



# The Journal of Education in Perioperative Medicine

ORIGINAL RESEARCH

## Changing the Culture: Increasing and Sustaining Anesthesiology Resident Physician Publication Rates

WILLIAM C. CULP, JR., MD  
RILEY J. HEDIN, DO, MPH  
DANIEL W. WATKINS, DO

CRAIG J. LILIE, MD  
J. CLINT TIPPETT, MD  
EMILY H. GARMON, MD

TIMOTHY M. BITTENBINDER, MD  
RUSSELL K. McALLISTER, MD

### BACKGROUND

Authorship of scientific publications is important for physician training and the advancement of medical practice, but residency training programs across specialties commonly experience challenges in achieving this goal. Many specialties, including anesthesiology, have recognized this as an existential problem and specifically issued calls to action to increase the number of scientific publications.<sup>1-3</sup>

At our medium-sized anesthesiology residency program (40-resident complement), residents were mandated to present at an annual departmental research forum as a scholarly activity, but these presentations only rarely progressed to publication. After receiving an “Area of Concern/Concerning Trends” warning from the Accreditation Council for Graduate Medical Education (ACGME) for inadequate resident scholarly works, department leaders sought to increase resident authorship while appreciating that (1) local culture drives actions, and (2) freedom of choice is valued and empowering.<sup>4,5</sup> These principles guided efforts to encourage and reward rather than to merely mandate scholarly works in order to increase resident authorship. In this retrospective cohort innovation, we hypothesized that a multifaceted academic works initiative would increase the number of residents authoring scientific publications annually. Our specific aim

was to increase resident publication rates via culture and value changes that are universally implementable, effective, and sustainable. While appreciating the value of the broad and current definition of scholarly works, our study focused on authorship of peer-reviewed journal publications and book chapters. Abstracts and other meeting presentations were severely limited during a portion of the study period due to COVID-19–induced travel restrictions and meeting cancellations. Further, electronic teaching tools, cell phone applications, and podcasts were not well-recognized as scholarly works in the early portion of the study period. As a result of these circumstances that were not equal across the 2 cohorts, we opted to focus on outcomes without likelihood of confounding the study. Herein we describe the development and implementation of an academic initiative that is based on creating a supportive culture with freedom of choice that led to a threefold increase in resident publication rates.

### MATERIALS AND METHODS

#### Interventions

After receiving an ACGME warning in early 2018, the Department of Anesthesiology Chair established a Vice Chair of Academic Affairs charged with overseeing and leading the department’s academic mission and increasing resident scholarly activity. With active and enthusiastic support of the Chair, multiple coordinated efforts

were implemented to shift departmental culture to one that increasingly valued the academic mission in general, and scientific publications in particular (Table 1). This multifaceted approach targeted (1) active support of resident scholarly works by department leaders, (2) engagement of faculty along with residents to better value scholarly works by raising awareness and social value of local scholarly activities, particularly publications, (3) recognition of those who produce scholarly works, and (4) providing residents freedom of choice.<sup>5,6</sup> The Vice Chair and other faculty leaders met with residents and faculty periodically to encourage scholarly activities and track progress. Specifics were outlined in the Scholarly Works Activities Policy (see Appendix 1) created by the departmental education committee, which was composed of 4 residency leaders, 6 core faculty, and 2 chief residents. The Scholarly Works Activities Policy embraced a recently expanded definition of scholarly works by the ACGME, recognizing both traditional scientific dissemination activities (i.e., journal articles and texts) and newer information distribution activities (i.e., podcasts, web pages, and electronic teaching tools).<sup>6</sup> The policy outlined a point system for scholarly activities, requiring residents to earn at least 10 points for graduation. Low-impact activities would earn 1 to 2 points, and a published manuscript would earn 10 or more points, thereby meeting the

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graduation requirement in a single project (see Table 2). The policy was designed to maximize each resident's freedom to choose topics, activity types, and the timing to complete the projects during the 4-year residency. (Postgraduate year [PGY]3 and PGY4 residents at time of implementation in mid-2018 had the option of participating in the new point system or continuing in the prior mandated system of scholarly works.) The graduating resident with the highest number of scholarly activity points received the prestigious Chair's Academic Achievement Award, consisting of a financial award, a legacy plaque placed prominently outside the Chair's office, and presented as a highlight of the graduation ceremony.

Costs associated with this initiative included modest expenses for plaques and financial awards (approximately \$1500 annually) and the Vice Chair's time, which was absorbed within preexisting academic time allocations. Trainees who chose to present their research extramurally were supported by institutional funds or faculty-donated departmental funds, up to \$1500 per meeting. Institutional funds were derived from operational revenue allocated to support the graduate medical education mission at the institution level, and departmental funds were donated specifically by faculty members to support resident educational activities. Approximately 1 to 3 of such presentations were funded per year. Multiple presentations by the same resident were permitted if they were separate projects. The travel funding support opportunities and policies were essentially unchanged during the study period; however, COVID restricted travel during some of the intervention years.

#### **Data Collection and Analysis**

Peer-reviewed journal articles and peer-reviewed book chapters authored by local residents during the study period were retrieved using independent publicly accessible search engines (National Library of Medicine via PubMed.gov and Google Scholar) and then reconciled with class rosters and reviewed by residency program directors. (Meeting presentation data were not analyzed largely because of the impact of COVID during a portion of this study,

which led to the cancellation of many regional and national meetings.) Two initial lists were developed independently (R.J.H., D.W.W.) and reviewed (J.C.T., R.K.M.) and finalized into a master data set for analysis (W.C.C.). Any potential inter-rater variability was reconciled using the PubMed Index as the master reference and arbitrated by the senior author (W.C.C.). The number of resident-authored publications was tabulated by academic year, with preintervention cohort 2014-2018 and postintervention cohort 2018-2022, representing 4 years before and after the intervention. Appreciating that there is often a delay of several months from research completion to final publication, each publication was credited to the academic year during which it was submitted to account for this latency. Using Microsoft Excel Version 2212, absolute publication numbers and the rate of resident-authored publications per year were determined in each cohort and subsequently analyzed using descriptive statistics and the unpaired Student *t* test, with  $P < .05$  representing statistical significance. Institutional review board approval was not required, and exemption granted. There was no potential harm with this retrospective study and anonymity was ensured. A data analysis and statistical plan was written, date-stamped, and recorded in the investigators' files before data were accessed.

#### **RESULTS**

Resident rosters revealed a mean  $\pm$  SD number of  $9.5 \pm 0.58$  and  $9.25 \pm 0.96$  residents per year and total number of residents of 38 and 37 in the pre- and postintervention cohorts, respectively. Residents included PGY1 to PGY4 trainees, for 4 classes each year. All residents in the program were included in the analysis. All residents had MD or DO terminal degrees, and none had PhD degrees or other advanced training in research. Total peer-reviewed publications in the pre- and postintervention cohorts were 7 and 24, including 3 peer-reviewed textbook chapters in the postintervention cohort, with this increase representing 343% of baseline publications. One publication had 2 resident authors, which was counted as 2 authorships. Publications per resident per year were  $0.183 \pm 0.16$  preintervention and

$0.654 \pm 0.11$  postintervention, representing 357% of baseline authorship rate (see Figure 1). Unpaired *t* test analysis demonstrated a significant difference in total publications per year ( $P = .002$ ) and authorship rate ( $P = .003$ ).

#### **DISCUSSION**

The absolute number of resident-authored publications increased to 343% of baseline and publication rates similarly increased to 357% of baseline when comparing the 4-year period pre- and postintervention. This effectiveness was achieved by a change in departmental culture that valued scholarly activities and a policy change that encouraged residents to choose the scholarly works of interest to them. This outcome far exceeded our aims established at the project outset and more than satisfied the ACGME, which subsequently provided a program review with no citations or recommendations for improvement.

Developing and maintaining a culture of academic inquiry is a core component of resident physician education and reflects a commitment to lifelong learning, critical thinking, and respect for scientific literature.<sup>7</sup> Academic inquiry harnesses intellectual curiosity, provides a foundation for career success, and inspires residents to choose academic faculty positions, all while expanding the scientific body of knowledge.<sup>3,8</sup> The traditional gold standard of scholarly works is discovery and dissemination through peer-reviewed scientific publication, which can be a struggle for residents across multiple specialties.<sup>9</sup> The resulting lack of scholarly activity has led to program citations by the ACGME<sup>10,11</sup> and remains an issue with anesthesiology programs.<sup>12</sup> Publication rates are inequitable across training program type and specialties, with residents in large research universities publishing many more publications than residents in smaller academic facilities or community practice models.<sup>13,14</sup> Commonly cited obstacles to resident authorship include inadequacies in resident and faculty nonclinical time, interest, funding, faculty mentorship, and research training and expertise. Proposed solutions include increased funding, nonclinical time for residents and faculty, research rotations, focused research and

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statistical training, hiring research mentors and research directors, financial incentives, and publication mandates. These solutions have resulted in varied degrees of success without clear demonstration of long-term sustainability<sup>15-17</sup> and are generally associated with substantial expense. To date, attempts at increasing resident publication rates have failed to demonstrate an educational best practice model that is universally implementable, affordable, effective, and sustainable. We believe that our bundled interventions detailed herein that together modeled a transformed culture while also providing residents the freedom to choose their own academic projects can be replicated in any size training program, including smaller and community-based programs. Further, this transformative process may have broad applicability across specialties.

No particular intervention has been established with universal applicability across multiple specialties and institutions. Our multifaceted initiative focused on changing the culture primarily through “transformational leadership” (processes that inspire cognitive change based on redefining goals and values) rather than “transactional leadership” (change based on material motivational factors like reward systems).<sup>18</sup> Department leaders actively promoted and publicized academic achievements, understanding that prominence and recognition are instrumental in changing culture, and that conversely, low visibility is a signal of low priority. Furthermore, use of a scholarly activity points system conveyed respect to residents, affording them the freedom to choose the project type, topic, and timing of their own scholarly activities. This system also gave value to more recently acknowledged scholarly activities such as podcasts, electronic educational materials, and medical society activities, reinforcing program flexibility and freedom of choice. Professional and personal demands throughout different time periods in residency frequently vary due to marriage, pregnancy, away rotations, illness, family crisis, exams, and fellowship and job interviews. As learned through informal graduating resident debriefs, this flexibility was welcomed by residents who

were empowered to tailor their scholarly activities to fit individual personality types, interests, schedules, and learning styles.

Throughout the study period, residents had access to very modest amounts of nonclinical time to dedicate to research. Similarly, the faculty did not have protected research time, although a small number of faculty had nonclinical time designated for educational and administrative duties. These nonclinical times were not changed throughout the course of the study, with nearly all work leading to publications occurring when clinical duties permitted and before and after clinical assignments. Motivation and prominent recognition of faculty members also seemed to play a role in the success of our culture changes. The heightened culture of academic inquiry department-wide led to the better availability of faculty support for the residents, which may have contributed to the increase in research projects that were ultimately published. A higher cultural value was placed on faculty promotion and the components necessary to achieve promotion. Our residents found that they now had many more faculty who shared their goal of successful academic inquiry projects. This aspect of faculty engagement and productivity will be explored in future studies.

Applying a largely transformational leadership approach, the value of scientific publications was emphasized publicly, recognizing authors using multiple venues, including department faculty meetings, events, email communications, bulletin boards, and awards displays. In addition, the Chair’s Academic Achievement Award was a local, highly visible means of encouraging scientific endeavors by showing that scholarly works are valued by the department. (Travel for scientific presentations was largely supported by the institution throughout the study period; however, during this period faculty increasingly donated funds to help support travel, as well.) The graduating resident with the highest scholarly activities points (i.e., the most publications) was presented this award by the Chair and Vice Chair at the annual graduation ceremony, honoring the recipient in front of department faculty, resident classmates, and perhaps most importantly, the families in attendance.

In debriefs with graduating residents, the high visibility of this award was a powerful motivator to pursue publications. Although the financial incentive was appreciated, recipients valued recognition more than the modest monetary compensation associated with the award. Thus, the foundation of departmental cultural transformation was creating clearly defined criteria for scholarly activities and recognizing academic accomplishment formally, consistently, and publicly.

Study limitations include a finite 4-year postintervention period, which may not capture variation in resident characteristics across epochs. Only peer-reviewed published manuscripts and book chapters were tabulated, excluding more recently recognized forms of scholarly works such as podcasts and other electronic educational tools. Hidden costs, particularly of resident and faculty time, were not measured. Although COVID decreased elective surgical volume tremendously at times, anesthesiology residents staffed expanded intensive care units with long shifts. Thus, normal patterns of clinical work and study were disrupted during these COVID surges, sometimes leading to altered schedules and wide variations in clinical duty hours, which may be a confounder. In addition, external motivators may exist that impact residents’ desire to perform research, such as perceived value of research for fellowship competitiveness, or desire to travel to meetings with institutional financial support.

Resident scholarly productivity is important for each specialty in order to continually discover new knowledge, inspire the next generation of investigators, and foster a culture of academic inquiry required for optimal training conditions.<sup>3,8,10</sup> Residents who are steered toward high-quality scholarship will become more discerning critical thinkers and competent physicians.<sup>19</sup> Resident scholarly productivity is also an ACGME requirement, with deficiencies resulting in accreditation citations or punitive actions. Our multifaceted, easily implemented, high-value innovation led to a more than threefold increase in resident publications comparing pre- and postintervention 4-year epochs. The largely transformational leadership approach was

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used to change departmental culture into one that valued science through a points system that offered freedom of choice and demonstrated respect to the residents. Importantly, these interventions are not specialty specific, and future studies are warranted to demonstrate reproducibility across specialties and varying program sizes to establish an educational best practice model for sustained resident research activity.

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*The authors are at the Department of Anesthesiology, Baylor Scott & White Medical Center, Temple, TX. The following authors are also at the Baylor College of Medicine-Temple, TX: William C. Culp, Jr., is Professor of Anesthesiology and Vice Chair of Academic Affairs; Craig J. Lillie is Assistant Professor and Associate Program Director; J. Clint Tippett is Clinical Associate Professor and Residency Program Director; Russell K. McAllister is Chair of Anesthesiology and Professor of Anesthesiology. The following authors are also at Texas A&M University College of Medicine, Temple, TX: Riley J. Hedin and Daniel W. Watkins are Cardiothoracic Anesthesiology Fellows; Emily H. Garmon is Clinical Associate Professor; Timothy M. Bittenbinder is Chair, Scott & White Board of Directors, Senior Vice President Baylor Scott & White Healthcare, and Associate Professor; and Russell K. McAllister is Chair of Anesthesiology and Professor of Anesthesiology.*

**Corresponding author:** William C. Culp, Jr., MD, Baylor Scott & White Health, Department of Anesthesiology, 2401 South 31st Street, Temple, TX 76708. Telephone: (254) 774-1713

**Email address:** William C. Culp, Jr.: [William.CulpJr@BSWHealth.org](mailto:William.CulpJr@BSWHealth.org).

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## Abstract

**Background:** Academic inquiry is foundational to the advancement of medicine and resident training and must be demonstrated to the Accreditation Council for Graduate Medical Education. Past attempts at increasing publication rates have failed to identify educational best practice models. Our aim was to increase resident publication rates via culture and value changes that are universally implementable, affordable, effective, and sustainable.

**Methods:** In 2018, a multifaceted initiative was implemented to shift departmental values and foster a culture of academic productivity. This culture change stressed the value of scientific publication through frequent, consistent messaging from department leaders. In addition, residents were provided the freedom to choose their scholarly activities. In this retrospective cohort innovation, resident authors were identified for 4 academic years before and after the intervention and publication rates were determined (2014-2018 vs 2018-2022). Resident authors and publications per resident per year were compared using descriptive statistics and Student *t* test.

**Results:** The pre- and postintervention groups included 38 and 37 residents, respectively. Resident-authored publications increased from 7 preintervention to 24 postintervention, representing 343% of baseline. Mean  $\pm$  SD publications per resident per year similarly increased 357% from  $0.183 \pm 0.16$  to  $0.654 \pm 0.11$  postintervention. Unpaired *t* test analysis demonstrated a significant difference in total publications per year ( $P = .002$ ) and authorship rate ( $P = .003$ ).

**Conclusions:** A multifaceted academic initiative resulted in a threefold increase in resident publication rates. This initiative demonstrates that local advocacy by leaders, freedom of choice for authors, and supportive departmental culture are driving factors in publication rates.

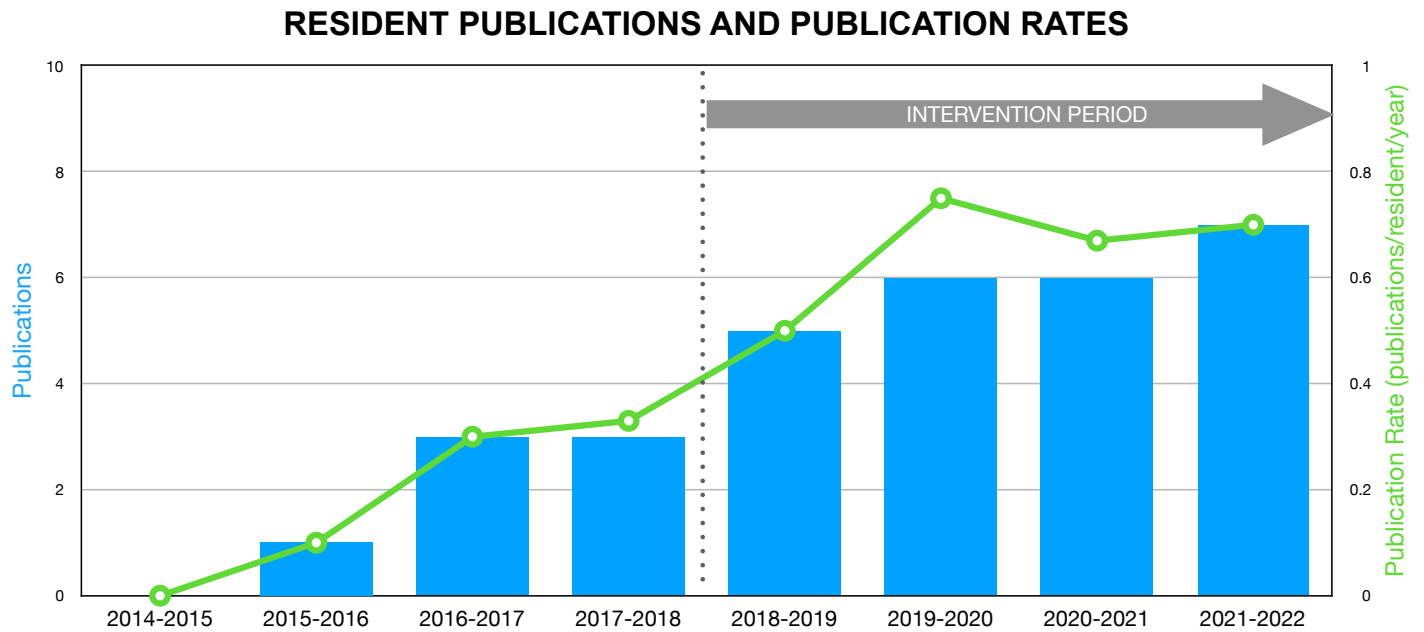
**Keywords:** Education, research, scholarly productivity, publication rates

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## Figure

**Figure 1.** Absolute numbers of resident publications are presented as blue vertical bars (see left vertical axis for value scale) and publication rates are shown as a green line (see right vertical axis for value scale). Data to the left of the vertical dotted line represent the preintervention era, and those data to the right indicate postintervention outcomes.



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## Tables

**Table 1. Academic Culture Interventions**

<p><b>Leadership</b></p> <ul style="list-style-type: none"> <li>• Chair established and publicized goal for residency to increase scholarly activity.</li> <li>• Chair appointed Vice Chair of Academic Affairs who was charged with leading and overseeing the department's academic mission and increasing resident scholarly activity.</li> <li>• Chair established prestigious Chair's Academic Achievement Award, including recognition and a financial reward, to be presented to the graduating resident with the highest number of scholarly activities points (publications highly scored).</li> <li>• Department leaders expressed active and vocal encouragement for resident, fellow, and faculty research participation and publication during faculty meetings and through email.</li> </ul>
<p><b>Faculty Engagement</b></p> <ul style="list-style-type: none"> <li>• Education Committee (composed of residency leaders, select core faculty, and chief residents) created and implemented Scholarly Works Activities Policy, expanding options for scholarly works while allowing freedom of choice regarding type and timing of projects.</li> <li>• Clinical Competency Committee began tracking ongoing activity points semi-annually to provide timely feedback and reminders to residents.</li> <li>• Faculty mentors and residency leaders began routinely asking residents about research progress during periodic evaluation meetings.</li> <li>• Faculty investigators began sending regular reminders to residents about opportunities for research projects.</li> <li>• One long-time faculty anesthesiologist established a Resident Travel Fund, providing a large initial donation (with a continuing commitment to match donated funds from other faculty) to help support resident travel to present research at scientific meetings, thereby removing cost as a barrier to participating in research.</li> <li>• "Research Pitch Fest" was instituted as a fun, interactive, light-hearted event, during which faculty and residents present ideas for possible research projects or inventions in a rapid-fire format with feedback from faculty mentors.</li> </ul>
<p><b>Recognition</b></p> <ul style="list-style-type: none"> <li>• Chair's Academic Achievement Award was created, which consisted of a personal plaque and a legacy plaque prominently displayed outside the Anesthesiology Department Chair's office, both proudly presented by the Chair and Vice Chair with monetary reward at the department's graduation ceremony in front of residents and their families, and faculty.</li> <li>• Faculty meetings were modified such that academic accomplishments were presented as the first order of business, listing and congratulating all participants and especially praising scientific publications.</li> <li>• Annual Department of Anesthesiology Research Forum had authors' recognition section added, during which all authors' names were presented, along with review of all department publications from the preceding year.</li> <li>• Academic bulletin board was created and actively maintained, posting academic announcements, published papers with authors' names highlighted, and giving special congratulations to faculty receiving academic promotion.</li> </ul>

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## Tables continued

**Table 2.** *The Education Committee Created the Scholarly Works Activities List, Which Established Guidelines for Point Ranges*

Scholarly Works Activities	Earned Point Value
Research	3-6
Research Publication	12-15
Case Report/Case Series	10-12
Grand Rounds	3-5
Review Article	10-15
Book Chapter	6-10
Clinical Practice Manual	1-6
Non-Peer-Reviewed Publication	1-6
Committee Work	1-6
Complex Case Presentation	2-4
Problem-Based Learning Discussion	3-5
Electronic Works (Podcasts, Websites)	1-10
Patent Application	5-30

Activities are submitted to the Program Administrator and Vice Chair of Academic Affairs. The Vice Chair assesses each project and assigns a point valuation using the guidelines as approved by the education committee with input from additional faculty members familiar with a given project.

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## Appendix

### Appendix 1. Scholarly Works Activities/Academic Assignments: 2022 Edition

Residents shall be free to choose their own scholarly works and activities, but shall consult faculty mentors for guidance before undertaking a project. Residents will report their activities in writing to the Program Administrator at least annually for submission to the ACGME. At least once per year, scholarly works will be evaluated and points assigned, based on the suggested point valuations listed below. The ACGME mandates that each resident participates in scholarly activities during residency. Graduation from residency will require each resident to earn at least 10 scholarly works points over the course of the residency. Residents must participate in some form of scholarly work before 01 Feb of their PGY 1 year.

Activity	Description	Point Category	Point Value
Research	Traditional scientific research, typically with IRB/IAUCUC approval or exemption, that asks a scientific question and tests a hypothesis using the scientific method.	Participation in project	3
		Presentation at department/local level	3
		Presentation at state or regional level	4
		Presentation at national/international level	6
		Abstract publication (as author)	4
		Manuscript publication (as author)	12-15
Case report/series	A retrospective report of a single patient or small series of patients describing a clinical problem.	Presentation at department/local level	2-5
		Presentation at state or regional level	4-5
		Presentation at national/international level	5
		Manuscript publication (as author)	10-12
Grand Rounds	An hour-long, formal presentation providing in-depth coverage of a relevant topic. Must meet requirements for CME (goals & objectives, learning gaps, etc.).	Presentation at department/local level	3-5
		Presentation at state or regional level	6
		Presentation at national/international level	10
		Invited presentation at another institution	10
Review article	A medical paper that summarizes and collates existing knowledge in a particular area.	Manuscript publication (as author)	10-15
Book chapter	A chapter or portion of a chapter in a medical textbook.	Publication (as author)	6-10
Manual for teaching or clinical practice, education program development	A document that aids in clinical practice (developing best practice clinical guidelines, clinical pathways, etc.) or in learning (rotation handbook, etc.).	Local publication (as author)	1-3
		State/regional publication (as author)	2-4
		National/international publication (as author)	4-6
Non-peer-reviewed publication	Documents that are published in places other than peer-reviewed, indexed journals, e.g., state society newsletters, national society newsletters, newspapers, online resources.	Local publication (as author)	1-3
		State/regional publication (as author)	2-4
		National/international publication (as author)	4-6

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## Appendix continued

Lecture, intern didactics	Formal presentation as PGY1 at intern conference.	Local presentation	0.5
Lecture, intern didactics	Formal presentation as PGY2-4 at intern conference.	Local presentation Note: Maximum of 2 total points for all intern conferences over the course of residency	0.5-1
Committee work	Serve on a professional medical society committee to improve medical practice or education. Other special activities such as ASA Policy Education Month may be considered in this category.	Local committee member	1
		Local committee chair	2
		State/regional committee member	2
		State/regional committee chair	4
		National/international committee member	4
		National/international committee chair	6
Complex case presentation/ medically challenging case		Presentation at a state/regional level	2
		Presentation at a national/international level	4
PBLD		Presentation at a state/regional meeting	3
		Presentation at national/international meeting	5
Electronic works	Podcasts, websites, cell phone applications, multimedia tutorials, etc.	Each work will be individually reviewed and assessed, with small-impact projects receiving fewer points, and highly visible (frequently accessed) works receiving more points. Examples: 10-minute podcast with minimal downloads on a low-traffic website might earn 1 point; developing a sophisticated website that teaches regional anesthesia with thousands of views per month might earn 10 points.	1-10
Patent application	A claim of a new invention or creation, filed with the U.S. Patent & Trade Office.	Each work will be individually reviewed and assessed. Points will be awarded based on commercialization potential, novelty, impact.	5-30

Abbreviations: ASA, American Society of Anesthesiologists; CME, continuing medical education; FAER, Foundation for Anesthesia Education and Research; IACUC, institutional animal care and use committee; IRB, institutional review board; PGY, postgraduate year; PBLD, problem-based learning discussion; TSA, Texas Society of Anesthesiologists.

### Notes:

“Publication” as is used herein means a publication in a peer-reviewed, PubMed-indexed journal with a PubMed ID identifier for each article. Manuscripts not receiving PubMed identifiers will be scored as “non-peer-reviewed” articles.

Point values listed in the table will be used as general guidelines to assess each scholarly activity. Awarded points may be adjusted up or down by department leadership to appropriately acknowledge exceptional performance under unusual circumstances (e.g., case report that is ground-breaking, high-profile publication, invention creation and patent award, high national society office).

Additional points may be awarded to recognize special achievements in the research or scholarly arena, e.g., TSA Clinical Research Award, FAER Awards, National Institutes of Health funding, grant awards, etc.