RESEARCH ARTICLES

Number and Impact of Published Scholarly Works by Pharmacy Practice Faculty Members at Accredited US Colleges and Schools of Pharmacy (2001-2003)

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Objective. To evaluate the quantity and quality of published literature conducted by pharmacy practice faculty members in US colleges and schools of pharmacy for the years 2001-2003.

Methods. The Web of Science bibliographic database was used to identify publication citations for the years 2001-2003, which were then evaluated in a number of different ways. Faculty members were identified using American Association of Colleges of Pharmacy rosters for the 2000-2001, 2001-2002, and 2002-2003 academic years.

Results. Two thousand three hundred seventy-four pharmacy practice faculty members generated 1,896 publications in Web of Science searchable journals. A small number of faculty members (2.1%) were responsible for a large proportion of publications (30.6%), and only 4.9% of faculty members published 2 or more publications in these journals per year. The average impact factor for the top 200 publications was 7.6.

Conclusion. Pharmacy practice faculty members contributed substantially to the biomedical literature and their work has had an important impact. A substantial portion of this work has come from a small subset of faculty members.

INTRODUCTION

The past decade has been a period of considerable growth for schools and colleges of pharmacy in the United States. The transition from the entry-level bachelor of science in pharmacy degree to the doctor of pharmacy degree is now complete. New schools of pharmacy have been established and student enrollment in many existing schools of pharmacy has increased.[1] All of these factors have dramatically increased the number of clinical pharmacy faculty members employed at colleges and schools of pharmacy.

Several attempts have been made to evaluate the current state of scholarship among clinical pharmacy practitioners in pharmacy practice departments nationwide.[2] One approach has been to evaluate the amount of funding received from the National Institutes of Health (NIH) or other governmental agencies. By this measure, pharmacy practice faculty members with NIH funding only constitute 1.2% of the total number of pharmacy practice faculty members nationwide.[2] The number of NIH dollars and number of NIH dollars per faculty member is a standard comparator employed by the American Association of Colleges of Pharmacy (AACP) for Pharmaceutical Science Departments nationwide.[3] A problem with this approach is that it does not directly reflect scholarship. Scholarship is an output of knowledge from an individual or group to the scientific/biomedical community. Whether from the NIH or any other funding source, research funding levels are an input that facilitates the conduct of scholarship, not an output of scholarly productivity. In some fields, valuable scholarly output can be accomplished with little funding, while in other fields this would be impossible and thus reduces the objectivity of the measure. Another approach is to survey pharmacy practice faculty members and ask them about the number of articles they have published. The American College of Clinical Pharmacy (ACCP) Research Affairs Committee surveyed all ACCP members, regardless of practice setting.[2] The response rate overall was only 10.1% and was not much better among those in academic settings (29%). ACCP members were asked to gauge their scholarly output over the past 5 years (September 1, 1998 to November 12, 2003). According to the

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survey, people in academic research-intensive settings averaged 13.1 original research articles over the 5 years (2.6 articles per year) compared to 3.3 original research articles over 5 years for people in academic but not research-intensive settings (0.7 articles per year). While this is a useful approach for gauging scholarly output, the relatively low survey response rate limits its effectiveness. While 133 people in research-intensive academic positions responded, only 52 people in positions that were not research intensive did, even though the majority of pharmacy practice faculty members in the United States are in the nontenure track.[2,4] Another limitation of the survey was not attempting to evaluate the impact of the scholarship on the biomedical field. A final limitation of the survey was that it did not take into account other forms of scholarship as defined by Ernest Boyer but focused solely on the ''scholarship of discovery''.[5] Another important and publishable form of scholarship is the ''scholarship of integration'' (ie, the integration of new knowledge into a review article), which is excluded by focusing only on research, as is the ''scholarship of discovery,'' resulting from a published case report or case series.[4]

Clearly a need exists for a more objective metric to gauge the scholarly productivity of pharmacy faculty members in the United States, but the need is even greater among pharmacy practice faculty members. In an attempt to devise a more meaningful metric, we conducted an evaluation of the quantity and quality of published literature conducted by pharmacy practice faculty members during the years 2001-2003.

METHODS

All faculty members in departments of pharmacy practice at accredited United States colleges or schools of pharmacy were eligible for inclusion in this analysis. Faculty members were identified through review of the AACP faculty rosters for the academic years 2000-2001, 2001-2002, and 2002-2003. Faculty members (including deans and department heads) regardless of tenure status (tenured, tenure track, or nontenure track) were included if they were listed as members of the department of pharmacy practice at their respective institution. Part-time faculty members and faculty emeritus were excluded from this analysis.

For this evaluation we used the Web of Science bibliographic database (The Thomson Corporation, www.thomsonisi.com) to identify relevant publication citation records. The Web of Science's ''Science Citation Index Expanded'' indexes all significant document types (original research, reviews, editorials, letters, etc) for approximately 6,376 unique journals. Each citation record contains information such as the publication's title, authors, abstract, institutional affiliations and addresses, keywords, cited references and other document details. The Web of Science database was used in this evaluation because of its unique ''analyze'' function that allows users to review the results of queries through various pre-built reports as well as to download query results into a spreadsheet program for further manual analysis.

We used the ''advanced search'' page for this evaluation. This page allows the creation of complex queries using 2-character field tags and multiple query combinations. The initial query was limited to the years 2001-2003 and used the 2-character field tag ''AU'' (searches only the author field within a record) and included each faculty member's name combined with the Boolean operator ''OR.'' Names were entered as last name, first initial, middle initial (when available) as listed in the AACP Faculty Rosters. Following the listing of each author, this query was combined using the Boolean operator ''AND'' with the 2-character field tag ''AD'' and the word ''pharm'' (searches only the address field of a record for the word ''pharmacy''). Resulting citation records of publications were then further scrutinized using the above-mentioned ''analyze'' function. First, citation records for meeting abstracts, letters to the editor, and corrections were excluded since these publication types generally do not undergo rigorous peer review. Next, citation records not containing an affiliation with an accredited US school or college of pharmacy in the address field was excluded, yielding our final list of publication citation records.

This final list of publication citation records was then examined both manually and using Web of Science analysis tools. In this evaluation we report general publication statistics, statistics on the subject type, and titles of specific journals in which faculty members publish articles, along with additional assessments of publication impact factor (a marker of a journal's relative importance to others in the same field). Impact factors were obtained from the ''Journal Citation Reports'' (The Thomson Corporation; www.thomsonisi.com). Premier journals are listed and defined in Table 1.

RESULTS

There were 2,374 full-time pharmacy practice faculty members affiliated with a US college or school of pharmacy during the 2001-2003 evaluation period. The initial query using their names in the author field in the Web of Science yielded 2,593 citation records (Figure 1). Of these records, 347 were excluded electronically by limiting the

Table 1. Clinically Oriented Journals With the Highest Impact Factors (''Premier'' Journals*) in Which Pharmacy Faculty Members Published

American Journal of Psychiatry
American Journal of Respiratory and Critical Care Medicine
American Journal of Transplantation
Annals of Internal Medicine
Annals of Surgery
Archives of General Psychiatry
Blood
British Medical Journal
CA-Cancer Journal for Clinicians
Clinical Infectious Disease
Clinical Pharmacology and Therapeutics
Circulation
Critical Care Medicine
Diabetes
Diabetes Care
Gastroenterology
Hepatology
Journal of Clinical Oncology
Journal of Pediatrics
Journal of the American College of Cardiology
Journal of the American Medical Association
Journal of the American Society of Nephrology
Kidney International
Lancet
Lancet Infectious Disease
New England Journal of Medicine
Pediatrics
Pharmacogenetics
Thorax

The list includes 5 general/internal medicine journals and 2 ''specialty'' journals for each of the following medical specialties: infectious disease, cardiology, critical care, psychiatry, pharmacy/pharmacology, gastroenterology/hepatology, endocrinology, respiratory medicine, hematology, oncology, surgery/transplantation, nephrology, and pediatrics

*Twenty-nine journals were included rather than 31, since some journals were considered to be ''premier'' journals in multiple disciplines

query to full articles, reviews, or editorial materials. Three hundred fifty of the remaining 2,246 were excluded electronically due to their lack of affiliation with an accredited US college or school of pharmacy. Thus, a total of 1,896 publications authored by pharmacy practice faculty members were identified for the years 2001-2003.

Of the 2,374 pharmacy practice faculty members, 116 (4.9%) published an average of ≥2 publications per year; 54 (2.3%) published an average of ≥3; and 25 (1.1%) published an average of ≥4. The 50 most published pharmacy practice faculty members (2.1% of the total) accounted for 580 publications, which is nearly one third (30.6%) of all pharmacy practice publications from 2001-2003.

Table 2 lists the 10 most common journals in which pharmacy practice faculty members had articles published during the evaluation period. Seven of these 10 journals are classified as ''pharmacology and pharmacy'' journals and nearly 63% of all publications by pharmacy practice faculty appeared in such journals. Forty-two percent (798/1,896) of publications were in one of the following journals: *Pharmacotherapy, Annals of Pharmacotherapy, American Journal of Health-System Pharmacy,* and the *Journal of Clinical Pharmacology*. In comparison, only a small percentage of publications (4.1% and 4.3%) appeared in a ''general or internal medicine'' or ''premier'' journal, respectively, such as *Journal of the American Medical Association* or *New England Journal of Medicine*.

Table 3 provides an assessment of publication impact factor. The 200 publications by pharmacy practice faculty members with the highest impact factors had an average impact factor of 7.6, a value well above that of the most common journals in which pharmacy practice faculty members published articles, which had an average impact factor of 1.9.

DISCUSSION

In the current project, we sought to establish the extent of the contributions of pharmacy practice faculty to the biomedical literature and the impact of the contributions for the years 2001, 2002, and 2003. In subsequent

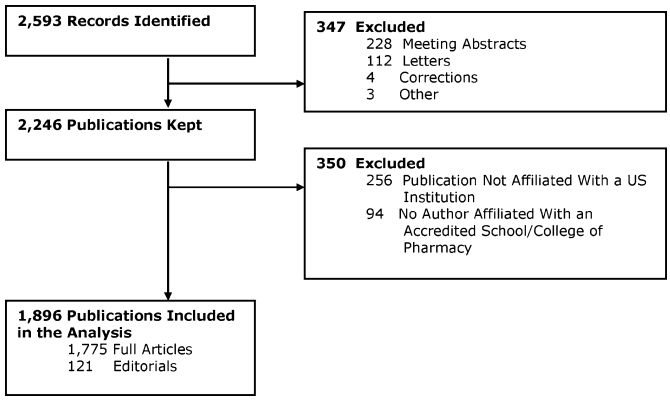

Figure 1. Process used for publication identification, inclusion, and exclusion in a research study examining the impact of published scholarly works by pharmacy practice faculty members at accredited US colleges and schools of pharmacy (2001-2003).

Table 2. "Top 10" Most Common Journals in Which Pharmacy Practice Faculty Members Published From 2001-2003*

Journal Title	Publication Count, No. (%)	Impact Factor†
Pharmacotherapy	301 (15.9)	1.9
Annals of Pharmacotherapy	274 (14.5)	1.8
American Journal of Health-System Pharmacy	189 (10.0)	1.4
American Journal of Pharmaceutical Education	66 (3.5)	0.8
Antimicrobial Agents and Chemotherapy	42 (2.2)	4.4
Clinical Therapeutics	38 (2.0)	3.0
Journal of Clinical Pharmacology	34 (1.8)	2.9
Journal of Antimicrobial Chemotherapy	21 (1.1)	3.9
Diagnostic Microbiology and Infectious Disease	19 (1.0)	2.7
Formulary	17 (90.9)	0.3
Total	1001 (52.9)	(1.9)‡

*Total number of publications identified using the Web of Science bibliographic database = 1896

†Impact Factor for 2005 used to assess all journals regardless of the year article was published.

‡Mean impact factor of publications in the "top 10" journals listed here

evaluations, we hope to compare the contributions from this baseline time period to future 3-year time periods. We chose 2001 as the first year of our 3-year assessment period since this was the first year that AACP started publishing the roster of pharmacy faculty members at United States Schools of Pharmacy in its current form.

We believe that this project has value for both the profession of pharmacy, colleges and schools of pharmacy, and individual faculty members. Since pharmacy practice department members are almost exclusively pharmacists, this project provides insight about the current state of clinical pharmacists as scholars. Colleges and schools of pharmacy can use this evaluation to gauge how their pharmacy practice faculty members are contributing to the biomedical literature in relation to national averages. We hope that projects such as this will provide the impetus for colleges and schools of pharmacy to support pharmacy practice faculty member's scholarly endeavors and to value the contribution that pharmacy practice members can make to the biomedical literature.

Table 3. Assessment of Publication Quality by Journal Impact Factors for 2001-2003

Rating	Mean Impact Factor
Top 50 publications	14.4
Top 100 publications	10.5
Top 200 publications	7.6

"Top publications" were those articles published in journals with the highest impact factors

Pharmacy practice faculty members at US colleges and schools of pharmacy made substantial contributions to the biomedical literature over this 3-year evaluative period with 1896 publications. However, the contributions were not evenly distributed among pharmacy practice faculty members. The top 2% of pharmacy practice faculty members were responsible for 31% of the total number of publications and only 5% of pharmacy practice faculty members nationwide contributed an average of 2 or more publications per year.

The impact of the scholarly contributions was substantial. Overall, 53% of publications were in 10 journals that had an average impact factor of 1.9. While most were pharmacy or pharmacology journals, one third of these top 10 journals were infectious disease specialty journals with impact factors ranging from 2.7-4.4. Given the in vitro, pharmacokinetic, and modeling nature of many infectious disease projects, pharmacists may be on a closer footing with physicians in infectious disease research, which supports the greater number of publications in journals for this subspecialty. Several publications by pharmacy practice faculty members were in premier journals. The impact factor for the top 50 articles was 14.4 and the top 200 publications averaged 7.6. Pharmacy practice faculty members clearly have the capacity to publish articles with tremendous impact on the biomedical literature.

Our assessment does not account for journals that were not included in Web of Science at the time of the study so there may be scholarly works produced and published by pharmacy practice faculty members that were not included in the assessment. We are not making a judgment that such scholarly works are not peer reviewed or that they are not important to the field, just that we were unable to evaluate them given our methodology. We also did not include book chapters or textbooks, which also are important types of scholarly productivity. While these limitations are inherent in the study, they made the study feasible. Even with these limitations, our study provides a strong assessment of the general level of scholarly productivity among pharmacy practice faculty members during this time period.

CONCLUSIONS

Pharmacy practice faculty members have contributed substantially to the biomedical literature and their work

has had an important impact. Pharmacy practice departments need to provide support and incentives so that a greater proportion of pharmacy practice faculty members contribute to their department's scholarly totals.

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