



Article

Exploring Publishing Patterns at a Large Research University: Implications for Library Practice

Kathleen Amos
Project Manager, Council on Linkages Between Academia and Public Health Practice
Public Health Foundation
Washington, District of Columbia, United States of America
Email: kamos@phf.org

Allyson Mower
Scholarly Communications & Copyright Librarian
Marriott Library
University of Utah
Salt Lake City, Utah, United States of America
Email: allyson.mower@utah.edu

Mary Ann James
Electronic Resources Manager
Marriott Library
University of Utah
Salt Lake City, Utah, United States of America
Email: maryann.james@utah.edu

Alice Weber
Interprofessional Education Librarian
Eccles Health Sciences Library
University of Utah
Salt Lake City, Utah, United States of America
Email: alice.weber@utah.edu

Joanne Yaffe
Associate Professor of Social Work
College of Social Work
University of Utah
Salt Lake City, Utah, United States of America
Email: joanne.yaffe@utah.edu

Mary Youngkin
Librarian Emerita
Eccles Health Sciences Library
University of Utah
Salt Lake City, Utah, United States of America
Email: mary.youngkin@utah.edu

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Abstract

Objective – The research project sought to explore the value of data on publication patterns for decision-making regarding scholarly communications and collection development programs at a research-intensive post-secondary institution, the University of Utah in the United States.

Methods – Publication data for prolific University of Utah authors were gathered from Scopus for the year 2009. The availability to University of Utah faculty, staff, and students of the journals in which University of Utah authors published was determined using the University of Utah Libraries' catalogue; usage was estimated based on publisher-provided download statistics and requests through interlibrary loan; and costs were calculated from invoices, a periodicals directory, and publisher websites and communications. Indicators of value included the cost-per-use of journals to which the University of Utah Libraries subscribed, a comparison of interlibrary loan costs to subscription costs for journals to which the University of Utah Libraries did not subscribe, the relationship between publishing venue and usage, and the relationship between publishing venue and cost-per-use.

Results – There were 22 University of Utah authors who published 10 or more articles in 2009. Collectively, these authors produced 275 articles in 162 journals. The University of Utah provided access through library subscriptions to 83% of the journals for which access, usage, and cost data were available, with widely varying usage and at widely varying costs. Cost-per-use and a comparison of interlibrary loan to subscription costs provided evidence of the effectiveness of collection development practices. However, at the individual journal title level, there was little overlap between the various indicators of journal value, with the highest ranked, or most valuable, journals differing depending on the indicator considered. Few of the articles studied appeared in open access journals, suggesting a possible focus area for the scholarly communications program.

Conclusions – Knowledge of publication patterns provides an additional source of data to support collection development decisions and scholarly communications programming. As the estimated value of a journal is dependent on the factor being studied, gathering knowledge on a number of factors and from a variety of sources can lead to more informed decision-making. Efforts should be made to expand data considered in areas of scholarly communications and collection development beyond usage to incorporate publishing activities of institutionally affiliated authors.

Introduction

Several librarians and researchers have written about scholarly communications and the current state of flux as digital technology proliferates (Battin, 1980; Byrd, 1990; Odlyzko, 1997; Shaughnessy, 1989; Tenopir & King, 1997, 2000). In response to these changes, many libraries have implemented scholarly communications programs to raise awareness, provide services, and advocate for changes in costs of and access to scientific, technical, and medical (STM) journals (Bergman, 2006; Malenfant, 2010).

The term “scholarly communications” encompasses the myriad ways in which scholars communicate their research findings and original creations to their peers and others. A library scholarly communications program must respond to a range of disciplines and their communication media and formats: journal articles, books, paintings, music, etc. Knowing what programming, services, content, and collections a library needs to provide requires a deep understanding of unique, discipline-specific scholarly communication and publishing patterns.

Publishing choices can indicate potential journal value. As Schauder (1994) has said, “to be a scientist or scholar it is necessary to write and to publish: it is not as essential to command a wide readership, or a contemporary readership” (p. 82). Such publishing choices can also demonstrate attitudes towards non-traditional approaches to journal article dissemination such as self-archiving and open access publishing. Attitudes regarding these venues play a primary role in the development of a scholarly communications program. If scholars, as one study has found, do not see or remain unaware of pricing or access problems in the journal publishing system, library programs and services need to respond accordingly to those realities (Rowlands, Nicholas, & Huntington, 2004).

This paper reports on initial research regarding one mode of scholarly communication – the journal article – and

explores journal publishing patterns, rates of access, and costs at a research-intensive university for the purposes of informing a scholarly communications program. This type of research can also inform collection development decisions. As library journal budgets continue to constrict, collection development practices may require rethinking, especially regarding evidence based decision-making. Collection development, “the process of planning and building a useful and balanced collection of library materials” (Reitz, 2004-2012), is a core function of librarians in many professional settings. A number of factors may contribute to the decision to select or deselect a particular journal (Dhawan, Phull, & Jain, 1980) and a variety of sources are potentially useful for guiding this type of activity, including knowledge of the journal publishing practices of faculty and research staff at the institution, journal download statistics, and interlibrary loan (ILL) requests. This paper demonstrates the potential value of these approaches and provides usage and cost analyses for the University of Utah (UU).

Literature Review

A limited number of studies have looked at publishing patterns as important data for evaluating library collections, but no literature was located that reflects the use of publishing pattern data to develop scholarly communications programs. Some authors have demonstrated the use of citation analysis to evaluate how libraries meet the information needs of a local campus. For example, Dykeman (1994) determined citation studies to be “one indicator of a collection’s strength or weakness” after looking at the publishing output of science and engineering faculty at a technical institute (p. 145). LaBonte (2005) analyzed publishing patterns as well as citations to determine the library’s journal collection in response to a newly created research institute, starting with faculty publication decisions, but focusing mostly on journals cited in these publications. Lascar and Mendelsohn (2001) identified 12 key researchers, searched Web of Science to determine where they published, and then reviewed the references cited in these

publications. The authors discovered only a few newer journals cited by researchers that the library did not hold and used these data to justify adding them to the collection, arguing that “collections must be focused on the needs of the researchers as indicated by their citation and publication patterns” (p. 432).

Other authors have suggested that while citation analysis provides important information for collection decisions, publication patterns should be given greater weight. For example, Salisbury and Smith (2010) concluded that usage statistics alone do not always reflect the true use and impact of a journal and that different types of data greatly improve the ability to assess a library’s collection, suggesting that libraries “at a minimum ... provide access to the periodicals in which ... researchers published more than five times” in addition to considering the number of citations (p. 76). Hughes (1995) obtained bibliographies from an academic department, developed a list of journals, and searched citations by faculty in SciSearch and journal impact factor ranking in Journal Citation Reports (JCR). Hughes gave faculty publication patterns the greatest weight in journal subscription decisions, arguing that publication patterns indicated the journal’s importance to faculty for both quality and readership. Wilson and Tenopir (2008) suggested that libraries should consider using a combination of publishing patterns and local citation analysis, as well as survey data on reading and writing productivity, in order to analyze the quality of a journal.

These studies indicate a range of decision criteria used by libraries to inform journal collection development decisions. While many libraries rely primarily on citation analysis for decisions, some libraries utilize usage and ILL statistics, and a few incorporate publishing patterns into decision-making. Emerging social tools such as altmetrics – metrics for measuring the impact of scholarship based on the social web (Priem, Taraborelli, Groth, & Neylon, 2010) – could provide another source of information beyond citation analysis. None of the articles located focused on evaluating costs in relation to the usage of the journals or

on potential ways such metrics can influence a scholarly communications program. The present study aims to contribute to this gap in knowledge related to libraries’ potential use of faculty publishing patterns and data about the costs associated with accessing journals in which faculty publish, in order to inform collection development decisions and scholarly communications efforts.

Aims

This research builds on that of previous authors by considering a university’s scholarly communications program and library journal subscriptions from the perspective of the publication patterns of university faculty and staff. The study explores the availability of journal articles published by prolific authors at the UU, as well as the associated usage and costs of access. Specifically, the research addresses the following seven questions with respect to the journals in which prolific authors publish:

1. What proportion of subscription journals is accessible to researchers at the UU through institutional holdings?
2. How often are these journals used at the UU?
3. What are the costs to the UU of providing access to these journals?
4. How do the costs of these journals relate to their usage at the UU?
5. Do the journals in which authors publish most frequently have the highest usage?
6. Do the journals in which authors publish most frequently provide the best value for the money spent?
7. What proportion of these journals is published under an open access model?

Methods

This study was based on a list of journals in which prolific UU authors published in 2009. To identify journals in which UU authors published, the Scopus database was used. Scopus was selected for its size and coverage of multiple disciplines; the other widely used,

multidisciplinary citation database, Web of Science, was not available at the UU at the time this research began. Using the affiliation search function, a search was conducted for "University of Utah" and the results were manually reviewed to identify entities affiliated with the UU. The database was searched for all articles published by authors listing one of these entities in their affiliation (for the full search string, see Appendix A). Search results were limited to items published in 2009, as this was the most current year for which access and cost data were available. Prolific authors were defined as those publishing 10 or more articles in a given year, in this case 2009. The threshold of 10 or more articles helped create a manageable sample size for an initial exploration. Scopus allows search results to be filtered based on a variety of factors, including author, and displays the number of items that will be retrieved if a filter is applied. Search results were filtered to identify UU-affiliated authors who had published 10 or more articles in 2009. The list of publications for each of these authors was exported, and the journals in which the publications appeared were identified. All Scopus searches were conducted in February 2010.

Access

Access to journals was assessed based on holdings listed in the UU Libraries' online catalogue. A catalogue search was conducted in early 2010 for each journal to determine whether the UU held an active subscription to the title during the 2009 calendar year. Journals publishing under an open access model were identified from entries in the UU Libraries' SFX link resolver.

Usage

To determine usage of the journals to which the UU Libraries subscribed, journal download statistics for 2009 were collected, either directly from publishers or from aggregators. Usage for the UU is determined by Internet Protocol (IP) address ranges and includes on-campus access as well as remote access by authenticated

users. Both PDF and HTML downloads were counted in the usage statistics.

For journals to which the UU Libraries did not subscribe, usage was estimated based on ILL requests. The number of ILL requests processed for university-affiliated faculty, staff, or students in 2009 for each journal was obtained from statistics maintained by the ILL Departments of the UU Libraries.

Costs

For each journal, the annual subscription cost for 2009 was determined. Several sources for establishing costs were available, and the source used depended on whether the UU Libraries subscribed to a journal. For journals to which the UU Libraries subscribed, invoices were reviewed to identify the cost paid. Approximately 70% of the journals in this sample were obtained through journal packages or consortium-based purchases, and individual prices could not be identified by means of invoices. Invoices for packages often do not itemize costs by journal title, and title prices within a package can vary significantly, limiting the utility of dividing the total package cost by the total number of journals. If it was not possible to identify the cost of a journal through invoices, the data were collected using, in order of preference, *Ulrich's Periodicals Directory*, journal publishers' websites, or personal communications with publishers or vendors. *Ulrich's* served as a single source and efficient means of checking prices for several journal titles. When *Ulrich's* did not list a journal or its price, the publisher's website was consulted. If pricing information was not included on the publisher's site, an email was sent to a publisher representative or vendor requesting the information. Estimations of annual subscription costs for journals to which the UU Libraries did not subscribe were based on the same sources, consulted in the same order, with the exception of UU Libraries' invoices.

The costs of providing journal access through ILL were estimated using a standard cost of \$30 per ILL request (Jackson, 2003). For each

journal, the number of ILLs processed for university-affiliated faculty, staff, or students in 2009 was multiplied by this standard cost estimate to provide an approximate ILL cost.

Value

After estimating journal costs and usage, these two factors were compared. A cost-per-use value was approximated by dividing the estimated subscription cost by the number of downloads for each journal to which the UU Libraries subscribed. For journals to which the UU Libraries did not subscribe, the estimated ILL cost was compared to the subscription price of the journal to identify journals for which purchasing a subscription might be more cost-effective than providing access through ILL. In addition, choice of publishing venue was compared to journal usage and to the estimated cost-per-use values.

Results

This exploratory study focused on the most prolific UU authors in 2009, as defined by number of published articles. The “University of Utah” affiliation search in Scopus returned 59,807 publications, 3,275 of which were published in 2009. There were 22 university-affiliated authors who met the criterion for inclusion, which was defined as publication of

10 or more articles in 2009. Collectively, these authors published 275 articles in 162 journals. A complete list of journals, along with the number of articles published by prolific UU authors in each journal, appears in Appendix B. Access, usage, and costs of these journals were investigated. Complete data on these three factors were available for 150 of the journals, containing 254 of the articles identified. The following analysis is based on those 150 journals.

Access

Of the 150 journals studied, 125 (83%) were accessible to university-affiliated researchers through library subscriptions (Figure 1).

The 125 journals that were accessible to university-affiliated researchers through subscription contained 217 (85%) of the 254 articles published by the university’s most prolific authors in 2009 (Figure 2). The remaining 37 (15%) of these articles appeared in journals that were not accessible through the UU Libraries.

Usage

Usage of the 125 journals to which the UU Libraries subscribed varied widely, from a high of 42,208 article downloads to a low of

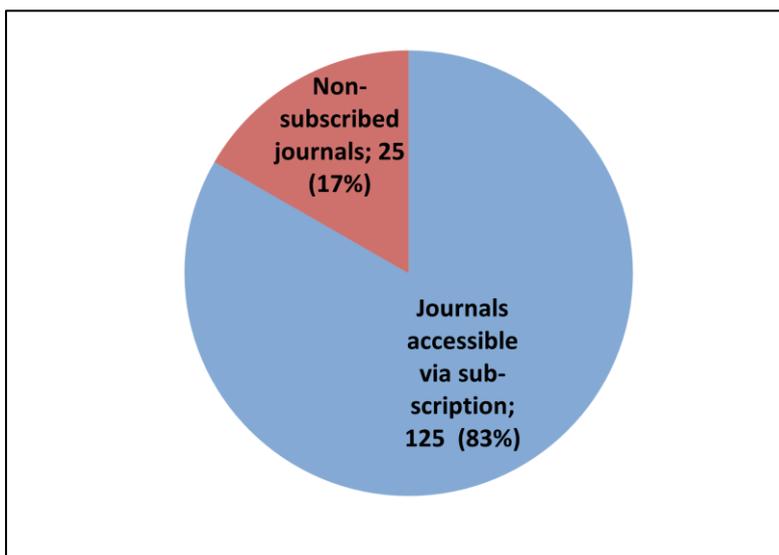


Figure 1
Access to journals in which prolific University of Utah authors published in 2009; n = 150

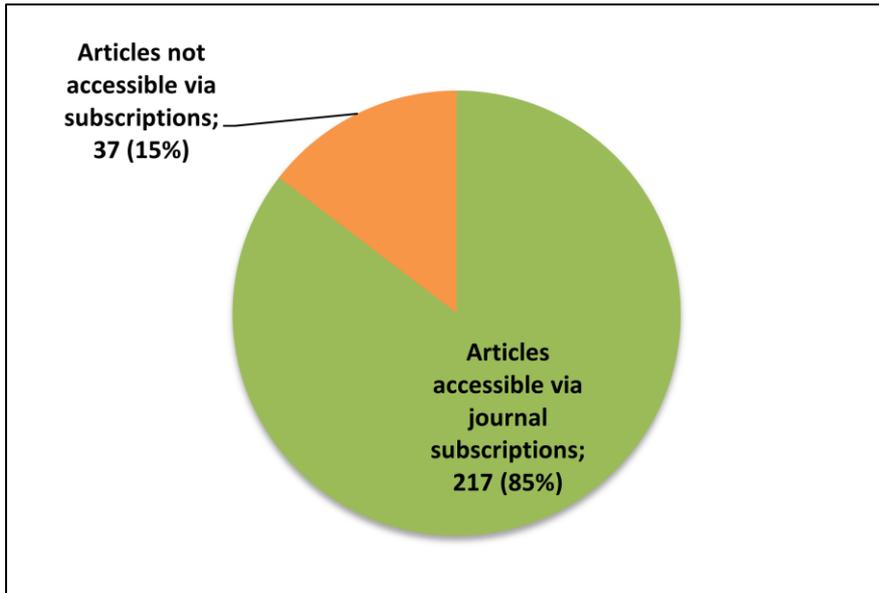


Figure 2
Access to articles published by prolific University of Utah authors in 2009; n = 254

zero downloads during 2009 (Table 1). Mean usage was 2,157 downloads per journal, while median usage was 365 downloads per journal. The most frequently used journal in this sample was *Nature*, followed by the *Journal of the American Chemical Society* with 32,792 downloads, *Science* with 29,943 downloads, and *Proceedings of the National Academy of Sciences of the United States of America (PNAS)* with 28,061 downloads. Articles from two journals were not downloaded at all during 2009, and four additional journals were each downloaded only once. The majority (89) of the journals in this sample were downloaded less than 1,000 times each, while only six journals had more than 10,000 downloads.

ILL statistics were collected for the 25 journals to which the UU Libraries did not subscribe (Table 2). Of these, 19 (76%) were requested at least once during 2009, while the remaining 6 (24%) were not requested. There were 184 ILL requests processed for the 25 journals, for an average of 7 requests per journal (*Mdn* = 5 requests per journal). There were 10 or more requests each for 7 (28%) of these journals. Of the journals that were requested, the number of requests per journal ranged from a high of 44 requests for *Toxicoln* to a low of 2 requests each for the *American Journal of Therapeutics*, *Computing and Visualization in Science*, and *Congenital Heart Disease*.

Table 1
Number of Article Downloads for Subscribed Journals;
n = 125

	Number of Article Downloads
Maximum	42,208
Mean	2,157
Median	365
Minimum	0

Table 2
Number of ILL Requests for Non-Subscribed Journals;
n = 125

Number of Requests	
Maximum	44
Mean	7
Median	5
Minimum	0

Table 3
Estimated Costs for Subscribed Journals;
n = 125

Estimated Subscription Costs	
Maximum	\$12,370
Mean	\$2,162
Median	\$1,160
Minimum	\$107
Total	\$270,250

Costs

Subscription costs were estimated for the 125 journals to which the UU Libraries subscribed. Cost estimates varied significantly from a high of \$12,370 to a low of \$107 (Table 3). The cost of 1 (1%) of the journals was more than \$10,000, while 66 (53%) journals cost more than \$1,000 each. In total, the cost paid to access these journals was valued at approximately \$270,250, an average of \$2,162 per journal (*Mdn* = \$1,160 per journal).

For the 25 subscription journals not purchased by the UU Libraries, the subscription cost was estimated to total approximately \$31,300, an average of \$1,252 per journal (*Mdn* = \$653 per journal). Costs again varied, from \$62 to \$5,039 (Table 4). The subscription costs of 9 (36%) of the journals were estimated at more than \$1,000 each.

For the subscription journals to which the UU Libraries did not subscribe, ILL costs were also estimated (Table 4). The cost of ILL in 2009 for these 25 journals amounted to approximately \$5,520, with individual journal costs ranging from \$0 to \$1,320 depending on the number of requests processed. The average ILL cost per

journal was estimated at approximately \$221 (*Mdn* = \$150).

Value

Cost and Usage

A comparison of cost to usage was used to assess value for the journals made accessible to the UU research community through library subscriptions. As was the case with cost and downloads, the calculated cost-per-use values varied widely for 123 of the 125 subscribed journals that were used, from a high of \$6,713 to a low of \$0.01 (*M* = \$1.00) (Table 5). The costs-per-use of 3 of the journals were greater than \$1,000 each, while the majority of journals (85) had costs-per-use of less than \$10 each. The cost-per-use of 31 (25%) of the journals was estimated at \$1 or less. Cost-per-use was not calculated for the two journals that were not downloaded at all during 2009.

A comparison of ILL costs, which reflect usage, to subscription costs was used to assess value for journals to which the UU Libraries did not subscribe. It was estimated that the ILL costs paid by the UU Libraries in 2009 were higher than the costs of the corresponding journal

Table 4
Comparison of Estimated Subscription and ILL Costs for Non-Subscribed Journals;
n = 25

	Estimated Subscription Costs	Estimated ILL Costs
Maximum	\$5,039	\$1,320
Mean	\$1,252	\$221
Median	\$653	\$150
Minimum	\$62	\$0
Total	\$31,300	\$5,520

Table 5
Estimated Cost-Per-Use for Subscribed Journals;
n = 123

	Cost-Per-Use
Maximum	\$6,713
Mean	\$1
Minimum	\$0.01

Table 6
Top 10 Subscribed Journals Ranked by Number of Articles by Prolific UU Authors and Rank by Usage in 2009;
n = 125

Title	Number of Articles	Rank by Usage (High to Low)
<i>Astrophysical Journal</i>	13	51st
<i>AIP Conference Proceedings</i>	7	86th
<i>Journal of Physical Chemistry B</i>	7	9th
<i>American Journal of Obstetrics and Gynecology</i>	6	19th
<i>Journal of the American Chemical Society</i>	6	2nd
<i>Biochemistry</i>	5	10th
<i>Inorganic Chemistry</i>	5	20th
<i>Pediatric Critical Care Medicine</i>	4	75th
<i>Physical Review B - Condensed Matter and Materials Physics</i>	4	16th
<i>Physical Review D - Particles, Fields, Gravitation and Cosmology</i>	4	85th

subscriptions for two (8%) journals. For an additional three (12%) journals, the equivalent of more than half of the subscription costs was spent in providing ILL. The ILL costs of 18 (72%) of the journals were equal to less than 25% of the costs for those journals, had they instead been purchased by subscription. For the journal requested most frequently, *Toxicol*,

the ILL cost was estimated to be \$1,320, approximately 42% of the estimated subscription cost.

Publishing Venue and Usage

Of the journals to which the UU Libraries subscribed, the largest number of articles was

published in *Astrophysical Journal*, followed by *AIP Conference Proceedings*, and the *Journal of Physical Chemistry B*. *Astrophysical Journal* ranked 51st out of 125 journals in usage by UU faculty, staff, and students, with 738 downloads in 2009, while *AIP Conference Proceedings* ranked 86th with 140 downloads (Table 6). Three journals were highly ranked in both number of UU articles published and number of downloads: the *Journal of the American Chemical Society* (ranked 2nd in downloads), the *Journal of Physical Chemistry B* (ranked 9th), and *Biochemistry* (ranked 10th). The most frequently used journal, *Nature*, contained two articles written by prolific UU authors.

Publishing Venue and Cost-per-Use

With respect to cost-per-use, *Astrophysical Journal* ranked 68th out of 123 journals, with an estimated cost of \$3.75 per download in 2009. *AIP Conference Proceedings* ranked 103rd at \$38.57 per download, and *Journal of Physical Chemistry B* ranked 33rd, with a cost-per-use of \$1.15. The *Journal of the American Chemical*

Society was the only journal ranked highly in both number of UU articles and cost-per-use, at \$0.13 per download, the fifth-lowest cost overall (Table 7). *The Lancet*, the journal with the lowest cost-per-use, published one article by a prolific UU author.

Open Access

Two (1%) of the journals in the full sample of 162 journals were open access. These journals contained 3 (1%) of the 275 articles by prolific UU authors published in the sample journals. For these journals, access was available to all university-affiliated researchers at no subscription cost to the UU Libraries. Download statistics of open access journals for UU affiliates were not available, so the value of these journals was not calculated.

Discussion

A review of the literature identified a potential gap in knowledge regarding libraries' use of data about institutionally affiliated authors' choices of publishing venues to inform

Table 7

Top 10 Subscribed Journals Ranked by Number of Articles by Prolific UU Authors and Rank by Cost-Per-Use in 2009;

n = 123

Title	Number of Articles	Rank by Cost-Per-Use (Low to High)
<i>Astrophysical Journal</i>	13	68th
<i>AIP Conference Proceedings</i>	7	103rd
<i>Journal of Physical Chemistry B</i>	7	33rd
<i>American Journal of Obstetrics and Gynecology</i>	6	11th
<i>Journal of the American Chemical Society</i>	6	5th
<i>Biochemistry</i>	5	25th
<i>Inorganic Chemistry</i>	5	38th
<i>Pediatric Critical Care Medicine</i>	4	48th
<i>Physical Review B - Condensed Matter and Materials Physics</i>	4	47th
<i>Physical Review D - Particles, Fields, Gravitation and Cosmology</i>	4	100th

scholarly communications and collection development programs. This case study illustrates how knowledge of such publishing decisions and various associated factors can inform decision-making at a large research institution. Factors considered included the accessibility, usage, costs, and value of the journals in which the most prolific university authors in 2009 published.

Access to the journals in which these authors published in 2009 was high, with more than 80% of the published articles available through UU Libraries subscriptions. Percentages of access to the journals in which university-affiliated authors published and to the individual articles published were similar – 83% and 85%, respectively. This alignment between publication patterns and subscription status reflects positively on the success of the collection development program in selecting resources relevant to the fields in which university research is occurring and providing the results of that research to users. That much of the university's research is available through library subscriptions could have implications for the perceived value of an institutional repository (IR), in that researchers may not feel as strongly about the necessity of an IR if most university research is already easily accessible. IR advocates may find more success focusing their efforts initially on the articles to which the libraries are unable to provide access through subscriptions.

Usage of the journals studied revealed a small number of very highly used journals, with most journals used only occasionally. Four high-profile journals – *Nature*, the *Journal of the American Chemical Society*, *Science*, and *PNAS* – were used more than 25,000 times each in 2009, more than double the number of downloads for the fifth-ranked journal. With median usage at 365 downloads per journal, half of the journals studied were used an average of once per day or less. Most journals to which the UU Libraries did not subscribe were accessed through ILL. Demand exists for these journals, but is not extreme; only slightly more than one quarter of journals were requested 10 or more times. As might be expected, a large difference in usage was shown between journals to which

university researchers had direct access and those to which they did not. The average usage of journals to which the UU Libraries subscribed was more than 300 times higher than for those available through ILL.

In general, providing access to university research through journal subscriptions is expensive. No journal to which the UU Libraries subscribed could be purchased for less than \$100, more than half cost more than \$1,000, and one journal subscription cost more than \$10,000. The cost of journals to which the UU Libraries did not subscribe was generally less than those to which subscriptions were purchased. However, the cost of providing ILL access to those journals was also generally less than that of purchasing subscription access. Because of this, ILL was an economical way to provide access to rarely used journals.

Several indicators of value were considered in this study: the relationships between cost and usage of journals, between publishing venue and usage, and between publishing venue and cost-per-use. A comparison of cost to usage demonstrated the need to consider this value independently for each journal studied. A simple average calculated by dividing the total cost of the journals analyzed by the total number of downloads would produce a cost-per-use of \$1; however, only 25% of the journals had individual costs-per-use of \$1 or less. The costs-per-use calculated for the majority of journals were less than the typical costs of providing access to an article through ILL or pay-per-view methods, a desirable measure for collection development. ILL was shown to be an effective practice for the UU Libraries, with the costs of ILL rarely exceeding the costs of subscriptions to the journals requested. Even for the journal requested most frequently, the ILL cost was estimated at only 42% of the subscription cost. Journals with high costs-per-use and ILL costs approaching subscription costs should receive special attention in collection development decisions, as they present opportunities in which changes in purchasing practice have the potential to significantly, and positively, impact the journal budget.

Results from this study have shown that the journals in which prolific UU authors publish are not necessarily those that UU faculty, staff, and students use frequently, nor those that might be considered the best value based on cost-per-use calculations. This finding is worthy of further study and merely scratches the surface of the complex topic of the reading habits of those active in the research enterprise. Some of the journals in which prolific UU authors published are used, while others are not, even though research in that area occurs on campus. While *Nature* had the highest number of downloads and *The Lancet* had the best cost-per-use, neither accounted for more than 1% of the papers published by the authors studied. Conversely, *Astrophysical Journal* contained the largest number of UU-authored articles, yet had less than 1,000 downloads and a cost-per-use in approximately the middle of the rankings. That rankings of journals by these three factors – number of university-affiliated publications, usage, and cost-per-use – differ highlights the complexity involved in selecting journals for purchase and illustrates the value added by considering multiple factors when making collection development decisions. In isolation, each factor could offer a very different perspective on value to the university. The *Journal of the American Chemical Society* represents the rare journal that performs well on all three factors, making it an ideal subscription candidate.

Finally, the study results indicated that very few prolific authors published in open access journals, perhaps showing that campus support of this model as an access mechanism to research is low. Open access journals offer benefits for readers in terms of access and cost, but their usage is more difficult to evaluate. Low levels of open access publishing among prolific UU authors have implications for a scholarly communications program, particularly in relation to increasing awareness of open access as a viable publishing option and considering the value for university funding of open access.

Limitations

This research offers a case study example of the journal publishing patterns at a large, research-intensive post-secondary institution in the US; results are reflective only of the institution and time period studied and may not be generalizable to other institutions or across time. As a pilot exploration, this research considered only journal articles by those authors who published 10 or more articles in 2009 and identified authors using only a single database, Scopus. Works by authors publishing in non-journal venues were not included in this analysis, and the choice of Scopus for identifying authors may have privileged those publishing in STM journals over the social sciences and humanities due to its disciplinary coverage. The publication patterns of less prolific authors may differ, and different authors may be identified as prolific using other definitions, data sources, or years of analysis. Analysis was limited by the inability to obtain complete pricing and usage data for all journals in the sample and by the need to use a variety of sources to gather this information. Furthermore, costs for journals purchased as part of packages represented estimates rather than actual prices paid, as these costs were derived from sources other than UU Libraries' invoices. Purchasing journals through packages rather than stand-alone subscriptions tends to reduce the subscription costs; therefore, determining individual journal costs from sources other than library invoices may have over-estimated the true costs paid to access the journals and inflated the calculated costs-per-use for journals obtained through package-based subscriptions. The use of download statistics to represent usage ignores use of other mechanisms for accessing literature and cannot provide article-level data. Similarly, the use of ILL requests ignores the use of journals accessed through pay-per-view or other means, and cost estimates may not be directly comparable to estimates based on subscription prices.

Conclusions

Decisions regarding a university's scholarly communications program or collection development activities can be based on a variety of factors. As illustrated in the literature, citation analysis is a popular strategy for gathering data; this research reflects on the value of a different type of analysis – publication analysis. An exploration of publishing patterns of university-affiliated authors and related data has been shown to provide additional information, which can help inform better decision-making.

In the case of the UU, access was available through the UU Libraries to the majority of journal articles published by the most prolific university-affiliated authors in 2009. Cost and usage data allowed for a consideration of the effectiveness of current journal selection decisions, and a comparison of the “best” journals when ranked by number of university publications, usage, and cost-per-use highlighted differences among analyses based on different factors. Articles published in open access journals accounted for only a very small portion of publishing in this study, suggesting a continued need for additional investigation and education in this area.

The results of this study have implications for both collection development and scholarly communication programming. Collection development decisions are routinely based on the usage of journals as measured by citations, download statistics, or ILL requests. However, more comprehensive decisions may be possible through the consideration of additional factors, including the publishing patterns of university researchers. A list of journals that are widely used is not necessarily identical to a list of journals in which researchers publish, even when those researchers are among the most prolific authors on campus. The consideration of usage or publishing patterns may paint a different picture of the value of journal subscriptions, and multiple types of data allow for improved decision-making when shaping the journal collection of a research library. Data about such patterns can also provide needed input

when developing the activities, events, and educational offerings of a scholarly communications program. In making scholarly communications and collection development decisions, efforts should be made to consider data related to as many potentially relevant factors as is practical given the constraints of time and other resources.

Further research is needed to explore the implications of these results on a broader scale and determine whether they are generalizable beyond the population and time studied. A more comprehensive illustration of university publishing could be obtained with a larger and more inclusive sample, including all university authors rather than limiting to the most prolific and using a more complete list of university publications. To further inform scholarly communications, additional study concerning the number of open access compared to subscription journals published in the areas in which research occurs at the university, reasons for choosing subscription rather than open access venues for publication, and rates of archiving in the IR could shed additional light on these findings. In addition, research to investigate the relationship between the journals in which authors publish and the journals authors cite in their work would provide further value for collection development decisions.

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Appendix A

Full "University of Utah" Affiliation Search String in Scopus

(AF-ID("University of Utah" 60025488) OR AF-ID("University of Utah School of Medicine" 60024978) OR AF-ID("University of Utah Health Sciences Center" 60019012) OR AF-ID("University of Utah Health Care" 60012445) OR AF-ID("University of Utah Hospital and Clinics" 60031018) OR AF-ID("Intermountain Injury Control Research Center" 60016976) OR AF-ID("University of Utah Research Park" 60011197) OR AF-ID("Utah Poison Control Center" 60014876) OR AF-ID("University of Utah Orthopaedic Center" 60008753) OR AF-ID("UTAH Cardiac Transplant Program" 60020272) OR AF-ID("University of Utah Neuropsychiatric Institute" 60013699) OR AF-ID("Utah Cancer Registry" 60021500) OR AF-ID("Utah Autism Research Program" 60024406) OR AF-ID("University of Utah Institute for Biomedical Engineering" 60010083) OR AF-ID("The Brain Institute at the University of Utah" 60011781) OR AF-ID("University of Utah College of Pharmacy, Pharmacotherapy Outcomes Research Center" 60026907)).

Appendix B

Journals Ranked by Number of Articles by Prolific University of Utah Authors in 2009; n = 162

Title	Number of Articles
<i>Astrophysical Journal</i>	13
<i>AIP Conference Proceedings</i>	7
<i>Journal of Physical Chemistry B</i>	7
<i>Pathology Case Reviews</i>	7
<i>American Journal of Obstetrics and Gynecology</i>	6
<i>Journal of the American Chemical Society</i>	6
<i>Biochemistry</i>	5
<i>Inorganic Chemistry</i>	5
<i>Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)</i>	5
<i>Pediatric Critical Care Medicine</i>	4
<i>Physical Review B - Condensed Matter and Materials Physics</i>	4
<i>Physical Review D - Particles, Fields, Gravitation and Cosmology</i>	4
<i>American Journal of Cardiology</i>	3
<i>American Journal of Kidney Diseases</i>	3
<i>Angewandte Chemie - International Edition</i>	3
<i>ChemMedChem</i>	3
<i>Concepts in Magnetic Resonance Part B: Magnetic Resonance Engineering</i>	3
<i>Hypertension</i>	3
<i>Journal of Cosmology and Astroparticle Physics</i>	3
<i>Journal of Organic Chemistry</i>	3
<i>New England Journal of Medicine</i>	3
<i>Sensors and Actuators, B: Chemical</i>	3
<i>Accounts of Chemical Research</i>	2
<i>Acta Neurochirurgica</i>	2
<i>Biometrics</i>	2
<i>Biophysical Journal</i>	2
<i>Cancer Epidemiology Biomarkers and Prevention</i>	2
<i>Channels</i>	2

Title	Number of Articles
<i>Chemistry - A European Journal</i>	2
<i>Clinical Cardiology</i>	2
<i>CrystEngComm</i>	2
<i>Current Opinion in Drug Discovery and Development</i>	2
<i>Econometric Theory</i>	2
<i>IEEE Transactions on Neural Systems and Rehabilitation Engineering</i>	2
<i>Inorganica Chimica Acta</i>	2
<i>International Journal of Modern Physics D</i>	2
<i>Journal of Clinical Neuroscience</i>	2
<i>Journal of Medicinal Chemistry</i>	2
<i>Journal of Molecular and Cellular Cardiology</i>	2
<i>Journal of Multivariate Analysis</i>	2
<i>Journal of Neurosurgery</i>	2
<i>Journal of Neurosurgery: Pediatrics</i>	2
<i>Journal of Physical Chemistry A</i>	2
<i>Magnetic Resonance Imaging</i>	2
<i>Magnetic Resonance in Medicine</i>	2
<i>Nature</i>	2
<i>Nephrology Dialysis Transplantation</i>	2
<i>Obstetrics and Gynecology</i>	2
<i>PACE - Pacing and Clinical Electrophysiology</i>	2
<i>PLoS ONE</i>	2
<i>Polyhedron</i>	2
<i>Postgraduate Medicine</i>	2
<i>Science</i>	2
<i>Toxicon</i>	2
<i>Academic Emergency Medicine</i>	1
<i>Academic Radiology</i>	1
<i>ACM SIGPLAN Notices</i>	1
<i>ACS Chemical Biology</i>	1
<i>Acta Diabetologica</i>	1
<i>American Heart Journal</i>	1
<i>American Journal of Clinical Pathology</i>	1
<i>American Journal of Emergency Medicine</i>	1
<i>American Journal of Hypertension</i>	1
<i>American Journal of Medicine</i>	1
<i>American Journal of Nephrology</i>	1
<i>American Journal of Perinatology</i>	1
<i>American Journal of Surgical Pathology</i>	1
<i>American Journal of Therapeutics</i>	1
<i>Annals of Human Genetics</i>	1
<i>Annals of Noninvasive Electrocardiology</i>	1
<i>Annals of Statistics</i>	1
<i>Annals of Thoracic Surgery</i>	1
<i>Atherosclerosis</i>	1
<i>Biomedical Microdevices</i>	1
<i>Breast Cancer Research and Treatment</i>	1
<i>Canadian Journal of Statistics</i>	1
<i>Cancer Causes and Control</i>	1
<i>Cancer Prevention Research (Philadelphia, Pa.)</i>	1

Title	Number of Articles
<i>Cardiology Clinics</i>	1
<i>Cardiovascular Research</i>	1
<i>Catheterization and Cardiovascular Interventions</i>	1
<i>Chemical Communications</i>	1
<i>Circulation</i>	1
<i>Circulation Research</i>	1
<i>Communications in Statistics - Theory and Methods</i>	1
<i>Computing and Visualization in Science</i>	1
<i>Congenital Heart Disease</i>	1
<i>Congestive Heart Failure</i>	1
<i>Critical Care Medicine</i>	1
<i>Critical Pathways in Cardiology</i>	1
<i>Current Biology</i>	1
<i>Current Opinion in Structural Biology</i>	1
<i>Diabetes</i>	1
<i>Diseases of the Colon and Rectum</i>	1
<i>DMM Disease Models and Mechanisms</i>	1
<i>Endocrinology</i>	1
<i>European Journal of Heart Failure</i>	1
<i>Expert Review of Ophthalmology</i>	1
<i>Faraday Discussions</i>	1
<i>Fertility and Sterility</i>	1
<i>IEEE Transactions on Biomedical Engineering</i>	1
<i>IEEE Transactions on Visualization and Computer Graphics</i>	1
<i>Information Processing in Medical Imaging: Proceedings of the ... Conference</i>	1
<i>International Journal of Cancer</i>	1
<i>International Journal on Software Tools for Technology Transfer</i>	1
<i>JACC: Cardiovascular Interventions</i>	1
<i>Journal of Biomedical Informatics</i>	1
<i>Journal of Cardiac Failure</i>	1
<i>Journal of Cardiovascular Pharmacology and Therapeutics</i>	1
<i>Journal of Chemical Physics</i>	1
<i>Journal of Chemical Theory and Computation</i>	1
<i>Journal of Clinical Endocrinology and Metabolism</i>	1
<i>Journal of Econometrics</i>	1
<i>Journal of Electrocardiology</i>	1
<i>Journal of Health Care for the Poor and Underserved</i>	1
<i>Journal of Heart and Lung Transplantation</i>	1
<i>Journal of Magnetic Resonance Imaging</i>	1
<i>Journal of Medical Genetics</i>	1
<i>Journal of Micromechanics and Microengineering</i>	1
<i>Journal of Molecular Biology</i>	1
<i>Journal of Neuro-Oncology</i>	1
<i>Journal of Neuroscience</i>	1
<i>Journal of Nutrition</i>	1
<i>Journal of Parenteral and Enteral Nutrition</i>	1
<i>Journal of Pediatrics</i>	1
<i>Journal of Physiology</i>	1
<i>Journal of Rheumatology</i>	1
<i>Journal of Scientific Computing</i>	1

Title	Number of Articles
<i>Journal of Statistical Planning and Inference</i>	1
<i>Journal of the American College of Cardiology</i>	1
<i>Journal of the American Society of Nephrology</i>	1
<i>Journal of the Electrochemical Society</i>	1
<i>Journal of the Royal Statistical Society. Series B: Statistical Methodology</i>	1
<i>Journal of Time Series Analysis</i>	1
<i>Journal of Women's Health</i>	1
<i>The Lancet</i>	1
<i>Microsystem Technologies</i>	1
<i>Molecular Biology and Evolution</i>	1
<i>Molecular Carcinogenesis</i>	1
<i>Molecular Phylogenetics and Evolution</i>	1
<i>Neurosurgical Focus</i>	1
<i>Neurotherapeutics</i>	1
<i>NMR in Biomedicine</i>	1
<i>Nutrition and Metabolism</i>	1
<i>Obesity</i>	1
<i>Orthopedics</i>	1
<i>Pediatric and Developmental Pathology</i>	1
<i>Pediatrics</i>	1
<i>Peptides</i>	1
<i>Physical Chemistry Chemical Physics</i>	1
<i>Pituitary</i>	1
<i>Probability Theory and Related Fields</i>	1
<i>Proceedings - Electronic Components and Technology Conference</i>	1
<i>Proceedings of SPIE - The International Society for Optical Engineering</i>	1
<i>Proceedings of the ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming, PPOPP</i>	1
<i>Proceedings of the National Academy of Sciences of the United States of America</i>	1
<i>Radiology</i>	1
<i>Seminars in Cell and Developmental Biology</i>	1
<i>Surgery for Obesity and Related Diseases</i>	1
<i>Surgical Neurology</i>	1
<i>Test</i>	1
<i>Theoretical Chemistry Accounts</i>	1