Does the *H* Index Correlate With Academic Rank Among Full-Time Academic Craniofacial Surgeons?

Srinivas M. Susarla, DMD, MD, MPH, Erin M. Rada, MD, Joseph Lopez, MD, MBA, Edward W. Swanson, MD, Devin Miller, BA, Richard J. Redett, MD and Anand R. Kumar, MD

Department of Plastic and Reconstructive Surgery, Johns Hopkins Hospital, Baltimore, Maryland

OBJECTIVE: To assess the relationship between the *H* index and the academic rank among full-time academic craniofacial surgeons.

DESIGN: This was a cross-sectional study of full-time academic craniofacial surgeons.

SETTING: Data were compiled and analyzed at the Department of Plastic and Reconstructive Surgery, Johns Hopkins Hospital.

RESULTS: The study sample included 127 full-time academic craniofacial surgeons. Overall, 89% were men, the mean number of years since completion of training was 16.2 ± 11.2 years. Most surgeons had a background in plastic and reconstructive surgery. Approximately 75% had completed formal fellowship training. The mean *H* index for the sample was 12.4 ± 9.9. The *H* index was strongly correlated with academic rank ($r_s = 0.62$, $p < 0.001$). In a multiple linear regression model, adjusting for multiple confounders/effect modifiers, including number of years since training and total number of publications, the *H* index was significantly associated with academic rank (coefficient = 0.33, $p = 0.04$).

CONCLUSIONS: Among full-time academic craniofacial surgeons, the *H* index is strongly correlated with the academic rank. (J Surg Ed 74:222-227. © 2017 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: *H* index, bibliometrics, craniofacial surgery, academic medicine, academic promotion

COMPETENCIES: Systems-Based Practice, Practice-Based Learning and Improvement, Interpersonal and Communication Skills

Correspondence: Inquiries to Anand R. Kumar, MD, Johns Hopkins Children's Center, 1800 Orleans Street, Bloomberg 7, Baltimore, MD 21287; e-mail: AKUMAR40@JHMI.EDU

INTRODUCTION

Historically, promotion among academic surgeons was largely based on research productivity.[1-16] More recently, many institutions have developed alternative tracks for promotion, which reward merits in nonresearch areas such as community service, teaching, clinical productivity, and leadership.[17-19] Although these alternate pathways reward non–research-based activities, research still remains an important component of an academic career and remains a component of the promotions process, regardless of academic track.

Clinicians' total number of publications is frequently used to assess the quality of their scholarly contribution to their field. Recent advances in bibliometrics have resulted in several additional measures of productivity, which account for not only the total number of publications but also the quality of the work, as assessed by the frequency of citation by other authors. Among these are the i-10 index, which represents the number of publications by an author that have at least 10 citations each, and the *H* index, which is the number of papers *h* that have at least *h* citations each.[1-3] These composite measures may, theoretically, provide a more accurate representation of scholarly activity. As such, several institutions have incorporated these metrics, particularly the *H* index, into promotion decisions.[17-20] Consequently, there is an increasing body of literature providing data on bibliometric parameters for various academic ranks among various specialties. Among these, the *H* index is the most extensively studied.[1-16]

Craniofacial surgery is a unique subspecialty that predominately comprised surgeons with backgrounds in either plastic and reconstructive surgery or oral and maxillofacial surgery. Analysis of academic productivity within this subspecialty is unique, as craniofacial surgeons may have academic appointments in either schools of medicine or schools of dentistry (or both), and different schools may have different criteria for promotions. Additionally, subspecialists may have more in common with each other than

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they do with their primary background specialty and, as such, may perhaps be unfairly judged for promotion by comparing to others within their primary field. This has been seen among full-time academic hand surgeons, who may have backgrounds in either orthopedic surgery or plastic surgery. The mean bibliometric measures for academic rank among hand surgeons are different from those for plastic surgeons and orthopedic surgeons overall.

The purpose of this study was to assess the association between academic rank and bibliometric measures of research productivity among full-time academic craniofacial surgeons. We hypothesized that there would be strong correlations between the *H* index and academic rank among full-time academic craniofacial surgeons. To address this hypothesis, our specific aims were to (1) identify a cohort of full-time academic craniofacial surgeons, (2) record demographic and academic rank data, (3) record bibliometric data, and (4) identify associations between the academic rank and the *H* index.

MATERIALS AND METHODS

Study Design/Sample

This was a cross-sectional study of full-time academic craniofacial surgeons. The study sample was identified by using the membership databases of the American Society of Craniofacial Surgeons (ASCFS) and the American Society of Maxillofacial Surgeons (ASMS), 2 multidisciplinary national societies that represent craniofacial surgery. Member surgeons were included as study subjects if they were in full-time academic practice. Surgeons who were in part-time academic practice and those in private practice were excluded from the analyses.

Study Variables—Predictors

The primary predictor variable was the *H* index (total number of publications *h* that have at least *h* citations each). The *H* index for each study subject was assessed using a commercially available citation database (Scopus, Reed-Elsevier, London, UK). For each subject, a Scopus search was conducted to identify the *H* index. In instances where multiple entries were identified for a single subject, or for common names (more than one search result), the data were cross-referenced with MedLine indices (e.g., PubMed) and publication lists were updated manually and the *H* index calculated manually.

In addition to the *H* index, we also recorded the total number of publications, total number of citations, maximum number of citations for a single work, and i-10 index (total number of publications with at least 10 citations each).

Secondary predictor variables were demographic measures thought to potentially influence academic rank. These included sex, number of years in practice, clinical degree (MD only, DDS/DMD, and MD), fellowship training (yes or no), and primary surgical training background (plastic and reconstructive surgery, oral and maxillofacial surgery, or multiple).

Study Variables—Outcome

The study outcome variable was the academic rank, and it was obtained by assessing faculty profile pages at the primary institution and cross-referencing with data from the ASCFS/ASMS databases. Academic rank was an ordinal variable and was classified as instructor/lecturer, assistant professor, associate professor, professor, or endowed professor.

Statistical Analyses

Data were collected and entered into a statistical database for analysis (SPSS v.24.0, SPSS Inc., Chicago, IL). Descriptive statistics were computed for the study sample. Bivariate associations were computed to identify associations between the predictors and outcomes. All associations with $p \leq 0.15$ in bivariate analyses were included in a multiple linear regression model, which was used to identify adjusted associations between the *H* index and academic rank. For all analyses, $p \leq 0.05$ was considered significant.

RESULTS

The study sample was composed of 127 surgeons (113 men and 14 women). The mean time since completion of surgical training was 16.2 ± 11.2 years. Overall, 87% of the sample had a medical degree alone; 11% had a medical degree and a dental degree, and 1.6% had a dental degree alone. A total of 4 surgeons (3.1%) had a PhD in addition to their clinical degrees. Most surgeons had a primary background in plastic and reconstructive surgery (82.7%). The remainder had a background in oral and maxillofacial surgery (5.5%), or had done residencies in both oral and maxillofacial surgery (9.4%) and plastic and reconstructive surgery, or plastic and reconstructive surgery and otolaryngology (2.4%). Most subjects had their primary academic affiliation in plastic surgery within the affiliated school of medicine (91.3%). Among the study subjects, the distributions of academic ranks were as follows: instructor/lecturer (3.1%), assistant professor (33.1%), associate professor (18.1%), professor (36.2%), and endowed professor (9.4%). For the sample, the mean *H* index was 12.4 ± 9.9. The mean total number of publications was 63.5 ± 78.5. The mean total number of citations was 1009 ± 1798. The mean maximum number of citations for a single work was 142 ± 310. The mean i-10 index was 23.4 ± 32.2. Descriptive statistics for the study sample are summarized in Table 1.

TABLE 1. Descriptive Statistics for Study Sample

Variable	$N = 127$ Subjects*
Sex	
Male	113 (89.0)
Female	14 (11.0)
Years since completion of training	16.2 ± 11.2
Clinical degrees	
DDS only	2 (1.6)
MD only	111 (87.4)
DDS + MD	14 (11.0)
Research doctorate (PhD, etc.)?	4 (3.1)
Residency training	
Plastic surgery (PRS) only	105 (82.7)
Oral and maxillofacial surgery (OMS) only	7 (5.5)
PRS + OMS	12 (9.4)
PRS + otolaryngology	3 (2.4)
Fellowship training	
Yes	95 (74.8)
No	32 (25.2)
Academic appointment	
Plastic surgery	116 (91.3)
Oral and maxillofacial surgery	6 (4.7)
Otolaryngology	1 (0.8)
Multiple	4 (3.1)
Academic rank	
Instructor/lecturer	4 (3.1)
Assistant professor	42 (33.1)
Associate professor	23 (18.1)
Professor	46 (36.2)
Endowed professor	12 (9.4)
Total number of publications	63.5 ± 78.5
Total number of citations	1009 ± 1798
Maximum number of citations for a single work	142 ± 311
i-10 Index	23.4 ± 32.2
H index	12.4 ± 9.9

Categorical measures are listed as number (percentage).
*Continuous measures are listed as mean ± SD.

Bivariate associations between the primary and secondary study variables are summarized in Table 2. The total number of publications, total number of citations, i-10 index, and *H* index were strongly correlated with the academic rank (r_s: 0.63-0.66, $p \leq 0.001$). The mean *H* index by academic rank is summarized in the Figure.

Associations between the secondary study variables with academic rank index are summarized in Table 3. The number of years since completion of training and research doctorate were significantly ($p \leq 0.03$) associated with academic rank. Associations between the secondary predictor variables and the *H* index are summarized in Table 4. Sex and number of years since completion of training were significantly or near significantly associated with the *H* index ($p \leq 0.07$).

The multiple linear regression models assessing the relationship between the *H* index and the academic rank are summarized in Table 5. After controlling for the effects of sex, number of years since completion of training, research doctorate, fellowship training, academic affiliation, and total number of publications, an increasing *H* index was significantly associated with increasing academic rank ($p \leq 0.001$).

TABLE 2. Correlations Between Academic Rank and Bibliometric Measures

	r_s	p Value*
Total number of publications	0.66	<0.001
Total number of citations	0.62	<0.001
Maximum number of citations for a single work	0.50	<0.001
i-10 Index	0.66	<0.001
H index	0.63	<0.001

*Statistically significant.

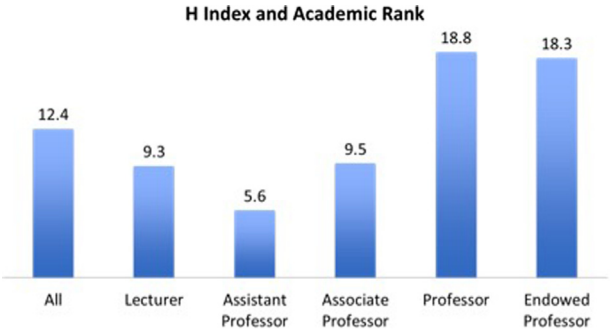

FIGURE. Mean *H* index by academic rank.

DISCUSSION

Promotion in an academic surgical career is based on myriad factors, including clinical excellence, community service, teaching, and scholarly activity.[1-3] Among these factors, scholarly activity has, historically, been emphasized, as it is quantifiable in terms of total number of publications and, more recently, through hybrid metrics that assess a researcher's impact on their field. Although no single measure is perfect, the importance of assessing the value of these metrics is paramount. For candidates and promotions committees, assessment can allow one to evaluate where they stand relative to others of the same rank at a national

TABLE 3. Associations Between Secondary Predictor Variables and *H* Index

	p Value*
Sex	**0.07**
Years since completion of training	**<0.001**
Clinical degrees	0.90
Research doctorate	0.46
Residency training	0.28
Fellowship training	0.21
Academic affiliation	0.34

*Statistically significant or near significant ($p \leq 0.15$) associations are indicated in bold.

TABLE 4. Associations Between Secondary Predictor Variables and Academic Rank

	p Value*
Sex	0.28
Years since completion of training	**<0.001**
Clinical Degrees	0.46
Research Doctorate	0.03
Residency Training	0.52
Fellowship training	**0.14**
Academic affiliation	**0.11**

*Statistically significant or near significant ($p \leq 0.15$) associations are indicated in bold.

level. Although institutional guidelines may vary significantly, such benchmarks have value in the context of establishing where a candidate for promotion fits in the national pool for their specialty or subspecialty. For smaller subspecialties, or those with niche areas, such as craniofacial surgery, specialty-specific benchmarks may not be as applicable, as the subspecialists may represent a different subset of the overall population. Indeed, it may be disadvantageous to the subspecialist to be compared to others with different focus areas within the same specialty, as there may be different degrees of difficulty with publication and opportunities for dedicated research support. Craniofacial surgery is one such subspecialty, which is a relatively small group comprising primarily of plastic and reconstructive surgeons and oral and maxillofacial surgeons. As such, the purpose of this study was to assess whether the *H* index was associated with academic rank among full-time academic craniofacial surgeons. We identified a cohort of full-time academic craniofacial surgeons and studied the association between the *H* index and the academic rank, after adjusting for the effects of confounders and effect modifiers.

The results of this study showed that the *H* index was strongly correlated with academic rank. Even after adjusting for the effects of multiple covariates, including the number of years since completion of training and the total number of publications, the *H* index remained significantly associated with academic rank. The mean *H* index for the sample was 12.4 ± 9.9, which is higher than the national average for full-time academic plastic surgeons (10.2 ± 9.0) and academic oral and maxillofacial surgeons (6.2 ± 7.4).[1,5] These results suggest that academic craniofacial surgeons may have fundamentally different research pursuits and successes relative to their parent specialties and, for promotion decisions, should merit consideration that is perhaps distinct. Interestingly, the correlation between the academic rank and *H* index was numerically similar among all 3 groups (r_s: 0.62-0.63).[1,5]

There are some limitations to the analyses herein that merit consideration. Given the cross-sectional nature of the data collection, our analyses are subject to the accuracy of web-based data regarding faculty appointments and rank. Although this is a potentially variable factor, it is unlikely to systematically influence the results for several reasons. First, data were cross-referenced through several different databases, including faculty registries and national subspecialty lists, which are updated annually. Second, for instances where there would potentially be a discrepancy owing to delay in updating web-based data, it is unlikely that such a delay would be systematic—such delays would more likely be random on a national and unlikely to affect the pooled results herein. An additional limitation is the primary focus of this study on research productivity. We acknowledge that, in the current climate of academic promotion, there are several tracks by which one can be promoted. Although research productivity is one metric that can assist with promotion, it is not the only one, nor is it the most important one. Clinical productivity, teaching, leadership, and service to the community are all important criteria as well. However, we cannot comment on the magnitude of these factors on academic rank compared to the *H* index. Finally, the *H* index itself is not a perfect metric. It does not adjust for self-citations and may be time sensitive (i.e., the longer one has been publishing, the higher their *H* index). Regarding self-citations, several studies have recently demonstrated that self-citations do not appreciably influence the *H* index.[14-16] The time-sensitive nature of the *H* index may be particularly important in craniofacial surgery, where the field is relatively small and those who have been publishing articles within this niche area for a long time have a higher likelihood of being cited by others. Although this is a valid limitation, it is somewhat mitigated by adjusting for number of years since completion of training in the multiple regression and by adjusting for total number of publications. A final potential limitation of the *H* index is the nature of a niche subspecialty and how this may influence metric validity. Craniofacial surgery is a relatively small surgical specialty, and surgeons may self-restrict their publications to a limited forum of journals. Articles in these journals would be read by other craniofacial surgeons and cited with some frequency, resulting in a perpetuating cycle of publication and citation among a small cohort of individuals, which could affect the *H* index. Although there are no specific data regarding the variety of journals academic craniofacial surgeons use as vehicles to showcase their work, this may not be a significant limitation for

TABLE 5. Multiple linear regression model for academic rank

Variable	Coefficient	p Value*
Sex	−0.01	0.93
Years since completion of training	**0.41**	**<0.001**
Research doctorate	−0.1	0.14
Fellowship training	−0.05	0.50
Academic affiliation	0.03	0.68
Total number of publications	−0.01	0.95
H Index	**0.33**	**0.04**

*Statistically significant ($p \leq 0.05$) associations are indicated in bold.

2 reasons. First and foremost, craniofacial surgery, while a small surgical subspecialty, is rooted in interdisciplinary care. As such, craniofacial surgeons, in conjunction with collaborators (e.g., orthodontists, pediatric dentists, neurosurgeons, speech and language pathologists, pediatricians.), may publish their work in journals other than those primarily related to the subspecialty. Such a scenario would make the *H* index comparable as a measure relative to larger specialties (e.g., plastic surgery). This may, in fact, be the case, as the *H* index for academic craniofacial surgeons was higher than that for the population of plastic surgeons at large. Second, in the event that surgeons are publishing frequently in a small range of journals with a small audience, the magnitude of influence of a given work may be more restricted, and the *H* index would be lower to the extent that citations are lower. Such a scenario serves to underscore the importance of specialty-specific metrics for promotion, as comparing specialists in large specialties (e.g., internal medicine) to those in smaller subspecialties may be fraught with bias.

In conclusion, among full-time academic craniofacial surgeons, the *H* index is strongly correlated with academic rank. Promotions committees should consider using the *H* index specific for craniofacial surgeons when assessing subspecialist candidates for promotion.

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