J Radiat Oncol
DOI 10.1007/s13566-013-0103-x

ORIGINAL RESEARCH

Citation-based estimation of scholarly activity among domestic academic radiation oncologists: 5-year update

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Received: 11 January 2013 / Accepted: 21 April 2013

Abstract
Objective The objective of this study is to analyze up-to-date Hirsch index (*h*-index) data to estimate the scholarly productivity of academic radiation oncology faculty.
Methods Bibliometric citation database searches were performed for radiation oncology faculty at domestic residency-training institutions. Outcomes analyzed included the number of manuscripts, number of citations, and *h*-index between 1996 and 2012. Analyses of overall *h*-index rankings with stratification by academic ranking, gender, and departmental faculty size were performed.
Results One thousand thirty-seven radiation oncologists from 87 programs were included. Overall, the mean *h*-index was 10.8. Among the top 10 % by *h*-index, 38 % were chairpersons, all were senior faculty, and 11 % were women. As expected, higher *h*-index was associated with higher academic ranking and senior faculty status. Recursive partitioning analysis revealed an *h*-index threshold of 20 ($p<0.001$) as an identified breakpoint between senior vs. junior faculty. Furthermore, *h*-index breakpoints of 12 ($p<0.001$) and 25 ($p<0.001$) were identified between assistant professor vs. associate professor, and associate professor vs. professor levels, respectively. Multivariate analysis identified higher academic ranking, male gender, and larger departmental faculty size as independent variables associated with higher *h*-index.
Conclusion The current results suggest an overall rise in scholarly citation metrics among domestic academic radiation oncologists, with a current mean *h*-index of 10.8 vs. 8.5 in 2008. Significant relationships exist between *h*-index and academic rank, gender, and departmental size. The results offer up-to-date benchmarks for evaluating academic radiation oncologist to the national average and potentially has utility in the process of appointment and promotion decisions.

Keywords Bibliometrics · Academic productivity · Publications · *h*-index · Radiation oncology

Presented in part at the 2012 annual meeting of the American Society for Therapeutic Radiology and Oncology, Boston, MA, USA.

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Introduction

Dedication to patient care, service, teaching, and research are important factors in assessing faculty members at academic institutions. Research productivity is difficult to quantify; nonetheless, it is important for the process of faculty recruitment, tenure, promotion, and awarding of grants. The Hirsch index (*h*-index) is a metric that is used widely for quantifying scholarly productivity in medicine and has been found to correlate with academic rank and US government grant funding [1–4]. The *h*-index also has predictive power for future academic productivity, making it a logical choice of metric for promotion

Published online: 04 May 2013

and tenure committees to use in assessing individuals seeking promotion [5]. Unlike other citation indices, the *h*-index is determined primarily by how often a publication is cited and defined as the number (*h*) of an investigator's publications that have been cited at least *h* times [6]. The *h*-index reflects the relative quality of each investigator's collective body of work because the more important a publication, the more frequently it is likely to be cited.

We previously reported on the relative scholarly productivity of domestic academic radiation oncologists and departments as defined by the *h*-index [7, 8]. Here, we provide a 5-year update of *h*-index trends among current US radiation oncologists between 1996 and 2012. Current quantitative benchmarks for faculty achievement are suggested.

Methods

Data selection criteria

All radiation oncologists who were faculty members of domestic residency-training institutions within the study period were included for analysis. A list of radiation oncology departments was compiled using the 2009 version of the Association of Residents in Radiation Oncology Directory as a guide [9]. Departmental websites were individually accessed between February 14, 2012 and February 28, 2012 for a listing of current faculty members. Only physicians (M.D./D.O.) and physician-scientists (M.D./D.O.-Ph.D.) were included. Faculty with Ph.D. or other doctoral degrees alone were excluded from the analysis. When available, demographic parameters, including gender and academic ranking within the department, were collected.

Bibliometric analysis

For each faculty member, a custom search was performed using SCOPUS, a bibliometric citation database of research literature (Elsevier BV, Amsterdam, The Netherlands) as previously reported [7, 8, 10]. The searches were conducted in random order and performed by a single data collector (E.H.) to minimize bias in data collection methods.

Hirsch index

The bibliographic database outputs of the total number of publications (N_p), total number of citations (N_c), and *h*-index were tabulated. A scientist has index *h* if *h* of his or her papers published within *n* years has at least *h* citations each and the other ($N_p - h$) papers have ≤*h* citations each. For example, the highest *h* among radiation oncologists within this series is 59. Thus, this individual has written 59 papers with ≥59 citations each.

Statistical analysis

A descriptive analysis was performed to calculate the mean, median, and standard deviation for the N_p, N_c, and *h*-index of individual radiation oncologists. A numeric ranking was performed of all included *h*-indices and with stratification by academic rank (professor vs. associate professor vs. assistant professor), junior vs. senior faculty status, and gender. Recursive partitioning analysis was performed to assess nonparametrically derived *h*-index "breakpoints" associated with senior vs. junior faculty status and academic rank. A multivariate logistic regression analysis was performed to determine which variables were best associated with *h*-index. Included candidate covariates were academic rank, gender, and department size, defined as number of physician faculty members. Post hoc statistical analysis was performed using Student's *t* test/ANOVA for between group comparisons. Principal component analyses and receiver operating characteristic curve analyses were performed to evaluate *h*-index, number of publications, and number of citations. All statistical analyses were performed using the SAS-based statistical software package JMP (Version 7; SAS Institute Inc, Cary, NC, USA).

Results

A total of 87 US academic radiation oncology departments were identified, and 1,037 radiation oncologists were included in the analysis.

Distribution of *h*-index

The *h*-index range was 0–59, with a highly skewed distribution. The mean *h*-index was 10.8 [95 % confidence interval (CI), 10.1–11.5], and the 25th, 50th, 75th, and 100th percentiles were 2, 7, 16, and 59, respectively. For N_p, the range was 0–591, mean was 46.6 (95 % CI, 42.4–50.8), and 25th, 50th, 75th, and 100th percentiles were 6, 20, 58, and 591, respectively. For N_c, the range was 0–21,742, mean was 1,225 (95 % CI, 1086–1364), and 25th, 50th, 75th, and 100th percentiles were 51, 277, 1168, and 21742, respectively.

The highest *h*-index was 59. The top 10 % of *h*-indices among radiation oncologists are listed in Table 1. For the top 10 %, the median *h*-index was 35 (range, 28–59); chairpersons comprised 38 % (*n*=40); all were senior faculty or the equivalent; and 13 % were women. Of the 21 individuals ranking in the top 2 %, over one third (38 %) were chairpersons; all were senior faculty or the equivalent; and only one was a woman, with *h*-index of 50.

h-Index distribution by academic rank

For 154 individuals (15 %), the academic position was not readily equated to the traditional hierarchical system of

Table 1 Top 10 % of *h*-indices in radiation oncology during past 16 years

Rank	Gender	Position	Institution	*h*-index	Articles (*n*)	Citations (*n*)
1	Male	Senior faculty	University of Chicago	59	591	21,742
2	Male	Senior faculty	Memorial Sloan–Kettering Cancer Center	56	279	12,745
3	Male	Senior faculty	William Beaumont	56	281	10,451
4	Male	Senior faculty	University of Pittsburgh	56	427	14,290
5	Male	NOS	William Beaumont	53	280	9,884
6	Male	Senior faculty	Harvard	52	318	12,993
7	Male	Senior faculty	M.D. Anderson Cancer Center	51	428	14,041
8	Male	Senior faculty	University of Chicago	50	283	10,236
9	Female	Senior faculty	M.D. Anderson Cancer Center	50	370	12,521
10	Male	Senior faculty	M.D. Anderson Cancer Center	49	332	8,251
11	Male	Senior faculty	University of Washington	49	178	12,154
12	Male	Senior faculty	Harvard	48	345	11,269
13	Male	Senior faculty	University of California, San Francisco	48	280	8,098
14	Male	Senior faculty	University of Michigan	48	303	9,201
15	Male	Senior faculty	Northwestern	47	316	9,229
16	Male	Senior faculty	University of California, Los Angeles	47	165	6,477
17	Male	Senior faculty	M.D. Anderson Cancer Center	47	324	12,667
18	Male	Senior faculty	University of Florida, Shands	45	470	10,690
19	Male	Senior faculty	Emory	44	280	10,537
20	Male	Senior faculty	Mayo, Rochester	44	251	5,642
21	Male	Senior faculty	Robert Wood Johnson	44	313	7,212
22	Male	Senior faculty	University of Miami	43	293	9,218
23	Male	Senior faculty	Yale	43	136	5,845
24	Male	Senior faculty	Harvard	42	262	10,161
25	Male	NOS	William Beaumont	42	135	4,748
26	Male	Senior faculty	University of Michigan	41	165	5,763
27	Male	Senior faculty	Duke	40	243	8,081
28	Male	Senior faculty	Fox Chase Cancer Center	40	152	4,860
29	Male	Senior faculty	Mount Sinai	39	100	4,971
30	Female	Senior faculty	Stanford	39	258	8,257
31	Male	Senior faculty	Harvard	38	201	6,734
32	Male	Senior faculty	Stanford	38	274	11,152
33	Male	Senior faculty	Washington University	38	166	6,573
34	Male	Senior faculty	M.D. Anderson Cancer Center	38	181	7,580
35	Male	Senior faculty	Columbia	37	119	5,923
36	Male	Senior faculty	Harvard	37	267	14,700
37	Female	Senior faculty	Stanford	37	123	4,313
38	Male	Senior faculty	University of North Carolina	37	295	6,796
39	Male	Senior faculty	Washington University	37	264	8,283
40	Male	Senior faculty	M.D. Anderson Cancer Center	37	139	4,184
41	Male	Senior faculty	Virginia Commonwealth University	37	164	5,946
42	Male	Senior faculty	Harvard	36	214	9,647
43	Female	Senior faculty	Harvard	36	207	7,972
44	Male	Senior faculty	Mayo Clinic, Rochester	36	105	6,211
45	Male	Senior faculty	M.D. Anderson Cancer Center	36	149	3,730
46	Female	Senior faculty	M.D. Anderson Cancer Center	36	158	5,934
47	Male	Senior faculty	M.D. Anderson Cancer Center	36	157	5,107
48	Male	Senior faculty	Henry Ford	35	193	4,581
49	Female	Senior faculty	Memorial Sloan–Kettering Cancer Center	35	306	5,761

Table 1 (continued)

Rank	Gender	Position	Institution	*h*-index	Articles (*n*)	Citations (*n*)
50	Male	Senior faculty	Memorial Sloan–Kettering Cancer Center	35	179	6,774
51	Male	Senior faculty	Mount Sinai	35	157	4,704
52	Male	Senior faculty	University of Pittsburgh	35	355	7,726
53	Male	Senior faculty	Mayo Clinic, Rochester	34	131	3,957
54	Male	Senior faculty	Memorial Sloan–Kettering Cancer Center	34	117	3,606
55	Male	Senior faculty	Tufts	34	168	4,431
56	Male	Senior faculty	M.D. Anderson Cancer Center	34	153	3,417
57	Male	Senior faculty	City of Hope	33	193	4,109
58	Male	Senior faculty	City of Hope	33	128	4,346
59	Male	NOS	National Capitol Consortium	33	143	3,386
60	Male	Senior faculty	University of Alabama	33	126	5,035
61	Male	Senior faculty	University of Iowa	33	144	3,967
62	Male	Senior faculty	University of Pennsylvania	33	138	3,691
63	Male	Senior faculty	Rush University	32	138	7,153
64	Male	Senior faculty	Stanford	32	109	4,033
65	Male	Senior faculty	Case Western	32	102	4,755
66	Male	Senior faculty	University of Washington	32	262	6,394
67	Male	Senior faculty	University of Wisconsin	32	127	6,243
68	Male	Senior faculty	Albert Einstein	31	210	6,705
69	Female	Senior faculty	Stanford	31	109	3,710
70	Male	Senior faculty	University of California, San Francisco	31	165	6,280
71	Male	Senior faculty	University of Chicago	31	155	4,065
72	Female	Senior faculty	University of Colorado	31	146	5,049
73	Male	Senior faculty	M.D. Anderson Cancer Center	31	100	4,792
74	Male	Senior faculty	Cleveland Clinic	30	146	2,898
75	Male	Senior faculty	Duke	30	105	5,483
76	Male	Senior faculty	Duke	30	124	2,647
77	Male	Senior faculty	Harvard	30	254	7,211
78	Female	Senior faculty	Memorial Sloan–Kettering Cancer Center	30	152	4,578
79	Female	Senior faculty	Memorial Sloan–Kettering Cancer Center	30	114	3,115
80	Male	Senior faculty	Johns Hopkins	30	93	3,425
81	Male	Senior faculty	Johns Hopkins	30	151	4,754
82	Male	Senior faculty	University of Florida, Shands	30	189	3,049
83	Female	Senior faculty	University of Michigan	30	112	4,494
84	Male	Senior faculty	Methodist Hospital, Houston	30	102	3,111
85	Male	Senior faculty	M.D. Anderson Cancer Center	30	143	3,157
86	Male	Senior faculty	Mayo Clinic, Rochester	29	61	2,734
87	Male	Senior faculty	University of California, Los Angeles	29	83	2,997
88	Male	Senior faculty	University of Florida, Shands	29	213	5,512
89	Male	Senior faculty	University of Louisville	29	122	3,022
90	Male	Senior faculty	University of South Florida, Moffitt Cancer Center	29	114	2,657
91	Male	Senior faculty	Washington University	29	135	3,707
92	Male	Senior faculty	William Beaumont	29	50	2,295
93	Male	Senior faculty	Thomas Jefferson	29	135	3,035
94	Male	Senior faculty	Vanderbilt	29	80	2,808
95	Male	Senior faculty	Albert Einstein	28	139	8,172
96	Male	Senior faculty	Georgetown	28	196	3,627
97	Male	Senior faculty	Mayo Clinic, Rochester	28	96	2,548
98	Male	Senior faculty	Mayo Clinic, Rochester	28	75	2,668

Table 1 (continued)

Rank	Gender	Position	Institution	*h*-index	Articles (*n*)	Citations (*n*)
99	Male	Senior faculty	New York University	28	126	2,547
100	Male	Senior faculty	Tufts	28	72	2,344
101	Male	Senior faculty	University of Michigan	28	99	2,878
102	Male	Senior faculty	University of North Carolina	28	190	6,000
103	Male	Senior faculty	University of South Florida, Moffitt Cancer Center	28	72	5,144
104	Male	Senior faculty	Georgetown	28	196	3,627
105	Male	Senior faculty	Thomas Jefferson	28	285	3,027
106	Male	Senior faculty	University of Michigan	28	99	2,878
107	Male	Senior faculty	University of Pennsylvania	28	81	2,054
108	Female	Senior faculty	New York University	28	126	2,547

h-index=Hirsch index; *NOS* position not otherwise specified

chairperson, professor, associate professor, assistant professor, or instructor. Of the remaining 883 individuals with traditional academic positions, 83 (9 %) were chairpersons, 159 (18 %) were nonchair professors, 169 (19 %) were nonchair associate professors, 408 (46 %) were assistant professors, and 64 (7 %) were instructors. Table 2 lists the *h*-index for each rank group. Chairpersons and nonchair professors had statistically distinct mean *h*-indices, with greater values for chairpersons (26.4 vs. 22.5, p=0.02). *H*-index for nonchair associate professors was markedly lower than for nonchair professors (mean, 11.8 vs. 22.5, p<0.01). There was a marked difference in distributions between assistant and associate professors (mean, 5.1 vs. 11.8, p<0.01). The difference between instructors and assistant professors was minimal (mean, 4.9 vs. 5.1, p=0.96). Recursive partitioning analysis revealed a statistically significant

Table 2 Distribution of publication metrics by academic position

Position	*N*	(%)	Mean	(95 % CI)	Median (range)		Quartile			
							25 %	50 %	75 %	100 %
Instructor	64	(7)								
h-index			4.9	(3.7–6.1)	3	(0–23)	2	3	7	23
N_{pubs}			12.1	(9.8–16.2)	8.5	(0–76)	3	8.5	16	76
N_{cites}			311.5	(381–629)	103	(0–2,750)	25.5	103	426.3	2750
Assistant Professor	408	(46)								
h-index			5.1	(4.6–5.6)	4	(0–23)	1	4	8	23
N_{pubs}			15.4	(21.8–26.5)	8	(0–372)	3	8	21	372
N_{cites}			267.7	(215–319)	87.5	(0–5,892)	15	87.5	300	5,892
Associate Professor[a]	169	(19)	11.8	(10.6–13.0)	11	(0–33)	6	11	17	33
h-index			41.4	(35.9–46.9)	33	(0–264)	15	33	59	264
N_{pubs}			957.3	(797.3–1,117.3)	679	(0–6,394)	208	679	1,169	6,394
N_{cites}										
Professor[a]	158	(18)								
h-index			22.5	(20.6–24.4)	21	(2–56)	13	21	30	56
N_{pubs}			119.1	(104.8–133.3)	93.5	(3–470)	54	93.5	152.3	470
N_{cites}			3494	(2,986.4–4,001.6)	2497.5	(30–14,290)	971.3	2,498	4,929	14,290
Chairperson	83	(9)								
h-index			26.4	(23.6–29.2)	27	(0–59)	16	27	35	59
N_{pubs}			137.5	(115.9–159.1)	126\	(0–591)	67.3	126	173.3	591
N_{cites}			4013	(3,204–4,822)	2960	(0–21,742)	1,195.8	2,960	5,761.8	21,742

CI confidence interval. Other abbreviations as in Table 1

[a] Nonchairperson

numeric *h*-index threshold of 12 (Logworth 24.6; $p < 0.0001$) between assistant professors and associate professors and a threshold of 25 (Logworth 27.15; $p < 0.0001$) between associate professors and professors.

Combining the chairpersons and nonchair professors into one group and associate professors, assistant professors, and instructors into another group, 242 (27 %) were senior faculty members and 641 (73 %) were junior faculty members. The *h*-index of senior faculty members ranged from 0 to 59 (mean, 23.9; 95 % CI, 23.4–25.5), and the 25th, 50th, 75th, and 100th percentiles were 14, 23, 31, and 59, respectively. The *h*-index of junior faculty members ranged from 0 to 33 (mean, 6.8; 95 % CI, 6.3–7.3), and the 25th, 50th, 75th, and 100th percentiles were 2, 5, 10, and 33, respectively. Recursive partitioning analysis revealed a statistically significant numeric *h*-index threshold of 20 (Logworth 96.1; $p < 0.0001$) between the two groups (i.e. senior vs. junior). The logistic fit of probability of senior vs. junior faculty status by *h*-index is represented in Fig. 1. Using the recursive partitioning analysis-derived threshold, 82 % of those with an *h*-index of ≥20 were senior faculty. In contrast, only 18 % of those achieving this benchmark were still junior faculty (Table 3). Of those with an *h*-index of <20, 87 % were junior faculty and only 13 % were senior faculty.

Distribution of publications and citations

Table 2 lists the publications and citations for each rank group. Chairpersons had greater numbers of publications and citations than nonchair professors, but the differences were not statistically significant (mean, 137.5 vs. 119.1, $p = 0.08$ and 4,013 vs 3493, $p = 0.14$, respectively). The differences between publication and citation numbers between nonchair professors and nonchair associate professors were

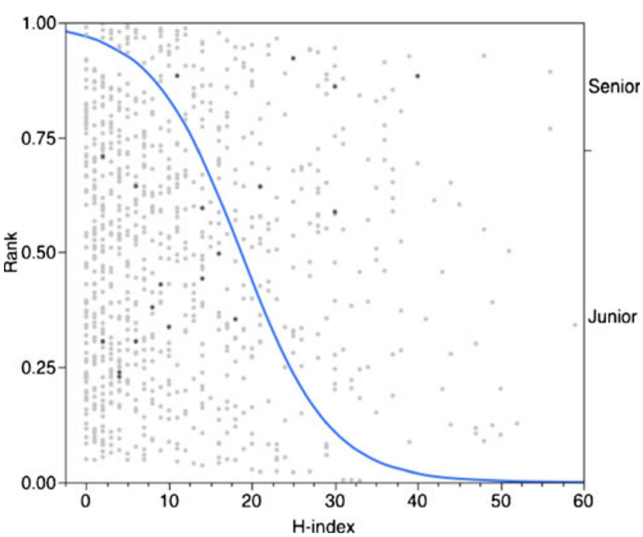

Fig. 1 Logistic fit of probability of senior vs. junior faculty status by Hirsch index (*h*-index)

Table 3 RPA-derived *h*-index breakpoint analysis

h-index	Junior faculty (*n*)	Senior faculty (*n*)
≥20	34 (4)	154 (17)
<20	607 (68)	93 (10)
Total	641 (72)	247 (28)

Data in parentheses are percentages of total number of faculty

RPA recursive partitioning analysis. Other abbreviations as in Table 1

even more pronounced and did reach statistical significance (mean, 119.1 vs 41.4, $p < 0.01$ and 3494 vs 957.3, $p < 0.01$, respectively). Similarly, there was a large difference in distributions of publication and citation numbers between associate and assistant professors (mean, 41.4 vs. 15.4, $p < 0.01$ and 957.3 vs. 267.7, $p < 0.01$, respectively). There was not a significant difference between the publication and citation numbers of instructors and assistant professors (mean, 12.1 vs. 15.4, $p = 0.06$ and 311.5 vs. 267.7, $p = 0.26$, respectively).

Multivariate logistic regression analysis

Multivariate logistic regression analysis was performed with *h*-index as the dependent variable and academic rank, gender, and department size as independent variables. The goodness of fit of our model was excellent (model $p < 0.01$, adjusted $R^2 = 0.49$). Higher academic rank was significantly associated with higher *h*-index as was male gender ($p < 0.01$). Furthermore, larger number of physician faculty members was associated with higher *h*-indices ($p < 0.01$).

Discussion

In a short period of time, the *h*-index has become a widely utilized measure of quantifying an individual's research output and is now a common portion of the promotion and tenure process for radiation oncologists [11]. In this study, we used the *h*-index as one measure of academic radiation oncologists' scholarly productivity.

Overall trends

Our results suggest a rise in citation metrics among domestic academic radiation oncologists with a current mean *h*-index of 10.8, as compared to 8.5 in our previous report on bibliographic data collected in 2007. As a group, academic radiation oncologists comprise a prolific group of individuals, with, however, a highly skewed distribution [12, 13]. Nearly 10 % of individuals included in the analysis had no publications during the period analyzed. Higher *h*-index correlated highly with higher academic ranking.

Among the top 10 %, all were senior faculty, 38 % were chairpersons, and a marked gender discrepancy was found, with just 13 % being women. The median *h*-index of the top 10 % was 35 (range, 28–59) vs. 26 (range, 21–48) in our 2008 report. In the top 2 %, median *h*-index was 49 (range, 44–59) vs. 35 (range, 23–48) previously [8].

This trend is not entirely surprising, as, in recent years, interest in bibliometric analyses of scholastic output has grown in academic medicine at the individual and departmental levels, and at all levels of career development [1–4, 14, 15]. In the field of radiation oncology, such analyses have already been undertaken in order to stimulate scholarly productivity, for example, to characterize publications patterns in leading specialty journals; to assess research productivity at resident, faculty, and departmental levels; and to gauge the academic productivity of research award recipients and graduates from training programs designed to nurture the development of future physician-scientists [8, 16–18].

Academic ranking

Our findings confirm established observations that scholarly productivity is related to faculty rank (Table 2) [2, 8, 19]. When stratified by academic position, *h*-index appears to correlate with the academic hierarchy. Current and previously reported mean *h*-indices are as follows: instructor, 4.8 vs. 2.8; assistant professor, 5.2 vs. 4.0; associate professor, 11.8 vs. 9.3; professor, 22.5 vs. 17; and chairperson, 26.4 vs. 18. These values point to the idea of an "*h*-index inflation" over time. When considering the academic appointment ladder, the *h*-index appeared to be fairly indicative of an individual's research caliber and, hence, the appropriate academic position for that individual.

According to the present analysis, the breakpoint *h*-index value for promotion to senior faculty rank appears to be 20, compared to 15 in our previous report. We also identified *h*-index threshold values for promotion to associate professorship and professorship of 12 and 25, respectively.

As expected, the trends were similar between those of h-index and those of publication and citation number. There is a high degree of correlation between the three metrics. Although it is possible to have an astronomically high number of publications and a very low *h*-index (for example, if 100 articles were published but not often cited) or a high number of citations and a very low *h*-index (for example, if one high impact article was published that was cited 100 times), it is reasonable to assume that typically the distribution will similar. Principal component analysis of *h*-index, number of publications and number of citations yielded a single a highly related domain. This was expected given the dependence of the *h*-index on both number of publications and citations. Furthermore, receiver operating characteristic curve analyses of *h*-index, number of publications, and number of citations yielded values for area under the curve that were within the confidence intervals of one another. These additional analyses showed that the information given by the *h*-index encapsulates both number of publications and citations in a single number. The value of the *h*-index is that it combines this information into an easily understandable, easily normed number, which can be compared across individuals within a field. The breakpoints in *h*-index associated with promotion to senior faculty status described above illustrate this well. For a contrasting example, when a similar recursive partitioning analysis was performed using number of publications, the breakpoint was 125 for promotion from professor to chairperson. When numbers become this large, it is difficult to account for quality. Although it is not difficult to compare the academic productivity between an individual with 1 publication and another with 100 publications, comparing someone with 120 and 130 publications is more challenging. Supporting this, when comparing the groups of nonchair professors with chairs in our cohort, although the difference between the mean *h*-indices was statistically significant, the differences between publication and citation numbers were not. Tools to discriminate among highly prolific authors are important because, as previously shown [12], literature in the field of radiation oncology is, in large part, driven by a small cohort of highly productive individuals.

Study strengths and limitations

The major strengths of this study include our data acquisition and analysis methods. A small team, using a single database to ensure homogeneity, acquired the data. The bibliometric citation software used is one of the largest citation databases of peer-reviewed studies. Given the high quality of data and the objective, systematic manner in which the numbers were assigned, the citation-based measures we analyzed can be applied with relatively high confidence.

Our study has several limitations. Because of the time sensitivity of the SCOPUS-derived citation numbers, although we used reasonable, up-to-date estimates of the *h*-index and other measures of scientific productivity at a given point in time, citation numbers are dynamic. Thus, the *h*-indices presented in the present study should be considered reliable estimates of productivity, rather than precise values. Although we attempted to be thorough, there is no guarantee of complete accuracy with regard to publication attribution. One source of error is authors publishing under different names, for example, when an author changes a name after marriage or simply includes a previously omitted middle initial and/or suffix. Conversely, if two authors share a name, the number of publications attributed to that author might be falsely high. Additionally, we relied on publicly available website data from academic institutions; if institutional websites were to inaccurately reflect current active faculty rosters, our data would be consequently inaccurate.

Because the bibliometric citation software data does not include information on book chapters, working papers, reports, patents, embargoed industry-sponsored manuscripts, nor articles in press, and does not readily yield information on author order or collaborative networks, we were unable to offer a more comprehensive assessment of scholarly activity that reflects some potentially important factors such as nonjournal publications, an individual's relative contribution, or patterns of collaboration [20]. For example, honorary co-authorships and the influence of self-citation may skew the results considerably [21–23]. Additionally, authors who loosely cite themselves or their co-authors might artificially inflate their listed *h*-index.

Conclusion

In conclusion, our study shows that radiation oncology faculty members at domestic academic centers continue to comprise a highly prolific group as defined by *h*-index and other bibliometric indices, and their productivity continues to rise. Higher academic rank and male gender continue to correlate with higher *h*-index, as does larger department size. Our updated analysis can hopefully serve as a benchmark for comparing a given academic radiation oncologist to the national average and potentially be used in the process of appointment and promotion decisions.

Conflict of interest statement On behalf of all authors, the corresponding author states that there is no conflict of interest.

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