
Online journals: impact on print journal usage

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Purpose: The research sought to determine the impact of online journals on the use of print journals and interlibrary loan (ILL).

Setting: The Library of the Health Sciences–Peoria is a regional site of the University of Illinois at Chicago (UIC) Library with a print journal collection of approximately 400 titles. Since 1999, UIC site licenses have given students and faculty affiliated with UIC–Peoria access to more than 4,000 online full-text journal titles through the Internet.

Methodology: The Library of the Health Sciences–Peoria has conducted a journal-use study over an extended period of time. The information collected from this study was used to assess the impact of 104 online journals, added to the collection in January 1999, on the use of print journals.

Results: Results of the statistical analysis showed print journal usage decreased significantly since the introduction of online journals ($F(1,147) = 12.10, P < 0.001$). This decrease occurred regardless of whether a journal was available only in print or both online and in print. Interlibrary loan requests have also significantly decreased since the introduction of online journals ($F(2,30) = 4.46, P < 0.02$).

Conclusions: The decrease in use of the print collection suggests that many patrons prefer to access journals online. The negative impact the online journals have had on the use of the journal titles available only in print suggests users may be compromising quality for convenience when selecting journal articles. Possible implications for collection development are discussed.

INTRODUCTION

Journal-use studies have traditionally been a way to monitor use of academic libraries' most costly resources. With the advent of online access to full-text journals, many academic libraries find themselves in the

position of offering both print and electronic access to journals. In this transitional environment, measuring journal use by both access methods is essential to collection development decisions.

The Library of the Health Sciences–Peoria, a regional site library of the Library of the Health Sciences, University of Illinois at Chicago (UIC), has conducted a continuous journal-use study over an extended period of time. The reshelving method is used to record combined inhouse use, circulation, and interlibrary

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loan (ILL) use of current and back issues of print journals. Supplied data are used to calculate cost per use as part of collection development decisions in the face of rising costs of biomedical journals and limited budgets.

In making all deselection decisions, however, the possibility of undocumented use is considered. Other factors—such as relevance to the curriculum, standard core lists, indexing, faculty research interests and recommendations, and availability at other local libraries—are given equal consideration. The online availability of a title is a new factor in the cost-per-use equation. The library currently receives 400 print journal titles and relies on intercampus delivery from the Chicago libraries and two additional site libraries in Rockford and Urbana to supplement the collection. Fifteen online core biomedical journal titles were introduced in 1998, followed by an additional 104 titles in January 1999. Throughout 1999, an additional 1,000 journals from a variety of disciplines were added through universitywide site licenses. In January 2000, an additional 800 online journal titles with a focus in the sciences were acquired. In 2001, the number of online titles stands at approximately 4,000. Faculty, students, and staff have Internet access to these titles, dramatically increasing users' access to the journal literature.

Desk-top access to online catalogs, bibliographic databases, and full-text journals is changing library use patterns. Gate count statistics show fewer patrons entering the library, resulting in lower inhouse use. Libraries need documented data to discern use patterns of print and electronic journal collections in this transformed information access environment. This paper describes the methodology used in a traditional journal-use study, compares print journal use during a period without online access to full-text journals to a period with access to online full-text journals, compares use of *Abridged Index Medicus (AIM)* titles during these time periods, and looks for significant patterns of change in print journal use over a period of five years.

LITERATURE REVIEW

Although there is sizable literature on the collection management rationalization of books, there are relatively few journal-use studies and even fewer studies about the impact of online journals on the use of print collections. Millson-Martula reviewed the purposes and methods of journal-use studies and discussed the importance of weight attached to use as a factor for retention and deselection decisions and the meaning of low use [1]. This review found that the importance of weight for retention or deselection decisions has varied considerably, as has the meaning of low use, ranging from zero to four uses per year. Different methods used in journal-use studies included reshelving

counts, scanned bar codes, and patron-supplied information. Milne and Tiffany pointed out that the monitoring of serials' usage by reshelving counts underestimated overall usage, because many users reshelved issues [2]. In particular, these authors believed that this method missed browsing and scanning uses that might account for three-quarters of all journal use. Bleic established a correlation between inhouse use, circulation, and citation by faculty, which suggests that the gathering of many types of data is impractical and that one method may be used with the confidence that it correlates with other types of uses [3]. Young tracked the frequency of citation printing of search results from bibliographic databases and looked for a correlation with journal usage, a difference in frequency of citation printing between titles marked as locally held or not, and an indication whether or not the 80:20 rule would translate in this environment [4]. Young found that titles held locally, and tagged as such, received an average of thirty-one printed citations compared to 3.92 printed records for titles not held. He also found that 80% of all printed citations were accounted for by 16.4% of the indexed journals.

Studies that have examined the use of full text on CD-ROM have generally measured use by undergraduate students. Eastern Washington University documented a significant decrease in ILL correlating with the introduction of full-text CD-ROM databases and a concurrent decrease in print material use [5]. Milton observed in this undergraduate population that "the immediate gratification of using full-text databases appears more important than any other criteria such as the quality of the information, the credibility of the author, subject validity, and the like." Penn State University also found a reduction in the number of ILL requests, while experiencing a 147% increase in the number of articles the library supplied to users with the addition of full-text databases [6]. In contrast, St. John's University did not find the implementation of a large collection of full text on CD-ROM had a significant impact on the use of ILL services [7]. One finding of particular interest in the St. John's study was the preference displayed by students to retrieve and print the full text, even if the library held the journals in print. In fact, 90% of the requests made via the fee-based, full-text document delivery system were for material owned by the library.

Several studies have shown that implementation of online databases has an impact on internal library use, particularly when databases are Internet accessible. Studies that have looked specifically at health professionals and students have all shown an increased reliance on online databases and electronic resources, especially when the products are made available by libraries at no cost [8–11].

Several factors including cost, convenience, and time considerations enter into users' decisions to obtain

journal articles. At the time of this study, library users were able to print articles retrieved online at no charge. On the other hand, users had to absorb the costs of photocopying articles from print journals. The hidden printing costs to the library, or to the users printing from their homes or offices, are not as obvious to users as photocopy costs. Printing the online version of an article saves the steps of retrieving and photocopying the original print version, offering obvious time-saving and convenience factors as well. For users accessing the databases remotely, perhaps the biggest advantage is the elimination of the need to travel to the library. According to a study by Joswick and Stierman, convenience is one of the most important variables influencing which journals students select for research papers, but the authors explain that use by faculty members working in specialized disciplines is quite different [12].

The literature about full-text journals on CD-ROM indicates an impact on the print collection. Reports are beginning to appear in the literature that suggest online access to full-text journals will have an even greater impact on print collection use. Online journal, print journal, and database data from 1998 to 2000 at a large research university show an increase in online journal use and a decrease in print journal use by faculty and graduate students [13]. A six-month use study in an academic health sciences library of biomedical literature available both in print and online shows that users accessed electronic versions more than ten times as often as the print versions [14]. Libraries are currently confronted with multiple sources of usage data for different formats and for multiple copies of titles that are available from several sources. A white paper by Luther on electronic journal usage statistics outlines important issues about data collection and interpretation that libraries face in getting usable data from vendors to measure and evaluate use of multimedia journal collections [15].

In designing this study, it was expected that print journal usage for those journal titles with an online subscription would decrease. Unknown was whether reliance on online, full-text journals would change information-seeking behaviors to the extent that relying on online access would decrease the use of journal titles available only in print. It was also expected that the level of ILL requests would drop to some extent, because a greater number of journal titles would be available in the online collection. However, the introduction of additional bibliographic databases and the resulting exposure to additional journal titles could offset the expected decrease. In summary, the purpose of this retrospective use study is to examine the impact of online, full-text journals on the use of print collections and ILL. Possible implications for collection development are also discussed.

METHODOLOGY

Journal use measurement

Print journal use statistics collected from 1995 to 1999 were used for the current study. Tabulation of print journal use (inhouse use, circulation, and ILL) was subdivided into the following journal year categories: 1995 to 1999, 1990 to 1994, 1985 to 1989, 1980 to 1984, 1970 to 1979, 1960 to 1969, 1950 to 1959, and pre-1950. The 104 online journals added in January 1999 were used as the independent variable. Certain criteria had to be met for a journal title to remain in the study. Journal titles without a print subscription from the beginning of 1995 through the end of 1999 were excluded from the study. In addition, journal titles with an online counterpart, outside of the 104 online titles added in January, were also dropped from the study. Remaining journal titles fell into two status groups: print journals with an online counterpart from a group of 104 online biomedical journals added in January 1999 (Online/Print Group) or print journals with no online subscription counterpart (Print Only Group). A total of 149 journals remained in the study: sixty-three, including thirty-three *AIM* titles, from the Online/Print Group and eighty-six journals, including thirty *AIM* titles, from the Print Only Group.

Use statistics for the 149 selected journals were entered into SPSS, and two sets of data were created. One set of data represented print journal use each year from 1995 to 1999 for journals published between January 1995 and December 1999. The other set of data represented print journal use from 1995 to 1999 for journals with pre-1950 to December 1994 publication dates. Print journal use statistics from journals with pre-1950 to 1994 publication dates were combined into one data set. Each spreadsheet contained the following information: journal name, print status, *AIM* status, and journal use by year for 1995, 1996, 1997, 1998, and 1999.

Interlibrary loan measurement

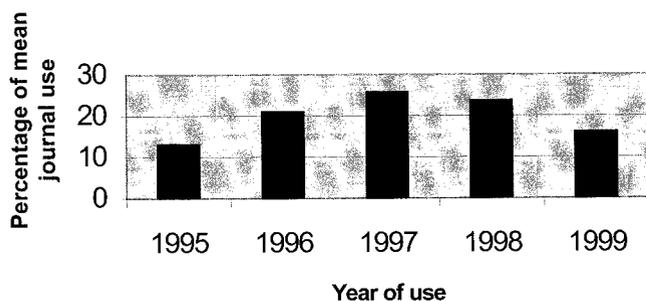
Interlibrary loan requests from UIC–Peoria students, faculty, and staff from 1998 through 2000 were used for the current study. Total requests each year from January to November were tabulated using QuickDoc, an ILL management system.

RESULTS

Journal publication years 1995 to 1999

A repeated measures analysis of variance (ANOVA) was performed to examine the effects of online journals on print journal use. There was a significant difference in the use of the print journals based on their status in the Print Only Group or Online/Print Group ($F(1,147) = 12.10, P < 0.001$). There was also a signif-

Figure 1
Mean journal usage of 1995 to 1999 print journals



icant difference in the use of the print journals each year ($F(4,588) = 39.06, P < 0.001$). These results showed that use of the print journals varied significantly from at least one year to the next. Figure 1 presents use patterns for the five years. Figure 2 presents use patterns for the five years by print status. Figure 3 presents use patterns for the five years by print status and AIM status.

Pairwise comparisons of each year showed that print journal use increased significantly each year until 1997 ($P < 0.05$) and decreased significantly in 1999 compared to 1998 ($P < 0.05$). A significant difference did not exist in the use of print journals between 1997 and 1998. To determine if print journal use significantly decreased in both print status groups from 1998 to 1999, additional separate comparisons were performed for each group. There was a significant decrease in the use of print journals in 1999 compared to 1998 ($P < 0.05$), regardless of whether the print journal was also available online.

Journal publication years pre-1950 to 1994

A repeated measures ANOVA was performed to examine the effects of online journals on print journal use. There was a significant difference in the use of the

Figure 2
Journal use of 1995 to 1999 journals by print status

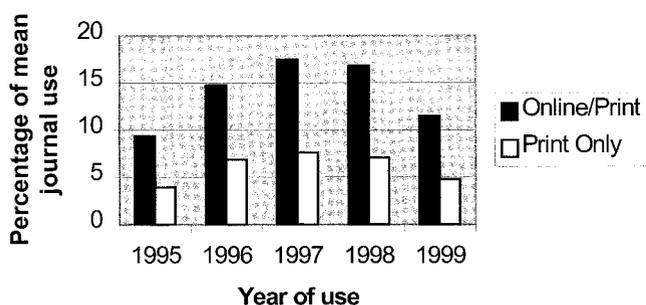
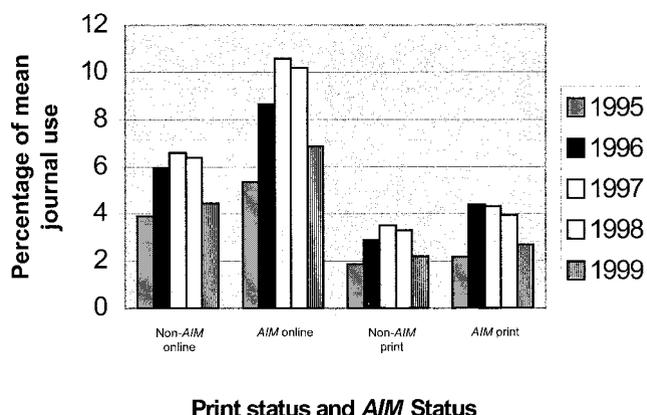


Figure 3
Use of 1995 to 1999 print journals by print status and Abridged Index Medicus (AIM) status



print journals based on their print status ($F(1,147) = 14.97, P < 0.001$) and in the use of the print journals by year ($F(4,588) = 104.51, P < 0.001$). Figure 4 presents use patterns for the five years by print status. Pairwise comparisons of each year showed that there was a significant decrease in journal use each year ($P < 0.05$).

Interlibrary loan 1998 to 2000

A one-way ANOVA was performed to examine the effects of online journals on ILL requests. There was a significant difference in ILL requests overall by year ($F(2,30) = 4.46, P < 0.02$). Therefore, the use of ILL varied significantly from at least one year to the next. The Scheffé's post hoc analysis showed a significant decrease in ILL requests occurred in 2000 ($P < 0.02$). Figure 5 presents ILL use patterns.

Figure 4
Journal use of pre-1950 to 1995 journals by print status

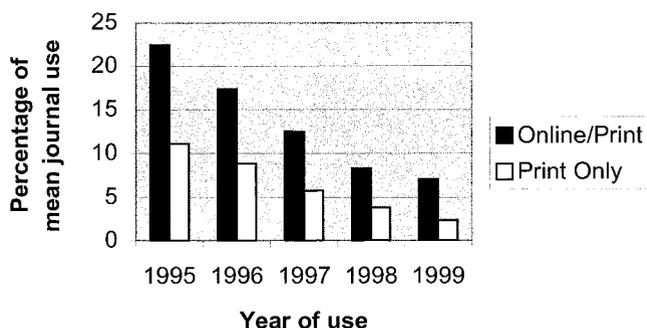
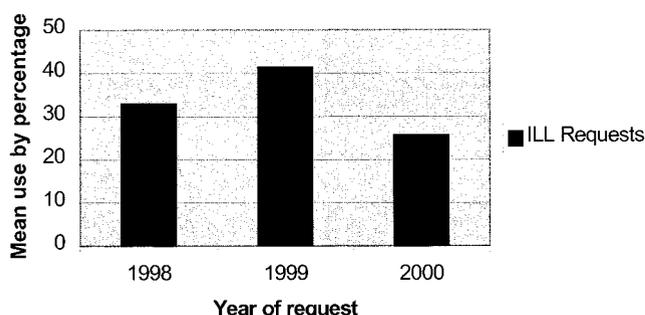


Figure 5
Interlibrary loan requests (January to November)



DISCUSSION

The results of this study may not represent the true use of the print journal collection, because journal-use studies often underestimate the extent to which a collection is used [16]. However, general use patterns do emerge. Print journals in the Online/Print Group experienced higher usage overall than journals in the Print Only Group. Selection criteria for purchasing online journal titles include the prominence of a journal and high use of the journal in print, and this could account for some of the difference in usage between these two groups. As the pre-1950 to 1994 print journals became older, their use significantly decreased each year. This use pattern reflects the findings of a study by Maxfield, DiCarlo, and DiCarlo, which found that after eighteen months, 50% of a journal's use has occurred [17]. After five years, approximately 90% of the use of a journal has occurred. Because use of older journals declines in general with age, it is difficult to determine if the introduction of online journals further impacted the decreasing reliance on older journal issues.

The results of the use study of journals from the years 1995 to 1999 suggested that the introduction of online journals had a negative impact on the use of the print journal collections for both the Print Only and Print/Online Groups. Journal usage increased each year from 1995 until 1997. The use statistics taken each year were cumulative within year categories, so each additional year created additional issues and volumes available within a title. Therefore, the additional journal issues in the collection probably accounted for the increase in usage. The lack of a significant increase in the use of journal titles between 1997 and 1998 could not readily be explained, although it did coincide with the introduction of fifteen online core biomedical journals. Another possibility was that the journal articles published in 1995/1996 might no longer have been viewed as current, resulting in less use of the 1995/1996 journals in 1997. This possibility was

supported by the pre-1950 to 1994 journal-use data and the study by Maxfield, DiCarlo, and DiCarlo [18]. As journal issues aged, patrons' reliance on the journals decreased.

The significant decrease in 1999 in use of the 1995-to-1999 print journals coincided with the introduction of 104 online core medical journals in January of 1999 and the subsequent introduction of another 1,000 journals from a variety of disciplines throughout the year. The decrease in use of the print collection suggested that patrons were instead accessing the journal titles online. The results of this study were in agreement with studies that have assessed the impact of full text on CD-ROM. Penn State, Eastern Washington, and St. John's University found the implementation of full text on CD-ROM decreased use of the print collection [19–21]. The results of this study also supported trends that have been observed in other studies examining the impact of remote database access. When possible, patrons preferred to access databases online and remotely [22–25]. The same appears to be true of online journals.

While use of print journals with an online counterpart decreased, these journals still retained higher usage than journals available only in print. However, the finding that journal usage was also declining for journals without an online counterpart raised concerns. Recall that thirty of the eighty-six titles available in the Print Only Group were *AIM* titles. This suggested that patrons might be sacrificing high-quality information for the sake of convenience by limiting selection to what was available in online full text. This trend has been observed in other studies as well. A small study conducted at Mercer University suggested students preferred convenience in selecting articles over quality [26]. Eastern Washington University also found that students preferred selecting articles based on full-text availability as opposed to selecting articles based on the relevance or quality of the information [27].

Interlibrary loan requests increased from 1998 to 1999 but decreased in 2000. No apparent reason was available for the increase in 1999, but it was possible that 1999 was an active year for research and therefore more literature was requested. In contrast, year 2000 ILL requests were significantly lower than 1998 and 1999 ILL levels. This decrease might be explained in part by the January 2000 acquisition of an additional 800 online journals focused on the sciences, including titles that had in the past been heavily requested through ILL. Given the current ILL-use patterns, determining what impact online journals have had on ILL was difficult. Mixed reports were found in the literature with regard to the impact of online journals on ILL [28–30].

CONCLUSIONS

The reduction in the use of titles available only in print suggests that library instruction should include a seg-

ment educating users to evaluate journals and articles for quality and reliability. This instruction may encourage users to pick articles based on quality, rather than convenience. In addition, libraries need to promote the availability of the print-only titles. Patrons may assume that all print journals owned by the library are also available online, a false assumption that would preclude use of quality titles such as those in the *AIM* set, some of which were available only in print in this study.

Although the results of this study demonstrate that the advent of online journals decreased the use of print titles, actual use declined only by slightly more than a quarter in 1999 compared to 1998. It is not reasonable to cancel print titles with online duplicates based on these findings. The impact of online journals on print journal usage needs to be studied for a longer period of time to achieve a better understanding of emerging use patterns. Therefore, definitive conclusions regarding implications for collection development, in terms of whether print journal subscriptions should be dropped if an online license is owned, cannot be made at this time. However, users' apparent preference for online over print journals suggests new journal titles added to a collection should be made available online, if possible. Nevertheless, having campuswide access to the online journals does allow site libraries with smaller collections the opportunity to drop lower-use print titles with online counterparts and add unique print titles of particular relevance to local users and of importance to the overall UIC collection.

If the observed preference for online titles continues, collection development policies may begin to reflect these changes. Policies will need to address the issues of title duplication in print and online formats, electronic access only, and continuation of print-only titles. If libraries make the choice for electronic access without print, there are important implications for current ILL practices. Libraries are beginning to challenge vendor licenses that prohibit the use of electronic titles to fill ILL requests. Without the guarantee of fair use in the copyright guidelines for electronic collections, traditional ILL among libraries will be diminished and access to information severely compromised.

The library in the current study subscribes to 400 journal titles in print, and, with the addition of more than 3,000 online journals, approximately 90 journals remain available only in print. The results of this study need to be replicated in a larger library where the number of journal titles available in print exceeds, or is comparable to, the number of journal titles available online. It is probable that in larger libraries more titles will remain available only in print, and reliance on the print collection may be more likely to continue.

Use-log data for online journals should also be examined to see which journals are heavily used and

which journals experience low usage. These data could suggest which disciplines are more likely to use online journals and be helpful in determining the direction of further online collection development areas.

Further studies are needed to examine the impact of online journals on information-seeking behaviors and patron use patterns. Studies to assess the characteristics of online journal users and user preferences for online or print journals will inform future collection development decisions. Some user characteristics already seem apparent, such as undergraduate students' preference for the convenience of full-text articles [31, 32]. However, research is needed to examine if the introduction of full text is affecting how professional school students and faculty obtain information. Studies are needed to track whether reliance on convenient personal journal collections will shift to include reliance on online journal collections. Studies to assess if computer literacy plays a role in the choice between online or print will further inform collection development decisions and library instruction programs.

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