

# ANESTHESIOLOGY

## Measuring Clinical Productivity of Anesthesiology Groups

### Surgical Anesthesia at the Facility Level

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Although the value proposition for anesthesiology groups has evolved to encompass many different activities throughout the perioperative period,<sup>1</sup> the core activity for all anesthesiology groups remains providing surgical anesthesia care. In other words, simply focusing on surgical anesthesia is not sufficient for an anesthesiology group, but on the other hand, if a group cannot provide surgical anesthesia services, then it does not matter what else the group is providing. Therefore, an anesthesiology group must still understand this core activity. The challenge for all groups is that as the number of facilities covered by a group expands, understanding surgical anesthesia activity and productivity at each facility can no longer be done by intuition and impressions but now must include data-driven decision making and the use of dashboards to follow trends and identify opportunities.

Although productivity measures can be used to compare facilities, groups, and/or individuals, we have limited this review to measuring at the group level, and we further focus on how to measure productivity of surgical anesthesia care at the group level, which is really the facility level. By understanding available measures and the variables that impact those measures, group leaders can develop actionable dashboard measurements to improve anesthesia clinical productivity. In table 1, terms, abbreviations, definitions, and formulas are provided as a reference to the reader to make it easier to follow the discussion.

## ABSTRACT

Benchmarking and comparing group productivity is an essential activity of data-driven management. For clinical anesthesiology, accomplishing this task is a daunting effort if meaningful conclusions are to be made. For anesthesiology groups, productivity must be done at the facility level in order to reduce some of the confounding factors. When industry or external comparisons are done, then the use of total ASA units per anesthetizing sites allows for overall productivity comparisons. Additional productivity components (total ASA units/h, h/case, h/operating room/d) allow for leaders to develop productivity dashboards. With the emergence of large groups that provide care in multiple facilities, these large groups can choose to invest more effort in collecting data and comparing facility productivity internally with group-defined measurements including total ASA units per full time equivalent.

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## Limitations because the Focus Is on Surgical Anesthesia Care

It is important to recognize that this review does not address productivity measurements of all activities performed by an anesthesiology group. This review discusses only clinical productivity from nonobstetric surgical anesthesia care. The purpose of limiting the focus is to allow for comparisons of like activities to allow for meaningful conclusions.<sup>2</sup> Therefore, the following activities that a group may perform are excluded in this review: obstetric anesthesia, non-ASA unit billed clinical activity, and other nonbilled activities.

Obstetric anesthesia includes both surgical anesthesia occurring in the labor and delivery suite as well as labor analgesia. Although these clinical activities are billed using anesthesia (ASA) units, there are multiple ways to bill for neuroaxial labor anesthesia care.<sup>3</sup> Furthermore, the staffing for both obstetric surgical cases and neuroaxial labor anesthesia is very different than the main operating room suite given that most of the patients are not “electively scheduled” patients.

As will be seen in this review, surgical anesthesia care in the United States is billed using ASA units. Therefore, for anesthesiology groups, ASA units billed are relatively easy data to find. In addition, because ASA units include both base units and time units, ASA units allow for differentiation of work performed more than a more general measurement such as “cases.” But because all other clinical care is billed with

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**Table 1.** Abbreviations, Definitions, and Calculations

Abbreviation	Definition	Calculation
ASA unit	Base or time units billed for anesthesia care	Applies to CPT codes 00100 to 01999
Base/case	Base units per case	$= (tASA/y - \text{time units}/y) / (\text{Case}/y)$
Call FTE%	% of workdays for a physician that are in-house call days*	$= \text{no. call days} / \text{total workdays}$
Case/y	Patient case billed (anesthesia charges only) per year	Excludes obstetric anesthesia cases
CRNA h/staffed h	CRNA billed time to staffed time*	$= \text{CRNA (time units)/4} / \text{staffed hours}$
FTE	Full-time equivalent	
h/case	Case duration = billed hour per case	$= ((\text{time units}/y)/4) / (\text{Case}/y)$
h/OR/d	Billed hour per site per weekday	$= ((\text{time units}/y)/4) / (\text{OR site}/d) / 250$
Non-OR anesthesia%	% of anesthetizing sites that are not located in the OR suite*	Non-OR anesthesia sites/OR sites
OR FTE/d	Number of faculty anesthesiologists needed to cover sites at the start of each regular workday	On surveys, estimated by 10th of each day (or 20th if 10th holiday or weekend)
OR FTE/FTE	% time spent providing care that is billed using ASA units, excluding obstetric anesthesia*	$= \text{no. of days in OR} / 250 \text{ days}$
OR sites/d	Anesthetizing sites covered at start of each regular workday	On surveys, estimated by 10th of each day (or 20th if 10th holiday or weekend)
OR/OR FTE	Concurrency or staffing ratio at beginning of workday (e.g., 7 AM)*	$= \text{OR sites at 7 AM} / \text{no. of physicians needed at 7 AM}$
Time units/y	15-min time units billed per year	Excludes obstetric anesthesia cases
Total ASA units (tASA)/h	Hourly billing productivity = total ASA units per billed hour	$= (tASA/y) / ((\text{time units}/y)/4)$
Total ASA units (tASA)/OR	Total ASA units per site	$= (tASA/y) / (\text{OR site}/d)$
Total ASA units (tASA)/OR FTE	Total ASA units billed per OR FTE	$= (tASA/y) / (\text{OR FTE}/d)$
Total ASA units (tASA)/y	Total ASA units billed per year	Excludes obstetric anesthesia cases
wRVU	Work RVU = work component of relative value unit/unit	Applies to all other CPT codes

\*Final definition and calculation are dependent on the group and the group's definition.

a different kind of unit (relative value units [RVUs], whose one component represents work [wRVU]), comparison of wRVUs and ASA units is not readily possible. Clinical work billed using wRVUs is excluded when comparing surgical anesthesia work. Types of activities include, but are not limited to, wRVU procedures done with surgical anesthesia (e.g., placement of arterial or central vein catheters, transesophageal echocardiography), acute postoperative pain blocks and inpatient hospital visits (consultations and follow-up visits), chronic pain medicine evaluation and management (E&M) services and procedures, and critical care E&M services and procedures.

Because ASA billed units will be used as a measurement of work performed, all nonbilled activities are not included when measuring surgical anesthesia care. These nonbilled activities include nonbilled direct clinical care and all other nonbilled activities. Nonbilled clinical activities may include preanesthesia assessment clinic work, immediate recovery room activities, clinical administrative work (e.g., daily running of the schedule, medical director work), and staff being available but no cases being performed. Other types of nonbilled activities may include hospital committee work; quality program work; and educational, research, and department administrative activities.

## What Is a Group?

Over the past 20 yr and accelerating more recently, the acquisition and merger of anesthesiology groups

have changed the definition of “anesthesiology group.” Previously, an anesthesiology group was synonymous with the anesthesiology department in one facility. That is, the anesthesiology group provided care in one facility, and sometimes in a smaller second facility. Today, there are national groups or companies that provide care in multiple facilities. Even local groups typically provide care in more than one facility. Academic departments now provide care in more than in a single large academic medical center. Because the type of facility is a major variable for productivity measurements,<sup>4</sup> it is not possible to make meaningful comparisons and conclusions when measurements at the group level encompass multiple and varied facilities. In other words, viewing “group” productivity at each facility is essential for anesthesiology leaders to make informed decisions. Because the term *group measurements* is still commonly used, we also use this term; however, one should note that measurements for a “group” really mean measurements at the “facility” level.

In addition, the methodology described in this review can also be applied to areas in one facility if these areas represent unique and distinct clinical areas. For example, non-operating room anesthesia care may be separated from operating room (OR) anesthesia care. Anesthesiology leaders might find this separation to be helpful in comparing productivity and may use it to show how non-OR productivity and OR productivity are very different and one might actually think of creating two virtual facilities in one building. On the flip side, if a group covers two

facilities but actually shares staff on a daily basis—that is, anesthesiology leaders may distribute mid-level providers and anesthesiologists between facilities based on actual demand by day or move providers between facilities during the day as demands are needed, then one could consider the two facilities as one facility because they combine resources. On the other hand, if the group uses economies of scale for administrative activities for multiple facilities but do not move staff during the day, then it would be better to understand clinical activity by keeping the facilities separate. Similarly, if the anesthesiologists at a facility are organized in distinct specialty teams providing care in distinct OR sites and/or with specific surgical services, group leaders might choose to compare productivity by specialty teams.<sup>5,6</sup>

Last, group leaders need to be cognitive that measuring group productivity is different than measuring individual productivity. Individual measurements should reflect activities under the individual's discretion and control. From a management perspective, individual measurements are used often as part of incentive systems or behavior modification systems.<sup>7–13</sup> In contrast, group measurements should be focused on how well the team of individuals are functioning and producing. Because the group has to provide care in multiple settings and functions, individual measurements will need to be tailored to each of these areas. To illustrate this concept that group and individual productivity measurements are not necessarily the same, one just needs to look at any team sport. For example, in baseball, how one measures productivity of individual players is very dependent on the player position. Different statistics (also known as productivity measurements) are used to determine who is the better hitter, better pitcher, or better fielder. In contrast, which team is the best is determined by a simply win—loss measurement. Applying this to anesthesia care, group measurements are used to: (1) evaluate how the group (at a facility level) is performing compared with the previous year; (2) how the group is doing compared with another group of a similar facility; and/or (3) when available, how the group is doing compared with an industry benchmark. In contrast, measurements of individual clinical productivity are exclusively applied within a group or facility and is often the primary measurement of variable or incentive compensation. Because individual measurements are exclusively “internal” comparisons, a group can make their own determination of measurements to use, their own definitions of the measurements, and how to use them. In this review, we are focusing exclusively on group measurements and comparisons.

## Comparing Group Clinical Productivity

The process of benchmarking productivity is the comparison of one's own productivity with industry measurements. Before anesthesiology groups covered multiple facilities, a group had only one choice in benchmarking: external comparisons with other groups using industry surveys.<sup>4,14,15</sup>

In contrast, a group that covers multiple facilities does not have to rely solely on external comparisons but can develop its own measurements and standards that may be unique to its group and facilities to allow for internal comparisons.

## External Comparisons of Group Productivity: Benchmarking Using Survey Results

In developing a methodology to externally compare group anesthesiology clinical productivity, the reliance on surveys created two major constraints in designing the survey and the measurements available from the results. First, to have a good response rate, the survey could not be time-consuming to complete. Second, the definitions of data needed to be clear and applied consistently among all respondents. Therefore, any measurements derived from surveys are limited by these constraints. Through a series of reports,<sup>14,16,17</sup> we showed that a relatively short survey could result in industry data that would allow a group to answer several important questions:

“Are we as productive as we should be?”

“Do we work longer hours than other groups?”

“Why do the anesthesiologists in one hospital produce more than any other hospital?”

## Hypothetical Groups

To understand how to answer these questions, take four hypothetical anesthesiology groups each covering one facility: group A, a private practice physician-only group in a full-service community hospital; group B, an academic department with medical direction staffing model with residents in an academic medical center; group C, a private practice group with medical direction staffing model with nurse anesthetists (CRNAs) or anesthesiologist assistants; and group D, a private practice physician-only group in an ambulatory surgical center.

For each group, “raw” data are shown in table 2. For each day, the number of anesthesiologists (OR FTE/d) needed to staff all the anesthetizing sites (OR Sites/d) at the beginning of regular work day are shown. In reality, these two data points can vary during the day and throughout the year and are sometimes difficult for a group to calculate. Furthermore, the number of OR sites covered in day-to-day operations is often not the same as the number listed in hospital service agreements. Therefore, a precise mean OR sites/d can be labor intensive to determine whether the group does not have the number readily available. To ensure a good survey response rate and consistent methodology among all respondents, OR FTE/d and OR sites/d were defined using an estimate: each group was asked to report the mean for all months of the number of anesthesiologists and sites covered at beginning of the workday on the tenth of each month (or the twentieth

**Table 2.** Hypothetical Groups: Staffing and Billing Data

Group	Facility Type	Staffing Model	OR FTE/d	OR Sites/d	Cases/y	tASA/y	Time Units/y
A	Full-service community	Physician only	20	20	25,000	300,000	150,000
B	Academic medical center	Medical direction	16	30	27,600	450,000	276,000
C	Full-service community	Medical direction, private practice	5	15	15,000	180,000	90,000
D	Ambulatory surgical center	Physician only	5	5	7,500	60,000	22,500

Hypothetical facilities and anesthesia care data to be used to determine productivity measurements (table 2). Group A is a full-service community hospital whose anesthesia care is provided in a physician-only staffing model. Group B is an academic medical center with a medical direction staffing model using residents and possibly mid-level providers (CRNAs or anesthesiologist assistants). Group C is a full-service community hospital with a medical direction staffing model using mid-level providers but no residents. Group D is an ambulatory surgical center with physician-only model.

Cases/y, patient cases billed (anesthesia charges only) per year; OR FTE/d, no. of faculty anesthesiologists needed to cover sites at the start of each regular workday; OR Sites/d, anesthetizing sites covered at start of each regular workday; tASA/y, total ASA units billed per year; Time Units/y, 15-min time units billed per year.

of the month if the tenth was a holiday or weekend).<sup>4,14</sup> The other three data shown in table 2 are more easily calculated by groups from their billing database. All three are yearly totals of the number of anesthesia cases (Cases/y), number of total ASA units billed (tASA; total ASA units/y), and the 15-min time units billed (time units/y). The survey instructions included that groups were to exclude obstetric anesthesia care as well as any care provided without billing ASA units.

### “Are We As Productive As We Should Be?”

The first question should be about overall productivity: Which group is most productive? In medicine, the most common measurement of productivity—individual or group—is wRVU/FTE. This focus on “per FTE” or “per physician” measurement for groups is favored by administrators (and consultants) because it is intuitively simple to understand...except in anesthesia care!

First, complicating units/FTE for anesthesia care is what should be chosen as the correct denominator? If ASA units are used as the unit of productivity, then only the percentage of time a physician spent providing care billed with ASA units should be used for the denominator, FTE. Hence, for individual productivity measurements, the term OR FTE refers to the percentage of time an individual FTE is assigned to provide surgical anesthesia. Sometimes

this is the same as “clinical FTE” but often it is a subset of the clinical FTE. For example, if a physician spends 1 day per week in the preanesthesia assessment clinic and 4 days per week in the OR, that physician would have 1.0 clinical FTE (full-time employee working 100% of his or her time clinically) but only 0.8 OR FTE (80% time working in the OR billing out ASA units). For group productivity, OR FTE refers to the number of anesthesiologists scheduled in the morning to provide surgical anesthesia care. For example, in group B (table 2), there is listed 16 OR FTE/d but the group may need 20 anesthesiologists per day to meet clinical commitments with the other four physicians working in labor and delivery, preanesthesia assessment clinic, intensive care unit, and the pain medicine clinic.

Second, many still wish that total ASA units/OR FTE can be used to determine staffing needs or to objectively support a staffing model. As anyone who has had to make assignments for an OR suite knows, the major determinants of the number of providers needed are the number of sites to cover, the staffing ratio, the need for break providers, and the number of late/call providers arriving later in the day.<sup>18</sup> Unfortunately, the number of OR sites is often not determined solely by productivity needs.<sup>19</sup>

Despite knowing the limitations of total ASA units/OR FTE, there is still a desire to use this measurement for comparing overall productivity for a group. In table 3, one can

**Table 3.** Hypothetical Groups: Productivity Numbers

Group	Facility/Staff	tASA/OR FTE	tASA/OR	h/OR/d	h/case	tASA/h	Base/case
A	Community/physician only	15,000	15,000	7.5	1.50	8.0	6.0
B	Academic medical center/direction	28,125	15,000	9.2	2.50	6.5	6.3
C	Community/direction	36,000	12,000	6.0	1.50	8.0	6.0
D	Ambulatory surgical center/physician only	12,000	12,000	4.5	0.75	10.7	5.0

Productivity measurements for each hypothetical facility whose data were shown in table 2. Because of differences in concurrency, when comparing tASA/FTE, one would draw very different conclusions than when tASA/OR site is used for overall productivity. h/OR/d describe the number of billed hours worked each day. tASA/h is inversely related to h/case. The difference in tASA/h accounts to why group A and B have the same overall productivity (tASA/OR site) but have different h/OR/d.

Base/case, base units per case; h/case, case duration = billed hour per case; h/OR/d, billed hour per site per weekday; tASA/h, hourly billing productivity = total ASA units billed per hour; tASA/OR, total ASA units per site; tASA/OR FTE, total ASA units billed per OR FTE.



see that the total ASA units/OR FTE varies tremendously between the four groups. The conclusion drawn by using this measurement for overall productivity would be that group C is most productive and more than twice as productive as group A. Obvious to most anesthesiologists is that the comparisons using total ASA units/OR FTE are confounded by the different staffing models, that is, the different OR sites/OR FTE among the groups.

In contrast, when the unit of input (the denominator) for productivity used is not FTE but instead anesthetizing sites (OR site), the conclusions are vastly different. In table 3, total ASA units/OR shows that groups A and B have identical productivity for each OR they cover, whereas groups C and D have the same productivity but less than that of groups A and B. Using total ASA units/OR allows for comparisons of output (total ASA units billed) with same input (OR site) while eliminating the issue of staffing model. For industry comparisons, this becomes paramount.<sup>16,17</sup>

In the MGMA Cost Survey of Anesthesia Practices, the survey in the past separated groups by the predominant staffing models—physician only *versus* medical direction. In the 2011 report, one can easily see how total ASA units/FTE can lead to misleading conclusions compared with total ASA units/OR as a measure of overall productivity for a group.<sup>14</sup> When comparing cases/FTE or total ASA units/FTE, the medical direction groups have almost twice as much productivity than do the physician-only groups (table 4). In contrast, when cases/OR and total ASA units/OR, both groups had almost identical overall productivity.

### “Why Is Our Productivity Different?” or “Why Has Our Productivity Changed?”

Although knowing how a group's overall productivity compares with other like facilities is an overriding goal, to make operational decisions, leaders need to understand better why productivity differs or if overall productivity has changed, and what has happened to cause the change.

One would expect that the number of billed hours per OR (h/OR/d) should explain differences in overall

productivity, but as can be seen in table 3, h/OR/d does not correlate directly with total ASA units/OR. Groups A and B have the same total ASA units/OR but much different h/OR/d. (A similar situation can be seen between groups C and D.) Because total ASA units/OR is simply the product of h/OR/d and hourly billing productivity (total ASA units/h), total ASA units/h must be different between the groups.

Total ASA units/h is determined by base units (base) and time units billed:

$$\text{total ASA units/h} = (\text{base} + \text{time units}) / (\text{time units}/4)$$

If two groups work the same number of time units, then the base units billed during this time determines the difference in the total ASA units/h. Base units may differ between groups due to differences in base/case or the number of cases done in the time period. For most full-service facilities, the base/case does not differ greatly (range, 5.4 to 6.4 units/case).<sup>6,16,17</sup> On the other hand, the surgical duration (h/case) often varies more widely, for example, between surgeons in a private practice and an academic practice.<sup>20</sup> As seen in table 4, the hypothetical surgical durations for groups A and C are consistent with survey results of approximately 90 min, while academic groups report 150 min. Longer surgical duration results in lower hourly productivity.<sup>21</sup> Therefore, both groups A and B have identical total ASA units/OR but group B (academic) has to work 1.7 h/OR/d more to achieve the same productivity. The implication is that group B will have higher staffing costs for the same productivity.

Longer-than-average surgical duration has a real economic impact, especially to academic anesthesiology departments that provide care to academic surgical departments.<sup>22</sup> Median values from the 2002 survey of academic anesthesiology departments showed the first scenario when comparing facilities that had “academic” surgeons (defined as always having a surgical resident involved in the care) compared with facilities that had either mixed (surgical residents sometimes, but not always, involved) or private practice (no residents) surgeons (table 5). Both groups had the same median total ASA units/OR, but because of differences in longer h/case and lower total ASA units/h, facilities with academic surgeons had to work longer h/OR/d to achieve this same total ASA units/OR.<sup>14</sup>

The net increased staffing costs due to longer-than-average surgical duration are difficult to quantify because the costs are dependent on staffing compensation levels and payer mix. For example, for a hospital with 24 OR sites, 12,800 annual cases, mean h/case of 2.9 h, when compared to private practice h/case of 1.5 h, the increased annual staffing costs due to the longer surgical durations were estimated for median compensation and median payer mix (2001 data) as \$672,100 or \$28,000/OR.<sup>22</sup>

The importance of h/OR/d worked cannot be dismissed. Comparing groups A and C, the groups have the same surgical duration and base/case, and thereto the same total ASA

**Table 4.** Comparing Group Productivity

		Physician-only Groups	Medical Direction Groups
Cases	Per FTE	907	1,653
	Per OR	933	915
tASA	Per FTE	8,769	16,647
	Per OR	9,157	9,323

Because staffing models and concurrency can differ among anesthesiology groups, comparisons of “per FTE” measurements lead to inaccurate conclusions. In contrast, meaningful comparisons can be done between groups by using “per OR site” measurements.

Data from Medical Group Management Association.<sup>15</sup>

FTE, full-time equivalent; OR, anesthetizing site; tASA, total ASA units.

**Table 5.** Surgical Duration (h/case) and Type of Surgeon

Type of Surgical Staff	N	tASA/OR	h/OR/d	h/case	tASA/h	Base/Case
Academic	34	11,700	7.4	2.7	6.5	6.3
Mixed or private practice	24	11,700	6.6	2.1	7.3	6.6

Surgical duration is the primary determinant of hourly anesthesia productivity (tASA/h) when types of cases are similar (base/case). A longer surgical duration results in lower hourly productivity. If overall productivity (tASA/OR) are similar, then the longer surgical duration results in longer billed hours and increases staffed hours and costs. Academic indicates facilities where a surgical resident is always involved in the surgery. Private practice indicates facilities where no surgical resident is involved in the surgery. Mixed indicates facilities where surgical residents sometimes, but not always involved in the surgery. All values median values of survey of academic anesthesiology departments. Adapted with permission from Abouleish *et al.*<sup>14</sup>

Base/case, base units per case; h/case, case duration = billed hour per case; h/OR/d, billed hour per site per weekday; tASA/h, hourly billing productivity = total ASA units billed per hour; tASA/OR, total ASA units per site.

units/h. As a result, the differences in total ASA units/OR can also be explained by the differences in h/OR/d.

In group D, it is not surprising that at the ambulatory surgical center, the base/case is smaller but this decrease does not result in lower total ASA units/h. Instead, the shorter h/case has a large positive impact on total ASA units/h.<sup>5,14</sup> That is, the difference in surgical duration is the dominant variable in determining the difference in total ASA units/h.

These differences in surgical duration and base/case illustrate that type of facility is an important factor to consider when comparing two facilities or benchmarking to industry data. Ambulatory surgical centers, academic medical centers, and community hospitals do not function similarly, and for meaningful comparisons one should not compare different types of facilities. Similarly, if specialty facilities (*e.g.*, heart hospitals, outpatient endoscopy centers, children's hospitals) exist, one must be careful comparing

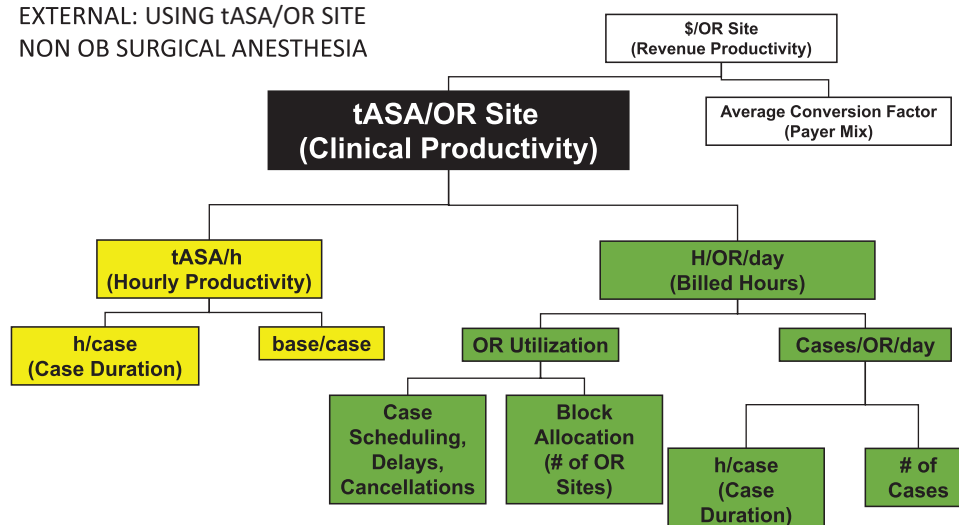
them with full-service facilities.<sup>4,14</sup> Furthermore, in a facility, one can also look at non-OR care *versus* OR care.<sup>5,6</sup>

Last, one must recognize that the h/OR/d measurement uses 250 days for all groups. Therefore, if a group does more work on weekends and holidays (*e.g.*, elective Saturday schedule), h/OR/d will be increased, not because each workday they are working longer hours, but because of the weekend and holiday work. Reporting per day rather than per year was done to h/OR/d to allow leaders to be able to better conceptualize the measurement of time worked/OR.

### Algorithm for Total ASA units/OR for Group Productivity

With this understanding of total ASA units/OR, an algorithm was developed, as shown in figure 1. Although from

EXTERNAL: USING tASA/OR SITE  
NON OB SURGICAL ANESTHESIA



**Fig. 1.** Algorithm for anesthesiology group productivity for surgical anesthesia used for external comparisons and benchmarking. Overall productivity is measured using tASA/OR. Two factors, tASA/h and h/OR/d, determine tASA/OR. Adapted with permission from figure 3 in Abouleish *et al.*<sup>14</sup> Base/case, base units per case; h/case, case duration = billed hour per case; h/OR/day, billed hour per site per weekday; OR, anesthetizing site; tASA/h, hourly billing productivity = total ASA units billed per hour; tASA/OR, total ASA units per site.

an economic perspective, a group may be very interested in tracking revenue collected per OR site that they staff, this revenue productivity is very dependent on the group's payer mix and contracts, specifically the mean revenue per unit billed (also known as mean or blended conversion factor). For external comparisons of clinical productivity, payer mix effects should not be included; hence, the overall measurement is total ASA units/OR. This measurement is independent of staffing models, so comparison between facilities can be done without adjustment. Also, even though total ASA units/OR is the measurement of overall clinical productivity of an anesthesiology group, the factors influencing this productivity are also major influences of OR productivity. Therefore, total ASA units/OR is also a surrogate for OR productivity.

As shown in figure 1, the two determinants of total ASA units/OR are hourly productivity (total ASA units/h) and billed hours (h/OR/d). When comparing two facilities, if facility A has a lower total ASA units/OR, but has similar h/OR/d as facility B, then the difference in total ASA units/OR must be because of a lower total ASA units/h. If both facilities are similar in clinical practice (*e.g.*, full-service hospitals), the base/case would be similar and therefore the lower total ASA units/h is because of longer surgical durations at total ASA units/h. The implication is that longer surgical durations results in lower billed units for the same staffed time. On the other hand, if total ASA units/OR is the same, then group A must work more hours to achieve the same billed units and incur higher staffing costs. Although full-service facilities have similar base/case, specialty facilities can differ greatly with ambulatory surgical centers having lower base/case as well as "heart" hospitals having much higher base/case.

The other major determinant, h/OR/d, is determined by OR utilization as well as workload. When a facility is found to have low h/OR/d compared with other like facilities, then group leaders need to look at OR management and utilization to determine the cause. Group leaders will then need to work with facility administration to improve OR management or need to negotiate financial support for staffing costs for non-revenue-generating time. On the other hand, if h/OR/d is high, then either the facility is running OR sites later on weekdays or running more cases on weekends compared with similar facilities. The high h/OR/d is a signal for further investigation to determine whether more sites were open and would surgeons be able to move after-hour cases to regular hours. If yes, then opening more sites could make economic sense. If not, then opening more sites will not relieve the after-hour case load, but instead result in low utilization of new sites.

## Internal Comparisons of Group Productivity

Despite the evidence that comparing group productivity by using "units per FTE" is problematic, group leaders as well

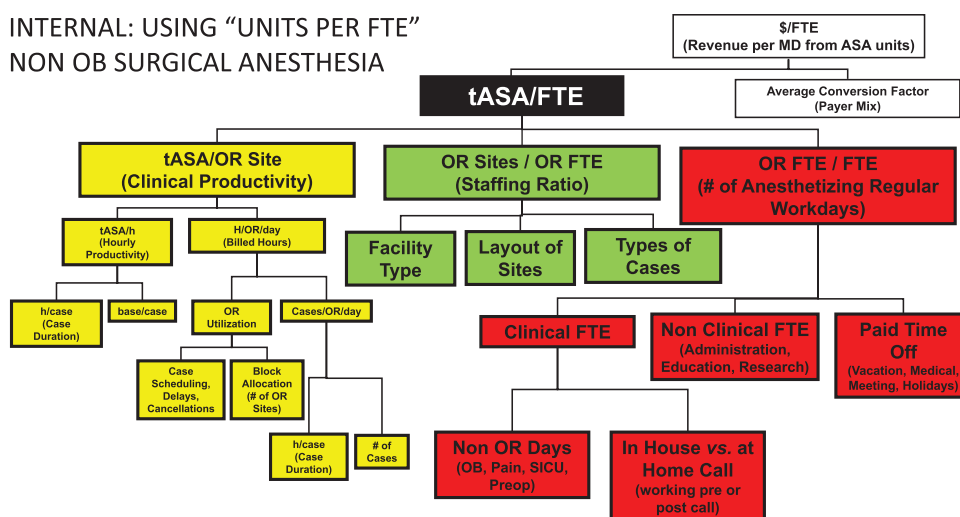
as facility administrators and healthcare system executives gravitate toward the definition of productivity of output per physician rather than output per anesthetizing site. As discussed earlier, there are many challenges that make using this measurement meaningful in industry-wide surveys because the survey would become extremely complex and difficult to maintain consistency among respondents on how FTE is calculated. In contrast, a group may choose to internally spend the resources to develop this measurement as well as other measurements because leaders find it helpful for the group. Furthermore, with the emergence of groups covering multiple facilities, the leaders can actually track, trend, and compare like facilities with their own internally defined measurements. Therefore, we have expanded the algorithm for total ASA units/OR in figure 1 to demonstrate how one could develop total ASA units/FTE within a group and to understand what determines total ASA units/FTE (fig. 2). Mathematically, total ASA units/FTE is made up of the product of three components:

$$\text{total ASA units/FTE} = \text{total ASA units/OR site} \times \text{OR site/OR FTE} \times \text{OR FTE/FTE}$$

The first component, total ASA units/OR, has been discussed in "Algorithm for tASA units/OR for Group Productivity" (Figure 1). The second component, OR site/OR FTE, is the staffing ratio or concurrency. The final component, OR FTE/FTE, describes percentage of time or days a full-time physician is providing care billed with ASA units.

The staffing ratio is generally determined by facility and case type. For academic medical centers, both of these factors result in lower staffing ratios in main ORs. For program requirements for accreditation of the anesthesiology residency programs, academic anesthesiology groups are limited to a maximum ratio of two rooms when one of the rooms has a resident (ACGME Requirement IV.A.6.j).<sup>23</sup> This requirement must be met independent of the time of day or day of the week (ACGME Requirement II.B.7). In addition, the ratio is sometimes 1:1 depending on the level of the resident, the type of surgical case, and the patient's medical comorbidities. Even when medically directing nonresidents (CRNAs or anesthesiologist assistants), the final staffing ratio is limited to four for medical direction and is often less, depending on the type of surgical case and the patient's medical comorbidities. These factors are very dependent on the type of the facility. In ambulatory surgical centers facilities, because there are no inpatient beds, patient selection, as well as type of surgical cases, are paramount to the proper functioning of the facility, leading to operational limitations that include healthier patients and less complex procedures. A full-service hospital with all types of surgical specialties and intensive care units does not have the limitations seen in ambulatory centers. In specialty hospitals (*e.g.*, children's hospitals or "heart hospitals"), the patients and types of procedures mandate a

# INTERNAL: USING "UNITS PER FTE" NON OB SURGICAL ANESTHESIA



**Fig. 2.** Algorithm for anesthesiology group productivity for surgical anesthesia that may be used for comparisons of facilities covered by one group. tASA/FTE is determined by three factors: tASA/OR, OR/OR FTE, and OR FTE/FTE. Because the OR/OR FTE and OR FTE/FTE are defined and determined locally, the use of tASA/FTE can only be used by a group when comparing facilities that the group covers and cannot be used to compare to industry survey data. Base/case, base units per case; FTE, full time equivalent; h/case, case duration = billed hour per case; h/OR/day, billed hour per site per weekday; OR, anesthetizing site; OR FTE / FTE, % time spent providing care that is billed using ASA units excluding obstetric anesthesia; OR sites / OR FTE, Concurrency or staffing ratio at beginning of workday; tASA/FTE, total ASA units/FTE; tASA/OR, total ASA units per site.

lower ratio for providing safe care. Last, geographic layout of sites in a facility may also limit staffing ratios. When a physician anesthesiologist medically directs care, the physician must be immediately available to return to the site.<sup>24</sup> In many facilities, some locations are geographically distant or even isolated, limiting the staffing ratio. All of these factors must be considered by group leaders when they use total ASA units/FTE to compare facility productivity.

The third component, OR FTE/FTE, describes an anesthesiologist's clinical commitment to providing care billed using ASA units. In other words, if ASA units is a measurement of output, then the right input would be to include only the time spent providing this type of care. As discussed earlier, for those that contribute to the clinical mission of a group in other areas (pain medicine, acute pain blocks, critical care, obstetric anesthesia, and preanesthesia assessment), the OR FTE is a subset of clinical FTE. But less intuitively obvious is that other factors reduce the OR FTE. For clinical work, a facility with in-house call requirements will lead to less time for anesthesiologists to be available during regular workdays compared with a facility with at-home call; therefore, measuring the call commitment is important in any comparison using FTE.<sup>6,13</sup> Even in private practice settings, many groups do not consider paid time off in their calculations, because paid time off does not differ between physicians. As more groups cover facilities in larger regional areas and even nationally, paid time off may differ among their facilities and even within a facility. For example,

if a provider takes 7 weeks of paid time off (2 weeks to attend CME meetings, 4 weeks of vacation, and 1 week of sick leave), a group may say that the provider then works 45 weeks of 52 weeks, but this is incorrect. One must also consider that on average each facility has 10 weekday holidays that are not regular schedule. Hence, the correct calculation would be 43 weeks of 50 weeks. Another provider may take only 5 weeks of paid time off (all vacation), whereas another takes 14 weeks of paid time off (12 weeks of maternity leave, 2 weeks of CME meetings). It is easy to see that although each provider may have the same possible paid time off, paid time off may actually differ for each provider and for each year and may affect the OR FTE calculation for each provider. Again, these factors must be considered when using total ASA units/FTE for comparing group productivity.

In figure 2, the algorithm for group productivity is expanded to illustrate how internal comparisons of different facilities can be done but also the number of variables that need to be considered. Again, revenue per FTE may be the ultimate goal, but this number is dependent on payer mix and average conversion factor; therefore, it should not be used for clinical productivity.

## Putting It All Together: An Example of Comparing Facilities in a Group

Hudson and Lebovitz recently published their experience of measuring and comparing productivity at 14 distinct



**Table 6.** Type of Facility and Productivity Measurements

Type of Facility	N	tASA/OR	h/OR/d	h/case	tASA/h	Base/Case
ASC	4	14,546	6.5	0.9	8.9	4.5
COM	6	14,242	7.6	1.6	7.4	5.4
AMC	3	12,551	7.5	2.4	6.7	6.4

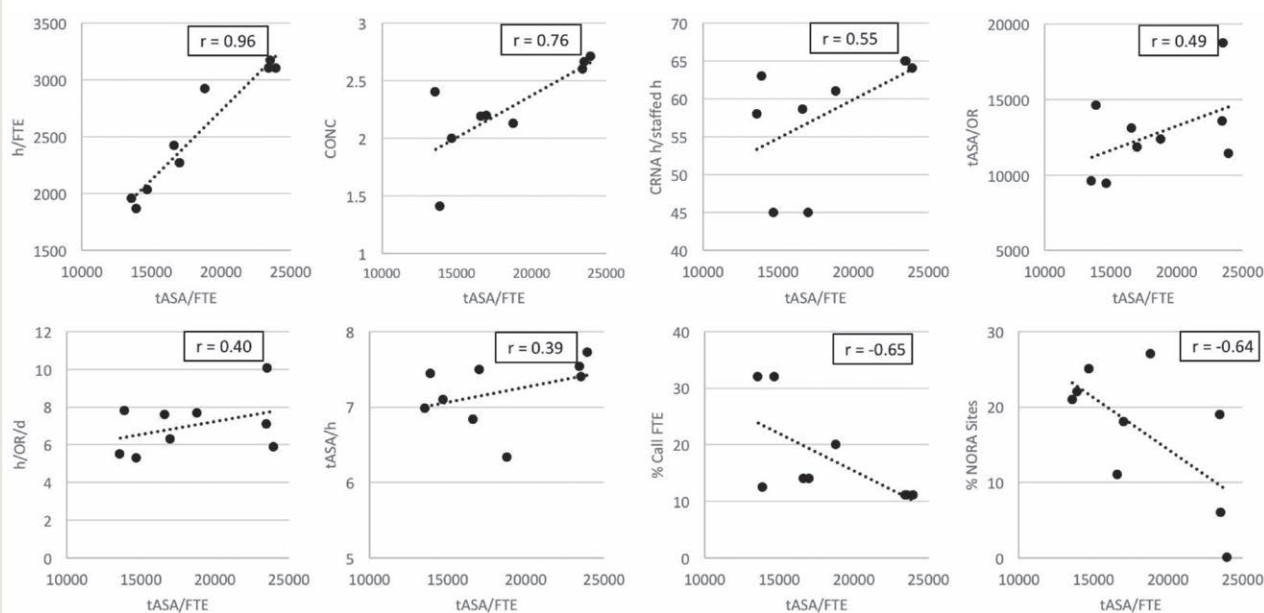
Similar to the hypothetical groups in tables 2 and 3, data from one group's evaluation of facilities covered shows that type of facility matters when comparing productivity. tASA/OR can be similar (ASC vs. COM), but the h/OR/d differ because of differences in h/case and tASA/h. When h/OR/d are the same, then tASA/h determine overall tASA/OR (COM vs. AMC). Even though tASA/h is determined by both h/case and base per case, differences h/case are greater and drive the final tASA/h in comparisons. AMC, academic medical center; ASC, ambulatory surgical center; Base/Case, base units per case; COM, community full-service facility; h/case, case duration = billed hour per case; h/OR/d, billed hour per site per weekday; tASA/h, hourly billing productivity = total ASA units billed per hour; tASA/OR, total ASA units per site.

facilities where their department provides anesthesia care.<sup>6</sup> In this report, they utilize measurements used in external comparisons and expand their evaluation to include internally developed measurements. Their facilities included academic medical centers, a large children's hospital, full-service community hospitals, small community hospitals, and ambulatory surgical centers.

Consistent with industry surveys noted earlier, they found that academic medical centers had longer h/case compared with community hospitals because of the difference between academic surgical staff and private practice surgical staff, as well as case complexity as measured by base/case. The h/case for the facilities were similar to survey results with community hospitals (h/case 1.4 to

1.6 h) and academic medical centers (2.3 to 2.7 h). As noted earlier, the longer h/case resulted in smaller total ASA units/h. On the other hand, the larger base/case should result in larger total ASA units/h. Because the difference in h/case is about three times that of base/case difference, the net result is smaller total ASA units/h (table 6).

Their results reinforce that even internal comparisons between facilities should be done between like facilities to allow for meaningful conclusions. They showed how the two determinants of overall productivity affected total ASA units/OR as described earlier (table 6). Even though academic medical centers and several of the community hospitals had similar overall productivity (total ASA units/OR), the academic groups had to work longer hours (h/OR/d) to



**Fig. 3.** tASA/FTE correlated with factors impacting productivity. tASA/FTE had a strong positive correlation with billable hours per FTE (h/FTE;  $P < 0.01$ ), and a strong positive correlation with concurrency (CONC;  $P < 0.01$ ), and CRNA billed to staffed hours' percent (CRNA h/staffed h). tASA/FTE was negatively correlated with call FTE percent (CallFTE%;  $P < 0.05$ ) and % non-OR anesthetizing locations (NORA%). A moderate degree of positive correlation was found between tASA/FTE and tASA/OR, h/OR/d, and tASA/h. CONC, concurrency; CRNA, nurse anesthetists; FTE, full-time equivalent; h/OR/d, Billed hour per site per weekday; tASA/FTE, total ASA units per FTE; tASA/OR, total ASA units per site. Adapted with permission from Figure 3 in Hudson *et al.*<sup>6</sup>

achieve this output because of the lower total ASA units/h. On the other hand, given the same total ASA units/h, the overall productivity correlated directly with h/OR/d. In addition, ambulatory surgical centers were shown to have very different productivity measurements. They actually had among the highest overall productivity, but similar or lower h/OR/d. Even though surgical centers had lower base/case, their h/case were significantly lower than the other facilities and resulted in the highest total ASA units/h.

Because they were comparing facilities covered by one group, they also examined total ASA units/FTE as well as other measurements. For utilization of sites, the group looked at “CRNA billed time per clinical staff time” defined as the percentage of total CRNA clinical staffed time that is accounted by billed time (CRNA h/staff). Using this measurement, they were able to track OR utilization, as well as identify those facilities that were outliers compared with other facilities. In addition, the group tracked the amount of in-house calls with postoperative day off for the anesthesiologist (CallFTE%) as well as the percentage of anesthetizing sites that were outside the OR suite.

As predicted, the higher concurrency was associated with higher total ASA units/FTE. Similarly, if more time was billed per FTE, then total ASA units/FTE was higher. Unadjusted OR utilization for other factors as measured by CRNA h/staffed h only moderately correlated with total ASA units/FTE. On the other hand, if one does not adjust the FTE for in-house call burden, one sees that the higher %Call FTE (in-house) is associated with lower total ASA units/FTE. Finally, the percentage of non-OR anesthesia was shown to have negative correlation with total ASA units/FTE (fig. 3).

These additional measurements (CRNA h/staffed h, %Call FTE, and %non-OR anesthesia) are examples of internally developed measurements that provide additional information to help group leaders in understanding productivity measurements and comparisons but may not be easy to calculate. Group leaders must decide the benefits of internally developed measurements with the cost of data collection required to determine the measurements.

## Conclusions

Benchmarking and comparing group productivity is an essential activity of data-driven management. For clinical anesthesiology, accomplishing this task is a daunting effort if meaningful conclusions are to be made. For anesthesiology groups, productivity must be done at the facility level to reduce some of the confounding factors. When industry or external comparisons are done, then the use of total ASA units per anesthetizing sites (total ASA units/OR) allows for overall productivity comparisons. Additional productivity components (total ASA units/h, h/case, h/OR/d) allow for leaders to develop productivity dashboards. With the emergence of large groups that provide care in multiple

facilities, these large groups can choose to invest more effort in collecting data and comparing facility productivity internally with group defined measurements including total ASA units/FTE.

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The authors declare no competing interests.

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## Appendix: Understanding Group Clinical Productivity through Example Cases

Although the following are not full case studies in comparing and measuring anesthesiology group productivity measurements, these brief discussion cases have been developed to illustrate the concepts discussed in this review and how anesthesiology group leaders can use the data in their conversations with facility leaders.

### Case 1: Consultant for the Hospital Finds That the ORs Are Underutilized and Has the Capacity to do 250 More Cases per OR per Year

The hospital has hired a consultant to evaluate their OR management and efficiency. As the chair of anesthesiology, you just received the preliminary findings that states that the ORs are being underused by 25%, implying that your department is not working as hard as an average group.

The consultant used the anecdotal benchmark that an average performing OR suite has 1,000 cases/OR/y and a high performing one has 1,250 cases/OR/y. Your OR suite has only 750 cases/OR/y. Hence, the consultant has found that you and the OR suite are underperforming.

This conclusion is not consistent with your perception of your department or the OR suite. How do you show this to the hospital administrator, who is excited to know that OR cases can be increased by 25% with current resources?

First, where did the consultant get the benchmark of 1,000 cases/OR/y? All you can do is try to reverse-engineer this number because the consultant is not sure where it comes from either. This benchmark is consistent with the following assumptions: average case duration for community hospital (*i.e.*, private practice setting) is 1.5 h. If the OR runs from 7 AM to 3 PM and has 75% utilization, then the average (billed) h/OR/d is 6 h/OR/d (= 8 staffed h × 75% utilization). So, this works out to be average of 4 cases/OR/d. Since OR suites usually run 250 weekdays/

**Table A1.** Appendix Case 1: “You Are Underusing Your OR Suite by 25%!”

	Cases/OR/y	Cases/OR/d	h/case	h/OR/d (billed)	Utilization	Staffed h/OR/d
Consultant benchmark	1,000	4	1.5	6	75%	8
	1,250	5	1.5	7.5	75%	10
Your reality	750	3	2.5	7.5	75%	10
Consultant recommendations	1,000	4	2.5	10	75%	13.3
	1,250	5	2.5	12.5	75%	16.7

The consultant hired by the hospital uses the benchmark of cases/OR/y to judge performance of anesthesiology group and OR suite. The consultant's benchmarks of 1,000 and 1,250 are based on surgical duration of 1.5 h. Your case duration is 2.5 h. Using consultant's benchmarks and your case duration, the recommendations would result in average staffed h/OR/d to increase from 10 h to either 13.3 h or 16.7 h.

Cases/OR/y, cases done per anesthetizing site per year; cases/OR/d, cases per anesthetizing site per day; h/case, Case duration = billed hour per case; h/OR/d, Billed hour per site per weekday; staffed hours/OR/d, h/OR/d divided by utilization; utilization, OR suite utilization, billed hours/staffed hours or patient in OR time/allocated block time.

year (52 weeks – 10 weekday holidays), the OR suite will have 1,000 cases/OR/y (table A1).

How about 1,250 cases/OR/y? Using the same case duration and days/y, the difference then has to be average staffed hours—in this case, 7 AM to 5 PM, or 10 h. Using the same 75% utilization, this 7.5 h/OR/d results in 5 cases/OR/d. Multiplying by 250 days, you get 1,250 cases/OR/d.

Examining your OR suite, you have been tracking group measurements, as outlined in figure 1. You know that because your facility has a surgical residency, your h/case is 2.5 h (not 1.5 h). In addition, the h/OR/d is 7.5 h (the same as a high-performing OR suite). Your utilization is 75% (this can come from the OR information system, or you may track regular utilization by CRNA h/staffed h). From these data, you can confidently say that for each OR, there are an average of three cases/OR/d and that the OR runs for average of 10 h each day. Multiplying by the 250 weekdays, you get 750 cases/OR/y.

But do you have additional 25% capacity with the same resources, as implied by the consultant's report? If you increase the number of cases to 1,000 cases/OR/y and do not change the surgical duration, then this would be four cases/OR/d or 10 h/OR/d (billed). Using the same utilization of 75%, this would mean, on average, each OR

would run 13.3 h—that is, 7 AM to 8:20 PM. If you increased to 1,250 cases/OR/y, the average OR would run for 16.67 h, or 7 AM to almost midnight.

### Case 2: We Have Two Full-service Hospitals. The Bigger, Busier One Has Less Units Billed per Physician. How Can That Be?

You are the head of your anesthesiology group, which is the merger of two smaller groups. Each of the smaller groups covered one full-service hospital. Your leadership team has decided to track and compare group productivity measurements by facilities. Because both facilities have 24/7 OR suites, the same staffing model (staffing ratio of 1 anesthesiologist for every 2.5 anesthetizing sites), and all anesthesiologists have the same 6 weeks of paid time off (vacation, meeting, sick leave), you are comfortable comparing them as “like facilities.” Hospital ABC is smaller, with five ORs, and usually finishes all the ORs by 5 PM, and the anesthesiologists take call from home. Hospital DEF has 15 ORs and usually has 3 to 5 ORs running at 5 PM and is down to 1 OR by 7 PM, but it can have cases run later and during the night. The anesthesiologists take call in house and come in for call at 3 PM with the post-call day off. Hospital

**Table A2.** Appendix Case 2: tASA/FTE Is Determined by Three Factors: tASA/OR, Staffing Ratio, and Operating Room FTE/FTE

Hospital	tASA/FTE	OR/OR FTE	OR FTE/FTE	tASA/OR	h/OR/d	h/case	tASA/h	Base/case
ABC	25,520	2.5	0.88	11,600	5.8	1.5	8	6
DEF	21,986	2.5	0.66	13,325	8.2	2.5	6.5	6.3

tASA/FTE can be used in a group to compare facility or specialty teams. Because tASA/FTE has three determinants (see fig. 2), simply relying on this measurement may not provide a complete understanding of clinical productivity. In this example, hospital ABC has higher tASA/FTE but lower tASA/OR than hospital DEF because of the difference in OR FTE/FTE. tASA/OR is influenced primarily by h/case and h/OR/d (see fig. 1).

OR FTE/FTE, percentage availability to work regular day providing surgical anesthesia and is influenced by multiple factors, including in-house call percentage, paid time off, and other clinical duties (see fig. 2); OR/OR FTE, staffing ratio and is influenced by facility geographic limitations, residency accreditation requirements, types of surgical procedures, and patient comorbidity.

Base/case, base units per case; FTE, full time equivalent; h/case, case duration = billed hour per case; h/OR/d, billed hour per site per weekday; OR FTE/FTE, % time spent providing care that is billed using ASA units, excluding obstetric anesthesia; OR/OR FTE, concurrency or staffing ratio at beginning of workday; tASA/FTE, total ASA units per FTE; tASA/OR, total ASA units per site; tASA/h, hourly billing productivity = total ASA units per billed hour.

ABC has higher total ASA units/FTE than hospital DEF even though hospital DEF ORs run later each day. You want to understand how that can be.

Because the overall productivity measurement is total ASA units/FTE, you should look at the algorithm in figure 3. As noted, there are three overall components to total ASA units/FTE: total ASA units/OR, OR sites/OR FTE, OR FTE/FTE. It will be important to evaluate each of these components to determine what are the potential causes of the differences in total ASA units/FTE.

**Total ASA Units/OR.** This value will examine whether the issue is found in clinical workload being done. As noted in the review, case duration and billed h/OR/d are primary determinants (fig. 1). Looking at these three measurements will help you focus on differences between the facilities if they exist.

**OR Sites/OR FTE.** Although the staffing ratio appears to be the same for each facility, one should always keep in mind that this component can influence total ASA units/FTE.

**OR FTE/FTE.** Interesting, one would think that if all the anesthesiologists have the same paid time off, then each anesthesiologist would work the same number of days. But in hospital DEF, the anesthesiologist on call comes in at 3 PM and is in house throughout the night with the post-call day off. This means the call anesthesiologist does not work a regular day before or after call and therefore has less opportunity to produce ASA units during regular work days compared with an anesthesiologist at hospital ABC, where call is at-home call. (The decision for in-house or at-home call,

and coming late or working regular pre-call day, needs to be made by each group considering physician fatigue and patient safety, and is beyond the scope of this discussion.)

For this case, the measurements you have calculated for each hospital are found in table A2. Anesthesiologists at hospital ABC bill out almost 15% more total ASA units/FTE than those at hospital DEF. It is interesting that total ASA units/OR is higher at hospital DEF. In fact, in hospital DEF, the ORs run significantly longer. Furthermore, case duration is higher at hospital DEF. Although all the anesthesiologists at both hospitals are in private practice (no residents), hospital DEF actually has a surgical residency program resulting in longer surgical duration (h/case). Despite the lower hourly productivity (total ASA units/h), the longer billed hours (h/OR/d) account for the higher total ASA units/OR. Therefore, the reason the total ASA units/FTE is lower at hospital DEF has to be the OR FTE/FTE measurement. At hospital ABC, the OR FTE/FTE is 0.88. This is determined by 6 weeks of paid time off and an additional 2 weeks of hospital weekday holidays. Therefore, on average, each anesthesiologist works 44 weeks of regular weekdays out of a possible 50 weeks of regular weekdays. Because the anesthesiologists work before and after call ("call" is home call), the measurement is simply 44 of 50, or 0.88. In contrast, at hospital DEF, on every weekday, there is one anesthesiologist after call and one before call (coming in at 3 PM). Because there are 15 ORs to cover a 1:2.5 ratio, there are six anesthesiologists working the regular day—meaning that each day, the facility needs eight anesthesiologists (6 + 1 after call + 1 before call). So, the OR FTE/FTE equals 44 of 50 × 6 of 8, or 0.66.