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Research Article

Bibliometric Analysis of AANS/CNS Joint Section on Tumors (JST) Award Recipients

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ABSTRACT

The AANS/CNS Joint Section on Tumors (JST) awards are given for tumor research and clinical achievements. Associations between scholarly awards and academic productivity in neurosurgery have not been thoroughly investigated. We explore associations between JST awards and measures of academic productivity to evaluate the relationship between scholarly output, fellowship training, and awarded recognition. Demographic information was collected from public data of 1671 academic neurosurgeons comprising 115 Accreditation Council for Graduate Medical Education accredited institutions. *h*-index was queried from Scopus. The mean-Relative Citation Ratio (RCR) and weighted-RCR were gathered from the NIH iCite database from 2002-2020. JST award reception was determined from the JST official resource. RCR, *h*-index, and NIH funding were compared between neurosurgeons who received JST awards and those who did not, using multivariable linear regression. Analysis showed w-RCR was higher among award recipients (β=15.02; 95% CI:4.741,25.29; $p<0.01$), while m-RCR was not significantly different (β=-0.049, 95%CI 0.2214,0.1238; $p=0.5336$). *h*-index was higher among award winners (β=2.155; 95% CI 1.164,3.147; $p=0.0008$). Award recipients also received greater NIH funding ($p<0.0001$) and were positively associated with Oncology/Skull Base, General, and Radiosurgery subspecialty training. Receiving a JST award may be correlated with a more productive research career and establishes benchmark metrics for JST award winning. To our knowledge, this is one of the first analyses on this type of award winning in neurosurgery using both the *h*-index and the more recently created RCR.

Keywords: Academic productivity, Bibliometrics, *h*-index, Relative citation ratio.

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INTRODUCTION

Bibliometrics is an evaluative tool that allows researchers to compare a variety of factors such as professorship, author level metrics, and the influence of a publication on future research productivity.[1] These metrics allow for recognition of an author's productivity, quantitative analysis of a publication's citations, downstream citations, and the impact factor of the particular journal in which the article was published.[1] There are multiple tools available to perform a bibliometric analysis, most notably the *h*-index. The *h*-index is a tool that enables comparison of productivity (quantity) and number of citations (quality) that a publication receives.[2] Although *h*-index is useful for evaluating an individual's scholarly output, there are limitations that reduce its accuracy and utility. Limitations of the *h*-index include its sensitivity to the amount of publications published, not necessarily the impact of those publications, and the lack of field and time normalization.[3] The *h*-index also places more weight on the number of publications than on the number of citations the article obtains and may therefore diminish the works of new authors.[4,5] Using the *h*-index, smaller medical or surgical fields may have a lower number of citations than larger programs, which may complicate objective comparisons across different medical fields.[6]

The Relative Citation Ratio (RCR) was designed by the National Institutes of Health (NIH) as a new metric aimed to address potential shortcomings of the *h*-index assessment.[6] While *h*-index compares the quantity and quality of publications, RCR uses the co-citation network of a reference article to determine the article's field. This network is a dynamically determined comparison tool based on NIH-funded R01 projects with a value of 1.0 being the determined median, allowing for comparisons between different fields and basing a higher number on the

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impact to that respective field.[7] In the field of neurosurgery where the exposure of publications is relatively limited compared to other specialties, RCR better elucidates individual productivity and allows for comparison between individuals of different fields and subspecialities.[6]

RCR can be broken down into two further evaluation methods: The mean-RCR (m-RCR) and weighted-RCR (w-RCR). The m-RCR measures how many citations a paper receives in one year and divides this by how many citations the average paper in that particular field receives. The w-RCR adds together all the RCR values across a researcher's career. In this way, the m-RCR is a measure of mean RCR values, allowing for a comparison of the impact of the author's publications, while w-RCR is more influenced by the number of publications and thus overall productivity.[7] In a prior study using RCR to measure academic productivity among neurosurgery-trained spine surgeons, the researchers found that the m-RCR for academic spine surgeons was 1.3, above the average 1.0 set by the NIH.[8] Given that neurosurgery is a highly productive field, this result demonstrates the accuracy of RCR in evaluating scholarly productivity.[8] Recently, in a study of 1687 academic neurosurgeons, Reddy *et al*. found that w-RCR is a reliable measure of productivity, while m-RCR is a reliable measure of impact.[6]

Academic productivity is an essential component of many specialties in medicine, especially in the field of academic neurosurgery. Prior research has shown that *h*-index increases significantly with academic rank from assistant professor, associate professor and full professor.[9] Other research has shown that m-RCR and w-RCR are significantly associated with academic rank.[5,6] The JST arm of the AANS/CNS is an organization that focuses on education and research on the tumors of the nervous system. As part of the investment in research, the JST collectively bestows 22 awards a year to physician scientists and trainees who have advanced the field of neurosurgery through research and innovative surgical practices.[10] The JST fosters research by providing these awards to top scoring abstracts submitted by researchers and clinicians working on topics relating to tumors of the nervous system that have a very high rate of progressing to full publication.[11,12]

Considering that JST award recipients are typically physicians who produce impactful research in the field, insight into their academic metrics could provide benchmarks for others seeking similar accolades. Investigating potential correlations between JST awards and other metrics such as *h*-index, RCR, NIH funding, and fellowship training could also broaden knowledge of academic productivity, clarifying whether individuals who are given these awards also have correspondingly high levels of success in these other areas. To date, few studies have investigated RCR in academic neurosurgery. Therefore, studying the association between JST awards and RCR is of particular interest given that this metric is fairly new. Evaluating academic productivity in this new context may help to reveal whether receiving these awards is predictive of future academic success. To that end, it would be highly valuable to delve deeper into the prognostic capacity of the JST and other metrics in determining academic achievement for neurosurgeons at various stages of their careers.

In the current study, we evaluated whether a higher m-RCR and w-RCR metric is associated with individuals who win awards in the AANS/CNS JST in comparison to other academic metrics. We hypothesize that award recipients are associated with having higher m-RCR and w-RCR indices, *h*-index, and NIH funding when compared to non-award winners. Additionally, we hypothesize that younger investigators will have lower m-RCR and w-RCR indices, *h*-index and NIH funding compared to more senior clinicians. Finally, we predict that Oncology/Skull Base and Spine Fellowship trained neurosurgeons will have a higher association of award winning than other fellowship training. Ultimately, we hope to gain a better understanding of this academic productivity marker and of the factors that contribute to receiving a JST award.

METHODOLOGY

Research Inclusion Criteria

Practicing academic neurosurgeons of all specialties from 115 US ACGME accredited neurological surgery programs were included in this cohort. Department and hospital websites were examined between July-August 2020 for faculty members' information (biographies, subspecialty listings). The cohort contains surgeons who completed a neurosurgery residency and currently practice as a neurosurgeon. Those who completed residency training in another field or do not currently practice neurosurgery were excluded from the database.

Demographic and Bibliometric Data

Publicly available resources were used to gather information such as, gender, subspecialty, academic rank, and length of practice. These resources included hospital and departmental websites, Castle Connolly,[13] Doximity,[14] and Healthgrades.[15] Neurosurgical subspecialties included in this study covered the breadth of neurosurgical practice: functional, general neurosurgery, oncology/skull base, pediatrics, peripheral, peripheral nerve, radiosurgery, spine, and vascular. All specialties were included because each specialty in our database contained at least one JST award winner. If neurosurgeons identified as practicing multiple subspecialties, they were designated in each respective category.

Demographic data and the four regions of Northeast, South, Midwest, and West were determined as established by the United States Census Bureau.[16] The Northeast includes Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania. The Midwest includes

Table 1: Cohort Demographics.

	Overall *n* (%)	JST Award Winners *n* (%)
Total	1671 (100)	112 (100)
Male	1525 (91.3)	106 (94.6)
Female	146 (8.7)	6 (5.4)
Region		
Northeast	474 (28.4)	35 (31.3)
Midwest	357 (21.4)	17 (15.2)
South	498 (29.8)	32 (28.6)
West	310 (18.6)	28 (25)

Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas. The South includes Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, and Texas. The West includes Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Washington, Oregon, California, Alaska, and Hawaii.

JST award recipients were identified using the official AANS/CNS website listing of awards, which include: Synaptive Brain Tumor Research Award, Rosenblum-Mahaley Clinical Award, ABTA Young Investigator Award, Journal of Neuro-Oncology Award, Ronald Bittner Award and Lectureship, Integra Foundation Award, Columbia Softball Skull Base Surgery Award, Brainlab Neurosurgery Award, Andy T. Parsa Fellowship Award, Lunsford and Leksell Radiosurgery Award, AANS/CNS Joint Section on Tumors Neuro-Oncology Trainee Award, Farber-Ahijit Guha Award, James Rutka Pediatric Brain Tumor Award, Brian D. Silber Award, 2020 CNS Tumor Section Award, 2020 Tumor Section Satellite Symposia Award, Preuss Research Award, NBTF Translational Research Grant Award, Pediatric Brain Tumor Foundation Award, Brainlab International Fellowship, ABTA Clinical Research Award. Award recipients included in this study are as of January 2021.[17] Certain JST awards are intended for more senior physicians (Preuss Award and Rosenblum-Mahaley Award) while other awards are reserved for junior trainees (ABTA Young Investigator Award and AANS/CNS JST Trainee Award). Non-award winners were determined as those neurosurgeons within our database who were not listed as a JST award recipient in the tumor section website.

RCR data (m-RCR and w-RCR) for all included academic neurosurgeons was collected using the NIH iCite (https://icite.od.nih.gov/analysis)[18] database between November-December 2020. The RCR data includes metrics concerning publications from 2002-2020 that are indexed on PubMed. *h*-index scores pertaining to each neurosurgeon were collected from the Scopus (https://www.scopus.com/search/form.uri?edit.scft=1#basic)[19] database as of December 2020.

NIH funding for organizations with ACGME accredited neurosurgery residency programs was obtained from 2020 funding data available using the NIH Research Portfolio Online Reporting Tools.

Statistical Analysis

M-RCR, w-RCR, *h*-index, and NIH funding were collected for all academic neurosurgeons defined by the inclusion criteria. Univariate analysis was performed using *t*-tests to compare demographic variables, m-RCR, w-RCR, *h*-index, and NIH funding between JST Award Recipients and Non-award winners. *t*-tests were also performed to compare these same variables, except for NIH funding, which was excluded, between senior clinician award recipients and junior clinician award recipients. Multiple linear regression with least squares assuming Gaussian distribution of residuals was used for comparison. The metrics were compared by gender, years in practice, academic rank (assistant, associate, and full professor), NIH funding, general neurosurgery, all neurosurgical subspecialties, and JST award. All tests were two-sided with statistical significance defined as $p< 0.05$. Statistical analyses and figure creation were performed with Prism 9.0.2 (GraphPad Software, San Diego, CA).

RESULTS

Cohort Demographics

Of the 1,671 academic neurosurgeons, 1,525 were male (91.3%). 30% of the cohort resides in the South (n=498), followed by 28% in the Northeast (n=474), 21% in the Midwest (n=357), and 19% in the West (n=310). These four regions were determined as established by the United States Census Bureau.[20] Not all neurosurgeons provided a demographic region in this study. The largest number of JST award recipients resided in the Northeast (n=35, 31%), followed by the South (n=32, 29%), West (n=28, 25%), then Midwest (n=17, 15%) (Table 1).

Of the senior award winners, 24 had a fellowship in oncology, 5 in spine, 2 in vascular, 2 in pediatrics, 1 general, 1 functional, 2 radiosurgery, and 1 was a non-neurosurgery specialty. Of the Junior award winners, 16 were oncology, 12 were residents, 3 were spine, 2 vascular, 1 pediatrics, 1 general, 1 functional, 0 radiosurgery, and 2 were non-neurosurgery (Table 2).

Univariate Analysis

Univariate analysis showed JST award recipients had higher *h*-index (p<0.0001) and w-RCR (p<0.0001), but not a higher m-RCR (p=0.3876). JST award winners were more likely to receive NIH funding than their non-award-winning counterparts (p=0.022). NIH-funded neurosurgeons were shown to have increased w-RCR (p=0.0087) and *h*-index (p<0.0001) compared to non-NIH funded neurosurgeons. Comparison of bibliometrics between senior award winners and junior award winners showed

Table 2: Senior and Junior Faculty Subspecialties.

	Senior (*n*)	Junior (*n*)
Residency	1	12
Oncology	24	16
Spine	5	3
Vascular	2	2
Pediatrics	2	1
General	1	1
Functional	1	1
Radiosurgery	2	0
Non-neurosurgical	1	2

Table 3: JST Award Univariate Results.

	JST Award Recipients (*n*=112) (sd)	Non-Award Recipients (*n*=1530) (sd)	*p*-value
m-RCR	1.742 (0.76)	1.563 (1.85)	0.3876
w-RCR	176.3 (231.2)	91.15 (149.6)	<0.0001
h-index	29.78 (16.78)	18.65 (16.78)	<0.0001
Institution NIH Funding	3,295,310.71	2,131,560.27	0.02
Faculty NIH Funding	178,324.94	24,611.30	0.03
	Junior Award Recipients (*n*=38)	**Senior Award Recipients (*n*=39)**	***p*-value**
m-RCR	1.71	2.13	0.06
w-RCR	90.38	202.05	0.01
h-index	18.71	28.31	0.01

Table 4: JST Award Linear Regression # JST Awards.

	Estimate	95% CI	*p*-value	|t|
m-RCR	-0.04877	-0.2214 to 0.1238	0.58	0.55
w-RCR	15.02	4.741 to 25.29	<0.01	2.867
h-index	2.155	1.164 to 3.147	<0.01	4.26
Years in Practice	-1.562	-2.468 to -0.6547	<0.01	3.38
Gender	-0.013	-0.102 to 0.073	0.74	0.33
Top 40 NIH	0.04	-0.014 to 0.087	0.15	0.15
Associate Prof	0.032	-0.037 to 0.101	0.37	0.90
Professor	-0.013	-0.093 to 0.067	0.74	0.33

increased w-RCR (p=0.0109) and h-index (p=0.0112) for those neurosurgeons who have won senior awards (Table 3).

Multivariate Analysis

Multivariable linear regression, controlling for gender, years in practice, academic rank (assistant, associate, and full professor), NIH funding, and neurosurgical subspecialties showed that winning a JST award was associated with increased h-index (β=2.155, CI=1.164 to 3.147, p<0.01; |t|=4.26) and increased w-RCR (β=15.02, CI =4.741 to 25.29, p<0.01; |t|=2.87). On the other hand, years in practice had a negative association with winning a JST award (β=-1.562, CI=-2.468 to -0.655, p<0.01; |t|=3.38). Lastly, winning a JST award did not significantly

Table 5: JST Award Logistic Regression Odds.

	Estimate	95% CI	*p*-value	|Z|
Intercept	0.0471	0.026 to 0.084	<0.01	10.56
m-RCR	1.029	0.78 to 1.15	0.76	0.31
w-RCR	0.998	0.99 to 1.00	0.07	1.79
h-index	1.066	1.04 to 1.09	<0.01	4.97
Years in Practice	0.931	0.90 to 0.97	<0.01	3.70
Gender	0.891	0.30 to 2.10	0.81	0.24
Top 40 NIH	0.99	0.59 to 1.63	0.95	0.056
Associate Prof	0.821	0.38 to 1.67	0.60	0.53
Professor	0.975	0.42 to 2.21	0.95	0.059

Table 6: Linear Regression of JST Award Winning Compared to Spine Subspeciality.

	Estimate	95% CI	*p*-value
[Vascular]	-0.008570	-0.08480 to 0.06766	0.83
[Functional]	0.007391	-0.07839 to 0.09318	0.87
[Oncology]	0.2265	0.1621 to 0.2910	<0.01
[Pediatrics]	0.03588	-0.03902 to 0.1108	0.35
[General]	0.08318	0.004500 to 0.1619	0.04
[Peripheral]	-0.03261	-0.2200 to 0.1548	0.73
[Radiosurgery]	0.2106	0.05473 to 0.3665	0.01
[Trauma]	0.1526	-0.02809 to 0.3332	0.09

modulate m-RCR (β=-0.049, CI = -0.221 to 0.125, p=0.58; |t|=0.55) (Table 4).

We also conducted a logistic regression analysis based on whether a neurosurgeon won a JST award or not. Results show that every 1-point increase in *h*-index increases the odds of winning a JST award by 1.066 (β=1.066, CI=1.04 to 1.09, p<0.01; |Z|=4.97). Years in practice was associated with an decreased odds of receiving a JST award (β=0.931, CI=0.90 to 0.97, p<0.01; |Z|=2.70) (Table 5).

Evaluating award recipients by specialty compared to Spine subspecialty and controlling for all the above factors showed that Oncology/Skull Base (β=0.227, CI=0.162 to 0.291, p<0.01), General (β=0.083, CI=0.0045 to 0.1619, p=0.04), and Radiosurgery (β=0.211, CI=0.055 to 0.367, p = 0.01) fellowship trainings were positively associated with winning a JST award. Vascular (β=-0.0086, CI=-0.085 to 0.0, p=0.83), Functional (β=0.007, CI=-0.078 to 0.093, p = 0.87), Pediatrics (β=0.036, CI=-0.039 to 0.111, p = 0.35), Peripheral Nerve (β=-0.033, CI=-0.220 to 0.155, p = 0.73), and Trauma (β=0.153, CI=-0.028 to 0.333, p = 0.09), neurosurgical specialties were not significantly associated with winning a JST award compared to Spine subspecialty in neurosurgery (Table 6).

Finally, we conducted *t*-tests comparing a variety of factors in award winners vs non-award winners. *h*-index (p<0.0001), total publications (p<0.0001), and weighted RCR (p<0.0001) showed significant differences between award winners and non-award winners. Years in practice (p=0.2192) and mean-RCR (p=0.3876) did not show a significant difference (Table 7). These results are shown graphically in (Figure 1).

DISCUSSION

Bibliometrics has facilitated the development of quantitative tools that assess the academic productivity of physicians. These metrics are often used to assess candidates for tenure or promotions, grant proposals, performance reviews, and benchmarking.[5] Prior work has shown that *h*-index predicts NIH funding and that neurosurgeons with higher bibliometric indices receive more total funding, total grants, and earlier attainment of their first grant.[21] Multiple studies have also shown that *h*-index is positively correlated with academic rank.[8,22,23] In-training factors during residency such as total publications and first-author publications also correlate with promotion to professorship and chairmanship.[24] Examining the bibliometric profiles of JST award recipients deepens our understanding of academic productivity and contributing factors. In this analysis of JST award recipients, we found that academic neurosurgeons with a JST award are more likely to have an increased *h*-index and w-RCR and are more likely to receive greater NIH funding compared to their counterparts without an award. Previous research has also shown that AANS sponsored research fellowships in neurosurgery lead to greater academic achievement with higher rates of NIH awarded funding, entering academic neurosurgery, and becoming

Table 7: *t*-Tests and Standard Deviations of Figure 1.

	JST Award Recipients (*n*=112) (sd)	Non-Award Recipients (*n*=1530) (sd)	*p*-value
Years in Practice	15.46 (11.21)	17.17 (11.21)	0.2192
h-index	29.78 (16.78)	18.65 (16.78)	<0.0001
Total Publications	96.68 (91.57)	58.37 (78.25)	<0.0001
Mean RCR	1.742 (0.76)	1.563 (1.85)	0.3876
Weighted RCR	176.3 (231.2)	91.15 (149.6)	<0.0001

neurosurgical chairs.[25] Award winning in neurosurgical fields has not been explicitly researched as being correlated to academic productivity.

Our analysis reveals an association with receiving a JST award and greater scholarly impact when measured by *h*-index and w-RCR. Both measures are influenced by the amount of time spent publishing in a field of interest.[9,26] We also found that m-RCR was not significantly different between the JST award and non-award cohorts. This finding may be related to the fact that m-RCR is a time-normalized metric and therefore effectively removes the contribution of greater publishing time since it relies on the overall influence of publications. However, these metrics also consider an entire career of work, while the JST awards are usually specific to a single research study.[26,27] Those who have been practicing longer have an increased likelihood of publishing more research, which increases the probability that one of their research topics may earn them a JST award. RCR measures the influence a person's work has on the determined field of the article, which allows for normalization across different specialties.[26] Therefore, m-RCR may be similar between JST award recipients and non-award winners because m-RCR represents the author's average citations of singular articles compared to the rest of their field and JST awards are based on a single study, eliminating the effects of cumulative work.

Geographic differences between award winners reflect the distribution of residency programs and the population of the respective areas of the United States, showing no obvious bias towards one particular region when correcting for density of residency programs and academic medical centers. The southern region had the most neurosurgeons compared to the Northeast, West and Midwest. However, the Northeast has the most JST award winners. A recent study by Rahman *et al*. reported that the geographical distribution of neurosurgeons per capita is not equal across the US.[28] This shortage of neurosurgeons in various parts of the country could have an impact on academic productivity. If neurosurgeons are in short supply, they may need to focus more on their practice and clinical care, or institutions may focus on other aspects of the medical environment other than scholarly output.

Members of the JST are all neurosurgeon scientists who have a vested interest in neuro-oncology, and the committee on selection is based on reviewers' recognition of innovative paper submissions. Several awards are reserved for junior faculty and trainees while other awards are geared towards senior faculty. This bibliometric comparison of junior versus senior award winners showed an increased w-RCR and *h*-index for the senior award recipients but no differences for m-RCR. The lack of difference in m-RCR indicates that scholarly output between junior and senior clinicians having received a JST award is similar. This result reflects the purpose of m-RCR, which eliminates the impact of publishing time within a field. In contrast, w-RCR and *h*-index are both influenced by length of publishing time. Thus, it is logical that recipients of more senior awards have greater overall academic productivity compared to their junior counterparts.

This analysis also found that recipients of JST awards received greater NIH funding. A correlation between scholarly impact (*h*-index, w-RCR) and winning a JST award was discussed previously. Prior studies have also shown that there is a strong association between scholarly impact and receiving NIH funding.[29,30] With both points in mind, it is expected that JST award winners are likely to receive more NIH funding. These correlations are important to mention because they relate to academic productivity which can influence career development and academic rank.[8,22,23,30] It is worth noting that this analysis is simply a report of the findings between JST award recipients and other practicing neurosurgeons and is not an attempt to elevate one group over another.

Finally, we found that fellowship training in Oncology/Skull Base neurosurgery, general neurosurgery, and radiosurgery was positively associated with winning a JST award when compared to spine surgery training. Previous research has shown that Spine, Oncology, and Vascular subspeciality training have higher academic productivity, with higher *h*-indices than other fellowships.[31,32] It was hypothesized that for a tumor specific conference, oncological neurosurgery training would have the highest association of award winning. Therefore, our finding that Oncology/skull base and radiosurgery were correlated with awards that prioritize research such as the JST was not unexpected. Other specialties in neurosurgery, while having high academic productivity, could be less likely to submit for JST specific awards. Future work is necessary to validate these

Figure 1: *t*-tests and ranges for JST award winning.

associations and uncover specific factors that account for the trends we detected in the present study.

Limitations

Limiting the "academic productivity" to bibliometrics is imperfect inherently and does not represent the entirety of a neurosurgeon's contribution to the field. A significant limitation of this analysis is the lack of a public record for the total membership of the JST. A physician must be a member of the JST to win an award. Therefore, our database most likely includes physicians who are not members of the JST, increasing the size of the reference cohort that has not won an award. Another limitation is that RCR only includes data on publications from PubMed that were published by 2002 or later, which does not allow a full statistical analysis of physicians who may have had significant academic contributions prior to 2002. We also do not have *h*-index/RCR data from the time when neurosurgeons won the award, so it is not possible to delineate whether higher *h*-index/w-RCR leads to a JST award or vice versa. In addition, the reliability of accurate information on faculty from hospital websites is variable, as some websites may fail to update their information regularly. The sample size is also small regarding junior awards versus senior awards given that only two are given every year. Finally, the accuracy of bibliometrics can be skewed depending on the publishing philosophy of a researcher and institution.[33] For example, some researchers may only choose to publish their best work in journals with high impact factors instead of their entire body of work in lower impact journals, which could effectively raise their m-RCR but does not reflect the productivity of their entire research. On the other hand, there are also researchers who try to disseminate as much research as possible even if it is not of the highest quality, which could lower their m-RCR but increase their w-RCR.

CONCLUSION

The RCR, *h*-index, and NIH-funding are indices used to measure scholarly output for academic neurosurgeons. The JST bestows awards to those who show innovative research that will have a large impact on its respective field. In this bibliometric analysis, we demonstrate that neurosurgeons who had received a JST award were more likely to have an increased w-RCR, *h*-index, and NIH funding than those who have not won an award. Fellowship training in Oncology/Skull Base, general neurosurgery, and radiosurgery was associated with JST award winning more than other fellowship subspecialities. This analysis provides novel insight into the utility of RCR as a newer bibliometric tool and establishes a valuable benchmark for neurosurgeons seeking awards from the JST.

AUTHORS' CONTRIBUTION

Addison Quinones: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Project administration; Supervision; Validation; Visualization; Roles/Writing-original draft; Writing-review and editing. Eugene I Hrabarchuk: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Project administration; Supervision; Validation; Visualization; Roles/Writing-original draft; Writing-review and editing. Alexander J Schupper: Conceptualization; Data curation; Methodology; Project administration; Supervision; Validation; Visualization; Roles/Writing-original draft; Writing-review ans editing. Vikram Vasan: Roles/Writing-original draft; Writing-review and editing. Jonathan Dullea: Formal Analysis; Visualization; Roles/Writing–review and editing Connor Berger: Roles/Writing-original draft; Writing-review and editing. Adam Y Li: Data curation; Formal analysis; Methodology; Writing-review and editing. Lily McCarthy: Validation; Roles/Writing-original draft; Writing-review and editing. John R Durbin: Data curation; Formal analysis; Muhammad Ali: Roles/Writing-original draft; Writing-review and editing. Roshini Kalagara: Data curation; Roles/Writing-original draft; Writing-review and editing. Zerubabbel Asfaw: Data curation; Roles/Writing-original draft; Writing-review and editing. Lisa Genadry: Roles/Writing-original draft; Writing-review and editing. William Shuman: Data curation; Roles/Writing-original draft; Writing-review and editing. Theodore C Hannah: Data curation; Formal analysis; Roles/Writing-original draft; Writing-review and editing. Tanvir F Choudhri: Funding acquisition; Investigation; Methodology; Project administration; Supervision; Validation; Visualization; Roles/Writing-original draft; Writing-review and editing.

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None.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

AANS: American Association of Neurological Surgeons; **CNS:** Congress of Neurological Surgeons; **JST:** Joint Section on Tumor; **m-RCR:** Mean Relative Citation Ratio; **NIH:** National Institute of Health; **RCR:** Relative Citation Ratio; **w-RCR:** Weighted Relative Citation Ratio.

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