RESEARCH

A Bibliometric Analysis of Peer-Reviewed Journal Publications of Pharmacy Practice Department Chairs

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Objective. To perform a bibliometric analysis of pharmacy practice department chairs at US schools and colleges of pharmacy to determine factors associated with their level of scholarly productivity.

Methods. Scopus was searched for all publications by pharmacy practice chairs from all pharmacy schools through August 11, 2020. Publication metrics (total number of publications and citations and the Hirsch-index (h-index), and year of first publication), as well as characteristics of the individual chair and institution were collected. Characteristics were compared across groups. A generalized linear model was used to determine the correlation between the total number of publications and h-index to school ranking by US News & World Report (USNWR).

Results. One hundred forty-one pharmacy practice chairs were identified. The majority were male and at the rank of professor, with a similar proportion from public and private institutions. The median total number of publications and citations was 19 and 247, respectively, with a median h-index of eight. Compared with female chairs, male chairs had a higher median total of publications and citations and a higher h-index. Chairs at public institutions had a higher median total of publications and citations and a higher publication rate, h-index, and m quotient. The USNWR ranking for the school was significantly correlated with total publications and the h-index.

Conclusion. Pharmacy practice chairs vary significantly in their scholarship productivity, although those at institutions with a larger emphasis on research were more prolific. Observed differences in the publication metrics of male and female chairs warrants further study to determine possible explanations for this finding and its potential impact.

Keywords: publications, bibliometrics, chair, pharmacy

INTRODUCTION

Scholarship is a core element of academic pharmacy across all 144 schools and colleges of pharmacy in the United States. However, faculty expectations for scholarship vary widely according to whether the institution is public or private, whether it is part of a health sciences center, its ranking by the Carnegie Classification of Institutions of Higher Education (Carnegie Classification), and the faculty member’s individual mix of duties.1,2 Pharmacy schools often have multiple departments, each with its own ways of contributing to the institution's overall mission. Basic science departments, such as medicinal chemistry or pharmacology, for example, tend to be more focused on the research mission, while pharmacy practice (or clinical) departments are primarily focused on the teaching mission.3 Faculty across all departments, however, are generally expected to make scholarly contributions, which primarily include authoring papers for publication in peer-reviewed journals but may also include writing textbook chapters and non-peer-reviewed work. Scholarly productivity is often an important consideration in determining the promotion and tenure of faculty members and is treated as one measure of faculty success.4

Individuals who achieve a certain level of success in academia may be given the opportunity to serve as a department chair. These mid-level administrative positions are filled by faculty who have been successful in most, if not all, areas of the academic triad and demonstrate considerable leadership abilities.5,6 While these
individuals are generally faculty who are already well published before taking on such a role, they may continue to contribute to the literature through ongoing research as part of their mix of duties. The faculty within a pharmacy practice department are often a heterogeneous group, and departments with a higher proportion of research faculty may have different expectations than those that are largely made up of clinical-track faculty. Given the absence of established benchmarks for scholarly productivity and the lack of available data for comparison, it may be challenging to assess this aspect of a candidate’s qualifications in the hiring and evaluation process for pharmacy practice chairs.

The challenges of evaluating the scope and impact of an academic pharmacist’s scholarly work have been extensively written about. Instead of relying on a single measure, most schools consider various factors, including total number of publications, citation counts, the Hirsch index or h-index (publication of at least h papers that have each been cited at least h times), and the m quotient (number of years over which papers have been published). Total number of publications and total citation counts are useful measures to assess raw productivity, but they may not provide insight into the quality or impact of the faculty member’s work. The h-index has become a popular measure of quantity and quality as it assesses both the number of publications and their impact. However, the h-index is challenging to interpret as a desirable h-index is largely discipline dependent and heavily favors more senior faculty who have had more time for their publications to accrue citations. To address this issue, the m quotient is calculated by dividing the h-index by the number of years since the author’s first publication.

More recently, there’s been additional consideration for the impact of one’s scholarly work online via social media, but this has yet to be associated with citation counts or other bibliometrics for pharmacy practice journals. Regardless of the measure used, contemporary publication benchmarks for pharmacy practice chairs are warranted.

The objective of this cross sectional study was to perform a bibliometric analysis of pharmacy practice department chairs at schools and colleges of pharmacy using the accessible online database, Scopus. The analysis aimed to compare pharmacy practice chairs according to publication metrics assessed in previous studies or that are commonly used benchmarks at pharmacy schools, including faculty rank, Carnegie Classification, institution type (public or private), National Institutes of Health (NIH) funding ranking, and US News & World Report (USNWR) ranking.

METHODS

A search of the American Association of Colleges of Pharmacy’s (AACP’s) online faculty directory that we conducted May 1, 2020, identified active pharmacy practice chairs from all listed schools and colleges of pharmacy, regardless of the institution’s accreditation status (n=144). The results were then confirmed using the faculty directory from each school’s website. Any remaining discrepancies were resolved by contacting the college or school dean for clarification. We excluded schools that either did not list an active chair or had an equivalent position. We then conducted a search of Scopus by department chair name from the earliest available date through August 11, 2020. Searches were not limited by language or publication type. When there were multiple authors listed with the same name, information based on present and past organizational affiliations was used to ensure accuracy. Publication-related information collected for each department chair included total number of publications, total number of citations, h-index at the time of the search, and year of their first publication.

Additional information about the chair included their current faculty rank (assistant professor, associate professor, professor), and whether they had ever received National Institutes of Health (NIH) funding, which was obtained using the NIH RePORTER (https://reporter.nih.gov/). In order to evaluate whether any differences existed between male and female chairs, we also collected data on gender using multiple sources, including the individual’s faculty profile on the school’s website if available and the AACP Roster of Faculty and Professional Staff. Additionally, we used an application programming interface (Gender API, www.gender-api.com), that determines sex using a database of over 3.2 million validated names from 191 different countries and has been found to have the lowest fraction of inaccuracies and smallest proportion of unclassified names compared to similar platforms. Because this information was not obtained directly from the department chairs, themselves, we will describe this characteristic as “sex” rather than “gender.” Information about the department chair’s institution included whether it was a private or public institution, association with a health sciences center (HSC), defined as, “an educational institution that includes a medical school and at least one allied health professional school and either owns or is affiliated with a teaching hospital or health care system,” the institution’s Carnegie Classification (research 1 [R1], research 2 [R2], or Special Focus), ranking according to NIH funding using the 2018-2019 Blue Ridge Institute for Medical Research (BRIMR), and ranking according to the USNWR.

Prior to analyses, additional calculations included years since first publication, publications per year (total number of publications divided by number of years since their first publication), and citations per publication (total number of citations divided by total number of
publications). We also calculated the m quotient by dividing the h-index by the number of years since their first publication (as of 2020). Pharmacy practice chair characteristics are presented either as proportions for dichotomous variables or as median (25th, 75th percentile) for continuous variables. Comparisons of characteristics across groups were made using either a chi-square or Kruskal-Wallis test according to the type of data. Identified groupings of interest included academic rank (assistant professor, associate professor, professor), Carnegie Classification, institution type (public vs private and HSC vs non-HSC), school ranking by NIH funding (top 25 vs below 25 vs unranked), and department chair sex (male vs female). We also ran a generalized linear model to determine the correlation between the total number of publications and h-index to school ranking (by USNWR). To further explore the impact of a faculty member’s sex on publication metrics, post-hoc comparisons of school characteristics (academic rank, institution type, HSC, Carnegie Classification, and NIH funding) were made. We performed all analyses using SAS, 9.4 (SAS Institute), with a p value <.01 defined as statistically significant.

RESULTS

One hundred forty-one pharmacy practice chair persons or equivalents were identified and their publication metrics were extracted from Scopus. Six schools did not have a pharmacy practice chair or equivalent position, while three schools had more than one individual fulfilling this role. The characteristics of the chairs and their institutions are reported in Table 1. A majority of chairs were male (51.8%), held the rank of professor (56.0%). A similar proportion of chairs were from public (49.0%) and private (51.0%) institutions. The majority (61.2%) of the institutions at which the chairs served had affiliated health sciences centers and the majority (56.5%) were designated as Special Focus schools according to the Carnegie Classification.

In general, the median (25th, 75th percentile) number of publications and citations was 19 (7, 36) and 247 (90, 958), with a median h-index of 8 (3, 13) and m quotient of 0.5 (0.3, 0.8). The median publication rate per year was 1.3 (0.7, 2.0) and the median number of citations per publication was 14.1 (7.7, 26.7). A comparison of the publication metrics for pharmacy practice chairs across individual and school characteristics is presented in Table 2. The median number of publications, total citations, and h-index were each higher for chairs at the rank of professor than for associate professor or assistant professor (p < .001 for all comparisons). Compared with female chair persons, male chair persons had higher median total publications (16 vs 30; p < .003), more total citations (175 vs 404; p = .02), and a higher h-index (6 vs 10; p = .01), with similar publication rates (p = .05), citations per publication (p = .19), and m-quotient (p = .23). To further explore the relationship between the sex of pharmacy practice chair persons, we compared school characteristics between male and female chairs. As seen in Table 3, no differences were seen between male and female chairs in academic rank (p = .98), institution type (p = .36), HSC status (p = .12), Carnegie Classification (p = .22), or proportion with NIH funding for projects on which they served as a principal investigator (p = .32).

Publication metrics varied by institution type, with chairs at public institutions having more total publications (p < .001) and citations (p < .001), higher publication rate (p < .001), and higher h-index (p < .001) and m quotient (p = .0014). Findings were similar for chairs at HSC-based schools and those in the top 25 for NIH funding received. Significant differences were seen according to Carnegie Classification (p < .01 for all). Publication metrics were highest for R1 schools, and there were similar values between R2 and Special Focus schools.

**Table 1. Characteristics of Pharmacy Practice Chairs at US Schools and Colleges of Pharmacy**

| Characteristic                      | Pharmacy Practice Chairs (n=141), n (%) |
|-------------------------------------|----------------------------------------|
| **Academic Rank**                   |                                        |
| Assistant Professor                 | 11 (7.8)                               |
| Associate Professor                 | 51 (36.2)                              |
| Professor                           | 79 (56)                                |
| **Sex**                             |                                        |
| Male                                | 73 (51.8)                              |
| Female                              | 68 (48.2)                              |
| **Institution Type**                |                                        |
| Public                              | 72 (49)                                |
| Private                             | 75 (51)                                |
| **Health Sciences Center**          |                                        |
| Yes                                 | 57 (38.8)                              |
| No                                  | 90 (61.2)                              |
| **Carnegie Classification**         |                                        |
| R1                                  | 40 (27.2)                              |
| R2                                  | 24 (16.3)                              |
| Special Focus                       | 83 (56.5)                              |
| **NIH Funding as PI**               |                                        |
| Yes                                 | 14 (9.9)                               |
| No                                  | 127 (90.1)                             |

**Abbreviations:** NIH = National Institutes of Health, PI = principal investigator, R1 = research 1, R2 = research 2.
The USNWR rankings for the schools were significantly correlated both with total publications ($R^2 = 0.21$, $p < .001$) and h-index ($R^2 = 0.27$, $p < .001$) (Figure 1).

**DISCUSSION**

The scholarship record of pharmacy practice chairs has not been evaluated since 2009 when there were only 89 schools and colleges of pharmacy listed in the AACP directory.\(^{16}\) Since that time, the number has increased by approximately 60%.\(^{17}\) Thus, it is important to reevaluate the scholarship productivity of pharmacy practice chairs as these data could be useful for guiding faculty expectations in pharmacy practice departments, informing hiring decisions, and serving as benchmarks for making comparisons across institutions. In this study, we conducted a comprehensive evaluation of all pharmacy practice chairs’ publication records.

Our results show a large variation in scholarship productivity among pharmacy practice chairs. Higher scholarship productivity was observed among chairs at higher faculty ranks, public institutions, HSCs, institutions with R1 Carnegie Classifications, a Top 25 NIH funding rank, and higher USNWR rankings. These findings were consistent with previous work in this area as these are indicators of more research-intensive institutions where scholarship may be a larger requirement in faculty mix of duties.\(^{1,2,16,18-20}\) The limited number of chairs who had received NIH funding was not surprising given that attainment of NIH funding is rarely an expectation of pharmacy practice faculty or chairs. A large proportion (44%) of pharmacy practice chairs were at the rank of assistant or

| Group                  | Total Publications | Pub/Yr | Total Citations | Citations/Pub | h-index | M Quotient |
|------------------------|--------------------|--------|-----------------|---------------|---------|------------|
| Academic Rank          |                    |        |                 |               |         |            |
| Assistant Professor    | 4 (0, 12)          | 0.9 (0.3, 1.3) | 4 (0, 99) | 5 (1.0, 11.2) | 1 (0, 6) | 0.3 (0.1, 0.5) |
| Associate Professor    | 11 (4, 21)         | 0.9 (0.6, 1.4) | 127 (27, 301) | 10.7 (5.5, 22.2) | 4 (2, 9) | 0.4 (0.2, 0.5) |
| Professor              | 30 (17, 68)        | 1.6 (1.0, 2.6) | 567 (183, 1577) | 19.4 (11.3, 31.2) | 11 (6, 20) | 0.5 (0.4, 0.9) |
|  p value               | <.0001             | .0003  | <.0001          | .0003         | <.0001 | .002       |
| Sex                    |                    |        |                 |               |         |            |
| Male                   | 30 (11, 55)        | 1.4 (0.7, 2.6) | 404 (98, 1293) | 18.0 (9.2, 30.2) | 10 (4, 19) | 0.5 (0.3, 0.8) |
| Female                 | 16 (5.5, 24)       | 1.1 (0.8, 1.6) | 175 (46.5, 618.5) | 12.0 (7.4, 23.0) | 6 (3, 10) | 0.5 (0.3, 0.6) |
|  p value               | .003               | .051   | .017            | .1861         | .01    | .27        |
| Institution Type       |                    |        |                 |               |         |            |
| Public                 | 32 (16.5, 74.5)    | 1.6 (0.9, 3.3) | 417.5 (130.5, 2104.5) | 18.0 (8.6, 30.6) | 10.5 (6, 20) | 0.6 (0.3, 1.0) |
| Private                | 13 (4, 22)         | 1.0 (0.6, 1.4) | 169 (27, 439) | 13.2 (7.7, 23.1) | 6 (2, 9) | 0.4 (0.3, 0.5) |
|  p value               | <.0001             | <.0001 | <.0001          | .23           | <.0001 | .001       |
| HSC-Based              |                    |        |                 |               |         |            |
| Yes                    | 35 (21, 79)        | 1.8 (1.2, 3.3) | 832 (183, 2332) | 18.1 (10.4, 32.7) | 12 (8, 22) | 0.7 (0.4, 1.0) |
| No                     | 12.5 (4, 23.5)     | 0.9 (0.6, 1.4) | 144 (26.5, 449) | 12.1 (5.7, 23.1) | 5 (2, 9) | 0.4 (0.3, 0.5) |
|  p value               | <.0001             | <.0001 | <.0001          | <.0001        |         | <.0001     |
| Carnegie Classification |                    |        |                 |               |         |            |
| R1                     | 62 (26.5, 121)     | 2.8 (1.6, 4.9) | 1230 (260, 3518.5) | 20.1 (12.4, 30.6) | 18.5 (9, 29.5) | 0.8 (0.5, 1.2) |
| R2                     | 19 (12.5, 24.5)    | 0.9 (0.7, 1.4) | 162.5 (47.5, 498.5) | 7.7 (4.6, 21.8) | 7 (4, 10.5) | 0.4 (0.3, 0.5) |
| Special Focus          | 13 (4, 24)         | 1.0 (0.5, 1.4) | 141 (37, 477) | 13.5 (7.7, 29.7) | 6 (2, 9) | 0.4 (0.3, 0.6) |
|  p value               | <.0001             | <.0001 | <.0001          | <.0001        | <.0001 | <.0001     |
| NIH Funding Rank       |                    |        |                 |               |         |            |
| Top 25 (n=25)          | 83 (31, 133)       | 3 (1.7, 6.0) | 1373 (832, 3471) | 23 (14.9, 30.9) | 20 (12, 30) | 0.8 (0.6, 1.3) |
| Below 25 (n=51)        | 21 (11, 35)        | 1.4 (0.8, 2.0) | 204 (90, 970) | 11.9 (5.3, 31.2) | 8 (4, 14) | 0.4 (0.3, 0.7) |
| Unranked (n=62)        | 12 (4, 19)         | 0.9 (0.6, 1.3) | 133 (36, 404) | 13.5 (8.3, 23.0) | 5 (2, 9) | 0.4 (0.3, 0.5) |
|  p value               | <.0001             | <.0001 | <.0001          | <.0001        | <.0001 | <.0001     |

**Abbreviations:** HSC=health science center, NIH=National Institutes of Health, PI=principal investigator, Pub=publication, R1=research 1, R2=research 2, Yr=year.
...associate professor, which was more commonly observed at private institutions that are not an HSC or have an R1 or R2 Carnegie Classification.

Unexpectedly, male chairs had a significantly higher publication output than female chairs, as well as a higher median number of total citations and h-index, although there were no differences in the number of publications per year or citations per publication. These findings could not be explained by faculty rank or school characteristics and could be attributable to persistent gender biases in science, technology, engineering, and mathematics (STEM). Importantly, we did find that female chairs had made progress in closing the gender gap observed in leadership positions. We found female chairs hold only a slight minority of pharmacy practice chair positions, which is a significant improvement over 2003 when only 27% of pharmacy practice department chairs were female. Nevertheless, there is still an underrepresentation of female pharmacy practice chairs given that there are nearly twice as many female pharmacy practice faculty members as male pharmacy practice faculty members according to data from AACP. Finally, reasons for the differences in scholarly productivity observed between male and female chairs could not be adequately explained, but certainly warrant further research to better understand why such differences exist.

Burghardt and colleagues recently conducted a bibliometric study of faculty from the top 50 NIH-funded schools and colleges of pharmacy and reported a median h-index of 6 for clinical faculty according to both Scopus and Web of Science (WoS). Basic science faculty had a much higher median h-index of 22 and 21 according to Scopus and WoS, respectively, which is unsurprising given that basic science faculty spend more time conducting research and publishing. Interestingly, the median h-index for all pharmacy practice chairs in our study was 8, which is the same h-index reported by Burghardt and colleagues for all clinical faculty at the associate professor rank, which represented over a third of pharmacy practice chairs in our study. This could explain the modest h-index among pharmacy practice chairs as the h-index increases over time as citation counts grow and favor more senior faculty. Furthermore, individuals who accept chair

| Characteristic                  | Male, n (%) | Female, n (%) | p value |
|--------------------------------|-------------|---------------|---------|
| Academic Rank                  |             |               |         |
| Assistant Professor            | 6 (8.2)     | 5 (7.4)       | .98     |
| Associate Professor            | 26 (35.6)   | 25 (36.8)     |         |
| Professor                      | 41 (56.2)   | 38 (55.9)     |         |
| Institution Type               |             |               | .36     |
| Public                         | 40 (54.8)   | 32 (47.1)     |         |
| Private                        | 33 (45.2)   | 36 (52.9)     |         |
| Health Sciences Center         |             |               | .12     |
| Yes                            | 34 (46.6)   | 23 (33.8)     |         |
| No                             | 39 (53.4)   | 45 (66.2)     |         |
| Carnegie Classification        |             |               | .22     |
| R1                             | 25 (34.3)   | 15 (22.1)     |         |
| R2                             | 10 (13.7)   | 14 (20.6)     |         |
| Special Focus                  | 38 (52.1)   | 39 (57.4)     |         |
| NIH Funding as PI              |             |               | .32     |
| Yes                            | 9 (12.3)    | 5 (7.4)       |         |
| No                             | 64 (87.7)   | 63 (62.7)     |         |

Abbreviations: NIH=National Institutes of Health, PI=principal investigator, R1=research 1, R2=research 2.

Figure 1. Correlation Between Number of Pharmacy Faculty Chair Publications and US News & World Report Ranking
Conclusions

The scholarship productivity of pharmacy practice department chairs varies widely depending on institutional and individual characteristics. Chairs who were at institutions that were public, HSC-based schools, among the top 25 for NIH funding ranking, have an R1 Carnegie Classification, and a higher USNWR ranking also had higher publication metrics. Chairs who were male and at the rank of professor were found to have higher publication metrics compared to those who were female and at lower faculty ranks, respectively. Reasons for the differences associated with sex of pharmacy faculty members’ sex remain unclear. Moreover, slightly less than half of pharmacy practice chairs are female, despite that female faculty account for two-thirds of all pharmacy practice faculty. Future research should explore the underrepresentation of female pharmacy practice chairs and factors that may contribute to their lower publication metrics.

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