The "Fourth Mission": The Time Commitment of Anesthesiology Faculty for Management Is Comparable to Their Time Commitments to Education, Research, and Indirect Patient Care

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Academic anesthesia departments have management responsibilities (e.g., coordinating sedation, directing the operating rooms [ORs], informatics, ongoing professional performance evaluation, staff scheduling, and workroom inventory management). For each of the 64 faculty, a survey sampled 10 weekdays and 4 weekend days of professional activity over $N = 56$ days. Faculty time in managerial activities was 126% of time spent on education, 107% of time spent in research, and 112% of time spent on mandatory indirect clinical support (e.g., fire safety training). The 95% lower confidence limits calculated using Fieller's theorem were 107%, 89%, and 91%, respectively. Corresponding bootstrap limits were 107%, 89%, and 90%, respectively. Thus, although our College of Medicine tripartite mission includes clinical care, education, and research, administrative activities constitute a "fourth mission" of our department. (A&A Case Reports. 2015;5:206–11.)

The May 2014 issue of *Anesthesia & Analgesia* included a collection of articles about the Perioperative Surgical Home. The Perioperative Surgical Home is an approach adopted by the American Society of Anesthesiologists, designed, in part, to increase quality, patient safety, and shared decision making and to decrease costs per patient by reducing waste.[1,2] Among the articles was a review of the economics of the Perioperative Surgical Home.[3] The review showed that substantive opportunities for net cost reduction are for activities wherein anesthesiologists serve principally as managers.[3] Management roles include directing the operating rooms (ORs), running the preoperative evaluation clinic, etc. (See partial list of responsibilities in Table 1).[3–13] Management per se is not part of the traditional tripartite mission of academic medical centers (i.e., patient care, education, and research). As such, faculty time and effort toward management can be "invisible" to traditional measures of professional productivity, such as hours billed, numbers of trainees, hours of lectures, papers published, and grants received.

Academic anesthesia departments have numerous management responsibilities. We assessed whether, in our department, faculty hours in managerial activities were comparable with hours of work for (1) education, (2) research, and/or (3) mandatory indirect patient care efforts. By the latter, we refer to completing clinical notes and billing forms, receiving continuing medical education, and attending mandatory courses (e.g., fire safety training and advanced cardiac life support recertification). We chose the 3 denominators of education, research, and mandatory indirect patient care because they contribute to the traditional tripartite mission of an academic medical center. All are readily recognized by physicians in other (nonanesthesia) specialties serving in academic positions. Because the time commitment of anesthesiology faculty in management roles likely will continue to increase in the future,[14] the lower limits of our estimates may be insightful for other institutions too.

METHODS

The University of Iowa IRB determined that this work was not human subjects research. Analyses were performed with de-identified data.

Description of the Survey

The survey was not designed or performed for this article. The Web-based survey was modeled after the US Medicare time survey, but codes for professional activities were revised to provide greater specificity for our department and to reflect better the activities of our faculty (Table 2). Each surveyed day was from 6:00 AM to 5:59 AM the next day, divided into 30-minute periods. Only a single professional activity code could be assigned to any 30-minute period. Periods during which no professional activity took place (e.g., sleep or personal activities) were to be left blank. Thus, reporting of professional time required active data entry.[a]

The survey was conducted over an 8-week period, starting Monday, February 3, 2014, and ending Sunday, March 28, 2014 (i.e., $N = 56$ days). Each of the 64 faculty members was asked to report all professional activities during 10 randomly selected weekdays (i.e., Monday to Friday) and on 4 randomly selected weekend days (i.e., Saturday or Sunday). Saturdays and Sundays that either followed or preceded a

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[a]Because data entry was not done in real time (e.g., not during patient care), there was oversight of the data collection effort. The Vice Chair (BJH) sent 189 individual reminder e-mails over the 8-week study period.

Table 1. Partial List of Recent Managerial Activities of Anesthesia Department Faculty

Acute and chronic pain management
Health-system patient access to care
Anesthesia informatics
Blood bar coding
Drug reconciliation errors
Implementation of department-wide quantitative neuromuscular blockade monitoring[4]
New billing software interfaced with anesthesia information management system
American Society of Anesthesiologists' physical status accuracy influencing mortality estimates
Anesthesia workroom
Revised analysis of appropriate number of anesthesia technicians[5]
Inventory and capital purchasing
Clinical safety
Departmental practice recommendations (e.g., patients on rivaroxaban having major surgery)
Hospital-wide standardized difficult airway carts
Faculty development
Development and management of new faculty development program[6]
Faculty time survey
Predictive factors for anesthesiologist recruitment
Residents' and Certified Registered Nurse Anesthetists' monitoring of faculty supervision[7,8]
Human resources
Assessing patient satisfaction with individual anesthesiologists
Comparisons of operating room anesthesia labor costs among different types of providers[13]
Faculty, resident, and CRNA staffing and staff scheduling
Ongoing professional performance evaluation metrics, anesthesiologists, and nurse anesthetists
Operating room and intensive care unit management
Capital purchasing
Decisions on numbers of and upgrades to operating rooms and intensive care unit beds
Implant cost contracts[3]
Reducing non-operative times (e.g., prolonged extubations)[9,10]
Regional anesthesia workflow revision
Preoperative evaluation clinic
Development, implementation, and use of daily specialty specific consultants
Revision of call center[11]
Sedation service
Nonoperating room anesthesia scheduling[12]

Table 2. Activities During Surveyed Period of the 64 Anesthesia Department Faculty

Direct clinical care (e.g., supervising OR case or discussing care with family of intensive care unit patient)	53.2%
Indirect patient care efforts	
Clinical care support activities (e.g., preoperative electronic chart review)	8.2%
Mandatory compliance activities (e.g., fire training or licensure issues)	0.4%
Continuing medical education activities (i.e., items for which anesthesiologist received credit)	2.9%
Total	11.5%
Education	
Resident, fellow, and/or Student Registered Nurse Anesthetist teaching (e.g., lectures)	4.9%
Resident, fellow, and/or Student Registered Nurse Anesthetist administration (e.g., assistant program director time)	2.7%
Medical student teaching and administration	1.2%
Other University of Iowa teaching and mentoring (e.g., graduate students)	1.5%
Total	10.3%
Research	
Externally funded research, including meeting attendance	5.2%
Unfunded or departmentally funded research, including meeting attendance	6.8%
Total	12.1%
Management	
Clinical care support (e.g., running operating room control desk)	1.4%
Indirect clinical support administration (e.g., medical director of a surgical suite)	2.9%
Hospital committees (e.g., work in office preparing materials)	0.7%
Collegiate and University committees (e.g., IRB)	1.3%
Departmental administration (e.g., faculty academic reviews and development)	5.8%
Extra-departmental administration	0.8%
Total	12.9%

For units of hours, see the Results and the second paragraph of the Appendix. The denominator for listed percentages is 14,392 half-hour entries. This total excludes the 5543 half-hour entries for time on-call from home but not otherwise working. This total also excludes 1034 entries for presenting at national meetings including travel to the site (e.g., department-sponsored educational event in Mexico during the surveyed period). The faculty reported professional activity on 91.6% of surveyed days (821 of 896, where 896 = 64 faculty members × [10 weekdays + 4 weekends]).

Friday or Monday vacation day were not selected for survey. Weekdays for which a faculty member was not scheduled to work for the University (e.g., part-time faculty, vacation, or sick time) were not selected for the survey. The days selected for each faculty member were distributed randomly among the 8 weeks by using a computer random number generator. This approach was taken because the schedules of some faculty members were correlated on successive days (e.g., a continuous week of working "third call"). The survey was not stratified based on the staff schedule because staff schedules overlap (e.g., hyperbaric medicine in the mornings and OR care in the afternoons).

The faculty received prior notification that the survey would take place during a preceding faculty meeting and by instructional e-mails in the weeks prior to startup. However, each individual faculty member was not told in advance which days would be surveyed. Specific e-mail notification that a day was to be surveyed was received by each faculty member at 6:00 AM on the day to be surveyed.[a]

In our department, essentially all communication other than that regarding individual patients is by e-mail (Microsoft Exchange server). This includes communications that influence compensation. Thus, checking e-mail each morning is a necessary work step for the clinical faculty.

Staff schedules were not available for the 6 of 64 faculty members who do not have clinical responsibilities (e.g., the first author F.D.). Consequently, each of these 6 faculty members was instructed and reminded that the goal "is not to ask for data on days that are vacation … or leave." If such a day was unknowingly selected, it was replaced with another future day (unknown to the faculty) selected at random among the remaining days.

Statistical Analyses

For each faculty, the survey sampled 14 days of their professional activity. Analyses were not performed for individual faculty member on each day (e.g., using a random effects analysis) because the workloads were correlated due to coordination of the staff schedules (e.g., 3 faculty daily

scheduled to the intensive care units). Instead, data were pooled and analyzed over the entire sampling period of $N = 56$ days. The $N = 56$ days were statistically independent observations. For example, for each of the 40 surveyed weekday workdays (i.e., not the Saturdays and Sundays), the mean total hours worked among the surveyed faculty was calculated. The Wald-Wolfowitz runs test for trend or correlation in the ratio among successive workdays had $P = 0.27$ based on the mean and $P = 0.99$ based on the median, indicating randomness.

When comparing overall departmental workloads between types of activities, the primary endpoint was the ratio of the sums of hours for each category of activity (e.g., total hours for management divided by total hours for research). The ratio of 2 sums equals the ratio of the corresponding means because the sums each have the same corresponding numbers of days (i.e., the same sample sizes). We calculated the 1-sided lower confidence limit for the ratio of the sums (i.e., ratio of the means) using Fieller's theorem. The sample size was the $N = 56$ days. Because this method assumes a bivariate normal distribution and is asymptotic, we also repeated the calculations using nonparametric bootstrapping with 10,000 bootstrap samples. Lower confidence limits apply to the managerial question because managerial work increases with greater implementation of the Perioperative Surgical Home.[3]

Secondary Analyses to Assess Validity of Results

Anesthesia information management system (AIMS) data were used as a secondary data source to assess validity of faculty survey entries regarding their patient care activities. The start and stop times of faculty supervision of OR cases (i.e., periods of continuous anesthesia presence) assessed patient care hours. These data are used daily in our department to choose which anesthesiology resident(s) and/or Certified Registered Nurse Anesthetist(s) (CRNAs) are asked to evaluate the quality of each anesthesiologist's supervision.[7,8] Details of the data extraction process, SQL programming, etc., are available in the supplementary content of Reference (7). These data were appropriate for assessing the validity of survey results because the hours faculty spent engaged in continuous clinical care (as documented in the AIMS) could be compared with those reported by the faculty on the survey. These secondary analyses were limited to the faculty doing OR cases because corresponding data are not available for other faculty clinical activities, such as staffing the pain medicine center or the surgical intensive care unit, wherein information system login and logout do not represent periods of continuous supervision (i.e., clinical responsibility).

Because OR data alone were used for assessing survey validity, we repeated the preceding statistical analyses of managerial activity after limiting the analyzed population to the 45 clinical faculty (anesthesiologists) who had at least 1 surveyed day with at least 1 time-based case at certain facility locations covered by the AIMS. These locations are the tertiary surgical suite, ambulatory surgery center, urological surgery suite, electroconvulsive therapy suite, and labor and delivery surgical suite (e.g., for cesarean sections). Labor epidural management and placement were excluded (Current Procedural Terminology [CPT] 59409) because there is not continuous anesthesia presence.

RESULTS

Among the 64 faculty, the median of the total weekly hours of professional activity was 54 hours and the mode was 52 hours. Managerial activities (Table 1) comprised 12.9% of all faculty time survey entries (Table 2, $N = 56$ days). Faculty time in these activities was 126% of time spent on education, 107% of time spent on research, and 112% of time spent on mandatory indirect clinical support.[b] The 95% lower confidence limits calculated using Fieller's theorem were 107%, 89%, and 91%, respectively. The corresponding bootstrap limits were 107%, 89%, and 90%, respectively.

Among the 45 anesthesiologists with clinical activity in the ORs, the median of the total weekly hours of professional activity was 54 hours and the mode was 50 hours. Time in managerial activities was 103% of education, 139% of research, and 104% of mandatory indirect clinical support. The 95% lower confidence limits calculated using Fieller's theorem were 83%, 107%, and 79%, respectively. The corresponding bootstrap limits were 83%, 106%, and 78%, respectively.

DISCUSSION

The effort of our faculty devoted to managerial activities includes quantitative management of the anesthesia department (e.g., strategic planning from statewide data), indirect clinical support administration (e.g., Medical Directorships of the surgical suites), and direct clinical support administration (e.g., running the OR control desk) (Table 1). Such management activity needs to be done for patient care to be provided long-term. Previously, we found that most of our younger faculty lacked formal training in either research or education but had skills for making systems-based changes in the organization (i.e., managerial activity).[13] More recently, we concluded that activities of anesthesiologists as managers have the largest opportunities for net cost reduction from the Perioperative Surgical Home.[3] In the current article, we showed that even before national expansion of such activities, managerial activities in our department took time comparable with the department's educational, research, and mandatory indirect clinical support missions (all estimates ≥100% and lower limits ≥79%).

These findings were important for our university because its tripartite mission excludes administration. Our department and individual faculty are monitored and evaluated based on metrics related to clinical care (e.g., OR days and relative value units), education (e.g., numbers of trainees and lecture hours), and research (e.g., grants and publications). Administrative activities constitute a hidden "fourth mission" of our academic medical center. Our results provide quantitative data documenting hours spent performing necessary managerial activities to facilitate negotiations for recognizing, valuing, and supporting financially these activities.[15,16]

Studies have addressed relative weaknesses in the research production of anesthesia departments relative to other specialties.[17–20] For example, program directors of anesthesiology

[b]Analyses were repeated with weekends excluded. Faculty time in these activities was 118% of time spent on education, 103% of time spent on research, and 112% of time spent on mandatory indirect clinical support. The 95% lower confidence limits calculated using Fieller's theorem were 99%, 85%, and 89%, respectively. The corresponding bootstrap limits were 99%, 84%, and 88%, respectively.

residency programs have less scholarly activity in terms of peer-reviewed publications and federal research funding than their peers.[20] Editorials have emphasized that, if this is to be reversed, future anesthesia faculty must have formal research training as residents or fellows.[21–26] Analogous concepts and concerns apply to management. Substantial management activities of anesthesia departments may be limited unless the faculty learn and apply the scientific advances in managing perioperative services.[12,27–32] One also can argue that managerial hours are substantial because the faculty lack training and thus are slow.

We used the data from the department's time survey because the large time and effort to collect 20,991 observations (Table 2) was substantial. Surveying actual hours spent on management was appropriate because, for management, hours worked (i.e., "attendance") is often the endpoint used for evaluating current or future financial support between an anesthesia department and hospital.[33] Although our lower confidence limits were much less than their respective point estimates (e.g., 139% of research had lower limit of 107%), we provided documented evidence of the time commitment for management. Our results provide a baseline for departments prior to or in lieu of performing their own survey (i.e., management activities are comparable to educational and research activities). However, our department is average sized among US academic departments.[13,34] Many management activities are nearly invariant to the size of the department (Table 1). Larger anesthesia departments may have lesser percentages for management, and smaller departments may have greater percentages. If another department seeks to obtain its own information on total hours worked department wide (i.e., not by individual), an alternative design would be complete sampling (i.e., all faculty reporting on the same few days). Stratify the days into weekends versus weekdays (i.e., nonoverlapping categories substantially influencing work).[35] Then, for each category of professional activity, estimate the ratios using Fieller's theorem. Our secondary analyses (Appendix) are important because they show these findings are real, and thus, the substantial effort of collecting data likely can be skipped entirely or reduced markedly by other academic medical centers. Furthermore, departments with institutions trying to quantify anesthesiologists' clinical hours by using billing or AIMS data can rely on the specific quantitative results in the Appendix to show why doing so is invalid.

The burden of management activities likely is distributed unequally among our faculty. Our results apply only to our department as a whole, not to individual faculty, because administrative responsibilities are not assigned to all faculty members. For example, the authors spend much of their time doing managerial activities. To estimate heterogeneity among faculty, the alternative design of surveying all faculty members on a few days would be appropriate.

APPENDIX

SECONDARY ANALYSES TO ASSESS SURVEY VALIDITY

Secondary analyses were limited to the data from the 45 faculty (anesthesiologists) who performed at least 1 OR anesthesia case during at least 1 surveyed date (see Methods). Of these $N = 46$ days, 40 were weekdays and 6 were weekends. The faculty excluded had no clinical assignments or worked only in the Pain Medicine Center, Intensive Care Unit, etc.

Assessing Face Validity Using National Comparative Data

The hours of professional activity in the Results excluded an additional median 7.0 hours on-call from home weekly but not otherwise working (see Methods and Table 2 footnote). Nevertheless, the median 54 hours weekly was similar to the hours worked by anesthesiologists at other institutions, indicating face validity. In the US, anesthesiologists' "hours spent seeing patients per week" were median "46–50" and mode "46–50."[c] In addition, the median and mode of "hours per week spent on paperwork and administration" were "1–4" hours both for "self-employed" and "employed" anesthesiologists. At the University of Pittsburgh, the expected faculty time commitment was 50 hours per week.[36] In another national study, anesthesiologists' total weekly hours averaged 51 hours per week among women and 57 hours among men.[d]

On each of the 40 weekday workdays (i.e., Monday through Friday), 70.4% ± 2.7% of the 45 surveyed faculty did at least 1 case and, on such days, reported on the survey 9.1 ± 0.2 hours of direct patient care. These are the mean ± standard error, calculated using Fieller's theorem (see Methods). The 9.1 hours is reasonable and thus indicates face validity too. The remaining secondary analyses use the AIMS data.

Assessing Face Validity Using Numbers of Simultaneous Cases

The "numbers of simultaneous cases" (concurrency) in 5-minute increments was obtained from the start and end of each minute of continuous anesthesia presence. For each of the 46 days with at least 1 anesthesiologist surveyed and doing at least 1 case, we calculated the daily maximum number of simultaneous cases.[37] The ratio of the daily maximum number of simultaneous cases to surveyed anesthesiologists was 1.53 ± 0.06. The value was indistinguishable when limited to the 40 weekday workdays (1.52 ± 0.06). If every OR started at the same time every day, and every anesthesiologist supervised 2 cases at all times, then the ratio would have been 2.00. We reviewed the outliers among the 46 days to understand why the value was significantly <2.0 even though the anesthesiologists sometimes supervised up to 3 CRNAs. Conveniently, among 3 of the 5 days with a ratio of 1.0, the minimum was 1.0 for both numerator and denominator (i.e., there was just 1 surveyed anesthesiologist for the day and the anesthesiologist never had >1 case ongoing simultaneously). All 3 of the 5 days were weekends (i.e., the anesthesiologists were assigned to in-house call and thus the outlier days were appropriate, indicating face validity).

[c]Peckham C. Medscape Anesthesiologist Compensation Report 2014. April 15, 2014. Available at http://www.medscape.com/features/slideshow/compensation/2014/anesthesiology. Accessed October 20, 2014. Approximately 1440 anesthesiologists participated in the survey December 11, 2013, through January 24, 2014.

[d]Baird M, Daugherty L, Kumar KB, Arifkhanova A. The anesthesiologist workforce in 2013, a final briefing to the American Society of Anesthesiologists. RAND Corporation 2014 page 52. Available at http://www.rand.org/pubs/research_reports/RR650.html. Accessed October 20, 2014.

The ratios were <2.0 because of weekday night call, weekends, liver transplant call, etc.

Assessing Convergent and Face Validity Using the Daily Total Supervised Hours

From the start and stop times of faculty supervision of OR cases (i.e., from AIMS data), we calculated the "total supervised hours" for the day, defined as the total time that the anesthesiologists surveyed were assigned to OR case(s). For example, if an anesthesiologist were supervising 3 ORs, and each OR had 1 case that lasted precisely from 7:00 AM to 5:00 PM, then the total supervised hours would be 30 hours.

The total supervised hours should be correlated to the surveyed clinical (OR hours), and this is what we found. The Pearson correlation was 0.926 ± 0.017 (N = 46 days). The substantial (significant) correlation shows convergent validity.

The overall ratio between the surveyed OR hours and total supervised hours from the AIMS data (i.e., total surveyed hours/total supervised hours) was 84.2% ± 2.5%.[e] The overall ratio was <100% because anesthesiologists supervised >1 case simultaneously (see above). We investigated the outliers. There were 4 days for which the surveyed clinical OR hours were ≥ 125% of the total supervised hours. All 4 of these days were Sundays, and the anesthesiologists were taking in-house call. Of those 4 days, the 2 days with the largest ratios were also the dates with the smallest surveyed hours of direct clinical care, 11.0 hours. In both circumstances, the surveyed anesthesiologist was working in-house "night call." One of these 2 days, the anesthesiologist worked 7:00 PM through 6:59 AM, and during that period supervised just 1 case, from 00:19 AM through 03:35 AM. The surveyed time ended at 5:59 AM (i.e., 11.0 hours after 7:00 PM). Thus, the ratio was 337%, where 337% = 11.00 hours/3.27 hours. On the other such day, the anesthesiologist supervised 1 case from 7:25 PM through 9:10 PM. Thus, the outliers were reasonable, showing face validity.

Assessing Convergent, Nomological,[f] and Face Validity Using Length of Supervisory Day

We calculated the "length of the supervisory day" worked by the anesthesiologists on days when supervising (or personally performing) at least 1 OR case. We did so using a maximum turnover time of 90 minutes.[3,8] In other words, if the time between periods of supervision from the AIMS data was longer than 90 minutes, only 90 minutes was used in calculating the length of the supervisory day. To interpret the length of the supervisory day, suppose that on the day the anesthesiologist's first time of supervision of an anesthetic with continuous presence was at 7:00 AM and last time was at 5:00 PM. Also, suppose that the anesthesiologist supervised CRNAs in 3 ORs, and every OR had different numbers of cases with staggered start and stop times, the first beginning precisely at 7:00 AM and the last ending at 5:00 PM. Then, the length of the supervisory day would be 10 hours.

The Pearson correlation between the surveyed clinical time and the length of the supervisory day was 0.978 ± 0.005 (N = 46 days). The substantial correlation shows convergent validity.

Because the faculty anesthesiologists supervise >1 OR, the correlation between surveyed hours and length of the supervisory day (from AIMS data) should be significantly greater than that between the surveyed hours and the total supervised hours (above, also from AIMS data). This was indeed so, $P = 0.0021$ (0.978 ± 0.005 > 0.926 ± 0.017), showing nomological validity.[f]

The ratio of the mean surveyed direct clinical care (OR) hours to mean length of the supervisory day was 123.0% ± 1.9%, seemingly reasonable for seeing patients in the morning in preoperative holding areas and caring for patients afterward in the postanesthesia care unit (i.e., showing face validity).[13]

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RECUSE NOTE

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[e]Results would be different if we had used billing data instead of our appropriate use of AIMS login data because the CRNAs bill independently even though they are supervised.[7,8] The numerator of surveyed OR hours would be the same while the denominator from billing data would be falsely smaller. The ratio would be 193.1% ± 8.9% (i.e., making the faculty appear from the billing data to be substantially clinically unproductive). Again, N = 46 days.

[f]Nomological validity is a type of validity in which a measure correlates positively in the theoretically predicted way with measures of different but related constructs.

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