Could H Index be a Beneficial Prospective Promotion Metric?

H-Index Retrospectively Correlates with Higher Academic Rank Among Shoulder and Elbow Surgeons Affiliated with Fellowship Programs

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Objectives: The purpose of this study is to investigate the association between Hirsch index (H-index) and academic rank among shoulder and elbow surgeons affiliated with American Shoulder and Elbow Surgery (ASES) fellowship programs.

Design: Database review.

Participants: Shoulder and elbow surgery faculty members at ASES fellowship programs.

Main outcome measurement: H-index, total number of publications, academic rank, and fellowship training pedigree

Results: There is a strong positive correlation between total number of publications and h-index. Overall, there is a strong positive association with number of publications, h-index and training program affiliation with higher academic rank, except at the chair/director position. Type of fellowship training was not a significant predictor of academic rank. A higher proportion of junior faculty were found to have academic appointments with their home training program.

Conclusions: H-index and total number of publications are associated with a higher academic rank among shoulder and elbow faculty surgeons at fellowship training programs. H-index may be a beneficial metric for recruitment and promotion decisions for academic orthopaedic faculty.

Level of Evidence: IV

Keywords: H-Index, Research, Productivity, Shoulder, Elbow, Academic Rank, Promotion, Human resources

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INTRODUCTION

Research productivity has been used as a benchmark for professional achievement in academic medicine.[1] Productivity has traditionally been measured using basic numeric measures such as citation and publication counts. However, these metrics reflect the volume rather than the quality of a researcher's work.[4,5,14,26] Other than publication volume, faculty recruitment and promotion decisions have traditionally been based on subjective criteria such as personal recommendations and institutional pedigree. Higher quality objective metrics offer a more successful way to identify quality candidates.

When evaluating faculty within an academic department, it is important to ensure that appropriate metrics are used to appraise a researcher's publications. The Hirsch Index (h-index) is a bibliographic metric of academic productivity that may be utilized to assess the quality and citation impact of an individual's work.[9] While initially created for use in the natural sciences, the h-index has been shown to correlate positively with academic rank, which progresses from assistant to associate to full professor, across a variety of medical fields.[2,3,9,11,17–19,22,24,25] Within the orthopaedic literature, the h-index has been validated as a measure of academic impact within the subspecialties of hand,[12] total joint replacement,[10] spine,[21] and sports medicine.[13]

The purpose of this study is to investigate the association between h-index and academic rank among shoulder and elbow surgery faculty members affiliated with American Shoulder and Elbow Surgery (ASES) fellowship programs. We hypothesize that a higher H-index will portend a higher academic rank.

Table 1: Demographic breakdown of the 100 shoulder and elbow fellowship program faculty members

Academic Rank (n)	Fellowship (n)	Gender (n)	Affiliated With program of Training
Chair/Director (36)	S&E (78)	Male (98)	Yes (31)
Professor (19)	Sports (16)	Female (2)	No (69)
Assoc Prof (26)	Hand (5)		
Assist Prof. (11)	Trauma (1)		
Non-Tenure (8)			

METHODS

This is a cross-sectional study of full-time academic shoulder and elbow surgeons in the United States. The study population was constructed by querying the American Shoulder and Elbow Surgeons (ASES) website to obtain a complete record of all ASES-recognized shoulder and elbow surgery programs. For each program, the department website was used to generate a list of faculty members with primary appointments. These data were cross compared with the ASES website, which provides a faculty listing.

Number of publications, h-index, location of fellowship training, and fellowship subspecialty were collected. The primary study outcome was academic rank, which was assigned one of five variables: chair/director, professor, associate professor, assistant professor or non-tenure track adjunct faculty. Geographic region was assigned based on United States Census regions.

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Table 2: Publication and H index by region and academic rank

			Publication		H-Index	
Region	**Rank**	**n**	Med	IQR	Med	IQR
North-east	Chair	15	77	112	27	20
	Professor	9	236	154	47	26
	Assoc Prof	12	59	28	13.5	5
	Asst Prof	5	57	48	15	13
	Non tenure	1	100	0	42	0
	Sub Total	*42*	*79*	*124*	*26*	*30*
South	Chair	7	135	123	36	16
	Professor	2	40.5	32	11.5	10
	Assoc Prof	6	31	18	10	7
	Asst Prof	2	21	13	4	1
	Non tenure	3	9	14	5	5
	Sub Total	*20*	*36*	*67*	*11*	*17*
Mid-west	Chair	10	82	84	22.5	19
	Professor	5	126	193	48	23
	Assoc Prof	3	311	287	44	29
	Asst Prof	3	126	64	17	8
	Non tenure	2	52	21	13.5	2
	Sub Total	*23*	*99*	*155*	*22*	*28*
West	Chair	4	46	38	18.5	7
	Professor	3	65	115	22	21
	Assoc Prof	5	3	6	3	5
	Asst Prof	1	92	0	17	0
	Non tenure	2	11	8	4.5	3
	Sub Total	*15*	*39*	*57*	*17*	*15*
Total	Chair	36	80	120	25.5	18
	Professor	19	147	196	41	34
	Assoc Prof	26	45	34	12	8
	Asst Prof	11	57	80	15	13
	Non tenure	8	24	34	8	9
	Total	*100*	**57**	**80**	**15**	**13**

RESULTS

The American Shoulder and Elbow Surgeons currently recognize 27 shoulder and elbow surgery fellowships, with 100 surgeons (Table 1). 78 (78%) of these surgeons are fellowship trained in shoulder and elbow surgery, 16 (16%) in sports, 5 (5%) in hand and upper extremity surgery and 1 (1%) in trauma. 98 (98%) are male. 31 (31%) are faculty at their fellowship alma mater. Overall, these 100 surgeons have published 11,306 publications (Figure 1). The total H-index for this group of surgeons is 2516.

There exists a strong correlation between the number of publications and respective H-index for shoulder and elbow surgeons, with a higher academic rank being associated with a larger H-index

Multivariate regression reveals a strong correlation between affiliated training pedigree, number of publications and h-index as a significant predictor of academic rank. Fellowship training specialty, however, was not a significant predictor of academic rank (Table 3). Further, there is a strong association with junior faculty (assistant and associate professors) having an appointment at their home institution (Table 4). Overall, academic rank and training affiliation by region was not significant. There exists no difference in research productivity with respect to training program affiliation.

The number of publications and h-index tend to increase with academic rank, except at that chair/director position (Table 2). H-index was a relatively stronger predictor of academic rank than total publications.

The Northeast and Midwest had a higher number of publications, higher productivity, and a higher median h-index when compared to the South and Western regions of the United States (Table 2). The median individual publications is significant, with the Northeast and Midwest having a significantly higher median amount of publication

DISCUSSION

This study aimed to evaluate the relationship between h-index, research productivity, and academic rank among fellowship-trained shoulder and elbow surgeons. The h-index is a bibliographic metric that provides insight regarding the aggregate impact of a researcher's published work. Our analysis showed a strong correlation between h-index, number of publications, and academic rank. H-index and number of publications increased with higher academic rank, except at the Chair/Director level. It is intuitive that h-index and number of publications would increase with higher academic rank and this relationship has been described in other orthopaedic subspecialties.[10,12,13,21]

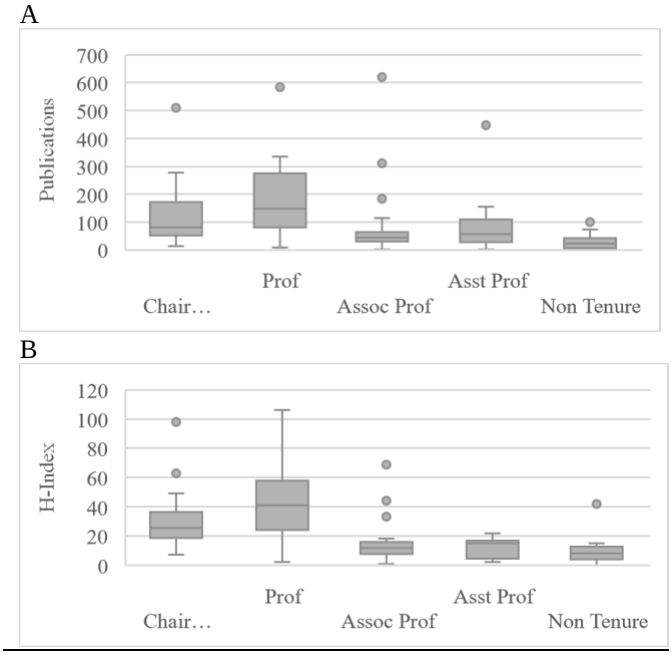
Table 3. Multivariate regression analysis for academic rank against fellowship training, affiliation of training pedigree to current fellowship program appointment, number of publications, and H-Index as predictors

	Coefficients	**Standard Error**	**P-value**	**Lower 95%**	**Upper 95%**
Intercept	3.63	0.51	2.48E-10	2.61	4.65
Fellowship	0.26	0.19	0.1780	-0.12	0.64
Affiliated Training	-0.53	0.25	0.0362	-1.03	-0.03
Number of pubs	0.01	0.002	0.0049	0.002	0.01
H-index	0.06	0.01	0.0001	0.09	0.03

Our results suggest that this association is applicable to fellowship-affiliated shoulder and elbow surgeons as well. While we did observe lower h-index and number of publications among surgeons in the Chair/Director category, this was a heterogeneous group whose duties range on a spectrum from administrative to academic. With regard to number of publications, surgeons in the Chair/Director category have achieved leadership roles within their department, possibly increasing their administrative obligations and decreasing time available to pursue research.

Several additional variables were included in our analysis. Affiliated training pedigree was found to correlate with a higher academic rank but was not associated with increased research productivity. Regarding geographic trends, Midwestern and Northeastern surgeons had more publications, higher productivity, and a higher median h-index when compared to Southern and Western regions. This finding is consistent with those reported by *Ence et al.*, who described lower h-indices among southern orthopaedic surgeons when compared to those practicing in other geographic regions.[6]

Figure 1. Number of publications by academic rank (A). H-index by academic rank (B)



While there is limited research available regarding hiring criteria for academic orthopaedic surgeons, research has traditionally been a key consideration in determining eligibility for promotion in academic medicine.[1] However, it is important to ensure that the most appropriate measures are used when evaluating faculty. Bibliometrics, such as number of publications and citation counts, provide objective data regarding quantity, but they do not account for the quality of a researcher's publications. In recent years, increased focus has been directed towards more complete methods of assessing academic achievement. Proposed academic metrics include the h-index, grant funding, presentations, academic journal editorial board positions, and involvement with major national conferences.[15,16] In the field of dermatology, weighted algorithms using these variables have been successfully employed to assess academic productivity at the program-level.[27] Our findings suggest that h-index may serve as a useful metric of research productivity among shoulder and elbow surgeons and therefore may have utility as an impartial measure in the review process prior to promotion.

The h-index's use as a measure of scholarly impact has been repeatedly validated by many studies.[7-19] However, h-index does not account for variability in research productivity over time, nor does it account for authorship position. Deliberate self-citation is a concern, although several studies have reported no significant differences in h-index after controlling for self-citation.[7,8,20,23] Additionally, while research productivity is an important factor, it is not the sole determinant of professional advancement within academic medicine. The h-index is unable to account for these additional factors that may influence promotion along the tenure track.

Weaknesses of our study include reliance on the accuracy of the ASES and individual department websites. It is possible that some of these pages may have contained the most up to date faculty information. Additionally, our sample population was limited to full time academic surgeons affiliated with fellowship training programs and therefore our findings may not be generalizable to those who are not affiliated with a fellowship program or who work part time. Concerning h-indices, the Scopus database may not have included all of an author's publications, or publications may have wrongly been ascribed to an author.

Table 4. Current affiliation with training progress shows proportionally higher junior surgeons with appointments at programs affiliated with their training pedigrees.

Rank	Surgeons	Affiliated Training (%)
Chair/Director	36	22%
Professor	19	21%
Assoc Professor	26	42%
Asst Professor	11	45%
Non tenure	8	38%
Total	100	31%

CONCLUSION

Our results indicate that h-index and number of publications are positively correlated with academic rank among full-time orthopaedic shoulder and elbow surgeons affiliated with fellowship training programs. While research productivity is not the only benchmark for achievement in academic medicine, it has traditionally been considered a key determinant for professional advancement. Our findings suggest that the h-index may be a useful measure for assessing academic impact within the field of orthopaedic shoulder and elbow surgery, and therefore offer a beneficial objective metric for recruitment and promotion decisions within orthopaedic departments.

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