

Research, Education, and Nonclinical Service Productivity of New Junior Anesthesia Faculty During a 2-Year Faculty Development Program

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BACKGROUND: As a specialty, anesthesiology has relatively low research productivity. Prior studies indicate that junior faculty development programs favorably affect academic performance. We therefore initiated a junior faculty development program and hypothesized that most (>50%) new junior faculty would take <50 nonclinical days to achieve a primary program goal (e.g., investigation or publication), and <5 nonclinical days to achieve a secondary program goal (e.g., teaching or nonclinical service).

METHODS: Twenty new junior faculty participated in the 2-year program which had a goal-oriented structure and was supported by nonclinical time, formally assigned mentors, and a didactic curriculum. Goal productivity equaled the number of program goals accomplished divided by the amount of nonclinical time received. Primary goal productivity was expressed as primary goals accomplished per 50 nonclinical days. Secondary goal productivity was expressed as secondary goals accomplished per 5 nonclinical days.

RESULTS: Median primary goal productivity was 0.45 primary goals per 50 nonclinical days (25th–75th interquartile range = 0.00–0.73). Contrary to our hypothesis, most new junior faculty needed >50 nonclinical days to achieve a primary goal (17/20, $P = 0.0026$). Median secondary goal productivity was 0.57 secondary goals per 5 nonclinical days (25th–75th interquartile range = 0.38–0.77). Contrary to our hypothesis, most new junior faculty needed >5 nonclinical days to accomplish a secondary goal (18/20, $P = 0.0004$). It was not clear that the faculty development program increased program goal productivity.

CONCLUSIONS: Even with structured developmental support, most new junior anesthesia faculty needed >50 nonclinical days to achieve a primary (traditional academic) goal and >5 nonclinical days to achieve a secondary goal. Currently, most new anesthesia faculty are not productive in traditional academic activities (research). They are more productive in activities related to clinical care, education, and patient care systems management. (Anesth Analg 2013;117:194–204)

Schwinn and Balser¹ wrote “anesthesiology is at risk of losing its status as a respected academic discipline.” They ascribed this to current anesthesia resident and fellowship training programs that, in their opinion, do not provide adequate research training. Consequently, new anesthesia faculty are not well prepared to engage in research. Similarly, Reves² called for major changes in the recruitment, training, and support of residents and faculty in anesthesia to restore our specialty’s contributions to biomedical research. Reves² recommended all junior faculty should be provided with: (1) encouragement and incentives to engage in research, (2) assistance in identifying and accessing resources needed to achieve their goals, and (3) an

individualized formal mentorship and professional development plan.

There is abundant evidence that junior faculty mentorship favorably affects career outcomes in academic medicine. In a systematic review, mentorship and faculty development programs were shown to: (1) increase professional satisfaction, (2) increase confidence in academic skills and roles, (3) promote research and other professional accomplishments, (4) accelerate professional advancement, and (5) support long-term retention and decisions to remain in academic practice.³ Nevertheless, of the 39 studies analyzed in the systematic review, none were from a department of anesthesia or were focused on anesthesia faculty.³ Flexman and Gelb^{4,5} reviewed the literature regarding mentorship and faculty development programs. They also concluded that these programs are beneficial but could not reference a single report regarding faculty development focused on anesthesia. Flexman and Gelb suggested that the lack of faculty development programs in anesthesia may contribute to the limited academic growth of our specialty.

Despite calls for increased support for professional development and increased academic productivity of new anesthesia faculty, there is almost no information regarding how productive anesthesia faculty actually are in various nonclinical activities. Currently, the only data comes indirectly from the report and supplemental materials provided by Reich et al.⁶ describing the anesthesia faculty compensation system at the Mount Sinai School

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Table 1. New Faculty and Advisor Characteristics

	New faculty (n = 20)	Advisor (n = 24)^a
Female	9 (45%)	4 (17%)
Age at start of program (y)	37 (34–42)	55 (49–57)
North American medical school	7 (37%) ^b	21 (88%)
North American residency	12 (63%) ^b	23 (96%)
Fellowship	15 (79%) ^b	14 (58%)
University of Iowa residency and/or fellowship	12 (63%) ^b	11 (46%)
Other advanced degree	4 (20%) ^c	7 (29%)
Prior faculty position in another department	8 (42%)	13 (54%)
Time between completion of training and start of program (y)	1.5 (1.0–3.0)	22 (14–26)
Time in department prior to start of program (y)	1.0 (0.3–1.5)	16 (11–24)
Academic rank at start of program	Associate: 5 (25%) ^d	Associate: 13 (54%)
	Assistant Professor: 15 (75%)	Professor: 11 (46%)
Time at rank prior to start of program (y)	0.9 (0.0–1.0)	7 (3–15)
Academic track	Clinical: 18 (90%) Tenure: 2 (10%)	Clinical: 11 (46%) Tenure: 13 (54%)

Data are presented as number (percentage) or as median (25th to 75th interquartile range).

^a During the 2 years of the program, 24 of 38 (63%) faculty at the rank of Associate Professor or Professor (either track) served as an advisor. Two of 24 advisors joined program at start of the second year.

^b Nineteen of 20 (95%) new faculty were physicians.

^c Three of 19 (16%) physicians had advanced degrees prior to the start of the program (Ph.D., Masters), and one new faculty was a nonphysician Ph.D. faculty member.

^d Associate is the most junior faculty rank, equivalent to Instructor.

of Medicine.^a In the Mount Sinai compensation system, a first-authored publication was valued as equivalent to 53 clinical days.⁶ This suggested that, for the department as a whole, the average faculty member could be expected to produce one first-authored publication (a primary academic activity) with approximately 50 days of nonclinical time. In this same compensation system, a major external lecture and a case report were valued as equal to 3.7 and 6.7 nonclinical days, respectively.^{6,a} This suggested that, for the department as a whole, the average faculty member could be expected to produce one of these less impactful (secondary) activities with approximately 5 days of non-clinical time.

The University of Iowa's Department of Anesthesia new faculty development program started in July, 2009, with the first cohort of new junior faculty completing the 2-year program in July, 2011. The program had a goal-oriented structure^{7,8} and was supported by non-clinical time, formally assigned mentors ("advisors"), and a didactic curriculum; see Methods. Primary program goals consisted of first-authored publications, grant applications, or new major clinical or educational

components. Secondary program goals included first-authored abstracts and/or national level presentations, lectures for departmental continuing medical education courses, mentorship of student or resident academic projects, committee or administrative activities, teaching activities, and publication coauthorship. Because of the high level of developmental support provided by this program, and reported benefits of such programs,^{3–5} we hypothesized most new junior faculty would have non-clinical productivity exceeding that reported by Reich et al.⁶ Specifically, we hypothesized that the majority (>50%) of new junior faculty would take <50 nonclinical days to achieve a primary program goal, and <5 nonclinical days to achieve a secondary program goal.

METHODS

This audit was performed originally as a quality improvement project. The information reported in this article was reviewed by the University of Iowa IRB and was declared to be exempt (#201205709). Information provided in the Methods, Results, Discussion, and Appendices is limited to preserve the confidentiality of individuals and the department.

Program concepts, aims, resources, expectations, and goals are provided in Appendix I. Program Outline. These were provided to all new faculty and advisors at the start of the program.

New Junior Faculty

The Iowa new faculty development program was a 2-year program for new junior faculty that started on July 1, 2009 to coincide with the start of 2009 to 2010 academic year. Junior faculty were defined as those at the rank of either Assistant Professor (either Clinical or Tenure Track) or Associate (equivalent to Instructor^b). Sixteen junior faculty who, before July, 2009, had appointments at these ranks for 2 years or less were invited to participate. In addition, a second group of 6 junior faculty, who joined the department in July 2009, were invited to participate, resulting in a total of 22 faculty who began program participation. During the first year of the program, 2 new junior faculty (one from each group) left the department. All subsequent results and discussion pertain to 20 new junior faculty who remained in the department and the program for the next full 2 years. The characteristics of these 20 new faculty are summarized in Table 1.

Advisors

Each new faculty member was assigned 2 advisors by the department head (MMT) and vice-chair (BJH). All advisors were at the rank of Associate Professor or Professor. For each new faculty member, at least 1 advisor was a member of the same anesthesia clinical subspecialty group (e.g., cardiothoracic, pediatric, etc.) as the new faculty member. Of the 9 new faculty who were female, 2 (22%) had at least 1 female advisor at the end of the 2-year program. Advisor characteristics are summarized in Table 1. Additional information regarding program advisors is available as an online supplement (Supplement I. New Faculty Program Advisor

^aThe information is provided as online supplement to the published manuscript at <http://www.anesthesia-analgesia.org/content/107/6/1981/suppl/DC1>. Accessed December 15, 2012.

^bInstructor is an entry level faculty position that does not require Board certification or prior demonstration of teaching effectiveness or scholarship. Faculty may hold the rank of Associate for up to 3 years.

Characteristics; see Supplemental Digital Content 1, <http://links.lww.com/AA/A537>). Advisors were expected to help new faculty: (1) define their program goals, (2) develop plans to meet their goals, and (3) to assess new faculty progress. Accordingly, advisors were responsible for writing the university-mandated annual academic reviews of their assigned new faculty, which took place during months 6 and 18 of the program.

Program Seminars

The program included a 2-year series of seminars based on the expressed interests of the new faculty. Information regarding seminar topic selection, attendance, and evaluation is provided as an online supplement (Supplement II. New Faculty Program Seminar Interest, Attendance, and Evaluations; see Supplemental Digital Content 1, <http://links.lww.com/AA/A537>). Although not part of the program, and not required, new faculty were also invited to attend a 20-hour seminar series regarding the design, conduct, and analysis of clinical trials presented by the department head and other faculty. To complete the series, attendees submitted an outline of a proposed clinical study. Nine of 20 (45%) new faculty completed this supplementary program.

Nonclinical Time and Other Support

New faculty nonclinical time is summarized in Table 2. A nonclinical day was defined as any nonholiday weekday when: (1) the faculty was not on vacation or leave, and (2) they were not assigned clinical duties. Days after an overnight in-house call and attendance of professional meetings outside of the department were included as nonclinical days.

The program aimed to provide each new faculty with at least 1 nonclinical day per 5-day work week averaged over a year (~20% nonclinical time). The number of nonclinical days was adjusted individually based on faculty clinical responsibilities, specific administrative responsibilities, and/or specific departmental research or development projects. Nonclinical days were usually provided as 1 to 2 days during a week. No physician faculty had extended periods (many days or weeks) without clinical responsibilities. As reported in Table 2, the median percentage of received nonclinical time was 25% (1.2 days per week), as compared to the national average of 15% to 16%.⁹

The program included financial support for specific laboratory or clinical research and to advance departmental initiatives coordinated by new faculty, including development of new clinical services and clinically related technologies (e.g., informatics). This financial support was primarily for salary support of research assistants (~75% of the total) with the remainder for research administration, some faculty salary support, and purchase of supplies and equipment.

Program Goals

Program goals were categorized as: (1) specialized training/skills, (2) primary program goals, and (3) secondary program goals; see Appendix I. Program Outline.

New faculty were expected to attain at least 1 specialized training/skills goal by the end of the 2-year program

period. New faculty also were expected to accomplish at least 1 primary goal or at least 5 secondary goals by the end of the program.

Primary program goals were based on the primary promotion criteria of the tenure and clinical tracks at the University of Iowa. These accomplishments establish the faculty member as either an investigator, or as a clinical or educational leader/innovator. A first-authored publication, grant application, or a new major clinical or teaching program counted as a primary goal. Secondary goals placed emphasis on education and nonclinical service. They included lecture and workshop presentations in departmentally sponsored continuing postgraduate continuing medical education courses, first-authored abstracts, case reports, and book chapters. Presentation of a standard resident didactic lecture did not count as a secondary goal. Additional information regarding program goals is provided as an online supplement (Supplement

Table 2. New Faculty Nonclinical Time

	Preprogram (n = 15) ^a	First and second years of program (n = 20)	Cumulative (n =20) ^b
Nonclinical days per week	1.2 (1.0–1.4)	1.2 (1.1–1.6)	1.2 (1.1–1.6)
Nonclinical percentage (% weekdays) ^c	23% (19–28)	25% (22–33) ^d	24% (22–31)
Nonclinical days per faculty member per academic year for 100% appointment ^e	53 (51–66)	56 (51–77)	55 (49–72)
Total nonclinical days per faculty member (absolute number) ^f	74 (49–118)	113 (101–153)	162 (126–233)

Data are presented as median (25th to 75th interquartile range).

^a Preprogram data pertain only to faculty who had appointments before start of the program and who remained in the program for the full 2 years (n = 15). The median preprogram interval for these 15 faculty was 1.0 years (25th–75th interquartile range = 0.9–1.9 y).

^b Cumulative data combine both the preprogram and program periods.

^c Based on survey data from the Society of Academic Anesthesia Chairs, the national medians for nonclinical time in United States academic anesthesia departments were 15% (2009–10)⁹ and 16% (2010–11); (2010–11 data: Personal communication, S. Kheterphal, University of Michigan).

^d Of the 15 faculty who had appointments before the start of the program, median nonclinical time preprogram was 23% and was 24% during the 2 years of the program. The Hodges-Lehmann estimate for the median individual increase equaled +3.5% (absolute) (95% CI = 2.0%–5.7%); Wilcoxon signed ranks *P* = 0.0004.

^e The values are the number of nonclinical days received by faculty over a single year, adjusted for the duration of their appointment and their full time equivalent (FTE) for the year. For example, if a faculty member received 50 nonclinical days with an appointment for the entire 12-month academic year at 100% FTE, the reported value would 50. On the other hand, if a faculty had received 40 nonclinical days over the 12-month year with a 80% FTE appointment, the adjusted value would be (40/(0.8))= 50. Alternatively, if a faculty had received 46 nonclinical days with a 100% FTE appointment, but they had been present only 11 of the 12 months of the year, the adjusted value would be (46/(11/12))= 50.

^f The values provided are the absolute number of nonclinical days received, without adjustments. Using the examples above, the values reported would be based on absolute values of 50, 40, and 46, respectively.

Table 3. Qualitative Assessments of Program Effectiveness

	First year		Second year	
	New faculty (n = 20)	Advisors (n = 19) ^a	New faculty (n = 20)	Advisors (n=18) ^a
Program value in key domains ¹⁰				
Teaching: clinical, didactic, or both	15 (75%)		18 (90%)	
Scholarship/Research: creating and disseminating new knowledge	15 (75%)		15 (75%)	
Service or administrative activities	11 (55%)		15 (75%)	
Professional development: writing skills, speaking skills, analysis skills, time management, etc.	17 (85%)		20 (100%)	
Clinical care ^b	8 (42%)		14 (74%)	
Program value in attaining goals				
In defining professional goals	16 (80%)	31 (78%)	15 (75%)	29 (73%)
In developing plans and strategies to meet professional goals	17 (85%)	31 (78%)	15 (75%)	28 (70%)
In actually attaining professional goals	16 (80%)	22 (55%)	15 (75%)	29 (73%)
Provision of resources				
Nonclinical time ^b	11 (58%)	25 (66%)	13 (68%)	21 (55%)
Professional development resources: funding, computer support, educational support	16 (80%)	30 (75%)	16 (80%)	31 (78%)
Advice, counseling, mentorship, and progress assessments	18 (90%)	32 (80%)	19 (95%)	38 (95%)
Overall impression				
The department has created an environment that aids, fosters, and supports development	17 (85%)	33 (83%)	17 (85%)	35 (88%)
Understand expectations of the New Faculty Program	18 (90%)	36 (90%)	20 (100%)	38 (95%)
The New Faculty Program and other departmental programs are worth the extra time and effort	17 (85%)	35 (88%)	18 (90%)	37 (93%)

Data are presented as number (percentage) of new faculty and advisors who answered either 4 (agree) or 5 (strongly agree) to program assessment questions ($n = 14$).

^a The number of advisors is the number who were participating at the end of each year. Because some advisors left the department or program, these values do not equal the total number of advisors who participated over the entire duration of the program reported in Table 1. The denominator for advisor assessments is 40 to correspond to 40 new faculty-advisor pairs.

^b Denominator is 19 clinical faculty.

III. New Faculty Program Goals; see Supplemental Digital Content 1, <http://links.lww.com/AA/A537>).

Assessments

At the end of each year of the program, each new faculty member gave a formal presentation to the department head, vice-chair, and their advisors regarding their progress toward meeting their program goals. Thereafter, each new faculty member assessed the effectiveness of the program and the mentorship provided by his/her advisors. Likewise, at the end of each year, advisors evaluated the effectiveness of the program, their relationship with their new faculty, and the advisor's role in the program. Qualitative assessments of program and mentorship effectiveness are summarized in Table 3¹⁰ and Table 4,^{11,12} respectively. Additional information regarding assessment instruments and mentorship characteristics is provided as an online supplement (Supplement IV. Assessment Instruments and Mentorship Characteristics; see Supplemental Digital Content 1, <http://links.lww.com/AA/A537>).

Statistical Analysis

The primary outcome measure was program goal productivity. We hypothesized that most (>50%) new junior faculty would take <50 nonclinical days to achieve a primary program goal. Primary goal productivity was calculated as the total number of primary goals accomplished by each faculty member over a defined period (preprogram, during the program), divided by the total number of nonclinical days that the faculty member received during that period. The ratio was then normalized to 50 nonclinical days.^c

We also hypothesized that most (>50%) new junior faculty would take <5 nonclinical days to achieve a secondary

program goal. Secondary goal productivity was calculated as the total number of secondary goals accomplished by each faculty member over a defined period (preprogram, during the program), divided by the total number of nonclinical days that the faculty member received during that period. For secondary goals, this ratio was normalized to 5 nonclinical days. Estimates for 25th and 75th percentiles for program goal productivity were calculated using the Cleveland method.

Primary and secondary goal productivity were analyzed separately because they were not significantly correlated ($P = 0.95$, Kendall $\tau_b = -0.017$, 95% asymptotic confidence interval [CI], -0.36 to $+0.33$).

As shown in Results, lower boundaries for the number of nonclinical days used to accomplish primary and secondary goals were estimated by calculating the percentage of the faculty who obtained at least 1 primary goal per year per 50 nonclinical days and the percentage who obtained at least 1 secondary goal per 5 nonclinical days; ($n = 20$). Specifically, the 2-sided binomial test was used to compare 50% (10/20) to the percentage of faculty who accomplished <1 primary goal per 50 nonclinical days. The test was used also to compare 50% (10/20) to the percentage who accomplished <1 secondary goal per 5 nonclinical days.

As a secondary analysis, we tested whether goal productivity changed during the program period compared with the preprogram period ($n = 15$ faculty

^cOur initial plan was to calculate nonclinical productivity as nonclinical days per goal (days/goals). However, some faculty accomplished zero primary goals during the program. Hence, dividing their nonclinical days by their primary goals (zero) resulted in values of infinity. By calculating and reporting nonclinical productivity as goals per nonclinical day (goals/days), faculty who accomplished zero goals had productivity values of zero.

Table 4. Qualitative Assessments of Mentorship Effectiveness

	First year		Second year	
	New faculty (n = 20)	Advisors (n = 19) ^a	New Faculty (n=20)	Advisors (n = 18) ^a
Mentorship quality ¹¹				
The relationship is very effective	33 (83%)	32 (80%)	38 (95%)	30 (75%)
Very satisfied with the relationship	34 (85%)	30 (75%)	38 (95%)	28 (70%)
Effective use of the advisor	30 (75%)	22 (55%)	30 (75%)	24 (60%)
High-quality relationship and interactions	30 (75%)	31 (78%)	35 (88%)	35 (88%)
Both parties benefited from interactions and relationship	29 (73%)	29 (73%)	32 (80%)	31 (78%)
Career mentoring ¹²				
Advisor takes a personal interest in new faculty's career	28 (70%)	37 (93%)	33 (83%)	37 (93%)
Advisor helps coordinate new faculty's professional goals	28 (70%)	28 (70%)	32 (80%)	31 (78%)
Advisor devotes special time and consideration to new faculty's career	29 (73%)	28 (70%)	34 (85%)	33 (83%)
Psychosocial mentoring ¹²				
Sharing personal problems	18 (45%)	18 (45%)	18 (45%)	13 (33%)
Exchanging confidences	25 (63%)	21 (53%)	22 (55%)	19 (48%)
Friendship	26 (65%)	32 (80%)	28 (70%)	29 (73%)
Role modeling ¹²				
Advisor as role model	29 (73%)	36 (90%)	36 (90%)	39 (98%)
Advisor as motivator	32 (80%)	31 (78%)	35 (88%)	33 (83%)
Advisor as teacher and guide	31 (78%)	32 (80%)	39 (98%)	35 (88%)
Other				
Communication is sufficiently frequent	31 (78%)	24 (60%)	35 (88%)	31 (78%)
The other is readily available	36 (90%)	32 (80%)	36 (90%)	32 (80%)
Continue to work together next year	35 (88%)	36 (90%)	37 (93%)	31 (83%)

Data are presented as number (percentage) of new faculty and advisors who answered either 4 (agree) or 5 (strongly agree) to mentorship assessment questions ($n = 17$). The denominator for all values is 40 to correspond to 40 new faculty-advisor pairs.

^aThe number of advisors is the number who were participating at the end of each year. Because some advisors left the department or program, these values do not equal the total number of advisors who participated over the entire duration of the program reported in Table 1.

with appointments prior to the start of the program). We calculated the differences in goal productivity for primary and secondary goals between these 2 periods. The Wilcoxon signed ranks test was used for inferential testing. The Hodges-Lehman estimate was calculated for the 95% CI of the median increase in productivity. Hodges-Lehman is the statistical method to calculate the CI for the median of a symmetric distribution of numbers.

All P values are 2-sided and exact. No corrections were made for multiple comparisons (see below). All analyses were performed using StatXact-9 (Cytel Software Corporation, Cambridge, MA).

RESULTS

Faculty program goal accomplishments are summarized in Table 5. Figure 1 shows primary and secondary goal productivity of the 20 new faculty during the program period. During the program, median primary goal productivity was 0.45 primary goals per 50 nonclinical days (25th–75th interquartile range = 0.00–0.73). As shown in Figure 1, most (>50%) of our new faculty achieved a primary goal productivity of <1 primary goal per 50 nonclinical days (17/20; $P = 0.0026$). Because most of our new faculty received approximately 50 nonclinical days each year, this means that most of our new faculty took more than a calendar year to accomplish a primary program goal.

During the program, median secondary goal productivity was 0.57 secondary goals per 5 nonclinical days (25th–75th interquartile range = 0.38–0.77). Figure 1 shows that most (>50%) of our new faculty achieved a secondary goal productivity of <1 secondary goal per 5 nonclinical days (18/20; $P = 0.0004$). Therefore, most of our new faculty took more than a calendar month to accomplish a secondary goal.

As a secondary analysis, Figure 2 shows changes in primary and secondary goal productivity of the 15 faculty who had appointments in the department before the start of the program, comparing their productivity during the program to their productivity before the program. For primary goals, the Hodges-Lehman estimate for the median productivity change is +0.58 primary goals per 50 nonclinical days, (95% CI = -0.04 to +1.21); $P = 0.068$. For secondary goals, the Hodges-Lehman estimate for the median productivity change is +0.18 secondary goals per 5 nonclinical days (95% CI = 0.02–0.35); $P = 0.021$. Because of the small sample size, borderline P values, and lack of randomization of sequence, we cannot conclude that program goal productivity increased during the program period.

As an additional secondary analysis, we tested for and detected association between the amount of program-based financial support and primary goal productivity ($P < 0.0001$; $\tau_b = 0.76$, 95% CI = 0.59–0.94). Among the 17 faculty achieving <1 primary goal per 50 nonclinical days, the median amount of program-based financial support was \$0 (range: \$0–\$8000). Among the other 3 faculty who achieved >1 primary goal per 50 nonclinical days (Fig. 1), the median support was substantially larger (65% of all new faculty program financial support), but cannot be specified to maintain confidentiality (see first paragraph of Methods). There was no association between the amount of financial support and secondary goal productivity ($P = 0.83$, $\tau_b = -0.04$, 95% CI = -0.41 to +0.32).

DISCUSSION

Our primary hypotheses were not supported. Even in the setting of a structured faculty development program, most new junior faculty required >50 nonclinical days to achieve

Table 5. New Faculty Program Goals, Expectations, and Productivity

	Preprogram (n = 15) ^a	First and second years of program (n = 20)	Cumulative (n = 20) ^b
Specialized training/skills			
Total training/skills goals attained by all new faculty	11.0	20.5	31.5 ^c
Training/skills goals attained per faculty	0.5 (0.0–1.0)	1.0 (0.5–1.3)	1.5 (1.0–2.0)
Faculty meeting training/skills goal expectation	7 (47%)	13 (65%)	19 (95%)
Primary program goals			
Total primary goals attained by all new faculty	7.3	44.5	51.8 ^d
Primary goals attained per faculty	0.0 (0.0–1.0)	1.0 (0.0–1.0) ^e	1.0 (0.0–2.3)
Faculty meeting primary goal expectation	5 (33%)	13 (65%)	14 (70%)
Primary goal productivity (goals per 50 nonclinical days)	0.00 (0.00–0.34)	0.45 (0.00–0.73) ^f	0.35 (0.00–0.56)
Secondary program goals			
Total secondary goals attained by all new faculty	106	324.5	430.5 ^g
Secondary goals attained per faculty	6.5 (3.3–8.3)	14.25 (8.5–19.9) ^h	19.5 (9.8–27.4)
Faculty meeting secondary goal expectation	10 (67%)	20 (100%)	20 (100%)
Secondary goal productivity (goals per 5 nonclinical days)	0.27 (0.14–0.50)	0.57 (0.38–0.77) ⁱ	0.51 (0.30–0.77)

Data are presented as number, median (25th–75th interquartile range), or number (percentage).

^a Preprogram data pertain only to faculty who had appointments before start of the program and who remained in the program for the full 2 years (n = 15). The median preprogram interval for these 15 faculty was 1.0 years (25th–75th interquartile range = 0.9–1.9 y).

^b Cumulative data combine both the preprogram and program periods.

^c Fifty percent of all training/skills expectations were met by attending clinical or scientific workshops and 29% were met by matriculation in our department's clinical trials seminar series.

^d Thirty-five percent of primary goals were grant applications as principal investigator, 23% were clinical trials as principal investigator, and 17% were first-authored publications in peer-reviewed journals.

^e There was a trend toward an association between the number of primary goals accomplished and the number of nonclinical days that were received (P = 0.16; $\tau_b = 0.25$; 95% confidence interval [CI] = -0.05 to +0.55).

^f There was no association between primary goal productivity and the number of nonclinical days that were received. (P = 0.95; $\tau_b = 0.02$; 95% CI = -0.33 to +0.30). There was an association between primary goal productivity and the amount of financial support provided toward program goals (P < 0.001; $\tau_b = 0.76$; 95% CI = 0.59–0.94).

^g Twenty-seven percent of secondary goals were from providing lectures for departmental continuing medical education courses, 14% from mentorship of student or resident academic projects, 13% from committee or service activities, 12% from teaching activities, 12% from abstract and national level presentations, and 7% from publication coauthorship.

^h There was a weak association between the number of secondary goals accomplished and the number of nonclinical days that were received (P = 0.036; $\tau_b = 0.34$; 95% CI = 0.069–0.62).

ⁱ There was no association between secondary goal productivity and the number of nonclinical days that were received (P = 0.39; $\tau_b = -0.15$; 95% CI = -0.48 to +0.19). There was no association between secondary goal productivity and the amount of financial support provided toward program goals (P = 0.83; $\tau_b = -0.04$; 95% CI = -0.41 to +0.32).

a primary program goal and >5 nonclinical days to achieve a secondary goal.

A key question is whether other academic anesthesia departments providing equivalent levels of support for all new junior faculty might observe similar levels of nonclinical productivity for their average new junior faculty. We

contend our observations are likely to be relevant to other departments for 2 reasons. First, the P values for primary goal (P = 0.0026) and secondary goal productivity (P = 0.0004) are sufficiently small as to have a strong likelihood of reproducibility by others.¹³ Second, our program took place in a clinical and educational environment similar to

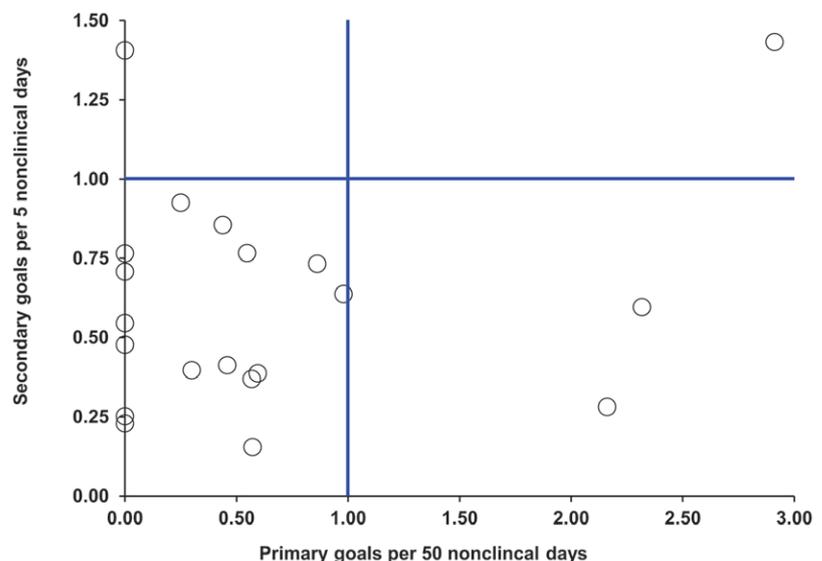


Figure 1. Individual new faculty primary and secondary goal productivity during the 2-year program, (n = 20). The vertical line shows the boundary for primary goal productivity, 1.00 primary goals per 50 nonclinical days. The horizontal line shows the boundary for secondary goal productivity, 1.00 secondary goals per 5 nonclinical days.

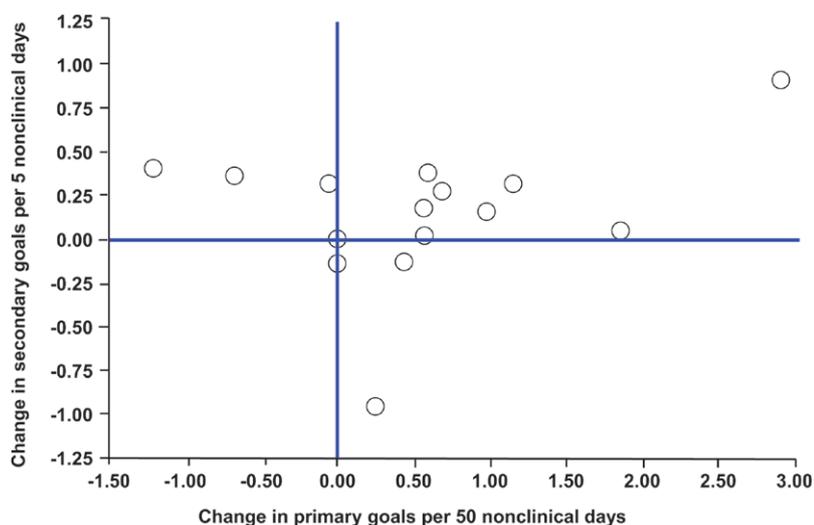


Figure 2. Individual change in primary and secondary goal productivity for faculty with appointments before start of the program ($n = 15$). Vertical and horizontal lines show zero change for primary and secondary goal productivity, respectively.

many academic anesthesia departments. Specifically, our department is currently composed of 64 faculty (57 clinical faculty), 40 residents (clinical anesthesia years -1, -2, and -3), 39 certified registered nurse anesthetists, 23 student registered nurse anesthetists, and 11 fellows, who collectively care for patients in 41 operating rooms, 40 critical care beds, and 2 pain clinics. These characteristics place our department near the “average” of United States academic anesthesia department in size and scope.⁹

Another key question is whether our observations are of potential value to other academic anesthesia departments. We contend that they are because academic anesthesia chairs reported that their 2 most difficult management challenges were “fostering research and scholarship” and “maintaining revenue to support faculty.”¹⁴ This report is the first in anesthesia to describe a system to categorize nonclinical (research, teaching, and nonclinical service) activities (primary and secondary goals) and to quantify new faculty productivity in accomplishing these activities. Accordingly, our methods and findings regarding the nonclinical productivity of new junior anesthesia faculty, and departmental investment in developmental support (nonclinical time, mentorship, and financial) to attain it, may serve as models and benchmarks for other departments when they assess the nonclinical (academic) performance of their faculty and/or in financial planning to support such activity.

Primary program goals placed emphasis on investigation and published scholarship. During the 2-year program period most (>50%) of our new faculty required >50 nonclinical days (a year’s worth of nonclinical time) to accomplish a primary program goal. We suggest that this level of academic productivity is not sufficient to start or sustain traditional research careers, garner external funding, or to earn tenure. Likewise, most departments will find it challenging to justify and sustain department-wide nonexternally funded nonclinical time at the level provided in this program (~25%) with an average primary goal (academic) productivity at the level we observed. Although some individual faculty members will exceed this average level of productivity, our focus is the majority, or average, faculty member. We observed an association between program-based financial

support and primary goal productivity. Because most primary program goals were research related, and because most of our faculty had <30% nonclinical time, faculty who engaged in research or major project development needed additional assistance to organize and conduct such projects. Therefore, the association between financial support and primary goal productivity is expected. However, we wish to emphasize that the projects preceded the funding, not the other way around. Program-based financial supported primary goals, but it did not create or lead to the projects per se.

During the 2-year program period, many more secondary program goals were accomplished than primary program goals (324.5 vs 44.5, respectively) and, accordingly, median secondary goal productivity was more than 10-fold greater than primary goal productivity. Secondary program goals largely consisted of educational activities, (e.g., teaching in departmentally sponsored continuing medical education courses, mentorship of student and resident projects, and high scores in didactic and clinical teaching), managing clinical divisions, and participation in hospital committees. Although first-authored case reports, book chapters, and national level abstracts and presentations also satisfied secondary goal requirements (which may be considered forms of traditional scholarship), these comprised only 12% of the secondary goals that were accomplished by our new faculty. The vast majority of secondary goals accomplished by our new faculty were more closely aligned with promotion criteria in the clinical track, emphasizing education, direct patient care, and the management and development of clinical practice systems. There was no association between the amount of financial support and secondary goal productivity ($P = 0.83$, $\tau_b = -0.04$, 95% CI = -0.41 to $+0.32$). Because most secondary program goals accomplished by our new faculty were derived directly or indirectly from clinical and/or teaching activities, additional support beyond existing staff and secretarial support was rarely needed to accomplish secondary goals. Therefore, the lack of association between program-based financial support and secondary goal productivity is expected.

Almost all (19/20, 95%) of our new faculty were physicians and, of this group, most (14/19, 74%) received <30%

nonclinical time. Accordingly, most of our new faculty functioned as clinician-educators, with most (>70%) of their professional time and effort going to providing direct patient care and teaching in that context. Most (>80%) of the secondary program goals that were accomplished by our new faculty were derived directly or indirectly from clinical and/or teaching activities. Thus, we hypothesize that the majority of new anesthesia faculty are most familiar with the activities of the clinician-educator and are psychologically and experientially prepared to engage in these activities as soon as they become faculty.

In contrast, even though most of our new physician faculty had fellowship training (15/19 physicians, 79%), most had low primary goal productivity, and some (7/19, 37%) had none. This is consistent with the lack of formal research training and experience offered by most 12-month clinically focused fellowships in anesthesia subspecialties.^{1,2} The structure and content of our new faculty development program met Reves² recommendations for: (1) encouragement and incentives to engage in research, (2) assistance in identifying and accessing resources needed to achieve their goals, and (3) individualized formal mentorship and professional development plan. Even though the program appeared to be well regarded by the new faculty, it is not clear that it actually affected goal productivity, particularly primary goal productivity. Based on our findings, we hypothesize that department-level faculty development programs, by themselves, may not be able to substantively increase the traditional academic (research) productivity of the average faculty member in our specialty.

Our results show that even with an intensive development program to support and promote nonclinical productivity, 20% to 25% (departmentally funded) nonclinical time is not likely to be sufficient for most new faculty to be productive in research at levels that can lead to or sustain traditional academic advancement and garner external funding. We agree with Reves² that, for our specialty to increase its contribution to biomedical research, anesthesia faculty would need to be paid less, in order to decrease the cost and increase the amount of nonclinical time for research. However, currently, recruiting and retaining new anesthesia faculty while paying lower salaries (in exchange for more nonclinical time) may be practically impossible because of resident perceptions of their medical school debt.¹⁵ Thus, the current balance between salary and nonexternally funded (departmentally funded) nonclinical time favors faculty productivity in secondary academic activities, and these may need to be the objective for most new anesthesia faculty. Secondary academic activities are an excellent pathway for anesthesiologists' increasing involvement in systems based practice, informatics, quality improvement, and other medical director roles outside of traditional operating room care.

Two major, and largely unavoidable, limitations of this report are its observational nature and small sample size ($n = 20$). Participating new faculty were aware that: (1) they were participating in a new experimental program, (2) their nonclinical productivity was being monitored, and (3) their program and advisor assessments would be known to program leadership. Accordingly, both their behaviors and assessments of program effectiveness may have been influenced as a result of a Hawthorne effect (special attention)

and/or their lack of anonymity. Observational studies with small sample sizes may lack statistical power to detect relationships (e.g., change in goal productivity) and, even when P values are significant (i.e., <0.05) such studies may have low reproducibility.¹³ In order to have larger sample sizes than reported here, individual departments (e.g., our department) will need to collect nonclinical productivity data over many years. However, it is possible that pooling of nonclinical productivity data from noncontemporaneous groups of faculty may not be valid. Alternatively, larger sample sizes could be obtained if multiple anesthesia departments were to collaborate to establish highly similar development programs with uniform assessments of nonclinical productivity. However, to our knowledge, at the present no other academic anesthesia departments in the United States have a program of this type, so data pooling is not currently possible. Measuring the effect of faculty development programs on academic productivity requires either: (1) randomizing new faculty to program participation or not (control), or (2) observing and comparing the productivity of faculty in development programs with faculty who are not (control). Because both of these approaches have major limitations, we elected to have faculty serve as their own historical controls, comparing their nonclinical productivity during the program with nonclinical productivity in the immediate preprogram period ($n = 15$).

Summary

As suggested by Reves² and by Schwinn and Balser,¹ at the present, it appears that most new junior anesthesia faculty are not prepared to be investigators after completing residency or fellowship training. Although our department-level faculty development program was evidence-based,³⁻⁵ goal-oriented,^{7,8} and well regarded by new junior faculty, it is not certain that it increased primary goal (academic) productivity. Our results suggest that, even with an structured development program and a substantive amount of nonclinical time, anesthesia departments should expect that most new faculty will need a considerable start-up period, at least 2 calendar years, before traditional academic (primary) goals can begin to be accomplished, if at all. Nevertheless, this level of departmentally funded academic productivity is not likely to develop or sustain faculty research careers or to be financially sustainable for most anesthesia departments. In contrast, new junior faculty appear to be much more productive in activities that are more directly related to their principal daily activities, namely, (1) providing clinical care and teaching in that context, and (2) developing and managing clinical care systems. Encouraging new anesthesia faculty to focus on these latter activities will not reverse our specialty's challenges in biomedical research, but is a potential pathway toward their success and anesthesiologists' widespread involvement in clinical enterprises. ■■

APPENDIX I: DEPARTMENT OF ANESTHESIA NEW FACULTY DEVELOPMENT PROGRAM

I. Concepts and Principles

1. The department's goal is to create an environment to aid, foster, and support the professional development of the faculty.

2. Each faculty member's development is individualized, based on their unique goals, interests, and strengths.
 3. The areas for development are clinical care, teaching, scholarship, service, and professionalism as defined as
 - a. Clinical care: To increase quality (doing what you do well) and proficiency (increasing the variety of things you can do and/or the skills you possess).
 - b. Teaching: To increase effectiveness in both clinical and didactic settings.
 - c. Scholarship: To create new knowledge and disseminate it.
 - d. Service: To advance the needs and goals of the department, college, hospital, profession, or society.
 - e. Professionalism: To exhibit personal conduct that is consistent with and promotes each of the other areas.
 4. Responsibilities of each faculty member.
 - a. Each faculty member needs to define his/her professional goals.
 - b. Each faculty member needs to develop plans to meet his/her goals.
 - c. Each faculty member is expected:
 - (i) To be accountable for resources provided to him/her (e.g., nonclinical time, funding).
 - (ii) To meet their goals within a defined time frame.
 - (iii) To meet the expectations of the department.
 5. The Department is responsible for providing faculty with:
 - a. Nonclinical (academic) time.
 - b. Academic resources (funding, computer support, educational support).
 - c. Advice, counseling, mentorship, and progress assessments.
- II. Program Aims and Construct
1. The aim of the New Faculty Program is to encourage and support academic development of new faculty through the provision of structure, resources, advice, written expectations, and defined end points.
 2. The Program will initially apply to all Associates and Assistant Professors who are in their first or second year.
 3. The Program will take place over 2 years. After 2 years, the conventional processes of faculty development and annual reviews will continue to be in place.
 4. The aim of the New Faculty Program is to establish:
 - a. The department's expectation of new faculty that they will continue to develop as clinicians, teachers, and scholars.
 - b. The department's expectation that senior faculty will share their experience and expertise and be engaged in the growth of the new generation of faculty.
 - c. A culture of shared values regarding what it is to be an academic anesthesiologist at the University of Iowa.
- III. Program Resources and Oversight.
1. The department of Anesthesia will provide each new faculty member supplemental financial support over the 2-year period of the Program to aid academic and professional development.
 - a. Additional departmental funding may be provided through other mechanisms, such as Lundsford fellowships, etc.
 2. All requests to utilize Program funds are to be in the form of a written proposal to justify the expenditures (aims, goals, end points).
 3. Funds may be used to support:
 - a. Nonclinical days (NCA) beyond the level assigned by the Department Head.
 - (i) The "cost" of each NCA day (~\$1200/d) is based on faculty salary and cost to cover clinical duties.
 - b. Project support personnel (research nurses, data collection/analysis).
 - c. Project development materials (software, assays, etc.).
 4. Funds may not be used to support travel or meeting attendance except as individually approved by the Department Head or Vice Chair for Faculty Development.
 5. The Vice-Chair for Faculty Development will be primarily responsible for Program oversight, reporting to the Department Head.
- IV. Senior Faculty Advisors
1. Each new faculty member will be paired with 2 senior members of the faculty who will serve as advisors.
 - a. Advisors are selected by the Department Head and Vice Chair for Faculty Development.
 2. Advisors are encouraged to make themselves available to their advisees as freely as possible (daily, weekly, monthly), providing council with regard to:
 - a. Clinical care issues and questions.
 - b. Approaches to clinical teaching.
 - c. Approaches to didactic teaching.
 - d. Initiation and development of new and creative ideas and projects, of either a scholarly and/or clinically innovative nature.
 3. The new faculty member and both of his/her advisors are expected to meet as a group at least every 3 months to discuss progress.
 - a. The Vice-Chair for Faculty Development and/or Department Head will participate in the group meeting at least every 6 months.
 4. Written Reviews by the advisors:
 - a. At month 6 of the Program (usually, December–January), the 2 advisors will serve as the primary reviewers for the annual academic review.
 - b. At month 12 of the Program (June–July), the 2 advisors will provide a brief (≤ 1 page) review that documents meetings that have taken place and their joint assessment of the new faculty member with regard to clinical service, teaching, and academic/professional development.
 - c. At month 18 of the program (usually, December–January), the 2 advisors will serve as the primary reviewers for the annual academic review.
 - d. At approximately 2 years into the program (June–July), the 2 advisors will provide a brief (≤ 1 page) final review that documents meetings that have taken place and their joint assessment of the new faculty member with regard to clinical service, teaching, and academic/professional development.
 5. At 1 year into the program, the Department Head will assess the relationships between the new faculty and their advisors and the effectiveness of the interactions.

- a. Criteria for the assessment will be based primarily on the attainment of goals (Sections VI. and VII.).
- b. Advisors may be reassigned at the discretion of the Department Head.

V. New Faculty Seminar Series

1. Approximately every 2 months (12 sessions over 2 years), new faculty are expected attend a seminar in a series specifically emphasizing elements essential to new faculty development.
 - a. Seminar topics will be presented on an alternating year-A/year-B cycle such that each year's new faculty will receive the entire 2-year series, without repetition.
2. The New Faculty Seminar Series will be directed by the Vice-Chair of Faculty Development, who is responsible for its content and scheduling.
 - a. Examples of content include: (1) University and collegiate requirements for promotion; (2) public speaking; (3) writing for publication; (4) essential software skills (Word, PowerPoint, Excel); (5) time management, etc.
3. New faculty members are expected attend at least 75% of all seminars (8/12 over 2 years).

VI. Early Goals

1. At the end 6 months in the Program (usually, December-January), each new faculty member is expected, with the assistance of his/her advisors, to define in writing a series of goals to be obtained by the end of the 2-year Program (see Section VII).
 - a. Alternative goals may be defined with preapproval of the Department Head.
2. At the end of 1 year in the Program, the new faculty member is expected provide a brief (≤ 15 minutes) summary of activities directed toward accomplishing their goals/aims (above) to their advisors, the Vice-Chair for Faculty Development, and the Department Head.

VII. Two Year Goals

A. Specialized Training/Skills

At the end of 2 years in the Program, the new faculty member is expected to have accomplished *at least 1* of the following goals. (Alternative goals may be defined with preapproval of the Department Head).

1. Completion of the Department of Anesthesia Clinical Trials Seminar Series.
2. Enrollment and continued participation in the K30 Program.
3. Enrollment and continued participation in an advanced degree program (e.g., Masters in Public Health, Masters Medical Education, PhD).
4. Participation in at least 4 College of Medicine-sponsored teaching workshops.
5. Participation in a least 2 multiday clinical or research workshops sponsored by either a national anesthesia/critical care society (e.g., American Society of Anesthesiologists, Society of Cardiovascular Anesthesiologists, International Anesthesia Research Society, American Society of Regional Anesthesia), or other academic institution (e.g., Harvard Simulation Course).

B. Primary Goals

At the end of 2 years in the Program, the new faculty member is expected to have accomplished *at least 1* of the

following goals. (Other primary goals may be defined with preapproval of the Department Head).

1. A manuscript has been submitted to a peer-reviewed journal
 - a. The new faculty member is the first author.
 - b. Only original research or review articles qualify.
 - c. Only established in-print journal qualify.
 - (i) Internet-based journals are excluded.
2. An IRB-approved clinical trial or record-review study is started.
 - a. The new faculty member is the primary investigator.
 - b. At least 30% of the expected patient enrollment has been completed.
3. A grant for funding external to the department is submitted.
 - a. The new faculty member is the primary investigator.
 - b. The grant request is to exceed \$10,000.
4. An Animal Care and Use Committee-approved laboratory-based study is underway.
 - a. The new faculty member is the primary investigator.
5. Establishment of a new clinical program or service that has been originated and/or directed by the new faculty member.
6. Establishment of a new teaching program with formal curriculum that has been originated and/or directed by the new faculty member.
 - a. Any University of Iowa student group qualifies.

C. Secondary Goals

At the end of 2 years in the Program, instead of achieving at least 1 of the primary goals (above), the new faculty member may meet expectations by accomplishing *at least 5* of the following secondary goals. Each accomplishment in a category qualifies—for example, 3 case reports counts as 3, 2 semesters of medical student teaching counts as 2. Other secondary goals may be defined with preapproval of the Department Head.

1. Acceptance of a case report to a peer-reviewed journal.
 - a. The new faculty member is the first author.
 - b. Internet-based journals are excluded.
2. Acceptance of an abstract for a national level meeting.
 - a. The new faculty member is the first author.
3. Acceptance of chapter in a book or monograph.
 - a. The new faculty member is the first author.
4. Participation as a coinvestigator in a clinical trial.
5. Serve as a Carver College of Medicine medical student course instructor for at least 1 semester.
6. Departmental medical student didactic teaching scores in the top 25th percentile for an academic year.
 - a. To qualify, the new faculty member must give at least 5 medical student didactic teaching sessions over the year.
7. Anesthesia resident didactic teaching scores in the top 25th percentile for an academic year.
 - a. To qualify, the new faculty member must give at least 4 resident didactic teaching sessions over the year.
8. Anesthesia resident clinical teaching scores in the top 25th percentile for an academic year.
 - a. Any resident teaching award ("Teacher of Year" or "Excellence in Education") also qualifies.
9. Presentation at a national level meeting:
 - a. Abstract.
 - b. Problem-based Learning Discussion leader.
 - c. Challenging case presenter.

- d. Refresher Course lecturer.
 - e. Panel Discussion speaker.
 - f. Workshop instructor.
10. Serve as faculty mentor for a medical student or resident presentation at the level of the College of Medicine or regional meeting (e.g., MARC).
 11. Presentation of lecture or workshop at a departmentally sponsored Continuing Medical Education (CME) activity (e.g., Regional Anesthesia Study Center of Iowa, Iowa Anesthesia Symposium).
 12. Administrative Responsibility:
 - a. Director of Clinical Division (Ambulatory Surgery, Pediatrics, Critical Care).
 - b. Fellowship Director (Critical Care, Regional Anesthesia).
 - c. Curriculum Director for defined major resident clinical rotation (e.g., Pediatrics, Orthopedics, Cardiac, Neuroanesthesia).
 - d. Director or Associate Director of Residency or Medical Student Clerkship.
 13. Participation as a member of a departmental, collegiate, university, hospital, or professional committee:
 - a. Department: Resident competency committee, resident applicant interview committee, etc.
 - b. Hospital: Pharmacy and Therapeutics committee, Critical Care committee, Sedation Committee, etc.
 - c. Professional: Service as member of professional society committees (e.g., American Society of Anesthesiologists, Iowa Society of Anesthesiologists, Society of Critical Care).
 14. Coauthorship of any publication (paper, abstract, chapter, letter-to-the-editor) will count as one-half (0.5) of a secondary goal.
 - a. Internet-based forums do not qualify.

RECUSE NOTE

Dr. Franklin Dexter is the Statistical Editor and Section Editor for Economics, Education, and Policy for the Journal. This manuscript was handled by Dr. Steven L. Shafer, Editor-in-Chief, and Dr. Dexter was not involved in any way with the editorial process or decision.

DISCLOSURES

Name: Bradley J. Hindman, MD.

Contribution: This author helped design the study, conduct the study, analyze the data, and write the manuscript.

Attestation: Bradley J. Hindman has seen the original study data, reviewed the analysis of the data, approved the final manuscript, and is the author responsible for archiving the study files.

Name: Franklin Dexter, MD, PhD.

Contribution: This author helped design the study, analyze the data, and write the manuscript.

Attestation: Franklin Dexter has seen the original study data, reviewed the analysis of the data, and approved the final manuscript.

Name: Michael M. Todd, MD.

Contribution: This author helped design the study, conduct the study, and write the manuscript.

Attestation: Michael M. Todd approved the final manuscript.

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