Journal of Clinical Neuroscience 17 (2010) 287–289

Contents lists available at ScienceDirect

Journal of Clinical Neuroscience

journal homepage: www.elsevier.com/locate/jocn

Education

Pre-residency peer-reviewed publications are associated with neurosurgery resident choice of academic compared to private practice careers

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ARTICLE INFO

Article history:
Received 15 May 2009
Accepted 7 July 2009

Keywords:
Academic neurosurgery
Neurosurgery residency graduates
Pre-residency peer-reviewed publications
Private practice neurosurgery

ABSTRACT

Factors predictive of neurosurgery resident or applicant choice of an academic career compared to private practice are highly desired and difficult to discern. Neither medical school choice, student induction to faculty membership, age nor gender predict academic *versus* private practice choice among neurosurgery residents. This study was performed to examine the role of pre-residency peer-reviewed publications (PRP) in post-residency career choice. Over five years (2001–05) the number of PRP prior to onset of residency of 422 graduates from 79 neurosurgery residency programs certified by the Accreditation Council for Graduate Medical Education was retrospectively examined. The number of publications until the end of the calendar year prior to the start of residency was determined using PubMed (www.pubmed.org). This number was then correlated with the choice of an academic or private practice neurosurgery career. A minority of graduates (46.2%) chose academic neurosurgery careers, 32.2% of graduates had at least one PRP at the time of application to neurosurgery residency, with 16.4% having more than one. A total of 41.6% of graduates with no PRP chose academic careers, compared to 53.7% with one PRP, and 58.0% with more than one. With regard to choice of academic career, the difference between no PRP and at least one were statistically significant ($p < 0.01$), but not between one PRP and more than one. Graduates with at least one PRP were 1.34 times more likely to choose an academic career than graduates with no PRP. Therefore, peer-reviewed PRP are strongly associated with resident choice of an academic over private practice neurosurgery career. This information might be useful in predicting the career choices of neurosurgery residents and residency applicants.

1. Introduction

Predictive factors of an academic compared to a private practice neurosurgery career choice by residents and residency applicants are highly desired and difficult to discern. A recent report examining applicants and residents from a single neurosurgery program over a 35-year period revealed that neither college choice, collegiate grade point average, medical school choice, medical school class rank, Alpha Omega Alpha induction (student membership of faculty), marital status, age nor gender could predict whether a neurosurgery resident would choose an academic *versus* private practice career.[1] The present study was performed to examine the role of pre-residency peer-reviewed publications (PRP) in post-residency career choice, utilizing a more heterogeneous sample of neurosurgery resident graduates.

2. Materials and methods

2.1. Identification of participants

Graduates from neurosurgery residency programs certified by the Accreditation Council for Graduate Medical Education (ACGME) Residency Review Committee from 2001 through 2005 were the focus of this analysis (Table 1). Names and career choices (academic *v.* private practice) were identified predominantly through Internet searches, electronic mail inquiries, and telephone interviews.

2.2. Definition of academic and private practice neurosurgery career choice

For the purposes of this study, an academic neurosurgery career choice was defined as an attending staff position directly affiliated with an ACGME-certified neurosurgery residency program. All other career choices, including positions with peripheral affiliation with neurosurgery residency programs, were considered to be private practice neurosurgery career choices. This analysis focused on

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doi:10.1016/j.jocn.2009.07.098

Table 1
Number of graduates in neurosurgery residency programs included in the analysis of the association between pre-residency peer-reviewed publications and the neurosurgical resident's choice of academic compared to a private practice career

Neurosurgery residency program	No. of graduates included (2001–05)	Neurosurgery residency program	No. of graduates included (2001–05)
Alabama	7	Northwestern	1
Albany	5	New York Medical College	3
Allegheny	1	New York University	4
Arkansas	4	Ohio State	11
Barrow Neurological Institute	11	Oklahoma	3
Baylor	4	Oregon	5
Brigham	6	Penn State	4
Case Western	4	Peoria (University of Illinois at Peoria)	5
Cleveland Clinic	4	Puerto Rico	1
Cincinnati	9	Rochester	1
Colorado	3	Rush	1
Columbia	10	Shreveport	2
Cornell	4	South Carolina	3
Dartmouth	5	Stanford	7
Duke	10	Syracuse	1
Emory	6	Temple	1
Georgetown	1	Tufts	5
George Washington	1	Tulane	3
Henry Ford	9	University of Florida	9
Indiana	1	University of Pennsylvania	10
Iowa	3	University of Pittsburgh	14
Thomas Jefferson	1	University of Virginia	8
Johns Hopkins	14	University of California–Davis	6
Loma Linda	5	University of California–Los Angeles	10
Louisville	1	University of California–San Diego	7
Loyola	1	University of California–San Francisco	10
Louisiana State University	5	University of Medicine and Dentistry in New Jersey	6
Mayo Clinic	13	University of North Carolina	5
Medical College of Georgia	5	University of Southern California	10
Medical College of Virginia	1	University of Texas–San Antonio	3
Medical College of Wisconsin	1	University of Texas–Southwestern	6
Memphis (University of Tennessee)	1	Utah	2
Massachusetts General Hospital	10	University of Texas–Medical Branch	5
Miami	9	University of Washington	12
Michigan	10	Vanderbilt	9
Minnesota	9	Vermont	1
Missouri-Columbia	4	Wisconsin	5
Mount Sinai	8	Washington University at Saint Louis	9
Nebraska	3	Yale	2
New Mexico	3	Total = 79	Total = 422

the graduate's initial career choice; therefore a graduate in private practice at the time of data collection who had initially started in academia was considered to have made an academic career choice. Similarly, graduates who had switched from private practice to academia were counted as private practice neurosurgeons.

Determination of pre-residency PRP occurred using the Entrez gateway of the PubMed database (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?DB=pubmed). PRP was defined as the number of publications up to the end of the calendar year preceding the start of residency. Residency program duration (six years *v.* seven years *v.* eight years) was taken into account. For example, for a resident graduating in 2001 from a seven-year program, the number of publications in PubMed through 1993 would be defined as that resident's PRP (since 1994 would be the official start year of residency), and the PRP for a 2004 resident graduate from a six-year program would be defined as the number of publications through the end of 1997. PubMed reviews were augmented by Internet searches for resumes, whenever such information was available. Each graduate was defined and categorized as having either no PRP, one, or more than one PRP.

The data for all years (2001–05) was then combined for statistical analysis. The chi-squared (χ^2) test for nominal data was performed to evaluate the relationship between PRP number and career choice, with statistical significance assigned at $p < 0.05$. An estimation of the relative risk was then computed for each cohort, with an accompanying 95% confidence interval.[2]

3. Results

Of the 422 graduates, 195 (46.2%) chose academic neurosurgery careers. A total of 136 graduates (32.2%) had at least one PRP, with 69 (16.4%) having more than one. Forty of the 69 graduates (58.0%) with more than one PRP chose academic careers, compared with 36/67 (53.7%) of graduates with one PRP and 119/286 (41.6%) of graduates with no PRP.

Graduates with at least one PRP were more likely to choose an academic over a private practice career ($p < 0.01$). However, there was no statistically significant difference in career choice between graduates with one PRP compared to those with more than one. The relative risk between graduates with or without a PRP regarding choice of academic career was 1.34 (95% confidence interval = 1.10–1.65), meaning that graduates with at least one PRP were 1.34 times more likely than graduates with no PRP to choose an academic over a private practice neurosurgery career.

Demographically, 384 graduates (91.0%) were male. There was no statistically significant difference between male and female gender with regard to choice of academic compared to a private practice neurosurgery career.

4. Discussion

Based on most personal statements and answers to interview questions from neurosurgery residency applicants, an academic career is highly sought over a private practice neurosurgery career prior to the start of residency.[1] Furthermore, most neurosurgery residency programs are designed with an academic career in mind, which manifests predominantly as a mandatory one-to-two years of additional research compared to residencies of other subspecialties, and an encouragement by faculty for residents to engage in research, with relatively few programs preparing residents for the socioeconomic complexities of private practice neurosurgery.[3–6] Consequently, the relatively low numbers of resident graduates choosing academic neurosurgery has been somewhat surprising; a recent American Association of Neurological Surgeons census revealed that only 24% of graduates between 2000 and 2006 (613 neurosurgeons total) described their practice as academic.[1]

This disparity between the number of graduates choosing private practice compared to academic neurosurgery has led to the search for factors that can potentially predict applicant and resident career choices. Given the aforementioned focus of neurosurgery programs on research, there lies an implicit assumption that the more active a resident is in research during residency, the more likely they will choose an academic career over a more financially lucrative private practice career. This study was performed to evaluate whether pre-residency PRP was associated with graduate neurosurgery career choice. The determination of PRP in this study was designed to approximate the number of PRP a neurosurgery resident applicant would have during their application to residency, a study that was enabled by the reliability of neurosurgery-applicant representation of peer-reviewed research compared to other specialties such as orthopaedic surgery, radiology, pediatrics, and emergency medicine.[7–11]

The goal of this study was to examine a simple, easily reproducible, objective measure (pre-residency PRP) utilizing a user-friendly medium (PubMed), and an objective outcome (initial career choice) as a potential predictor of career choice for a neurosurgery resident applicant. This potential predictive information would be reported to a committee and/or program director regarding neurosurgery residency applications prior to the start of the residency. The results revealed that graduates with at least one PRP were 34% more likely to choose academia as an initial career choice than graduates with no PRP ($p < 0.01$). However, there was no difference with regard to initial academic neurosurgery career choice between residents with one PRP and more than one. Additionally, there was no difference between men and women with regard to initial career choice.

This study has several limitations. First, it is retrospective, which limits the strength of the conclusions that can be drawn regarding the link between PRP and neurosurgery career choice. Second, both the graduates and their career choices were obtained predominantly through Internet searches, which may have falsely skewed the data towards an academic rather than private practice career choice, because those in academic neurosurgery careers might have an more visible Internet presence than graduates in private practice careers. Indeed 46% of the graduates in this study chose academic careers compared to the 24% in the American Association of Neurological Surgeons 2000–2006 graduate census, which is assumed to be a more complete resident sample than that in the present study. Third, is the reliance of this study on PubMed to accurately reflect the number of PRP for each graduate; a graduate having published in a journal not listed in PubMed would have been counted falsely as having no PRP according to the criteria of this study. Fourth, the study focused exclusively on neurosurgery programs within the United States of America (USA); therefore, these results may not be as applicable in other countries where the political and financial dynamics of academic compared to private practice neurosurgery may differ significantly from those in the USA. Finally, this study is not able to provide information on whether initial career choice correlates with long-term career choice; therefore, future studies will be necessary to determine whether initial choice of academic compared to private practice neurosurgery correlates with the graduate's final career choice.

5. Conclusions

Neurosurgery residency graduates with at least one peer-reviewed publication prior to residency were 34% more likely to choose an academic neurosurgery career as their initial career choice than graduates with no pre-residency peer-reviewed publications. However, graduates with more than one pre-residency publication were no more likely to choose an academic career initially than graduates with one publication. Men were no more likely to choose academia than women. This information may be useful in predicting the career choices of neurosurgery residents and residency applicants.

References

1. Lawton MT, Narvid J, Quinones-Hinojosa A. Predictors of academic career choice among neurosurgery residents and residency applicants. *Neurosurgery* 2007;**60**:934–9.
2. Morris JA, Gardner MJ. Calculating confidence intervals for relative risks (odds ratios) and standardised ratios and rates. *Br Med J (Clin Res Ed)* 1988;**296**:1313–6.
3. Ausman JI, Pawl RP. What neurosurgeons should do to succeed in tomorrow's scientific and socioeconomic environment. *Neurosurg Focus* 2002;**12**:E9.
4. Brem H, Amundson E. Preparing Hopkins medical students for a career in academic neurosurgery. *Surgery* 2003;**134**:414–5.
5. Lunsford LD, Kassam A, Chang YF. Survey of United States neurosurgical residency program directors. *Neurosurgery* 2004;**54**:239–47.
6. Myles SR, McAleer S. Selection of neurosurgical trainees. *Can J Neurol Sci* 2003;**30**:26–30.
7. Baker DR, Jackson VP. Misrepresentation of publications by radiology residency applicants. *Acad Radiol* 2000;**7**:727–9.
8. Bilge A, Shugerman RP, Robertson WO. Misrepresentation of authorship by applicants to pediatrics training programs. *Acad Med* 1998;**73**:532–3.
9. Cohen-Gadol AA, Koch CA, Raffel C, et al. Confirmation of research publications reported by neurological surgery residency applicants. *Surg Neurol* 2003;**60**:280–4.
10. Dale JA, Schmitt CM, Crosby LA. Misrepresentation of research criteria by orthopaedic residency applicants. *J Bone Joint Surg Am* 1999;**81**:1679–81.
11. Gurudevan SV, Mower WR. Misrepresentation of research publications among emergency medicine residency applicants. *Ann Emerg Med* 1996;**27**:327–30.