Factors that Predict Academic Success among Academic Spine Surgeons: An Analysis of the Research Productivity of Spine Fellowship Selection Committees

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INTRODUCTION:
Research productivity is an important metric of success for academic spine surgeons. For fellowship applicants interested in a career in academic spine surgery, an analysis of the research productivity of spine surgeons at each fellowship program may serve as an academic benchmark and a tool to inform fellowship choices. Therefore, the purpose of this study is to summarize the research productivity of academic spine surgeons in fellowship selection committees and analyze factors that influence academic productivity as an attending academic spine surgeon.
METHODS:
Orthopaedic and neurosurgical spine fellowship selection committee members for each institution participating in the spine fellowship match through the San Francisco (SF) Residency and Fellowship Match Services were identified using the 2021-2022 North American Spine Society (NASS) Spine Fellowship Directory. The current institution of practice and medical education history (graduation year of medical school, residency, and fellowship) for each surgeon was recorded through an online search of institutional websites. A search on PubMed was then used to collect data on the total number, first author, and senior author publications through December 31, 2021. The number of articles published prior to residency, during residency, during fellowship, and following fellowship was then determined based on the recorded medical education history. The publication rate prior to residency, during residency, during fellowship, and following fellowship (as an attending surgeon) was calculated by dividing the total number of articles published by the total number of years at each institution. Descriptive statistics were recorded as mean and standard deviation or number of occurrences and percent of total. The data was then stratified by attending start year (1960-1990 vs. 1990-2000 vs. 2000-2010 vs. 2010-2021) and institutional geographic location (Midwest vs. Northeast vs. Southeast vs. West). Continuous variables were compared using one-way analysis of variance (ANOVA) or Kruskal-Wallis H tests. Categorical variables were compared using Pearson's chi-square or Fisher's exact tests. A multivariate linear regression model was developed to determine if the pre-residency, residency, or fellowship publication rate was independently predictive of the publication rate as an attending surgeon. Alpha was set at $P<0.05$.
RESULTS:
A total of 310 orthopaedic and neurosurgical spine surgeons, representative of 77 fellowship programs, were identified on the NASS directory as being involved in spine fellowship mentoring. Overall, 92 (29.7%) were listed as fellowship directors. The average number of total publications per surgeon was 80.1 $\pm$ 102, with 11.8 $\pm$ 14.7 being first author publications, and 21.0 $\pm$ 35.2 senior author publications. The average number of articles published prior to residency was 0.79 $\pm$ 2.03 (average rate 0.20 $\pm$ 0.51 articles per year), during residency 3.91$\pm$5.68 (average rate 0.98 $\pm$ 1.42 articles per year), and during fellowship 1.45 $\pm$ 3.56 (average rate 1.45 $\pm$ 3.56 articles per year). Overall, the average number of years in practice as an attending was 17.2 $\pm$ 11.0 and the average publication rate was 4.87 $\pm$ 6.53 articles per year. There was no significant difference in attending publication rate based on fellowship director status (Director: 5.00 $\pm$ 5.47 vs. Non-Director: 4.81 $\pm$ 6.94 articles per year, p=0.796) or attending start year (1960-1990: 2.52 $\pm$ 2.20 vs. 1990-2000: 4.27 $\pm$ 5.57 vs. 2000-2010: 5.03 $\pm$ 5.33 vs. 2010-2021: 5.77 $\pm$ 8.40 articles per year, p=0.079). When examining the attending publication rate based on current institution geographic location, programs located in the northeast had a significantly higher publication rate compared to those in the midwest, west, and southeast (Northeast: 7.41 $\pm$ 9.25 vs. Midwest: 4.25 $\pm$ 4.37 vs. West: 3.88 $\pm$ 4.71 vs. Southeast: 2.49 $\pm$ 2.98 articles per year, p<0.001) (Figure 1). Multivariate linear regression analysis identified that the publication rate during residency (b=0.95, p<0.001), and during fellowship (b=0.77, p<0.001) were significant predictors of an increased publication rate as an attending surgeon, while the pre-residency publication rate (b=0.22, p=0.729) was not significantly predictive of attending publication rate (Table 1). A trend of the attending publication rate over time is shown in Figure 2.
DISCUSSION AND CONCLUSION:
Spine surgeons involved in spine fellowship mentoring who are located in northeast had the highest yearly publication rate. Overall, there was no significant difference in the yearly publication rate based on fellowship director status or attending start year, however, there appears to be a trend toward an increased publication rate for surgeons that reached attending status more recently. Ultimately, an increased yearly publication rate in residency and fellowship was significantly predictive of an increased yearly publication rate as an attending surgeon, indicating that an emphasis on research throughout surgical training is advantageous for fellowship applicants interested in a career in academic spine surgery.

Figure 1: Boxplot of Attending Publication Rate Stratified by Current Institution Location

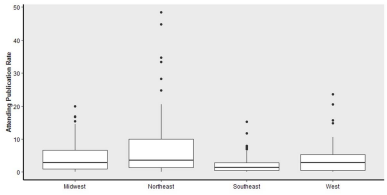

Figure 2: Trend of Attending Publication Rate Over Time

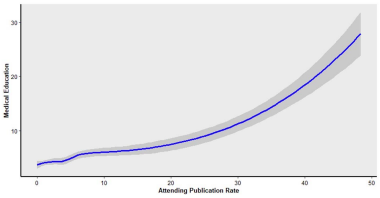

Table 1: Multivariate Linear Regression of Attending Publication Rate

Variable	Estimate (β)	P-Value	Lower 95	Upper 95
Pre-Residency Pub Rate	0.22	0.729	-1.03	1.47
Residency Pub Rate	0.95	**<0.001***	0.49	1.41
Fellowship Pub Rate	0.77	**<0.001***	0.59	0.95