The Impact of Fellowship Training on Scholarly Productivity in Academic Dermatology

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PRACTICE **POINTS**

- As residents decide whether to pursue fellowship training, it is important to consider the importance of fellowship completion for academic promotion and productivity.
- Although there is greater scholarly productivity among fellowship-trained dermatologists compared to non–fellowship-trained dermatologists, this difference is minimized when controlling for academic rank and publication range.
- Fellowships may provide more opportunity for structured research experiences but may not be necessary for successful careers in academic dermatology.

An increasing number of dermatology residents are pursuing postresidency fellowships to augment their knowledge in dermatology subspecialties. The purpose of this study was to determine whether fellowship training affects the scholarly impact of academic dermatologists, as measured by the h-index. A secondary objective was to compare scholarly productivity among different dermatology subspecialties. Overall, fellowship training is associated with increased scholarly impact; however, when stratifying for academic rank and years of publication activity, this difference does not exist.

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The percentage of dermatology residents pursuing fellowship training is steadily increasing. A report from the American Board of Dermatology described an increase in the percentage of residents entering fellowships approved by the American Board of Dermatology and Accreditation Council for Graduate Medical Education from 10% in 2006 to 24% in 2010.[1] The American Medical Association Residency & Fellowship Database FREIDA Online showed that 30% of dermatology residents or fellows pursued further fellowship training in 2013.[2] The number of dermatology fellowship positions offered also is steadily increasing. Data from SF Match showed that the number of participating applicants in Mohs micrographic surgery (MMS) fellowships increased from 64 in 2002 to 86 in 2014, and the number of programs increased from 48 to 56, respectively.[3] Similarly, in pediatric dermatology the SF Match reported an increase from 14 to 22 in participating applicants and an increase in available programs from 14 to 20 in 2009 and 2012, respectively.[4] Reports on dermatopathology programs also have suggested either a stable or increased percentage of residents pursuing fellowships in this specialty.[5,6]

There are several reported factors that influence the pursuit of dermatology fellowships. Fellows often

hope to gain further exposure to a dermatology subspecialty,[7] which is especially applicable to procedural dermatology, as the prevailing opinion among dermatologists is that residency training should emphasize medical dermatology much more than surgery.[8,9] Increased financial compensation, responsibility to provide for a family, and increased levels of educational debt do not notably influence the desire to pursue a fellowship, though these factors often play a role in the decision to pursue a career in academia.[6,10-12] Additionally, it has been reported that fellowship-trained dermatologists are more likely to teach students, residents, and fellows and are up to 8 times more likely to participate in research than non–fellowship-trained dermatologists.[6,8,11] Research activity also correlates with the decision to pursue an academic career. As such, fellowship training may present physicians with opportunities to improve clinical care, garner more research opportunities, and advance in academic rank.[13]

Scholarly productivity, measured by contribution to research, is a heavily weighted factor when hiring and promoting within academic medicine.[14-17] Despite the importance of scholarly productivity, it is difficult to accurately quantify the measure. Commonly used metrics include number of publications, number of citations, amount of National Institutes of Health funding, number of research presentations, and number of lectures.[18,19] However, taken individually, none of these measures entirely represents an individual's research contribution. For example, a physician may have a large number of relatively low-quality publications. Additionally, if considering the number of citations, one of an author's publications may have many citations, while the remaining publications do not.

The h-index, introduced in 2005 by Hirsch,[20,21] is a measure of academic productivity that takes into account both the quantity and impact of research measured by recording the number of published articles and the number of citations in peer-reviewed journals. A high h-index indicates a high number of significant publications. For example, if a physician has 10 published articles cited 10 times each, his/her h-index is 10. Another physician with an h-index of 10 may have published 50 articles, which indicates that the remaining 40 articles were cited fewer than 10 times. Prior studies on the use of the h-index in fields as diverse as otolaryngology, radiology, anesthesiology, neurosurgery, ophthalmology, and urology indicate a strong association between the h-index and academic rank.[22-28] Other studies indicate that fellowship-trained individuals tend to have a higher h-index than their non–fellowship-trained counterparts.[29,30] One study demonstrated that fellowship-trained dermatologic surgeons had significantly increased academic productivity ($P=.001$), as measured by the number of publications in PubMed, compared to non–fellowship-trained dermatologic surgeons.[11]

The goal of this study was to determine whether dermatology fellowship training impacts scholarly productivity and academic promotion. Additionally, the scholarly productivity of procedural dermatology/MMS, dermatopathology, and pediatric dermatology fellows is compared to determine if type of subspecialty affects research productivity.

Methods

A list of academic dermatology departments was accessed using FREIDA Online. Individual departmental websites were visited to compile a list of academic faculty members. Additional recorded data included academic rank, gender, and fellowship training. Academic rank was classified as assistant professor, associate professor, professor, and chair. Physicians listed as chairs were not listed as professors to avoid duplication of these individuals. Voluntary, nonclinical, and nonacademic faculty members were excluded from the analysis. Departments that did not list the academic rank of faculty members also were excluded. Faculty members were organized by fellowship type: procedural dermatology/MMS, dermatopathology, pediatric dermatology, other fellowship, and no fellowship. Individuals with multiple fellowships were counted in multiple categories.

Faculty members were subsequently searched on the Scopus database to determine the h-index and publication range in years. Correct author identity was ensured by confirming correct departmental affiliations and publications related to dermatology. (Results collected from the Scopus database have been shown to correlate well with those of ISI Web of Knowledge.[23])

Kruskal-Wallis tests were used to compare continuous variables, and the Pearson χ^2 test was used to compare categorical variables. Statistical significance was set at $P<.05$. All statistical analyses were performed using SAS software. This study qualified as nonhuman subject research per the institutional review board of Rutgers New Jersey Medical School (Newark, New Jersey).

Results

The analysis included 1043 faculty members from 103 academic departments. There were 144 dermatologists (13.8%) with procedural dermatology/MMS fellowships, 162 (15.5%) with dermatopathology fellowships, 71 (6.8%) with pediatric dermatology fellowships, 124 (11.9%) with other

fellowships, and 542 (52.0%) with no fellowships (Figure 1). Fellowships classified as other included immunodermatology, dermatology-rheumatology, clinical education, dermatoepidemiology, cutaneous oncology, dermatopharmacology, and photobiology. Fellowship-trained dermatologists had a higher mean h-index than dermatologists without fellowships (13.2 vs 11.7; $P<.001$)(Figure 2).

There were significant statistical differences among the fellowships examined (Kruskal-Wallis analysis of variance, $P<.05$). Academic dermatologists who completed dermatopathology or other fellowships had higher scholarly productivity than those who completed pediatric dermatology and procedural dermatology/MMS fellowships ($P<.05$) (Figure 3). Those who did not complete a fellowship had a higher mean h-index than those who completed pediatric dermatology and procedural dermatology/MMS fellowships; however, the difference was not statistically significant.

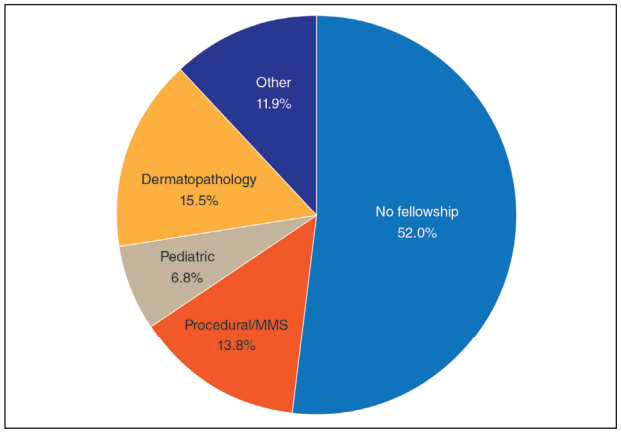

Figure 1. Distribution of academic dermatologists according to fellowship (N=1043).

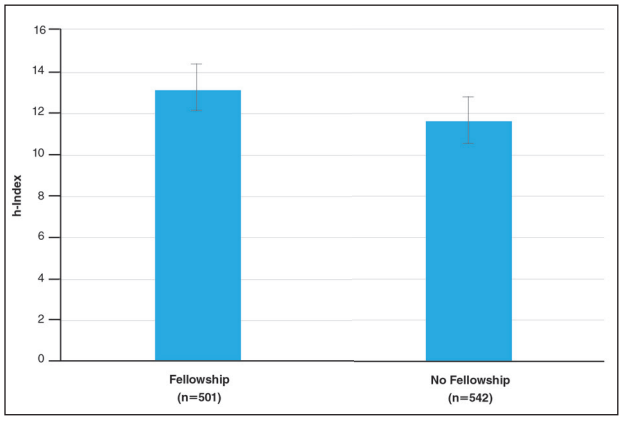

Figure 2. Mean h-index of fellowship-trained (n=501) and non–fellowship-trained (n=542) academic dermatologists from 103 departments. Error bars represent standard error of the mean.

Regarding academic rank, there was a significant increase in scholarly productivity (as measured by the h-index) from assistant professor to professor ($P<.05$). There was no statistical difference in scholarly productivity between professors and chairs. When controlling for academic rank, there were no statistically significant differences in h-index between fellowship-trained versus non–fellowship-trained dermatologists, except at the level of associate professor. However, fellowship-trained dermatologists consistently had a higher mean h-index compared to non–fellowship-trained dermatologists in each rank (Figure 4). Fellowship-trained dermatologists made up 48.2% (222/461) of assistant professors, 45.2% (103/228) of associate professors, 47.3% (125/264) of professors, and 56.7% (51/90) of chairs.

When controlling for the number of active publication years, no statistically significant differences were found between scholarly productivity in fellowship-trained versus non–fellowship-trained dermatologists. However, fellowship-trained academic dermatologists consistently had a higher mean h-index than non–fellowship-trained dermatologists within each 10-year range, except for the 31- to 40-year range (Figure 5).

Comment

The proportion of dermatology residents who pursue fellowship training has been steadily increasing, according to data from the American Medical Association and American Board of Dermatology.[1,2] Fellowship training allows graduating residents to have greater exposure to a dermatology subspecialty and often provides a narrower focus for future clinical activities. In our study, we found that fellowship-trained dermatologists had significantly higher research productivity, as measured by the h-index, than academic dermatologists without fellowship, which is likely because fellowship training

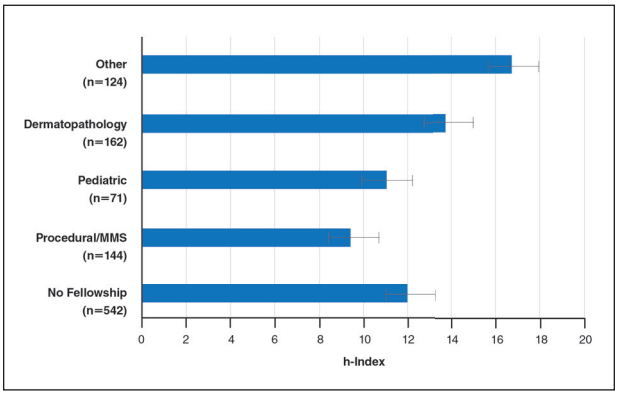

Figure 3. Mean h-index of 1043 academic dermatologists included in this study distributed by fellowship. Error bars represent standard error of the mean.

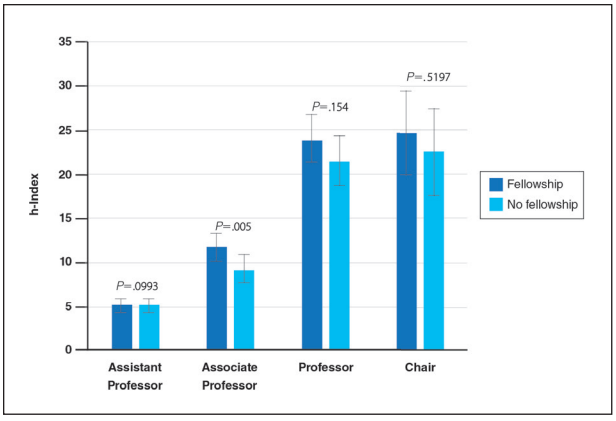

Figure 4. Mean h-index of fellowship-trained and non–fellowship-trained dermatologists stratified by academic rank. Errors bars represent standard error of the mean.

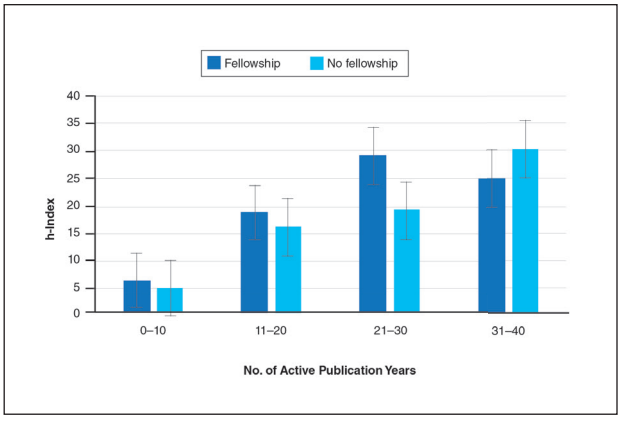

Figure 5. Mean h-index of fellowship-trained and non–fellowship-trained dermatologists stratified by number of active publication years. Errors bars represent standard error of the mean.

offers an opportunity to hone teaching skills and pursue more research activity.[13] For instance, several fellowship programs allow focused research time during training.[11] Additionally, residents pursuing fellowships may be more likely to engage in research activities.

Greater scholarly productivity is especially important for academic physicians, as it plays an important role in hiring and promoting.[14,15,19,31] Additionally, increased research productivity has been found to be associated with improved teaching and clinical activity.[19] Research productivity of faculty members also influences the reputation and prestige of the department and the institution's subsequent ability to attract higher-quality residents and faculty members.[28]

There were significant differences in mean h-index between dermatology subspecialties. Academic dermatologists who completed procedural dermatology/MMS fellowships had the lowest mean h-index, while those who completed dermatopathology or other fellowships had the highest mean h-index. These findings suggest that an emphasis on research productivity may be greater in dermatopathology. Additionally, dermatologists who completed other fellowships, such as immunodermatology or dermatopharmacology, may have received such fellowships prior to dermatology training. It would be interesting to determine the amount of time allocated for research within each subspecialty fellowship training.

A greater amount of clinical responsibility also may influence the difference in measures of scholarly productivity within each subspecialty. For instance, there is a known shortage of pediatric dermatologists,[32] which may translate as a decreased amount of time that can be dedicated to research activity because of higher clinical volume per physician. Dermatologists with no fellowship had a higher mean h-index than those with pediatric and procedural dermatology/MMS fellowships, which may reflect the smaller number of subspecialists compared to non–fellowship-trained dermatologists (13.8% procedural dermatology/MMS; 6.8% pediatric dermatology; 52.0% no fellowship). As such, the research of subspecialists is targeted to a narrower audience and will garner fewer citations than non–fellowship-trained dermatologists. However, the lower number of subspecialists is not the only factor impacting scholarly productivity, as dermatopathologists had higher scholarly impact than non–fellowship-trained individuals despite comprising only 15.5% of the cohort.

In corroboration with prior studies of academic medicine, the h-index increased with increasing rank from assistant professor to professor and chair.[29,30,33] This increase confirms that research productivity is associated with academic rank. When stratifying the 2 cohorts of fellowship-trained and non–fellowship-trained academic dermatologists by academic rank, there was no significant difference in the h-index for both groups at each rank, except for associate professor. In addition, there was a relatively equal distribution within each rank of fellowship-trained and non–fellowship-trained individuals. This lack of statistical difference also was demonstrated when stratifying for years of active publication experience. Academic dermatologists have been shown to be more interested in pursuing research activity, and research is pivotal to pursuing a dermatology residency.[11] Future studies may extend the comparison of scholarly productivity to nonacademic dermatologists.

It is important to acknowledge certain limitations in the data collection process and use of the h-index. Many of the dermatology department websites do

not provide information about whether individual faculty members are pursuing a tenure track or nontenure track. This distinction may have bearing on the h-index, as research is more heavily emphasized in the tenure track. Moreover, the h-index does not take into account the type of research (ie, clinical vs basic science research). Therefore, while basic science research often is more time intensive than clinical research, a publication is weighed solely by its number of citations. As such, the h-index may not capture the true amount of time dedicated to research activities. In addition, the h-index cannot account for self-citation, which may increase this measure.[34] However, to greatly influence the h-index, many self-citations of each work would be necessary, making it less concerning. Another limitation of this study is that it does not take into account time dedicated to the education of residents and medical students, an act that is necessary for preservation of the field. Although education portfolios that detail an individual's contribution to teaching are starting to become more popular, there currently is no measure for educational activities.[18,35] Finally, dermatology department websites are not frequently updated; as such, data gathered from websites regarding academic rank may not always be recent.

Conclusion

Scholarly productivity, as measured by the h-index, is a major contributory factor to hiring, promoting, and developing reputations in academic medicine. Our findings demonstrate that there is greater scholarly productivity among fellowship-trained dermatologists compared to non–fellowship-trained dermatologists. However, when controlling for academic rank and publication range, this difference is minimized. As such, fellowships may provide more opportunity for structured research experiences but may not be necessary for successful academic careers. In addition, individuals who wish to dedicate a substantial portion of time to research may find that fellowships in dermatopathology, immunodermatology, dermatology-rheumatology, clinical education, dermatoepidemiology, cutaneous oncology, dermatopharmacology, and photobiology are more conducive to performing research. We also recommend that other activities, including clinical and teaching activities, serve as supplemental measures to scholarly productivity when evaluating a physician's contribution.

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