Factors Influencing Scholarly Impact: Does Urology Fellowship Training Affect Research Output?

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PURPOSE: Residents seek postresidency fellowship training to increase competency with novel surgical techniques and augment their fund of knowledge. Research productivity is a vital component of advancement in academic urology. Our objectives were to use the *h-index* (an objective and readily available bibliometric that has been repeatedly shown to correlate with scholarly impact, funding procurement, and academic promotion in urology as well as other specialties) to determine whether any relationship exists between fellowship training and scholarly impact among academic urologists. Additional examination was performed to determine whether any differences in scholarly influence are present among practitioners in the major urologic subspecialties.

MATERIALS AND METHODS: Overall, 851 faculty members from 101 academic urology departments were organized by academic rank and fellowship completed. Research productivity was calculated using the *h-index*, calculated from the Scopus database.

RESULTS: There was no statistical difference in *h-index* found between fellowship-trained and nonfellowship-trained academic urologists. The highest *h-indices* were seen among urologic oncologists (18.1 ± 0.95) and nonfellowship-trained urologists (14.62 ± 0.80). Nearly 70% of department chairs included in this analysis were urologic oncologists or general urologists.

CONCLUSIONS: No difference in *h-index* existed between fellowship-trained and nonfellowship-trained urologists, although practitioners in the subspecialty cohorts with the highest research productivity (nonfellowship-trained and urologic oncologists) comprised 70% of department chairpersons. This relationship suggests that a strong research profile is highly valued during selection for academic promotion. Differences existed on further comparison by subspecialty. Fellowship training may represent another potential opportunity to introduce structured research experiences for trainees. (J Surg 71:345-352. © 2014 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: academic promotion, scholarly productivity, fellowship training, urology, research productivity, research output

COMPETENCIES: Medical Knowledge, Professionalism, Practice-Based Learning and Improvement

INTRODUCTION

The advent of novel surgical techniques and rapidly accumulating clinical knowledge has changed the climate of surgical specialties. In urology, laparoscopic and robotic techniques are rapidly becoming the standard of care in all subspecialties. In both academic and private practice settings, the use of these minimally invasive techniques has increased over time.[1,2] Consequently, it is not surprising that these technologies are increasingly incorporated into residency training. Nonetheless, recent surveys have suggested that most urology residents do not feel they have adequate technical and clinical training to begin their careers.[3,4] One

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analysis of urology physicians found that nearly half of participants in the study (49%) anticipated pursuing a fellowship when they applied for urology residency and an even greater number (69%) actually applied for a fellowship.[5] Among residents surveyed, the most important factors considered by individuals pursuing fellowships included the intellectual appeal of additional training, the presence of mentors with specialized training, and a desire for an additional point of view for surgical training.[5]

In addition to honing technical skills, fellowships potentially offer trainees further structured opportunities for conducting research, contributing to both their edification and the productivity of their department, scholastically and clinically.[2] Research productivity has been linked to better clinical care and increased opportunities for academic promotion, and may also be a factor in the tendency toward pursuing a fellowship.[6-12] Clinical and basic research is a time-consuming endeavor often limited during residency training.[13] According to the Fellowship and Residency Electronic Interactive Database,[14] 66 of the 124 nonmilitary residency programs in urology have a required research rotation, varying in length from a few weeks up to a year. Recently, the duration of many urology training programs has decreased to 5 years. This has the potential to decrease the opportunity to produce meaningful research during residency training, though the data related to this subject have been mixed.[5,6]

It has been reported that those who author or coauthor a manuscript during residency are 6-times more likely to pursue a fellowship.[5] When in fellowship, trainees often have more dedicated time to increase their clinical competency as well as their scholarly activities. It is suggested that participating in a fellowship exposes an individual to research, which may ultimately increase the propensity to enter academic medicine.[5]

In academia, advancement is directly linked to various attributes of the clinician. Patient care, teaching ability, grant support, scholarly activities, and national recognition are important factors in the evaluation of a faculty member.[7,15-18] Nonetheless, a study examining the views of faculty being considered for promotion reported that clinical research and written scholarship were the 2 criteria perceived to be most important in the promotion process.[19] Scholarly activity in the form of research publications is a relatively objective measure as compared with other criterion, which may explain its outsized importance in the advancement process. In addition to advancing the career of the clinician, academic productivity can augment the recognition and status of the home institution, further justifying its relationship with advancement.[20]

Quantifying research contribution is a complicated task that should ideally consider all of attributes of an individual's authorships. Factors such as total publications, total citations, and overall effect of the work are often used as measures of productivity.[21] The value of each of these factors individually is limited, however Hirsch[22] developed the *h-index*, an objective measure to quantify research and characterize the scientific output of an individual. Taking into account these various attributes related to a person's research output, the *h-index* measures the relevance of an individual's published work.

Hirsch proposed[22] that the *h-index* is best used when comparing individuals within a field. Studies undertaken in multiple fields, including urology, have illustrated a strong association between the *h-index* and other factors such as academic advancement, grant funding procurement, and other measures of scholarly impact.[15,16,18,23-46] This bibliometric serves as an excellent tool with which to compare researchers within the field of urology. Our objectives were to examine whether scholarly impact, as measured by the *h-index*, is affected by fellowship training status. Additionally, we aimed to further characterize whether there are differences in research productivity among academic practitioners in the various subspecialties to better understand whether there may be differences in research emphasis among these fields.

MATERIALS AND METHODS

The American Medical Association's Fellowship and Residency Electronic Interactive Database (FREIDA) was used to retrieve a listing of urology residency programs. Of the 124 academic urology departments on this list, faculty members from 101 programs were included in this analysis after application of exclusion criteria. Exclusion criteria included the following: nonurology-trained faculty, nonacademic faculty, nonphysician faculty, part-time clinical faculty, and faculty for whom academic rank or fellowship training status or both were not available on their respective departmental websites. Twenty-three websites had incomplete information about fellowship training or academic rank or both; therefore, all faculty members from these academic departments were also excluded.

Fellowship training information was used to organize faculty by the following major urologic subspecialties: endourology/minimally invasive urology, female urology/urodynamics, male infertility/andrology, pediatric urology, urologic oncology, other clinical fellowship, and multiple clinical fellowships.

The *h-index* of each faculty member was calculated using the Scopus database (www.scopus.com). As searching for commonly occurring names may result in multiple author profiles in Scopus, current and past departmental affiliations as well as journal source history were used to ensure the Scopus entries used for *h-index* calculations were for the appropriate author. The Scopus database is a widely used resource previously used to calculate the *h-index* in multiple other analyses.[15,16,18,23-26,29,32,47] It is one of a number of resources, including Publish or Perish and ISI Web of Knowledge. A previous analysis reported that *h-index* calculations from Scopus have a high degree of correlation with those from another widely used source, Google Scholar.[26] Data collection for this analysis was completed in February 2013.

Statistical Analysis

Mann-Whitney *U* test and Kruskal-Wallis test were used for comparison of continuous variables as appropriate, with threshold for significance set at $p < 0.05$. Statistical analysis was conducted using SPSS v20 (SPSS Inc., an IBM Company, Chicago, IL).

RESULTS

Mean scholarly impact, as measured by the *h-index*, increased with successive academic rank (Kruskal-Wallis test, $p < 0.01$), although this difference did not reach statistical significance on comparison of professors and departmental chairpersons (Mann-Whitney *U* test, $p = 0.10$) (Fig. 1). All chairpersons held the rank of professor; however, they were only counted in the chairperson category in Figure 1 to avoid double-counting faculty. The *h-index* of all professors (including chairpersons) was 21.3 ± 0.76 standard error of mean.

There was no statistical difference in *h-index* between fellowship-trained and nonfellowship-trained academic urologists (Mann-Whitney *U* test, $p = 0.80$) (Fig. 2). Differences were present on further examination by subspecialty. Urologic oncologists had a higher *h-index* than practitioners from all other specialties (Mann-Whitney *U* tests with each specialty, $p < 0.002$). Nonfellowship-trained academic urologists had a higher *h-index* than other specialties aside from urologic oncologists, although this difference only reached significance on comparison with faculty practicing pediatric urology or female urology/urodynamics (Mann-Whitney *U* tests, $p < 0.01$). Endourologists had a higher *h-index* than faculty practicing pediatric urology ($p = 0.01$)

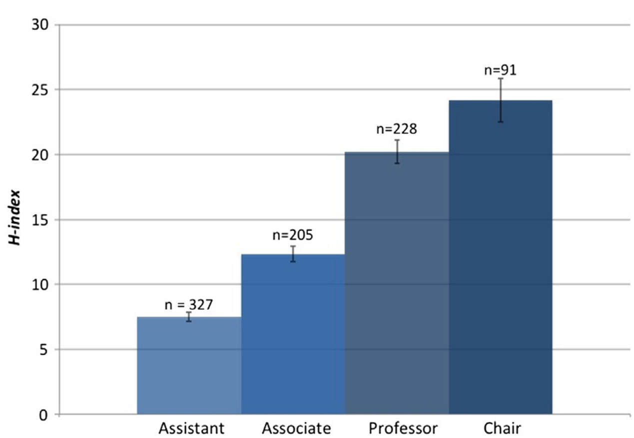

FIGURE 1. *h-Index* of 851 academic urologists organized by academic rank. *n* = Sample size, error bars represent standard error of mean.

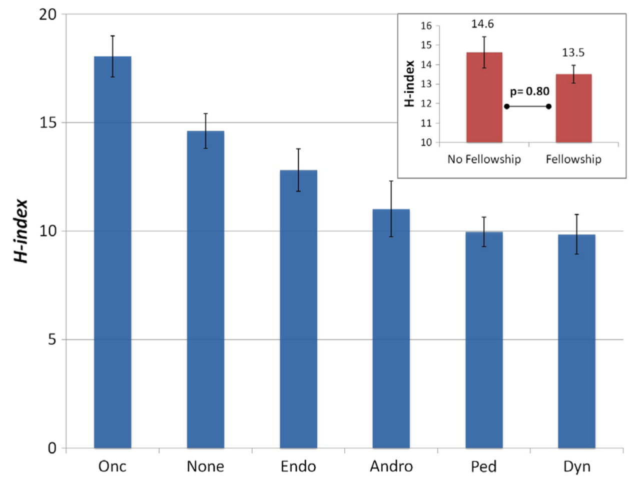

FIGURE 2. Scholarly impact organized by fellowship training status (inset, top right) and subspecialty training. Error bars represent standard error of mean. Onc, urologic oncologists; none, nonfellowship trained; Endo, endourology/minimally invasive urology; Andro, male infertility/andrology; Ped, pediatric urology; Dyn, female urology/urodynamics.

and urodynamics ($p = 0.052$), although this difference only bordered statistical significance on comparison with the latter. Scholarly impact of the 11 practitioners having undergone multiple clinical fellowships was 15.3 (± 2.8 standard error of mean). Information regarding practitioners completing training in a fellowship other than the 5 major subspecialties illustrated in Figure 2 can be found in Table 1. The previously described relationship of increasing *h-index* with successive academic rank was also noted on breakdown of faculty by subspecialty training (Fig. 3). Urologic oncologists and nonfellowship-trained urologists collectively comprised 69.2% of departmental chairpersons in this analysis (Fig. 4).

DISCUSSION

Urology as a surgical subspecialty has a growing number of trainees, with a consequent 33% increase in practicing urologists over the past 3 decades.[48] In addition to an increasing number of practitioners, research impact of academic urologists has also increased considerably in recent years. A recent analysis using the *h-index* determined that urologists had among the highest academic productivity relative to other surgical specialties.[24] The *h-index* is a

TABLE 1. Scholarly Impact of Practitioners in Other Urologic Clinical Fellowships

Fellowship	Mean *h-index* (±SEM)	Range	*n*
Trauma and recon	7.2 (±1.08)	1-27	28
Neurourology	19.3 (±4.73)	6-46	8
Renal transplant	27.8 (± 11.72)	8-65	5

SEM, standard error of mean.

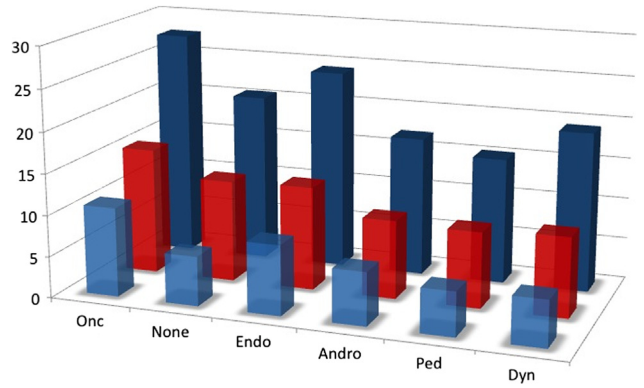

FIGURE 3. Scholarly impact organized by academic rank and subspecialty. Vertical axis represents *h-index*; depth axis (front to back) represents successive academic rank (Assistant Professor, Associate Professor, Professor). Onc, urologic oncology; none, nonfellowship trained; endo, endourology/minimally invasive urology; Andro, male infertility/andrology; Ped, pediatric urology; Dyn, female urology/urodynamics.

relatively new modality for the assessment of an author's scholarly accomplishments. This index takes into consideration the number of articles written and the number of times those articles have been cited.[22] For example, if an individual has published 20 articles and each article has been cited 20 different times, the *h-index* would equal 20. Similarly, if that individual published 30 articles but only 20 of them had been cited at least 20 times, the *h-index* would remain 20. This effectively displays the influence of a person's contribution to science by incorporating the number of times their work has been cited.

Overall, 851 urologists were analyzed across 101 urology academic departments; 63% of whom were fellowship trained. No significant difference in scholarly impact, as measured by the *h-index*, existed between fellowship and nonfellowship-trained urologists (*h-index* = 13.5 and 14.6, respectively, $p = 0.80$). Considerable differences were certainly seen, however, on comparison of the various urologic subspecialties (Fig. 2). Several factors may explain this finding. An important issue to consider when evaluating practitioners from each fellowship for academic output is the number of practicing physicians in that particular subspecialty. For example, in 2011, there were 10,601 practicing urologists, of which, only 232 were fellowship-trained pediatric urologists.[49] Practitioners in pediatric urology had the second lowest mean *h-index* of the major fellowships examined in this analysis. Those trained in pediatric urology represent only 2% of academic urologists in the United States and even a smaller fraction of the medical community. Given these statistics, publications from individuals in this field may be seen by a smaller audience and are thus cited less frequently, possibly leading to a lower *h-index*. Conversely, the nonfellowship-trained academic urologists may have a larger target audience, thereby increasing the chance that their work would be cited. Similarly, urologic oncologists had a statistically significantly higher *h-index* than any other group. This may be reflective of the fact that the field of urologic oncology is pertinent not only to the urologic specialty but to other specialties of medicine and research. Fields such as medical oncology, obstetricians/gynecologists, and the basic sciences may all benefit from the research produced by these fellowship-trained urologists.

Despite the possibility that the number of practitioners within a field may influence the frequency with which works are cited, examining scholarly impact by the *h-index* still may relay differences in research emphasis among differing specialties. A previous examination comparing scholarly impact among various surgical specialties had shown that urologists, along with neurological surgeons and general surgeons, had the highest mean *h-index*.[24] For example, neurological surgeons number approximately 5000 practitioners in the United States. This number is approximately 5 times less than the number of general surgeons, yet neurosurgeons had equivalent research productivity in that analysis, as well as higher scholarly impact than physicians in several other larger fields such as orthopedic surgery, ophthalmology, and plastic surgery. Additionally, although there were approximately 40,000 practicing obstetricians and gynecologists in 2008 according to the Association of American Medical Colleges (the largest surgical specialty in the aforementioned *h-index* analysis), practitioners in this specialty had the lowest scholarly impact as measured by this bibliometric. These figures indicate that emphasis on research certainly plays a role in differences among surgical specialties, rather than size of audience alone.

The lack of a difference in *h-index* between fellowship-trained and nonfellowship-trained practitioners potentially suggests that research is not highly emphasized at the fellowship level. This is in contrast to analyses of research productivity in other fields; 1 analysis of the influence of fellowship training on research productivity among academic otolaryngologists found that fellowship-trained practitioners

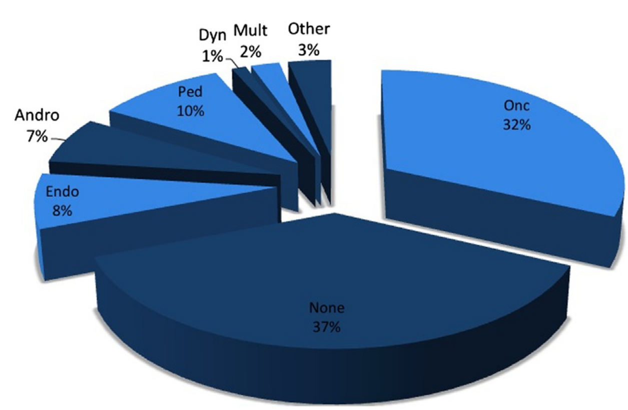

FIGURE 4. Subspecialty breakdown of departmental chairpersons. Onc, urologic oncology; none, nonfellowship trained; Endo, endourology/minimally invasive urology; Andro, male infertility/andrology; Ped, pediatric urology; Dyn, female urology/urodynamics.

had a significantly higher *h-index* than their nonfellowship-trained colleagues.[29]

Factors other than fellowship training obviously play an important role in influencing scholarly productivity. A 2010 study looking at *h-indices* of radiologists found a significant difference in *h-indices* of all levels of academic rank when comparing the top 25 NIH-funded programs and the non–top 25 NIH-funded programs.[15] A recent study looking at urologists and NIH funding showed that increased grant funding was related to higher *h-index* scores.[27] Concordantly, a study in 2011 revealed a significantly higher *h-index* among urologists from the top 50 urology hospitals in 2009 as listed by the U.S. News and World Report.[50] It is possible therefore that fellowship-trained urologists are producing more research and thus higher *h-indices* more so at the top NIH-funded programs. This is not to suggest that research is not valued at other training locations, and a future study examining the *h-index* of urologists at these programs may reveal a significant difference at institutions where research and manuscript preparation may be more highly emphasized.

The present analysis also found that as academic rank increased, there was a significant increase in *h-index*, consistent with previous studies in various fields of medicine and surgery. Interestingly, nearly 70% of departmental chairpersons had fellowship training in urologic oncology or no fellowship training. These 2 fields comprised the 2 highest *h-indices*. It has been previously suggested that research productivity is a significant factor involved in academic progression, underscoring this finding.[19]

There are some limitations that are important to acknowledge in the data collection process. The information was obtained from program websites, which are updated periodically. The websites may not accurately reflect factors such as the faculty position or new fellowships completed if such a lag exists. Furthermore, the websites do not always provide information about the academic track of a physician. Academic institutions often provide a tenure track and nontenure track for faculty. In the latter, research may not be highly emphasized.[51,52] The definitive track could not be determined by the website information and thus, the influence of the track on scholarly output was not measured.

h-index integrates individual measures of research output to produce a reliable and easily calculable measure of the relevance of the author's contributions. This tool, however, has some inherent limitations regarding evaluation of researchers. One major criticism of the *h-index* includes a potential bias toward clinical research. As an example, basic and translational research pursuits often require a more substantial investment of time. Though this research may ultimately prove to have a larger influence on the scientific community, the amount of time required to produce such research may potentially lower the total *h-index* score of the physician scientists involved in such work. The *h-index* consequently may not accurately reflect the significance of their contributions.[22,53] In a similar manner, authors often include "honorary" authorship, such as department chairs, as additional contributors to the article. Although this may inflate an individual's *h-index*, it is difficult to assess an author's actual contribution. Thus, the effect of this phenomenon cannot be accurately assessed.

Self-citation is another criticism of the *h-index*.[18,22,27,54] Although this may have a more profound effect on increasing one's *h-index* at low values, it becomes exceedingly difficult for those already at a higher *h-index* scores, as it would require repeated and sustained citation to raise one's *h-index* by more than 1 or 2.[24,55] Recent reports have noted that there is minimal change in the *h-index* owing to self-citation.[55,56] Another limitation is that the *h-index* does not take into account the author's contribution to the work. An individual who is consistently a coauthor to a prolific author could possibly have a sizeable *h-index* not indicative of the quality of their scholarship. However, this would be difficult to effectively raise the *h-index* without consistently being a coauthor on a large number of publications. Despite these drawbacks, the *h-index* remains one of the few measurements that take into account numerous attributes regarding an individual's scholarly activities in an objective manner, such as how frequently an author is contributing relevant and highly cited material toward scholarly discourse within a field, making it an invaluable tool in assessing academic research productivity.

CONCLUSION

Several factors influence career advancement in academic urology, including mentorship, administrative responsibilities, and patient care. Research productivity also plays an important role in this process. In addition to furthering a clinician's career, it boosts the recognition and status of the home department and the institution. Approximately 70% of department chairpersons in this analysis were either nonfellowship-trained or urologic oncologists, the 2 subspecialties with the highest mean *h-index*, suggesting that a strong research profile is highly valued during selection for academic promotion. Although no overall difference was noted in scholarly impact between fellowship-trained and nonfellowship-trained urologists, differences existed on further comparison by subspecialty. Fellowship training represents another potential opportunity to introduce structured research experiences for trainees, as only 50% of urology residencies have research built into their schedules.

REFERENCES

1. Duchene DA, Rosso F, Clayman R, McDougall EM, Winfield HN. Current minimally invasive practice patterns among postgraduate urologists. *J Endourol*. 2011;25(11):1797-1804.

2. Grober ED, Elterman DS, Jewett MA. Fellow or foe: the impact of fellowship training programs on the education of Canadian urology residents. *Can Urol Assoc J*. 2008;2(1):33-37.

3. Erickson BA, Voelzke BB, Myers JB, et al. Practice patterns of recently fellowship-trained reconstructive urologists. *Urology*. 2012;80(4):934-937.

4. Duchene DA, Moinzadeh A, Gill IS, Clayman RV, Winfield HN. Survey of residency training in laparoscopic and robotic surgery. *J Urol*. 2006;176(5):2158-2166 [discussion 2167].

5. Freilich DA, Nguyen HT, Phillips JL. Factors influencing residents' pursuit of urology fellowships. *Urology*. 2011;78(5):986-992.

6. Hellenthal NJ, Ramirez ML, Yap SA, Kurzrock EA. Manuscript publication by urology residents and predictive factors. *J Urol*. 2009;181(1):281-286 [discussion 286-287].

7. Atasoylu AA, Wright SM, Beasley BW, et al. Promotion criteria for clinician-educators. *J Gen Intern Med*. 2003;18(9):711-716.

8. Beasley BW, Wright SM, Cofrancesco J Jr, Babbott SF, Thomas PA, Bass EB. Promotion criteria for clinician-educators in the United States and Canada. A survey of promotion committee chairpersons. *J Am Med Assoc*. 1997;278(9):723-728.

9. Chapman T, Carrico C, Vagal AS, Paladin AM. Promotion as a clinician educator in academic radiology departments: guidelines at three major institutions. *Acad Radiol*. 2012;19(1):119-124.

10. Dixon AK. Publishing and academic promotion. *Singapore Med J*. 2009;50(9):847-850.

11. Holden G, Rosenberg G, Barker K. Bibliometrics: a potential decision making aid in hiring, reappointment, tenure and promotion decisions. *Soc Work Health Care*. 2005;41(3-4):67-92.

12. Sanfey H, Hollands C. Career development resource: promotion to associate professor. *Am J Surg*. 2012;204(1):130-134.

13. Koh CJ, Freeman MR, Retik AB. Increasing the ranks of physician-scientists in urology through the promotion of fellowship training: the example of pediatric urology. *J Urol*. 2005;173(6):2110-2111.

14. Association Medical Association. FREIDA Online. Available at: ⟨http://www.ama-assn.org/ama/pub/education-careers/graduate-medical-education/freida-online.page⟩ Accessed 12.03.13.

15. Rad AE, Brinjikji W, Cloft HJ, Kallmes DF. The H-index in academic radiology. *Acad Radiol*. 2010;17(7):817-821.

16. Eloy JA, Svider P, Chandrasekhar SS, et al. Gender disparities in scholarly productivity within academic otolaryngology departments. *Otolaryngol Head Neck Surg*. 2013;148(2):215-222.

17. Buckley LM, Sanders K, Shih M, Kallar S, Hampton C. Obstacles to promotion? Values of women faculty about career success and recognition. Committee on the Status of Women and Minorities, Virginia Commonwealth University, Medical College of Virginia Campus. *Acad Med*. 2000;75(3):283-288.

18. Svider PF, Choudhry ZA, Choudhry OJ, Baredes S, Liu JK, Eloy JA. The use of the h-index in academic otolaryngology. *Laryngoscope*. 2013;123(1):103-106.

19. Beasley BW, Wright SM. Looking forward to promotion: characteristics of participants in the prospective study of promotion in academia. *J Gen Intern Med*. 2003;18(9):705-710.

20. Akl EA, Meerpohl JJ, Raad D, et al. Effects of assessing the productivity of faculty in academic medical centres: a systematic review. *Can Med Assoc J*. 2012;184(11):E602-E612.

21. Aoun SG, Bendok BR, Rahme RJ, Dacey RG Jr, Batjer HH. Standardizing the evaluation of scientific and academic performance in neurosurgery-critical review of the h index and its variants. *World Neurosurg*. 2012 Feb 03; Epub ahead of print; DOI: 10.1016/j.wneu.2012.01.052.

22. Hirsch JE. An index to quantify an individual's scientific research output. *Proc Natl Acad Sci U S A*. 2005;102(46):16569-16572.

23. Benway BM, Kalidas P, Cabello JM, Bhayani SB. Does citation analysis reveal association between h-index and academic rank in urology? *Urology*. 2009;74(1):30-33.

24. Svider PF, Pashkova AA, Choudhry Z, et al. Comparison of scholarly impact among surgical specialties: an examination of 2429 academic surgeons. *Laryngoscope*. 2013;123(4):884-889.

25. Pagel PS, Hudetz JA. H-index is a sensitive indicator of academic activity in highly productive anaesthesiologists: results of a bibliometric analysis. *Acta Anaesthesiol Scand*. 2011;55(9):1085-1089.

26. Lee J, Kraus KL, Couldwell WT. Use of the h index in neurosurgery. *J Neurosurg*. 2009;111(2):387-392 [Clinical article].

27. Colaco M, Svider PF, Mauro KM, Eloy JA, Jackson-Rosario I. Is there a relationship between National Institutes of Health funding and research impact on academic urology? *J Urol*. 2013;190(3):999-1003.

28. Eloy JA, Svider PF, Cherla DV, et al. Gender disparities in research productivity among 9952 academic physicians. *Laryngoscope*. 2013;123(8):1865-1875.

29. Eloy JA, Svider PF, Mauro KM, Setzen M, Baredes S. Impact of fellowship training on research productivity in academic otolaryngology. *Laryngoscope*. 2012;122(12):2690-2694.

30. Eloy JA, Svider PF, Patel D, Setzen M, Baredes S. Comparison of plaintiff and defendant expert witness qualification in malpractice litigation in otolaryngology. *Otolaryngol Head Neck Surg*. 2013;148(5):764-769.

31. Eloy JA, Svider PF, Patel D, Setzen M, Baredes S. In response to comparison of plaintiff and defendant expert witness qualification in malpractice litigation in otolaryngology. *Otolaryngol Head Neck Surg*. 2013;149(4):649-650.

32. Svider PF, Mauro KM, Sanghvi S, Setzen M, Baredes S, Eloy JA. Is NIH funding predictive of greater research productivity and impact among academic otolaryngologists? *Laryngoscope*. 2013;123(1):118-122.

33. Castillo M. Measuring academic output: the H-index. *Am J Neuroradiol*. 2010;31(5):783-784.

34. Pagel PS, Hudetz JA. Bibliometric analysis of anaesthesia journal editorial board members: correlation between journal impact factor and the median h-index of its board members. *Br J Anaesth*. 2011;107(3):357-361.

35. Pagel PS, Hudetz JA. Scholarly productivity of United States academic cardiothoracic anesthesiologists: influence of fellowship accreditation and transesophageal echocardiographic credentials on h-index and other citation bibliometrics. *J Cardiothorac Vasc Anesth*. 2011;25(5):761-765.

36. Quigley MR, Holliday EB, Fuller CD, Choi M, Thomas CR Jr. Distribution of the h-index in radiation oncology conforms to a variation of power law: implications for assessing academic productivity. *J Cancer Educ*. 2012;27(3):463-466.

37. Rezek I, McDonald RJ, Kallmes DF. Is the h-index predictive of greater NIH funding success among academic radiologists? *Acad Radiol*. 2011;18(11):1337-1340.

38. Eloy JA, Svider PF, Kovalerchik O, Baredes S, Kalyoussef E, Chandrasekhar SS. Gender differences in successful NIH grant funding in otolaryngology. *Otolaryngol Head Neck Surg*. 2013;149(1):77-83.

39. Svider PF, Mady LJ, Husain Q, et al. Geographic differences in academic promotion practices, fellowship training, and scholarly impact. *Am J Otolaryngol*. 2013;34(5):464-470.

40. Svider PF, Lopez SA, Bhagat N, Eloy JA, Langer PD. The association between scholarly impact and National Institutes of Health funding in ophthalmology. *Ophthalmology*, 2013 Sep 23; Epub ahead of print; DOI: 10.1016/j.ophtha.2013.08.009.

41. Svider PF, Husain Q, Folbe AJ, Couldwell WT, Liu JK, Eloy JA. Assessing NIH funding and scholarly impact in neurological surgery. *J Neurosurg*, 2013 Nov 12; Epub ahead of print; DOI: 10.3171/2013.8.JNS13938.

42. Pashkova AA, Svider PF, Chang CY, Diaz L, Eloy JA, Eloy JD. Gender disparity among US anaesthesiologists: are women underrepresented in academic ranks and scholarly productivity? *Acta Anaesthesiol Scand*. 2013;57(8):1058-1064.

43. Svider PF, Blake DM, Setzen M, Folbe AJ, Baredes S, Eloy JA. Rhinology fellowship training and its scholarly impact. *Am J Rhinol Allergy*. 2013;27:e131-e134.

44. Agarwal N, Clark S, Svider PF, Couldwell WT, Eloy JA, Liu JK. Impact of fellowship training on research productivity in academic neurological surgery. *World Neurosurg*, 2013 Sep 17; Epub ahead of print; DOI: pii: S1878-8750(13)01119-4. 10.1016/j.wneu.2013.09.020.

45. Eloy JA, Svider PF, Folbe AJ, Couldwell WT, Liu JK. Comparison of plaintiff and defendant expert witness qualification in malpractice litigation in neurological surgery. *J Neurosurg*, 2013 Sep 27; Epub ahead of print; DOI: 10.3171/2013.8.JNS13584.

46. Eloy JA, Svider PF, Setzen M, Baredes S, Folbe AJ. Does receiving an American Academy of Otolaryngology–Head and Neck Surgery Foundation centralized otolaryngology research efforts grant influence career path and scholarly impact among fellowship-trained rhinologists? *Int Forum Allergy Rhinol*. 2013. [Epub ahead of print] http://dx.doi.org/10.1002/alr.21224.

47. Pagel PS, Hudetz JA. An analysis of scholarly productivity in United States academic anaesthesiologists by citation bibliometrics. *Anaesthesia*. 2011;66(10):873-878.

48. Neuwahl Simon, Thompson K, Fraher PE, Ricketts T. HPRI data track. Urology workforce trends. *Bull Am Coll Surg*. 2012;97:46-49 [Accessed 24.03.13].

49. Association of American Medical Colleges. Careers in Medicine. Available at: ⟨https://wwwaamcorg/students/medstudents/cim/⟩ Accessed 10.03.13.

50. Jacob BA, Lefgren L. The impact of research grant funding on scientific productivity. *J Public Econ*. 2011;95(9-10):1168-1177.

51. Fleming VM, Schindler N, Martin GJ, DaRosa DA. Separate and equitable promotion tracks for clinician-educators. *J Am Med Assoc*. 2005;294(9):1101-1104.

52. Todisco A, Souza RF, Gores GJ. Trains, tracks, and promotion in an academic medical center. *Gastroenterology*. 2011;141(5):1545-1548.

53. Patel VM, Ashrafian H, Bornmann L, et al. Enhancing the h index for the objective assessment of healthcare researcher performance and impact. *J R Soc Med*. 2013;106(1):19-29.

54. Purvis A. The h index: playing the numbers game. *Trends Ecol Evol*. 2006;21(8):422.

55. Engqvist L, Frommen JG. The h-index and self-citations. *Trends Ecol Evol*. 2008;23(5):250-252.

56. Rad AE, Shahgholi L, Kallmes D. Impact of self-citation on the H index in the field of academic radiology. *Acad Radiol*. 2012;19(4):455-457.