should not expect a higher percentile based on perception of a hospital's strong financial strength.

Although, for simplicity, we considered agreements of one type or another, in practice an agreement may be of the "Known compensation" type (Table 1) for obstetrics or weekend OR cases and of the "Compensation for inefficient use" type (Table 2) for weekday OR cases.

Although our examples referred to anesthesiologists and CRNAs working in ORs, our article applies fully to the statistical calculation of institutional support for anesthetics performed by other mixes of providers at other sites, provided the anesthetics are billed, in part, based on time. However, most institutional support agreements are more complex.²² Agreements often address uncompensated obstetric care, trauma resuscitations, and pain practices. They often include provisions for good citizenship, marketing efforts, and medical directorship. Finally, the lengthiest portions of the agreements usually are those that address important legal issues such as malpractice coverage, liability, and termination.²²

Although Section 3 showed that terms in Tables 1 and 2 should not be recalculated frequently (e.g., monthly or quarterly), the appropriate interval to do so is unknown. Since accurate forecasts of specialty-specific staffing and workload rely on 9 months to 1 year of data,^{2,8,15} the interval between changes in calculated support should be, at most, annually. Whether an agreement should have a term of 1, 2, or 3 yr depends on future studies.

Although in Section 5 we considered staffing to a high percentile of current workload, a hospital may also plan to increase OR block time to encourage some

surgeons to increase their workload. Increases in block time characteristically mean increases in the numbers of ORs. There are well developed financial methods to balance (a) the investment of increased support to the anesthesia group for the resulting extra underutilized OR time versus (b) the expected increase in revenue (minus variable costs) from the additional cases.^{12,21,26} It is important that such analysis includes consideration of both the risk of lower than planned reimbursement for those new cases relative to their costs²⁷ and the risk of lack of market growth.^{21,26}

Although our formulation of agreements of the "compensation for inefficient use" type (Table 2) shows that anesthesia groups should expect to be paid by hospitals so long as there is underutilized OR time caused by inefficient staffing and case scheduling, society and the specialty of anesthesiology may remain disadvantaged. Nationally, this planned underutilized OR time causes reduced productivity of anesthesia providers⁶ and thus higher surgical costs for the population. We hope that our article facilitates the use of agreements that align incentives between anesthesia groups and hospitals to make managerial decisions to reduce future underutilized OR time. Such interventions include using statistical methods to match staffing to the workload of each specialty,²⁻⁵ scheduling cases based on reducing expected overutilized OR time,^{2,17,18} and forecasting specialties' potentials to grow their OR workload^{21,28} before they are allocated more block time than they can consistently fill.²⁹

In conclusion, anesthesia groups play vital roles in OR management. Agreements for institutional support for clinical care are very common.¹ We showed that poor agreements can reduce incentives for good OR management. An agreement based on the expected incremental hours of underutilized OR time (i.e., nonbillable idle time) caused by the specialty-specific staffing and case scheduling creates incentives wherein both the anesthesia group and hospital benefit from increased OR workload^{11-13,21} and more accurate matching of staffing to workload.²

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