The Effect of Self-Citations on the Hirsch Index Among Full-Time Academic Hand Surgeons

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OBJECTIVE: To assess the magnitude of self-citation among a cohort of academic hand surgeons and estimate the effect of self-citation on the Hirsch index (*h*-index).

DESIGN: Cross-sectional study.

SETTING: Johns Hopkins Hospital, Department of Plastic and Reconstructive Surgery, Division of Hand Surgery.

RESULTS: The study sample comprised 364 full-time academic hand surgeons. Study subjects had an average of 45 ± 73 publications. The mean total number of citations was 800 ± 1738, the median number of self-citations was 2.5 (interquartile range [IQR]: 0-14.8), and the average frequency of self-citation was 2.2% ± 3.7%. Older surgeons were slightly less likely to self-cite (coefficient = 0.07; p = 0.001). Furthermore, as the total number of publications increased, the frequency of self-citation increased (coefficient = 0.03; $p < 0.001$). The *h*-index increased because of self-citation in 57 surgeons (15.7%). After adjusting for American Society for Surgery of the Hand status and academic rank, increasing rates of self-citation were associated with an increase in the *h*-index. Surgeons with 7 or more self-citations were more likely to have their *h*-index influenced by self-citation.

CONCLUSIONS: The rate of self-citation among full-time academic hand surgeons affiliated with fellowship programs is fairly low. For most of the surgeons, self-citation did not affect the *h*-index. (J Surg Ed 73:317-322. © 2015 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: academic productivity, bibliometrics, hand surgery, *h*-index, self-citation

COMPETENCIES: Professionalism, Practice-Based Learning and Improvement, Systems-Based Practice

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INTRODUCTION

The academic promotion process is a complex procedure.[1-3] Not only is the process highly variable at both the inter- and intrainstitutional levels, but it is also based on several academic performance variables that are often difficult to objectively assess, including leadership, clinical performance, teaching or mentorship, service, and research.[4,5] Research has historically been measured by quantity, namely number of publications and total number of citations.[6] Recently, there has been a growing interest in developing better bibliometrics to measure the quality of a given faculty member's scientific work.[7] One such measure is the Hirsch index (*h*-index).[8] Developed by Hirsch in 2005, it is defined as the number of papers, *h*, with at least *h* or more citations.[9] For example, if a researcher has 10 papers, but only 5 papers have been cited at least 5 times (i.e., the 6th paper has been cited fewer than 6 times), then that researcher's *h*-index is 5. The application of the *h*-index in academic medicine has been validated in several medical specialties.[10-13] Recent studies have even advocated for its use in academic promotions,[14,15] university rankings,[16] noble laureate awards,[17] and the National Institute of Health grant funding selection process.[18,19] Although the use of this metric to measure a faculty member's academic productivity is promising, the *h*-index is vulnerable to several limitations.[20] One such limitation is its potential for manipulation by self-citation. Although journal self-citation has been extensively studied, primarily in the medical literature, with alarming results,[21,22] only a few studies to date have examined the effect of author self-citation.[23,24]

As more studies advocate for the use of the *h*-index in academic medicine, it is important to determine the effect of self-citation on this newly adopted bibliometric in specific medical disciplines. A study by Bartneck and Kokkelmans[25] recently demonstrated that strategic self-citation can dramatically alter the *h*-index. The purpose of this study was to determine the incidence of self-citation in academic hand surgery and determine its effect on the

h-index. We hypothesized that self-citations would have a measurable but minimal effect on the *h*-index. The aims of this study were the following: (1) identify a cohort of academic hand surgeons; (2) obtain demographic and bibliometric variables (corrected and uncorrected for self-citation) from this cohort; and (3) estimate the magnitude of self-citation among this cohort and estimate the effect of self-citation on the *h*-index.

MATERIALS AND METHODS

Study Design

This was a cross-sectional study of full-time academic hand surgeons in the United States and Canada. The study sample was identified by querying the American Society for Surgery of the Hand (ASSH) website to obtain a list of all American Council of Graduate Medical Education (ACGME)-accredited hand surgery fellowships on April 2015. A total of 81 programs were identified across the United States and Canada. For each program, we queried the supporting department's website for the names of faculty members with primary appointments. The following inclusion criteria were used to determine the eligibility of a surgeon to be included in this cohort: (1) full-time faculty member with primary appointment as a hand surgeon in an orthopedic or plastic surgery department or division within the context of an associated ACGME-accredited fellowship in hand surgery and (2) actively practicing as a hand surgeon. Surgeons who were part-time or adjunct faculty, not affiliated with a hand surgery fellowship program, or not actively engaged in the practice of hand surgery were excluded.

Study Variables

The primary predictor variables were bibliometric measures that were assessed using a subscription bibliographic citation database (Scopus, Reed Elsevier, London, UK), with the data cross-referenced with PubMed or National Center for Biotechnology Information (http://www.ncbi.nlmh.nih.gov) data to ensure consistency and adequate capture of data for surgeons who have moved across institutions. The bibliometric measures included the *h*-index (the number of publications, *h,* which are cited $\geq h$ times), total number of publications, and total number of citations. The *h*-index and total number of citations were collected with and without self-citations. Bibliometric measures with self-citations included were considered, uncorrected, and those with self-citations removed were defined as corrected for self-citation. Demographic measures were used as secondary predictor variables, including sex (male or female), research doctorate (PhD or equivalent), other nonclinical degree (MS, MBA, etc.), fellowship training (hand surgery, other, none or not listed), years since completion of training, primary affiliation (orthopedic surgery or plastic surgery), and ASSH member status (yes or no). Academic rank was classified as clinical instructor or lecturer, assistant professor, associate professor, professor, and endowed professor. Demographic data were collected by assessing department or division websites and cross-referencing faculty lists with data from the ASSH and American Association of Hand Surgeons.

Statistical Methods

Deidentified data were entered and stored in a commercially available statistical database (SPSS, version 23.0, © SPSS Inc., Chicago, IL). Once data collection was completed, the analysis strategy was implemented as follows. Descriptive statistics were used to provide an overview of the sample. Bivariate statistics were computed to identify factors associated with self-citation. Associations that were significant or near significant ($p \leq 0.15$) in bivariate analyses were included in multiple regression models, which were used to compute adjusted associations between the predictors and outcomes. A multiple linear regression analysis was used to identify factors associated with the frequency of self-citation. Receiver-operator characteristic curves were generated to identify the threshold of self-citation that would influence the *h*-index. A multiple logistic regression model was constructed to compute the adjusted association of self-citation on the change in the *h*-index. For all analyses, $p \leq 0.05$ was considered significant.

RESULTS

We identified 364 hand surgeons who were full-time faculty affiliated with hand surgery fellowship programs. Among the cohort, 311 surgeons (85.4%) were men, and 249 surgeons (68.4%) were ASSH members. In all, 260 surgeons (71.4%) had their primary academic appointment in orthopedic surgery and 104 (28.6%) had primary appointments in plastic surgery. Nearly all surgeons (362, 99.5%) had completed formal fellowship training. The average time since completion of training was 17.4 $\pm$ 1.0 years. Academic rank across the sample was distributed as follows: instructor or lecturer (14, 3.8%), assistant professor (151, 41.5%), associate professor (97, 26.6%), professor (85, 23.3%), and endowed professor (17, 4.7%). The average total number of citations was 800 $\pm$ 1738 before removing self-citations and 763 $\pm$ 1616 after adjusting for self-citations. The mean number of self-citations was 36.5 $\pm$ 165.6; the median number of self-citations was 2.5; and 121 surgeons (33.2%) had no self-citations. The frequency of self-citation was 2.2 $\pm$ 3.7%. The mean *h*-index among the cohort was 10.6 $\pm$ 10.2. After adjusting for self-citation, there was a small but statistically significant decrease in the *h*-index to 10.4 $\pm$ 9.8 ($p \leq 0.001$). In all, 57 surgeons (15.7%) had a decrease in

their *h*-index because of removing self-citations. Among these surgeons, the mean unadjusted *h*-index was 22.4 ± 14.8 and the adjusted *h*-index was 21.0 ± 14.3, corresponding to a mean change of 1.4 units ($p \leq 0.001$). Descriptive statistics for the study sample are summarized in Table 1.

Table 2 summarizes the bivariate associations between the predictors and the frequency of self-citation. In bivariate analyses, primary academic affiliation, years since completion of training, academic rank, total number of publications, and *h*-index were associated with the frequency of self-citation.

A multiple linear regression model, used to identify adjusted associations between the predictor variables and the frequency of self-citation, is summarized in Table 3. After adjusting for the effects of multiple covariates, the number of years since completion of training and total number of publications remained associated with the frequency of self-citation. Older surgeons were slightly less likely to self-cite (coefficient = 0.07; $p = 0.001$). As the total number of publications increased, the frequency of self-citation increased (coefficient = 0.03; $p < 0.001$).

Table 4 lists the associations between the predictor variables and a change in the *h*-index because of self-citation. In bivariate analyses, ASSH membership, years since completion of training, academic rank, total number of publications, and *h*-index were associated with a change in the *h*-index because of self-citation.

TABLE 1. Descriptive Statistics for Study Sample

Predictor	Value*
ASSH member	
Yes	249 (68.4)
No	115 (31.6)
Primary academic affiliation	
Orthopedic Surgery	260 (71.4)
Plastic Surgery	104 (28.6)
Sex	
Male	311 (85.4)
Female	53 (14.6)
Fellowship training (Yes)	362 (99.5)
Years since completion of training	17.4 ± 11.0
Academic rank	
Lecturer	14 (3.8)
Assistant Professor	151 (41.5)
Associate Professor	97 (26.6)
Professor	85 (23.3)
Endowed Professor	17 (4.7)
Total citations	800 ± 1738
Total citations, adjusted	763 ± 1616
Total number of self-citations	
Mean	36.5 ± 165.6
Median	2.5
Total publications	45.0 ± 72.5
h-Index	10.6 ± 10.2
h-Index, adjusted	10.4 ± 9.8
% Change in citations	2.2 ± 3.7
Change in *h*-index	57 (15.7)

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

TABLE 2. Bivariate Associations Between Predictors and Self-Citation Frequency

	Self-Citation Frequency	p Value*
ASSH member		0.38
Yes	2.3 ± 3.8	
No	1.9 ± 3.5	
Primary academic affiliation		**0.05**
Orthopedic Surgery	2.0 ± 3.2	
Plastic Surgery	2.8 ± 4.6	
Sex		0.33
Male	2.1 ± 3.6	
Female	2.7 ± 4.4	
Fellowship training		0.58
Yes	2.2 ± 3.7	
No	0.5 ± 0.2	
Years since completion of training	r = − 0.08	**0.15**
Academic rank		**0.003**
Lecturer	1.8 ± 2.5	
Assistant Professor	1.9 ± 4.3	
Associate Professor	1.7 ± 2.4	
Professor	2.7 ± 3.3	
Endowed Professor	5.3 ± 5.5	
Total publications	r = 0. 47	**<0.001**
h-Index	r = 0.34	**<0.001**

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

A receiver-operator characteristic curve was used to identify a threshold level of self-citation that would be associated with a change in the *h*-index. A threshold of 7 self-citations (area under the curve 0.85, sensitivity 0.82, and specificity 0.73) was identified as the minimum number of self-citations necessary to potentially influence the *h*-index. Among the sample, 128 surgeons (35.2%) had at least 7 self-citations.

The multiple logistic regression model for predicting change in the *h*-index because of self-citation is summarized in Table 5. After adjusting for the effects of ASSH status, primary academic affiliation, years since completion of training, academic rank, total number of publications, and *h*-index, surgeons who self-cited at least 7 times were 3.3 times more likely to have their *h*-index change because of self-citation (odds ratio [OR] = 3.3; 95% CI: 1.2-8.8;

TABLE 3. Multiple Linear Regression Model for Self-Citation Frequency

	Coefficient	p Value*
Primary academic affiliation	−0.487	0.211
Years since completion of training	**−0.065**	**0.001**
Academic rank	0.251	0.321
Total publications	**0.034**	**<0.001**
h-Index	−0.079	0.065

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

TABLE 4. Bivariate Associations Between Predictors and Change in *h*-Index Because of Self-Citation

	Change in *h*-Index		
	Yes (*N* = 57)	**No (*N*2 = 307)**	**p Value***
ASSH member			**<0.001**
Yes	50 (20.1)	199 (79.9)	
No	7 (6.1)	108 (93.9)	
Primary academic affiliation			0.82
Orthopedic Surgery	40 (15.4)	220 (84.6)	
Plastic Surgery	17 (16.3)	87 (83.7)	
Sex			0.6
Male	50 (16.1)	261 (83.9)	
Female	7 (13.2)	46 (86.8)	
Fellowship training			1
Yes	57 (15.7)	305 (84.3)	
No	0 (0.0)	2 (100.0)	
Years since completion of training	**21.7 ± 11.7**	**16.6 ± 10.7**	**<0.001**
Academic rank†			**<0.001**
Lecturer	0 (0.0)	14 (100.0)	
Assistant Professor	9 (6.0)	142 (94.0)	
Associate Professor	14 (14.4)	83 (85.6)	
Professor	25 (29.4)	60 (70.6)	
Endowed Professor	9 (52.9)	8 (47.1)	
Total publications	**129.4 ± 138.6**	**29.3 ± 33.9**	**<0.001**
***h*-Index**	**22.4 ± 14.8**	**8.4 ± 7.2**	**<0.001**

*Statistically significant values ($p \leq 0.05$) are indicated in bold.
†Comparison of the distribution of academic rank among those who had a change in their *h*-index vs. those who did not.

$p = 0.02$). Among surgeons who self-cited ≥7 times, the unadjusted and adjusted *h*-indexes were 20.4 ± 10.8 and 19.9 ± 10.3, respectively ($p < 0.001$). Among surgeons who self-cited <7 times, the unadjusted and adjusted *h*-indexes were not significantly different (5.30 ± 4.1 vs. 5.28 ± 4.1; $p = 0.34$).

DISCUSSION

Research productivity is an important academic performance variable that is used by academic promotion committees at university-affiliated medical centers across the United States.[26-28] Until recently, research productivity was measured by quantity, specifically number of publications and total number of citations. However, these quantitative metrics fail to take into account a given faculty member's quality of research. The *h*-index was recently introduced to address this specific limitation.[8] The *h*-index not only takes into account a given researcher's quantity of publications, but also incorporates citation rates, as a proxy of quality, into its calculation.[9] Though the *h*-index has been demonstrated to be highly correlated with academic rank across multiple medical and surgical specialties,[29-32] a major limitation is its potential for manipulation via self-citations.

The results of our analysis support the notion that self-citations have a statistically significant, yet minimally relevant, effect on the *h*-index among a cohort of academic hand surgeons. Of our cohort of 364 surgeons, the mean *h*-index was 10.6 ± 10.2 and decreased slightly to 10.4 ± 9.8 after adjusting for self-citations. The *h*-index increased because of self-citation in only 57 surgeons (15%). The median number of self-citations (2.5) and the average frequency of self-citation (2.2%) among this cohort of academic hand surgeons were quite low. After controlling for effect modifiers and confounders, self-citation was still associated with a change in the *h*-index. However, our data suggest that a high rate of self-citation would be required to significantly affect the *h*-index. Using a receiver-operator characteristic curve, a threshold of 7 self-citations was identified as the minimum number of self-citations necessary to potentially influence the *h*-index in a cohort of academic hand surgeons ($p = 0.02$). Among surgeons within the cohort, only a few (35%) had 7 or more self-citations.

TABLE 5. Multiple Logistic Regression Model for Change in *h*-Index Because of Self-Citation

	OR	95% CI	p Value*
ASSH member	1.9	0.6-6.1	0.26
Primary academic affiliation	0.9	0.4-2.1	0.86
Years since completion of training	1.0	0.9-1.1	0.43
Academic rank	1.0	0.6-1.7	0.85
Total number of publications	1.0	1.0-1.1	0.15
h-Index	1.0	1.0-1.1	0.34
Self-citations (≥7)	**3.3**	**1.2-8.8**	**0.02**

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

Over the last 2 decades, several studies have explored the effect of journal self-citations on a journal's impact factor (IF).[22,33] These studies have found that journal self-citations are common in high-IF journals and have been implicated in hyperinflating a journal's IF.[33,34] Kulkarni et al.[34] found that approximately 1 in 15 citations of articles in high-profile general medicine journals, such as the *New England Journal of Medicine, Journal of the American Medical Association, and Lancet*, was a self-citation, and associated with increasing the journal's IF. Fassoulaki et al.[35] reviewed journal self-citation in 6 anesthesia journals and found a "positive correlation between a journal's IF and its self-citation rate." The frequency of self-citation among these journals was fairly high, ranging from 17%-35%. Other similar studies analyzing the literature in ophthalmology,[21] diabetes,[36] gastroenterology,[22] and neurology[37] have found similar results.

Unlike journal self-citations, the effect of author self-citations had not received considerable attention in the literature until recently. Rad et al.[24] evaluated the effect of self-citations on the *h*-index in academic radiology and found that 70% of *h*-index numbers did not change because of self-citations. Moreover, this study found that self-citation did not change with academic rank. More recently, Swanson et al.[23] analyzed a cohort of academic plastic surgeons from institutions with a historical emphasis on research and found that surgeons who self-cited at rates less than 5% were less likely to have their *h*-index change because of self-citation. Thus far, these studies and ours have shown that self-citations have a minimal and consistent effect on the *h*-index; these findings should provide reassurance to promotion committees regarding the validity of this measure of research productivity.

Our study has several limitations. Our analysis was performed in a specific cohort of academic hand surgeons. Hand surgeons who were part-time faculty, based on private practice, or not affiliated with an ACGME-accredited hand fellowship programs were excluded from our analysis. Additionally, our analysis did not correct for specialty scope and readership size. Previous studies have suggested that smaller subspecialties with narrow research focuses (e.g., congenital hand deformities) could be more appropriately prone to self-citations owing to the size and scope of the respective field. However, our results suggest that, across our cohort of hand surgeons, the rate of self-citation was consistent and had very few outliers. As hand surgery is a smaller field (in comparison with internal medicine or other specialties like cardiology) with several niche research focuses, our analysis suggests that this last limitation may be an unlikely concern. Finally, our data may potentially underrepresent self-citations because of the average surgeon's lack of knowledge of the *h*-index and its potential for manipulation. A recent study by Bartneck and Kokkelmans[25] determined that authors could inflate their *h*-index by targeting publications that have number of citations that are just lower than their *h*-index. As academic surgeons are well versed in citation indices through their knowledge of journal impact factors, this last concern may also be unlikely.

CONCLUSION

The results from this study suggest that self-citations are uncommon in academic hand surgery. As the incorporation of the *h*-index, or other bibliometric measures of scientific productivity, increases in academic medicine, promotion committees should be reassured that self-citations have a minimal effect on the *h*-index.

REFERENCES

1. Atasoylu AA, Wright SM, Beasley BW, et al. Promotion criteria for clinician-educators. *J Gen Intern Med*. 2003;18:711-716.
2. Benway BM, Kalidas P, Cabello JM, Bhayani SB. Does citation analysis reveal association between *h*-index and academic rank in urology? *Urology*. 2009;74:30-33.
3. Fang D, Moy E, Colburn L, Hurley J. Racial and ethnic disparities in faculty promotion in academic medicine. *J Am Med Assoc*. 2000;284:1085-1092.
4. Pollack M. Promotion Guidelines at the University of Michigan, June 2015. Available at: ⟨https://www.provost.umich.edu/faculty/promotion_guidelines/provost_memo.html⟩. Accessed on 06.10.2015.
5. Pierson R.N. A guide to the promotions and tenure process. University of Maryland Medical School. ⟨http://medschool.umaryland.edu/Offices-of-the-Dean/Faculty-Affairs-and- Professional-Development/docs/New-Faculty-Orientation/Promotion-and- Tenure.asp⟩. Accessed 10.06.15.
6. Kulkarni AV, Aziz B, Shams I, Busse JW. Comparisons of citations in web of science, scopus, and google scholar for articles published in general medical journals. *J Am Med Assoc*. 2009;302:1092-1096.
7. Ashrafian H, Rao C, Darzi A, Athanasiou T. Benchmarking in surgical research. *Lancet*. 2009;374:1045-1047.
8. Hirsch JE. An index to quantify an individual's scientific research output. *Proc Natl Acad Sci U S A*. 2005;102:16569-16572.
9. Hirsch JE. Does the H index have predictive power? *Proc Natl Acad Sci U S A*. 2007;104:19193-19198.
10. Lopez J, Susarla SM, Swanson EW, Calotta N, Lifchez SD. The association of the H-index and academic rank among full-time academic hand surgeons affiliated with fellowship programs. *J Hand Surg Am*. 2015;40:1434-1441.

11. Khan NR, Thompson CJ, Taylor DR, et al. An analysis of publication productivity for 1225 academic neurosurgeons and 99 departments in the United States. *J Neurosurg*. 2014;120:746-755.

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

13. Sharma B, Boet S, Grantcharov T, Shin E, Barrowman NJ, Bould MD. The *h*-index outperforms other bibliometrics in the assessment of research performance in general surgery: a province-wide study. *Surgery*. 2013;153:493-501.

14. Susarla SM, Lopez J, Swanson EW, et al. Do quantitative measures of academic productivity predict academic rank in plastic surgery? A national study *Plast Reconstr Surg*. 2015;136(3):613-621 10.1097/PRS.0000000000001531.

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

16. World University Rankings. QS World University Rankings by Subject 2014:Methodology, June 2015.

17. Patel VM, Ashrafian H, Almoudaris A, et al. Measuring academic performance for healthcare researchers with the *h*-index: which search tool should be used? *Med Princ Pract*. 2013;22:178-183.

18. 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;190:999-1003.

19. Svider PF, Lopez SA, Husain Q, Bhagat N, Eloy JA, Langer PD. The association between scholarly impact and national institutes of health funding in ophthalmology. *Ophthalmology*. 2014;121:423-428.

20. Gaster N, Gaster M. A critical assessment of the h-index. *Bioessays*. 2012;34:830-832.

21. Mimouni M, Segal O. Self-citation rate and impact factor in ophthalmology. *Ophthalmic Res*. 2014;52:136-140.

22. Karimi Elizee P, Karimzadeh Ghassab R, Raoofi A, Miri SM. The more publication, the higher impact factor: citation analysis of top nine gastroenterology and hepatology journals. *Hepat Mon*. 2012;12:e8467.

23. Swanson EW, Miller DT, Susarla SM, et al. What effect does self-citation have on bibliometric measures in academic plastic surgery? *Ann Plast Surg*. 2015 Jun 20. [Epub ahead of print].

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

25. Bartneck C, Kokkelmans S. Detecting h-index manipulation through self-citation analysis. *Scientometrics*. 2011;87:85-98.

26. The Johns Hopkins Gold Book. Appointments & Promotions of Full-Time Faculty. Chapter 2. Available at: ⟨http://www.hopkinsmedicine.org/som/faculty/_downloads/2013_gold_book.pdf⟩. Accessed 10.06.15.

27. Ohio State University School of Medicine. Appointments, promotion, and tenure document. Available at: ⟨http://medicine.osu.edu/faculty/promotionandtenure/pages/index.aspx⟩. Accessed 05.10.15.

28. COAP Guidelines. Internal Guidelines for faculty appointments and promotions at the Columbia University Mailman School of Public Health. Available at: ⟨https://www.mailman.columbia.edu/sites/default/files/pdf/03_coap_guidelines.pdf⟩. Accessed 07.01.15.

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

30. Siebelt M, Siebelt T, Pilot P, Bloem RM, Bhandari M, Poolman RW. Citation analysis of orthopaedic literature; 18 major orthopaedic journals compared for impact factor and SCImago. *BMC Musculoskelet Disord*. 2010;11:4-2474-11-4.

31. Therattil PJ, Hoppe IC, Granick MS, Lee ES. Application of the *h*-index in academic plastic surgery. *Ann Plast Surg*. 2014 Nov 21. [Epub ahead of print].

32. Turaga KK, Gamblin TC. Measuring the surgical academic output of an institution: the "institutional" H-index. *J Surg Educ*. 2012;69:499-503.

33. Opthof T. Inflation of impact factors by journal self-citation in cardiovascular science. *Neth Heart J*. 2013;21:163-165.

34. Kulkarni AV, Aziz B, Shams I, Busse JW. Author self-citation in the general medicine literature. *PLoS One*. 2011;6:e20885.

35. Fassoulaki A, Paraskeva A, Papilas K, Karabinis G. Self-citations in six anaesthesia journals and their significance in determining the impact factor. *Br J Anaesth*. 2000;84:266-269.

36. Gami AS, Montori VM, Wilczynski NL, Haynes RB. Author self-citation in the diabetes literature. *Can Med Assoc J*. 2004;170:1925-1927 [discussion 1929-30].

37. Foley JA, Della Sala S. The impact of self-citation. *Cortex*. 2010;46:802-810.