

# Operating Room Nursing Directors' Influence on Anesthesia Group Operating Room Productivity

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**BACKGROUND:** Implementation of initiatives to increase anesthesia group productivity depends not just on anesthesia groups, but on operating room (OR) nursing administration. OR nursing directors may encourage organizational change based on the needs of their hospitals and nurses. These changes may differ from those that would increase the anesthesia group's productivity. We assessed reward structures using (A) letters of nomination for the "OR Manager of the Year" award offered annually by the publication *OR Manager*, and (B) data from a salary/career survey of OR directors by the same publication.

**METHODS:** (A) There were 164 nomination letters submitted from 2004 through 2007 for 45 nominees. The letters contained  $n = 2659$  full sentences and  $n = 50,821$  words. We systematically created a list of 36 terms related to finance, profit, and productivity. We also analyzed the frequency of use of these terms relative to the use of the 15 most common relationship-oriented terms (e.g., compassion, encourage, mentor, and respect). (B) The salary/career survey's questions relevant to anesthesia group productivity had responses from 303 US OR directors, 97% of whom were nurses. We tested the strength of the relationship between the budget responsibility of the OR nursing director and his or her annual salary.

**RESULTS:** (A) 2.6% of sentences in the nomination letters included at least one term related to profit and productivity (95% confidence interval 2.0%–3.2%). Relationship-oriented terms were 9.0 times more prevalent (95% confidence interval 7.1–11.4). (B) There was statistically significant positive proportionality between the OR nursing director's operational budget (including personnel) and his or her salary (Pearson  $r = 0.64$ ,  $P < 0.001$ ). The 10th percentile of the operational budget was \$1 million and the 90th percentile was \$36 million. The budget of \$1 million was associated with a salary 22% less than the median and the budget of \$36 million was associated with a salary 22% larger than the median.

**CONCLUSION:** Through (A) organizational constituencies, and (B) compensation, many US OR nursing directors likely are encouraged to enhance relations with nursing staff, not to champion organizational initiatives that would reduce under-utilized OR time and OR nursing labor costs. Resulting decisions can differ from those that would increase the productivity (profit) of the anesthesia group. Anesthesia groups need to champion initiatives to increase anesthesia productivity, while being sensitive to institutional expectations of nursing directors.

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Consider the numerator of an anesthesia group's operating room (OR) productivity to be the American Society of Anesthesiologists' Relative Value Guide units of care that it provides in ORs during a year. Let the denominator be the labor costs of the group, including both direct costs and indirect/intangible costs associated with over-utilized OR time, during

the same period.<sup>1</sup> Then, OR productivity can be increased by a reduction in labor costs without a reduction in units of work performed. Efforts to increase the productivity of anesthesia providers in the United States of America (US) are important, because anesthesia productivity has been *declining* nationally,<sup>2,3</sup> resulting in increased societal costs.

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Initiatives to increase anesthesia productivity rely principally on changing OR staffing and case scheduling.<sup>1,4-6</sup> Although the initiatives can be presented as providing the potential to increase future OR workload without an increase in labor costs, we consider the equivalent reduction in under-utilized OR time.<sup>1,7</sup> The value to the hospital is proportional to the resulting absolute reduction in costs (e.g., \$1.4 million annually vs 12%).<sup>8</sup> Calculation of the absolute reduction depends on knowing whether the savings will be achieved mostly by OR nursing administration (department) or the anesthesia group. If the principal goal of reducing under-utilized OR time is to reduce OR nursing costs (e.g., through attrition),<sup>9,10</sup> then the champion for change likely needs to be the OR nursing director. Alternatively, anesthesia group managers would argue for change to reduce the anesthesia group's costs and thereby reduce future hospital contractually<sup>7</sup> specified financial support, albeit with a net increase in the group's profits. Then, anesthesiologists would initiate change, dependent on the tacit approval of the OR nursing director.

Little has been published about the factors that may influence OR nursing directors as they consider organizational changes that would increase anesthesia productivity. Nursing directors' jobs are first and foremost about nursing, even though their decisions may have considerable influence on the anesthesia group's productivity and profit.

OR directors are generally facility employees whose responsibilities include surgery scheduling, managing departments, supervising OR personnel, budgeting and financial management, purchasing of supplies and equipment, and patient safety.<sup>11</sup> For 17 yr, the publication *OR Manager* has conducted a salary/career survey of OR directors and other management level OR nurses. In addition, the organization has offered an annual award for "OR Manager of the Year" based on letters of nomination. *OR Manager* is widely read and respected in the US and is listed in PubMed. There are hundreds of responses annually to the salary/career survey. There are approximately two dozen nomination letters submitted annually for the award. We statistically analyzed the raw survey data from 2007 and qualitatively (textually) analyzed of the nomination letters from 2004 to 2007. Our objective was to evaluate whether the quantity and quality of implicit rewards for OR nursing directors were inconsistent with attention to reducing under-utilized OR time [i.e., decisions that would increase the productivity (profit) of the facility's anesthesia group]. We expected inconsistency, because the nursing director works for the facility and represents the interests of her nurses.

## METHODS

### Salary/Career Survey

*OR Manager's* 2007 salary/career survey was designed with the assistance of Readex Research, which

handled its production and distribution. Separate surveys were sent to hospital OR directors and ambulatory surgery center (ASC) nursing directors. For hospital OR directors, the questionnaires were eight pages long (64 questions) and for the ASC nursing directors four pages long (52 questions). The surveys were mailed in April 2007 to 800 hospital and 1000 ASC nursing directors. The mailing list for hospital OR directors was from *OR Manager's* circulation list while the mailing list for the ASC directors was the *OR Manager* circulation list supplemented by a list of ASCs purchased from Verispan (Yardley, PA). After a month, the survey was mailed again to the 1375 directors who had not yet returned the survey. Questions were asked about many topics including salaries, budgets, hospital reporting structure, scope of management responsibilities, number of departments supervised, and information systems. The results were published in *OR Manager* in October 2007.<sup>11,12</sup> Since all directors whose responses we could analyze were from the US and 97% were nurses (Table 1), we effectively studied a convenience sample of 303 US OR nursing directors. The population was likely similar to what would have been obtained if there had been an exhibition booth at *OR Manager's* annual conference, Managing Today's OR Suite, and 303 attendees agreed to complete a survey. Because the population was a convenience sample, we limited our consideration to the relationships among responses to different questions. In other words, we did not study the incidences of responses to individual questions.

To develop a model for the relationship between OR nursing directors' responsibilities and his or her salaries, we relied on the economic behavior of non-profit hospitals,<sup>13-18</sup> where most surveyed directors work (Table 1). From agency theory,<sup>19</sup> the "principal" (i.e., the hospital) hires the "agent" (i.e., the OR nursing director), but cannot practically monitor the agent's activities.<sup>19</sup> Pay is used to align the behavior of the agent with the interests of the principal.<sup>19</sup> For example, being as university departments strive for prestige and status,<sup>20</sup> the dominant predictor of 353 professors' salaries was the number of publications in top-tier journals.<sup>19</sup> Hospitals behave economically as if their interests are to maximize their physicians, prestige, production, or some combination.<sup>13-18</sup> For example, a nursing director's performance evaluation may be based partly on growth in the numbers of cases at her ORs and on success at opening new ORs. The end point in the current survey that represents the hospital's overall economic behavior is the OR nursing directors' budget. Thus, from agency theory, we expect to observe a strong correlation between the budget responsibility of the OR nursing director and his or her salary (i.e., reward for promoting the interests of the hospital). This pair of survey questions together had a 16% response rate.

Continuing with classical healthcare economics,<sup>13-15,17,18</sup> executives establish total OR capacity and

**Table 1.** Effect of Surveyed Characteristics on Operating Room (OR) Directors' Reported Salaries with Statistical Control for the Director's Operational Budget

Characteristic	Responses	Association with salary	Groups	Distribution among respondents (%)	Mean incremental effect on salary
Gender	N = 298	P = 0.80	Women	88	—
			Men	12	+1%
Credentials	N = 300	P = 0.47	Registered Nurse	97	—
			Other	3	+5%
Corporate status	N = 300	P = 0.39	Not for profit hospital	62	—
			Joint venture surgery center	14	-2%
			Physician owned surgery center	10	-6%
			For profit hospital	7	+7%
			Hospital surgery center	4	+4%
			Corporate surgery center	3	-2%
Number of surgical technologists <sup>a</sup>	N = 293	P = 0.30	≤19% of staffing	10	+2%
			≤30% of staffing	25	+1%
			≤40% of staffing	50	—
			≤50% of staffing	75	-1%
			≤50% of staffing	90	-1%
Number of operating rooms <sup>b</sup>	N = 302	P = 0.28	≤2 rooms	10	0%
			≤4 rooms	25	0%
			≤7 rooms	50	—
			≤12 rooms	75	0%
			≤22 rooms	90	+1%
Type of facility	N = 302	P = 0.11	Community hospital	50	—
			Ambulatory surgery center	30	-3%
			Teaching hospital	17	+7%
			Other hospital	3	-3%
Location	N = 297	P = 0.002	Suburban	41	—
			Rural	30	-9%
			Urban	29	-4%
Region	N = 303	P = 0.001	Southern United States	33	—
			Midwestern United States	32	-4%
			Western United States	19	+8%
			Northeast United States	16	+7%
Education <sup>c</sup>	N = 279	P < 0.001	Masters	42	—
			Bachelor's	39	-11%
			Associate's	19	-12%

<sup>a</sup> The ratio of the numbers of surgical technologists to registered nurses in each OR was not related by *OR Manager* to directors' salaries, unlike the other variables.<sup>11,12</sup> However, as a highly visible way to reduce a nursing budget, we expected that it would indicate whether salary is directly affected by budget or actions affecting budget. The lack of statistical significance suggests an effect of budget *per se*. There was also no correlation between the logarithm of salary and the ratio (Pearson correlation 0.01, two-sided  $P = 0.88$ ).

<sup>b</sup> Although the numbers of surgical technologists and ORs are listed as categories, they were analyzed statistically as being ratio levels of measurements.

<sup>c</sup> The overall Pearson correlation was 0.63 between the logarithms of budget and salary (Fig. 1). Among respondents with versus without a master's degree, the Pearson correlations were 0.56 and 0.55, respectively. The direct correlation between salary and education was large, because directors with more education were responsible for larger budgets. Median budgets were \$3 million among directors with an associate degree, \$5 million among directors with a bachelor's degree, and \$16 million among directors with a master's degree.

then use loosely enforced rules and negotiation to manage surgeons when the hospital is especially busy.<sup>14</sup> The resulting never-ending noncooperative scrambling for and use of OR capacity can result in growth in OR budgets<sup>13,14</sup> and workload,<sup>15</sup> in excess of public need.<sup>18</sup> This process is sustainable through specialties subsidizing one another<sup>17</sup> and the need only for hospitals to operate without a financial loss,<sup>15,16,21</sup> which for surgery hardly ever occurs.<sup>22-25</sup> The consequence is progressive increases in the OR nursing director's budget and in the anesthesia group's labor costs, with a net decline in the group's productivity, and profit if it were not for institutional support.<sup>7</sup> If this model holds, there should be absence of correlation between OR directors' salaries and

efforts associated with profit. Two questions related to this relationship: 1) proportional use of less expensive surgical technologists in lieu of registered nurses; and 2) corporate status of the facility (Table 1).

Although we hypothesized (from economic theory<sup>13-18</sup>) that there would be a strong relationship between budget and salary for OR nursing directors, such a relationship had not been described previously, even though *OR Manager* had performed and published results of its statistical analysis for years. We tested each factor that *OR Manager* had reported<sup>11,12</sup> to be related to OR nursing directors' salaries for the factor's incremental predictive value after controlling for the director's budget, expecting its residual effect to be small. Specifically, *OR Manager* found that ASC

nursing directors' annual salaries were less than for hospital directors, more for managers of hospital-owned versus physician-owned surgery centers, more for directors with five or more ORs versus fewer than five ORs, and more for directors in the Northeast and West than in the Midwest and South.<sup>12</sup> Hospital OR directors' annual salaries were more for directors of teaching versus community hospitals, more for directors with five or more ORs versus fewer than five ORs, more for managing multiple departments and facilities versus for managing just the surgical suite, and more for directors in the Northeast and West than in the Midwest and South.<sup>11</sup> We hypothesized that the simple model of "increases in budget responsibility cause increased salary" would fully account for observed variability among directors in their salaries, with a small residual effect of region. We also assessed the impact of basic demographic information such as gender and education. The statistical methods are described below.

### Nomination Letters

The preceding assessment of correlation between the operational budget of the OR nursing director and his or her salary served as a test of the prediction that compensation reflects the non-profit's objective of growth provided that there is no net loss.<sup>15,16,21</sup> To achieve such an objective, a successful nursing director would need to recruit and retain employees. The survey lacked data to test for this intermediary process. However, the letters of nomination for OR Manager of the Year provided us an opportunity to evaluate qualitatively what organizational constituents considered to be skills of successful nursing directors.

When addressing retention, anesthesia providers focus on higher salary, reimbursement for continuing education, and "more monetary rewards."<sup>26</sup> OR nurses, in contrast, report leaving facilities mostly because of lack of recognition, poor communication, and/or insufficient staffing.<sup>27</sup> In addition, hospital teamwork culture (e.g., "managers in my facility are warm and caring") is far more strongly correlated with resignation rates of nurses than physicians.<sup>28</sup> Different management styles may address these different interests. Profit-conscious management style emphasizes employee effort, attitude, efficiency, and effectiveness.<sup>29</sup> Relatedness management style focuses on interpersonal relations and maintenance of a pleasant work atmosphere.<sup>29</sup> At a large US nonprofit with services such as hospice care, managers' relatedness style predicted their subordinates' organizational commitment (i.e., belief in and plan to continue to work for the non-profit), whereas their profit focus did not.<sup>29</sup> Thus, we hypothesized that the nomination letters would exemplify the relatedness management style by focusing on compassion, relationships, and human resources, and not on profit or productivity.

The details of the letters are as follows. Each October for the past 19 yr, *OR Manager* has recognized one "OR Manager of the Year" at its annual conference. For example, in 2007, "the person selected as OR Manager of the Year receive[d] an expense-paid trip to the conference . . . . In addition . . . she receive[d] a scholarship . . . to attend the Georgetown University Healthcare Leadership Institute."<sup>30</sup> The instructions given were "to nominate a leader for OR Manager of the Year, write a letter of about 300 words describing what makes the manager deserving of the award." Since no other criteria were given, the criteria were sufficiently open-ended that the letters were likely unbiased assessments of the values that stakeholders appreciate in their OR nursing directors.

*OR Manager* saved and provided us with the 164 letters that were submitted from 2004 through 2007. There were 48 letters for 13 nominees from 2004, 15 letters for 10 nominees from 2005, 24 letters for 5 nominees from 2006, and 77 letters for 17 nominees from 2007. Among the 45 nominees, 35 were identified as US nurses, 8 were from the US but not said to be an administrator, physician, or nurse, 1 was a US administrator, and 1 was a Canadian nurse. There was more than one signatory for 7.9% of the letters and more than 10 signatories for 3.7% of the letters. Among the signatories, there were 8 identifying themselves as administrators, 12 as anesthesiologists, 22 as surgeons, 166 as nurses or surgical technologists, and 217 without a listed academic degree or professional status. Our textual analysis of the content of the letters inferred what this broad constituency valued in their OR nursing directors' behavior.

We scanned the letters, applied optical character recognition (Adobe Acrobat 8.0 Professional, Adobe Systems, San Jose, CA), deleted headers and salutations, and checked every sentence manually for errors in scanning. There were  $n = 2659$  full sentences and  $n = 50,821$  words in the 164 letters. To systematically identify characteristics of messages that were relevant to the productivity of anesthesia providers, we used PubMed searches to create a list of 36 terms related to finance, profit, and productivity (Table 2). We used both MeSH terms and words present in abstracts of articles that studied anesthesia group productivity. Then, to ensure the relevancy of the terms' usage in the letters, the context of each management term used in a letter was reviewed manually. Usage was considered relevant when it referred to the nominee (rather than the letter writer) and when the term was even potentially being used in a management context.

We tested our hypothesis of a larger focus on relationships than on productivity by using counts of words. Among the nomination letters' 50,821 word occurrences and 3063 unique words, the following 15 relationship-oriented terms were each used more than 25 times: care, collaborate, compassion, encourage, fair, family, mentor, people, personal, recognition, relationship, respect, share, support, and team. We

**Table 2.** Numbers of Sentences from Among the Nomination Letters' 2659 Full Sentences in Which Each Finance, Profit, or Productivity Term was Present

Word or phrase <sup>a</sup>	Monetary or productivity usage	Present but not relevant to productivity
Efficiency	11	7
Allocation	7	1
Staffing	7	15
Revenue	5	0
Financial	4	4
Savings	4	0
Analyze	3	2
Evidence-based	3	0
Productivity	3	0
Projections	3	0
Capacity	2	4
Capital	2	1
Strategy	2	9
Workflow	2	0
Case scheduling	1	0
Caseload	1	0
Contribution margin	1	0
Cost containment	1	0
Cutting costs	1	0
Informatics	1	0
Marketing	1	0
Staffing cost	1	1
Throughput	1	0
Waste	1	0
Accounting	0	1
Forecast	0	0
Labor cost	0	0
Occupancy	0	1
Patient waiting	0	0
Personnel scheduling	0	0
Practice guideline	0	0
Practice management	0	0
Profit	0	0
Queue	0	0
Under-utilized	0	0

<sup>a</sup> All tenses, verb forms, and alternate spellings were used for each word or phrase, such as 1) "allocate" in addition to "allocation," 2) "finance" in addition to "financial," 3) "labour cost" in addition to "labor cost," and 4) "productive" in addition to "productivity." The following are some examples of phrases that were present in sentences but not in monetary or management usage: 1) "... her ... responsibility includes ... three hospitals accounting for a total of 47 operating rooms," 2) "I am writing in my capacity as surgeon-in-chief," 3) "... new ... hospital ... for July 1980 occupancy", and 4) "the need to have active recruitment strategies".

compared the prevalence of use of those 15 terms to the prevalence of use of the 36 profit-focused terms in Table 2. Because the relationship words were used commonly, we let the context be controlled statistically by assessing the relative incidence of the two types of terms, unlike as in the preceding paragraph in which we estimated the absolute incidence of the uncommon profit terms.

### Statistical Methods

Generalized Linear Modeling was used to analyze the survey results. The logarithms of the nursing directors' budgets and salaries followed normal distributions (Shapiro-Wilk  $P = 0.11$ , and  $P = 0.13$ , respectively,  $n = 303$ ) (Systat 12, SYSTAT Software, San Jose, CA). Therefore, we repeatedly tested for the relationship between  $\log(\text{salary})$  and two dependent

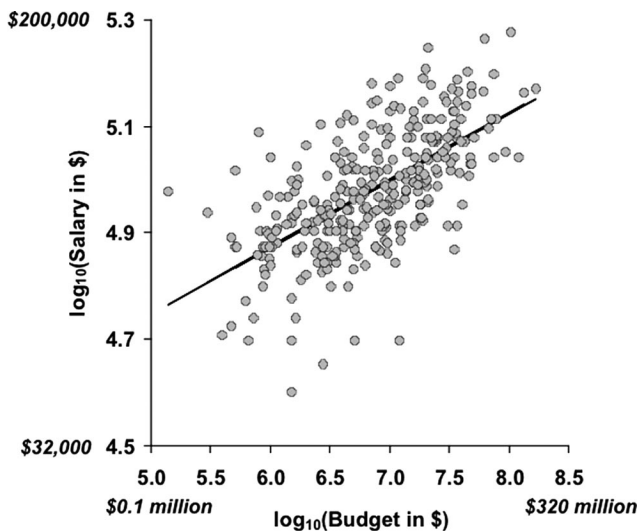
variables, one being  $\log(\text{budget})$  and the other being a secondary variable. The secondary variables included numbers of ORs, gender, etc. To understand the analysis, consider the statistical model:  $\text{salary} = \text{secondary} \times \text{budget}$ .<sup>2</sup> For secondary = 1 and budget = {1, 2, 3}, the salary = {1, 4, 9} (e.g.,  $9 = 1 \times 3^2$ ). Thus,  $\log_{10} \text{salary} = \{0.00, 0.60, 0.95\}$ . The so-called "least squares mean" equals 0.52, where  $0.52 = (0.00 + 0.60 + 0.95)/3$ . For secondary = 2 and budget = {1, 2, 3}, the salary = {2, 8, 18}. Thus,  $\log_{10} \text{salary} = \{0.30, 0.90, 1.26\}$ . The least squares mean equals 0.82, where  $0.82 = (0.30 + 0.90 + 1.26)/3$ . The difference between the least squares means for the two values of the secondary variable equals 0.30, where  $0.30 = 0.82 - 0.52$ . The proportional difference between the two values of the secondary variable equals 2.0, where  $2.0 = 10^{0.30}$ . In Table 1, secondary = 1 would be listed with a mean incremental effect of "-" indicating that it is the baseline. The value of secondary = 2 would be listed with an effect of +100%, where +100% indicates that a proportional difference of 2.0 is 100% more than baseline. To relate this example to the results shown in Table 1, no assumption was actually made about the power to which the budget was raised (i.e., the actual exponent was not 2 but closer to 0.14). The "secondary" represents the other variables tested one at a time, whether categorical or continuous.

Confidence intervals (CI) for percentages and rates were used to analyze the nomination letters. The Clopper-Pearson method was used to estimate the 95% CI for the percentage of sentences containing one or more productivity or profit oriented term(s) from Table 2.<sup>31</sup> The 95% CI for relative usage of relationship-oriented to productivity-oriented terms was based on a Poisson distribution.<sup>32</sup>

### RESULTS

There was statistically significant proportionality between the OR nursing director's operational budget (including personnel) and his or her salary (Fig. 1) (Pearson  $r = 0.64$ ,  $P < 0.001$ ). For example, the 10th percentile of the operational budget was \$1 million and the 90th percentile was \$36 million. The budget of \$1 million was associated with a salary 22% less than the median and the budget of \$36 million was associated with a salary 22% larger than the median. After controlling for the budget, only the OR nurse director's education had a mean incremental effect on salary exceeding 10% (Table 1). Practice characteristics expected to be associated with increased profits (e.g., increased proportional use of less expensive surgical technologists in lieu of registered nurses) were not associated with salary (Table 1).

Table 2 shows that the nomination letters for OR Manager of the Year included at least one of the 36 terms related to profit and productivity in just 2.6% of sentences (95% CI 2.0%-3.2%). Relationship-oriented terms such as compassion, encourage, mentor, and



**Figure 1.** Proportionality between the operating room (OR) nursing director's operational budget (including personnel) and his or her salary. The Pearson  $r = 0.64$ ,  $P < 0.001$ . The 10th percentile of the operational budget was \$1 million and the 90th percentile was \$36 million. The budget of \$1 million was associated with a salary 22% less than the median and the budget of \$36 million was associated with a salary 22% larger than the median. The 25th percentile of the operational budget was \$3 million and the 75th percentile was \$19 million. The budget of \$3 million was associated with a salary 11% less than the median and the budget of \$19 million was associated with a salary 12% larger than the median.

respect were 9.0 times more prevalent (95% CI 7.1–11.4,  $n = 682$  vs 76 words).

## DISCUSSION

Our findings suggest that compensation and organizational constituencies may encourage OR nursing directors to enhance relations with nursing staff, not to champion organizational initiatives that would reduce under-utilized OR time and OR nursing labor costs. As reviewed in the Methods, these incentives make eminent sense for hospitals and OR nurses. However, resulting decisions often will differ from those that would increase the productivity (profit) of the anesthesia group.<sup>1,4,5,7,8</sup>

An anesthesia group aiming to increase its productivity, and/or a hospital trying to encourage the same, should first assure that the group's agreement with the hospital does not paradoxically reduce incentives for increasing OR/anesthesia productivity.<sup>7</sup> For example, it may seem intuitively reasonable for institutional support to be recalculated regularly based on the group's actual workload and labor costs. Yet, if support per hour exceeds net collections per hour for a subspecialty, reductions in the group's workload for the specialty would result in increased profit.<sup>7</sup> The agreement should result in financial incentives for anesthesia groups to apply the scientific advances in OR management that have been made during the past decade.<sup>1,4,7,33</sup>

The anesthesia group should next assure that its providers are not making managerial decisions on the day of surgery using experience and "rules of thumb" ("heuristics") that seem reasonable but perform poorly.<sup>4,5</sup> For example, a well-intentioned clinician may perceive that she is contributing to increases in the group's productivity by increasing her clinical work per unit time.<sup>4,5</sup> Yet, resulting decisions are suboptimal when involving more than one OR.<sup>4–6</sup>

Provided that an anesthesia group *truly* satisfies both such conditions, we recommend that its managers then consider implementing a complementary strategy that is based on our findings of OR nursing directors' institutional priorities. The group can identify opportunities, and encourage administrators, to expand the nursing budget to hire additional personnel who would increase the anesthesia group's productivity. Importantly, it is the anesthesia group that should take the lead in getting more hospital resources for the OR nursing director. Examples include hiring more: 1) postanesthesia care unit (PACU) nurses,<sup>34</sup> or transporters to reduce delays in PACU exit,<sup>35</sup> if there are delayed PACU admissions from ORs with more than 8 h of cases<sup>36</sup>; 2) anesthesia technicians and supervising nurses to reduce turnover times for ORs with consistently more than 8 h of cases<sup>37</sup>; 3) nurses to setup, assist anesthesiologists, and monitor patients in block rooms<sup>38,39</sup> for ORs with more than 8 h of brief cases<sup>40</sup>; and 4) marketing, finance, and operations analysts to work with surgical groups and schedulers to increase workload that can be handled in ORs that consistently have fewer than 8 h of cases.<sup>1,22–25,35,41</sup> Each example may also improve the OR environment for surgeons. The latter example is particularly important, because many staffed ORs have fewer than 8 h of cases.<sup>42</sup> Furthermore, a recent survey of OR management at 87 German hospitals found that anesthesia group productivity was better predicted by OR workload than by corporation type, existence of an OR manager, independence of the OR department, presence of working documents on surgical departments' OR usage, numbers of facilities, or presence of regular OR meetings.<sup>43</sup>

Our recommendation is based on the anesthesia group providing hospital executives with analytical results for the purposes of persuasion. Knowing this, results of previous experimental findings can be applied. The use of quantitative analysis enhances the persuasiveness of reports, especially when an explanation that the analysis is objective is included (e.g., two people doing the work should get the same answer unless one makes a mathematical error).<sup>44</sup> Quantification enhances persuasion mostly by increasing the perception of the competence of the preparer.<sup>44</sup> If there are existing reports of low statistical value (e.g., percentage utilization of surgeon's block time),<sup>45,46</sup> the new analysis should include quantification of the expected difference in resulting productivity from relying on the new approach.<sup>47</sup>

The major limitations of our study were described in the Methods section. First, our data were limited to the US and therefore the basis for the studied relationships was similarly limited. Second, neither the salary/career survey nor letters of nomination were designed to address our study questions. Similarly, the letters were generally not written by hospital executives. However, as we summarize in the third paragraph of the Discussion, simply asking OR nursing directors about their decision making would likely not be of scientific value. Hopefully our paper motivates investigators with other sources of data to study further behavioral operations research in OR management. Third, we do not think that we have the data to study the impact of survey response rate on our results, partly because we lack an argument for why the relationship between salary and budget would be different for respondents versus managers who did not participate in the survey. Fourth, since we do not know the salary distribution of the 45 nominees, we could not make a direct connection between the letters and the salary survey.

In summary, we studied the characteristics of 303 US hospital and ASC OR nursing directors' paper surveys and 164 nomination letters for OR Manager of the Year. As hypothesized from economic theory,<sup>13-18</sup> the OR nursing director's budget alone predicted his or her salary (Fig. 1), and all previously reported<sup>11,12</sup> individual predictors of budget had little or no residual effect (Table 1). Consequently, many US OR nursing directors likely lack organizational rewards to champion initiatives that would reduce under-utilized OR time and thereby reduce their facility's budget. In addition, as hypothesized from a previous study of how management style influences retention of staff in nonprofit organizations,<sup>29</sup> and the relatively<sup>26,28</sup> high importance of management style on nurses' retention,<sup>27,28</sup> only a small proportion ( $\leq 3\%$ ) of sentences in the nomination letters mentioned profit, productivity, or finance terms. Instead, the language used in the letters stressed relationship-oriented words such as compassion and respect. The implicit rewards for nursing directors make sense for nonprofit hospitals and for OR nursing, but differ from those that would increase productivity of anesthesia groups. An implication for anesthesia groups is that they should champion initiatives to increase anesthesia productivity while being sensitive to institutional expectations of nursing directors.

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