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Attributes of a surgical chairperson associated with extramural funding of a department of surgery

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ABSTRACT

Background: Chairpersons of surgery departments are key stakeholders and role models and leaders of research in academic medical institutions. However, the characteristics of surgical chairpersons are understudied. This study aimed to investigate the association between the personal academic achievement of a surgical chairperson and the National Institutes of Health (NIH) funding of the department.

Methods: We calculated the Hirsch index (H-index), a measure of research productivity, for chairpersons of surgery of the top 90 research medical schools that were ranked by *U.S. News & World Report*. Specialty training, y as chairperson, location, and NIH institutional and department funding were analyzed. Nonparametric tests and linear regression methods were used to compare the different groups.

Results: Of the 90 chairpersons, 20 positions for chairs (22%) are either recent (<1 y) or unfilled ($n = 6$). Only 3% of all chairpersons are women, and the median H-index for the chairpersons is 20 (Interquartile range 14–27) with a median 101 publications with 14 cites per publication. Median surgery-specific NIH funding in 2011 was $1.7 million (Interquartile range $721,042–5,085,305). The chairperson's H-index was exponentially associated with department funding in multivariate models adjusting for institution rank, except when the H-index was extreme (<4 or >49) (coefficient 0.32, $P = 0.02$).

Conclusions: The research productivity of a chairperson is the only personal attribute of those studied that is associated with the departmental NIH funding. This suggests the important role an academically productive surgical leader may play as a champion for the academic success of the department.

1. Introduction

Chairpersons of surgery are individuals of preeminence who have excelled clinically and academically over their career while developing good administrative skills. Although becoming a chairperson requires skills far beyond research, surgeons are generally expected to demonstrate academic achievement to be considered for such a position. The impact of a chairperson on the department is difficult to measure, but it is intuitive to believe that a chairperson has a substantial impact on the three main academic functions of the department: clinical care, education, and research. Success in the research academic arena is often measured by success in securing extramural funding.

Characteristics of surgical chairpersons of academic institutions in the United States are poorly studied. Their impact on

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extramural funding of a department can only be speculated. For instance, a chairperson may influence departmental research productivity by being a role model for faculty or as a catalyst for developing programs and collaborations. An important component to the success of a department in extramural funding is the ability to recruit clinician scientists, which is highly dependent on the mission determined by the chairperson, especially in a competitive economic environment.

We believe that the personal academic accomplishments of a surgical chairperson impact their efforts to promote departmental research, especially when faced with competing economic forces. Our primary hypothesis for this study was that the academic productivity of a chairperson, which we measured by the Hirsch index (H-index), is positively associated with department-specific NIH funding. In doing so, we also attempted to characterize the personal characteristics of surgical leaders with the intention to establish a benchmark of what would be considered a superior academic achievement.

2. Methods

We included all research medical schools ranked by the *U.S. News & World Report* 2012 ranking [1]. This ranking methodology has previously been reported, and we did not analyze the actual methodology of the ranking. General components of the ranking include quality assessment (measured by peer assessment, residency director's assessment), research activity (measured by NIH funding, research per faculty member), primary care rate, student selectivity, mean Medical College Admission Test scores and grade point average, acceptance rate, and faculty resources. Deciles were generated by rank; however, due to ties, the deciles were not evenly distributed.

The Hirsch index was originally described by Jorge Hirsch as a tool for measuring scientific impact of theoretical physicists [2,3]. An index of "h" indicates that a researcher has at least "h" publications with "h" citations or more. This captures both the impact and productivity of the research work [4,5]. For instance, if a researcher publishes 50 papers in his or her career, and 20 of them have more than 20 citations each, the H-index is 20. This number would remain unchanged if the researcher had 40 papers with 20 citations or 20 papers with 40 citations each. It would only change if both the number of papers and the number of citations/paper increased. This metric avoids the bias of using the total number of papers (which does not account for the quality) or the total number of citations (which could be biased by one paper with numerous citations). Therefore, this index is weighted toward the researcher who publishes highly cited work more often, rather than those publishing "few" highly cited papers or "numerous" low-citation papers.

The calculation of the H-index was performed using the ISI Web of Knowledge citation report, accessed between January and June 2012. This service is available by subscription to academic institutions, and the author finder was used to identify each chairperson's publications. The calculation of the H-index requires that an author be found in an electronic database with a search strategy as opposed to manually inputting the publications from a resume. The profile of each individual was downloaded from the institution website after using a web search powered by Google Search. Surgery department websites were used to gather information such as duration as a chairperson and specialty of the chairperson. We employed two search strategies to identify each author. In search strategy one, wild cards were used after the first initial to capture all the articles published by individuals with the same last name. For instance, for John R. Hancock, a search term hancock, J* was used. Of all the articles retrieved, we included only those articles that had been published from any institution where the author had been. All articles published from the Veterans Affairs system were excluded when the geographic affiliation of the Veterans Affairs hospital was unknown. We were unable to separate articles based on authorship order from the available citation manager, and we included all articles that included the chairperson as any-order author. Articles retrieved were restricted to life sciences and biomedicine only (of arts and humanities, social sciences, and physical sciences as other options).

A second search strategy was employed to identify articles published by an author. The search term included the exact name of the author, such as "hancock JR," and other authors (such as hancock J, hancock JA, etc) were excluded. Although this may have limited the number of articles extracted per author, it provided an accurate way of extracting articles. Logic checks regarding the institution where the author had been were similarly employed as described. We verified the membership of chairs against the Society of Surgical Chairs roster.

We classified chairpersons based on their areas of practice as General Surgeons/Trauma/Minimally Invasive Surgeons. Chairpersons with membership to surgical subspecialty societies, such as Society of Surgical Oncology, the American Society of Transplant Surgeons, Society of Thoracic Surgery, Society for Vascular Surgery, and the American Pediatric Surgical Association, were classified as such.

We extracted the number of y as a chairperson from the department web page and included time spent as interim chair as duration as chairperson as well. We were unable to obtain y since training for all chairpersons, and this metric was not used for the analysis. When a chairperson at an institution was recorded as an interim chair, we abstracted the H-index and characteristics of the immediately preceding chair. Although this would indicate 1 y or more lag in the publications from the previous chair, its impact on the H-index was considered minimal since the citations increase with time and the delayed effect of research on the H-index is well described. This, however, included the risk of including a chairperson twice, especially if he or she moved from one institution to another.

The geographic locations were classified into Northeast, Midwest, South, and West based on standard definitions based on a US geographic map. We abstracted the NIH funding of a department from the Blue Ridge Medical Institute website (www.brimr.org), and the institution-specific NIH funding and the number of awards was obtained from the NIH website (www.nih.gov) [6,7].

All data were manually extracted by the authors (K.K.T., D.G., and M.H.) and entered into Microsoft Excel-2010 spreadsheet. Search strategies were verified by two authors in

case of doubt. Random logic checks were performed and the search strategies were recorded for each chairperson. In case of missing data regarding a chairperson's attributes, the departments were called to verify y as chairperson or surgical specialty.

The data were analyzed using Stata Version 9.0 (StataCorp, TX) using nonparametric tests (Kruskal-Wallis). Deciles and tertiles based on the rank of the medical school were made and used for analysis. We categorized y in office in two separate ways: as ≤1 y, 1–5 y, and >5 y as chairperson and as ≤1 y, 1–3 y, 3–6 y, 6–9 y, and >9 y as chairperson. Sensitivity analysis was performed after stratifying by y of experience of the chairpersons, assuming that recent chairs might not contribute as much to funding of a department in a year prior to their taking office. Pairwise correlation was performed to analyze for association. Log normal and square root transformations were performed on NIH funding and H-index, respectively, to obtain normal distribution. All *P* values reported were two-tailed and an alpha of <0.05 was considered significant.

3. Results

We were able to identify the top 90 research medical schools that were ranked by *U.S. News & World Report*. We were able to abstract the data on NIH awards and NIH funding for the institution for 89 of the 90 included institutions (99%) and the department of surgery for 74 institutions (82%).

Of the 90 chairpersons, 88 were unique and 2 chairs had recently moved, appearing twice on the list (University of Vermont to Connecticut and Indiana University to Massachusetts General Hospital/Harvard University). At the time of the search, 6 chair positions were yet to be filled (6.7%) and 14 chairs had recently undertaken their appointments (≤1 y, 15%). There were 3 female chairpersons (3.3%) and majority of the chairpersons were from the Midwest ($n = 27$, 30%).

The median H-index was 20 (interquartile range 14–27) for all chairpersons, and the median number of publications was 101 (56–160) with 14 cites per publication (9–20) (Fig. 1). The median H-index was higher among chairpersons of schools with a higher decile rank ($P = 0.006$, Table 1). There was no difference based on location of the school, y of experience, subspecialty practice, and gender of the chairperson. The H-index generated from the first search strategy was significantly correlated with the H-index generated by the second search strategy ($r = 0.98$, $P < 0.001$).

The median NIH funding for the department of surgery in 2011 was $1.7 million (interquartile range $721,042–$5,085,305), which was significantly correlated with the overall funding of the institution ($r = 0.65$, $P < 0.001$) and the number of NIH awards in the institution ($r = 0.65$, $P < 0.001$). However, this constituted a small percentage of the overall institution funding (4.5% [1.9%–8.1%]). The amount of funding of an institution and the number of awards were almost collinear ($r = 0.98$, $P < 0.001$). The NIH funding for Harvard University was not captured accurately, given the nature of the institutional affiliation at the NIH and Blue Ridge Institute for Medical Research [6,7]. This is likely due to the three academic departments of surgery affiliated with the university with separate NIH funding budgets not reflected in the overall funding. This was excluded from our analysis.

The NIH funding of the department (log transformation) was significantly associated with the H-index of the chairperson (square root transformation), which remained significant even after excluding recent chairpersons (≤1 y in office, $P = 0.03$, Table 2). In order to fit the data for the majority of the chairpersons, we created a "spline" or a break function at both tails of the spectrum (very high or low H-index). For the majority of the institutions (65 of 74), the H-index of the chairperson was positively associated with the NIH funding of the department (beta coefficient 0.44 [0.13–0.74], $P = 0.005$, Figure 2), the NIH funding of the institution (coefficient 0.33 [0.20–0.47], $P < 0.001$), and the number of NIH awards (coefficient 0.33 [0.20–0.45], $P < 0.001$) and negatively associated with the rank (coefficient −7.12 [−10.3, −3.8], $P < 0.001$; the better the rank, the higher the H-index).

In a multivariate analysis, after adjusting for y as chairperson, rank of the institution, and subspecialty practice, the H-index of a chairperson was significantly associated with the NIH funding (coefficient 0.32, $P = 0.02$, Table 3). At the two ends of the spectrum (H-index <4 or H-index >49, $n = 9$), there was no association between the H-index of a chairperson and the NIH funding of the department.

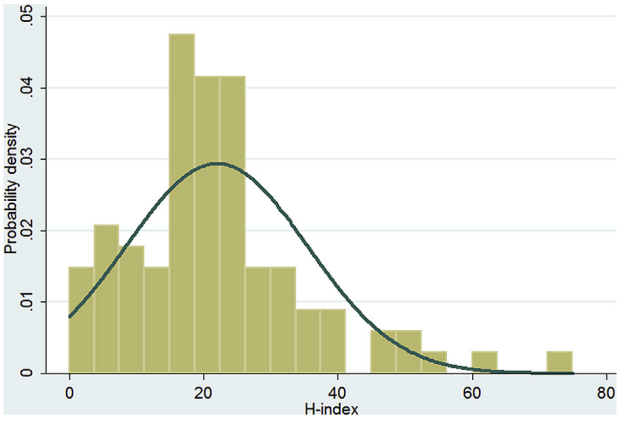

Fig. 1 – Histogram depicting the distribution of H-indices among chairpersons. (Color version of figure is available online.)

4. Discussion

Chairpersons of surgery are key academic leaders in medical schools and help direct a significant portion of the research endeavors. In attempting to understand the characteristics of a chairperson associated with the academic success of a department, we found that the personal academic achievement (measured by the H-index) of a chairperson was associated with the NIH funding of the department. This was independent of the institution rank, which is also an important determinant of funding, while gender, geography, subspecialty training, and y of experience had no association with the extramural funding of the department.

This finding suggests that chairpersons who are prolific researchers themselves are more likely to have better-funded departments of surgery independent of the institution rank

Table 1 – Characteristics of surgical chairpersons of the top 90 research medical schools ranked by *U.S. News & World Report*, 2012.

Variable	Median H-index	*P* value	Median number of publications	*P* value	Median number of cites/publication	*P* value
Medical school rank (decile)						
1st	19 (18–27)	0.0061*	112 (85–147)	0.02*	19 (13–22)	0.04*
2nd	24 (18–29)		128 (90–165)		14 (13–17)	
3rd	24 (16–29)		121 (70–229)		12 (10–18)	
4th	30 (22–36)		156 (99–266)		21 (17–30)	
5th	26 (18–30)		116 (81–167)		18 (12–20)	
6th	18 (15–36)		94 (46–171)		15 (10–24)	
7th	19 (18–22)		91 (66–142)		11 (9–18)	
8th	11 (5–14)		30 (15–70)		8 (6–11)	
9th	8 (4–26)		38 (19–182)		10 (4–22)	
10th	9 (2–18)		24 (5–80)		8 (4–17)	
Geographic region						
Midwest ($n = 27$)	22 (15–34)	0.86	121 (77–219)	0.58	12 (9–24)	0.47
Northeast ($n = 24$)	19 (13–26)		100 (50–142)		17 (10–26)	
South ($n = 25$)	19 (14–26)		79 (59–123)		13 (10–20)	
West ($n = 14$)	22 (15–30)		106 (62–156)		15 (9–18)	
Years of experience as chairperson						
≤1 y ($n = 14$)	20 (13–29)	0.55	107 (62–142)	0.29	13 (9–28)	0.10
>1 & 3 y ($n = 12$)	18 (16–28)		85 (65–191)		11 (9–16)	
>3 & 6 y ($n = 20$)	22 (17–25)		122 (80–179)		11 (9–14)	
>6 & 9 y ($n = 19$)	26 (15–30)		138 (50–222)		19 (9–22)	
>9 y ($n = 25$)	17 (11–25)		70 (35–111)		18 (12–21)	
Gender						
Female ($n = 3$)	25 (17–31)	0.47	133 (107–156)	0.42	17 (7–20)	0.98
Male ($n = 87$)	20 (13–27)		99 (50–165)		14 (9–20)	
Specialty						
General/trauma/MIS ($n = 33$)	16 (13–24)	0.006*	78 (49–118)	0.002*	14 (10–21)	0.20
Surgical oncology/endocrine ($n = 22$)	24 (19–32)		132 (81–190)		16 (9–28)	
Transplant ($n = 8$)	30 (23–35)		216 (158–316)		14 (11–18)	
Thoracic ($n = 12$)	23 (20–26)		112 (82–172)		16 (10–20)	
Vascular ($n = 7$)	17 (8–26)		73 (21–138)		13 (8–18)	
Pediatric ($n = 6$)	13 (3–19)		50 (7–107)		9 (6–17)	
Plastic surgery ($n = 2$)	8 (4–11)		40 (19–62)		5 (4–5)	
NIH funding of department ($n = 74$)						
1st quartile ($n = 19$)	20 (10–26)	0.45	86 (35–168)	0.22	18 (9–22)	0.81
2nd quartile ($n = 18$)	22 (17–30)		115 (83–167)		13 (9–24)	
3rd quartile ($n = 19$)	22 (17–27)		107 (79–191)		16 (10–19)	
4th quartile ($n = 18$)	26 (19–31)		148 (85–222)		14 (11–22)	
Missing ($n = 16$)	10 (4–16)		34 (18–60)		10 (5–13)	

MIS = Minimally Invasive Surgery.
* $P < 0.05$.

(unless extreme). Whether this is due to their abilities to lead by example or to facilitate research, or to quality recruitment, cannot be discerned from our data. The value attached to research by different chairpersons may vary based on their own personal experiences, and this may partly explain the effect.

The institution rank is a confounding variable in the analysis. A highly ranked institution would attract well-funded researchers as well as a prolific publishing chairperson. We controlled for this by including institution rank in our multivariate model. Additionally, a decile-based analysis revealed heterogeneity ($P = 0.006$, Table 1) in the median H-index of chairpersons but revealed that the highly ranked institutions did not always have the highest-ranked chairpersons by H-index. We were unable to examine all interaction terms, given the number of medical schools in the analysis.

This association was not seen at the tails of the curve (H-index <4 and >49). This is perhaps due to the fact that H-index was significantly correlated with the institution rank, and at extremes of rank (very high or low) the effect of the institution surpassed that of the chairperson's H-index ($P < 0.001$). Therefore, at a very high-ranked institution, the likelihood of attracting prolific research faculty may be independent of the chairperson, thus contributing to greater NIH funding.

Clinical productivity, teaching, and research funding are all components that contribute to the traditional "triple threat" of an academic surgeon and need to be considered to assess the performance of an academician. With the economic pressures on most chairpersons, it is highly likely that a significant portion of their job is to improve the clinical mission, which could easily compromise the research mission of an academic medical center. In such an environment, our data suggest that

Table 2 – Linear regression model demonstrating the association of departmental NIH funding with characteristics of chairperson and medical school.*†

Variable	Univariate beta	P value	Univariate beta	P value
			Excluding chairs in their first year	
Female gender of chairperson	−0.91 (−2.5, 0.64)	0.25	−1.27 (−3.2, 0.67)	0.19
Location of medical school				
Midwest	Referent		Referent	
Northeast	−0.78 (−1.59, 0.02)	0.06	−0.56 (−1.48, 0.36)	0.23
South	−0.28 (−1.09, 0.52)	0.49	−0.25 (−1.14, 0.63)	0.57
West	0.12 (−0.82, 1.06)	0.79	0.09 (−0.94, 1.14)	0.85
Years as chairperson				
≤1 y	Referent		Excluded	
1–3 y	0.92 (−0.26, 2.10)	0.12	Referent	
3–6 y	0.55 (−0.49, 1.59)	0.29	−0.37 (−1.45, 0.70)	0.49
6–9 y	0.83 (−0.25, 1.91)	0.13	−0.09 (−1.21, 1.02)	0.87
>9 y	0.40 (−0.62, 1.43)	0.43	−0.52 (−1.57, 0.54)	0.33
H-index	0.23	0.03	0.26 (0.03, 0.49)	0.03‡
Specialty				
General/trauma	Referent		Referent	
Surgical oncology/endocrine	−0.35 (−1.12, 0.41)	0.36	−0.27 (−1.12, 0.58)	0.52
Transplant	0.63 (−0.49, 1.75)	0.27	0.80 (−0.43, 2.04)	0.20
Thoracic	−0.19 (−1.21, 0.83)	0.71	−0.09 (−1.20, 1.00)	0.86
Vascular	0.51 (−1.10, 2.13)	0.53	0.47 (−1.19, 2.14)	0.57
Pediatric	−0.12 (−1.41, 1.17)	0.85	−0.39 (−2.40, 1.62)	0.70
US News & World Report rank	−0.03 (−0.04, −0.02)	<0.001	−0.03 (−0.04, −0.02)	<0.001

* (Excluding Harvard University.)
† Square root transformation for H-index and logarithmic transformation of NIH funding used for the analysis.
‡ $P < 0.05$.

a successful researcher and administrator is necessary to fulfill the research mission of the school.

The Hirsch index, or H-index, captures the academic productivity and impact of a researcher and has been widely used in the physical sciences but uncommonly applied to the medical sciences. It is objective and easy to obtain, and hence has reached widespread popularity. It may allow one to objectify the scientific achievement with respect to fund allocations, rank and tenure, and perhaps promotions [4,8].

The H-index does have several fallacies, including a bias against researchers who practice a selective publication strategy. A single high-impact paper does not contribute to the index beyond the "h" number of citations, and this underestimates the impact of a paper. The "clinical" impact, which is an important outcome for surgeons, cannot be assessed by citations alone, and measurement of practice change is difficult. The H-index is not comparable among fields and is dependent on the scientific age of a researcher, since the number of citations increases with y of academic productivity. Several modifications have been proposed to the H-index, yet it remains a robust index with good correlation with other bibliometric measures, such as number of citations and number of publications [2–5,8–11]. We believe that the

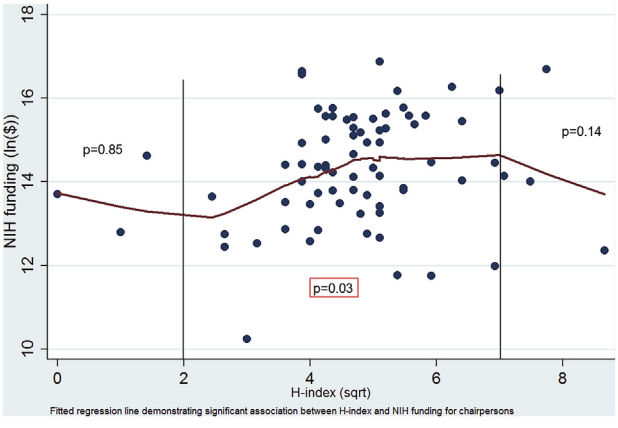

Fig. 2 – Department of surgery NIH funding by H-index of chairperson. (Color version of figure is available online.)

Table 3 – Multivariate analysis of characteristics of a chairperson associated with departmental NIH funding.*

Variable	Beta (95% CI)	P value
Years as chairperson		
≤1 y	Referent	
1–5 y	0.33 (−0.52, 1.19)	0.45
>5 y	0.20 (−0.64, 1.03)	0.64
H-index†		
<4	−0.67 (−1.79, 0.46)	0.24
4–49	0.32 (0.05, 0.60)	0.02‡
>49	−1.01 (−2.32, 0.30)	0.13
Subspecialty practice	−0.04 (−0.63, 0.54)	0.87
U.S. News & World Report rank	−0.02 (−0.04, −0.01)	<0.001‡
Intercept	15.7 (13.40, 18.04)	<0.001

* (Excluding Harvard University.)
† Square root transformation for H-index and logarithmic transformation of NIH funding used for the analysis.
‡ $P < 0.05$.

essence of a chairperson or an academic surgeon cannot be captured by the H-index alone, and we recommend that the index be used wisely in conjunction with other characteristics for assessment of the impact of a researcher.

In answering our study question, we have also been able to provide benchmarks for academic surgeons to aspire to until further research is conducted to validate the use of the H-index for academic surgeons (Table 1). This allows surgeons an objective assessment of their success, and allows them to track their career progress. We certainly do not condone unscientific behavior or self-citations merely to improve such an index, yet we encourage all academic researchers to be aware of such measures of performance.

In excluding Harvard University due to the inability to capture funding to partner hospitals, we recognize that this phenomenon could occur at other institutions. We did not believe that the magnitude of funding at a satellite hospital for other universities might be quite as big, yet we recognize this as a fallacy of our analysis.

We realize that our search strategy could include fallacious results due to the difficulty in identifying an author from a public database. We carefully cross-referenced articles to ensure validity, especially articles that had a significant impact on the H-index. In addition, our second search strategy also correlated positively with our first search strategy. This was verified independently by two researchers to ensure maximum validity. By restricting the search items by institution, we could potentially exclude papers published by a chairperson in which the communicating author was from a different institution. We do not believe that this would inhibit our assessment of the role of the chairperson in the success of his department. Inclusion of non–first/last authorship articles may inflate the chairperson's H-index, but we believe that any scientific contribution of a leader to an article reflects personal achievement, which may be occurring through bringing teams of researchers together. We also did not feel that this would generate directional bias, since this effect would happen uniformly to all chairpersons. It is interesting to notice that 20 positions for chairs (22%) are either recent (<1 y) or unfilled ($n = 6$). This reflects the flux that is seen in academic medical centers, especially at the top management positions. Also, only 3% of all chairpersons are women, reflecting the discrepancy between the ever-enlarging female surgical workforce and their appointment to leadership positions. Additionally, the overall contribution of the department of surgery to the institutional NIH funding is low (4.5%), suggesting that the clinical mission may sometimes overshadow the research mission of a department of surgery.

In conclusion, the academic success of a department of surgery measured by NIH funding is directly associated with the personal academic success of a chairperson measured by his or her H-index. If proven to be causal in nature, this suggests the important role a surgical leader plays in acting as a role model and a champion for the academic success of the department. This effect is not seen at the extremes, where the institutional rank may play a greater role in determining departmental funding.

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