An assessment of collections at the University of Wisconsin–Madison Health Sciences Libraries: drug resistance

*By Phillip L. Bergen, M.A.**
Information Services Librarian

Dolores Nemec, M.A.
Pharmacy Librarian

Health Sciences Libraries
University of Wisconsin–Madison
Madison, Wisconsin 53706

In December 1997, the authors completed an in-depth collection assessment project at the University of Wisconsin–Madison Health Sciences Libraries. The purpose was to develop a framework for future collection assessment projects by completing a multifaceted evaluation of the libraries' monograph and serial collections in the subject area of drug resistance. Evaluators adapted and synthesized several traditional collection assessment tools, including shelflist measurement, bibliography and standard list checking, and citation analysis. Throughout the project, evaluators explored strategies to overcome some of the problems inherent in the application of traditional collection assessment methods to the evaluation of biomedical collections. Their efforts resulted in the identification of standard monographs and core journals for the subject area, a measurement of the collections' strength relative to the collections of benchmark libraries, and a foundation for future collection development within the subject area. The project's primary outcome was a collection assessment methodology that has potential application to both internal and cooperative collection development in medical, pharmaceutical, and other health sciences libraries.

INTRODUCTION

Although much has been written about collection assessment in academic libraries, the body of literature regarding collection assessment in health sciences libraries is relatively small [1]. This dearth of literature exists despite the fact that health sciences librarians have recognized the application of traditional methods of collection assessment to the evaluation of biomedical collections as problematic [2]. In December 1997, the authors completed an in-depth collection assessment project at the University of Wisconsin (UW)–Madison Health Sciences Libraries (HSL). The purpose was to develop a framework for future collection assessment projects by completing a multifaceted evaluation of the libraries' monograph and serial collections in a specific subject area.

BACKGROUND

The UW–Madison Health Sciences Libraries comprise three libraries, the Middleton Health Sciences Library, the Weston Clinical Science Center Library, and the Power Pharmaceutical Library. Because the libraries support students, faculty, and researchers in both the clinical and basic sciences, the evaluators considered drug resistance to be a particularly appropriate subject area for evaluation. Since the 1950s, health professionals, clinical and basic science researchers, and lay people alike have shown a growing interest in drug resistance, which, defined in its broadest sense, includes resistance of organisms or conditions to antimicrobi-

* Currently at Falk Library of the Health Sciences, University of Pittsburgh, 200 Scaife Hall, De Soto and Terrace Streets, Pittsburgh, PA 15261.

als, antineoplastic agents, multiple drugs, hormones, insulin, and insecticides [3]. Recently, interest in the subject has intensified as increasing numbers of microorganisms have become resistant to conventional drug therapy. According to Jungkind et al.:

> One of the most ominous trends in the field of antimicrobial chemotherapy over the past decade has been the increasing pace of development of antimicrobial resistance among microbial pathogens .... Physicians are now seeing and treating patients for which there are few therapeutic alternatives, and in some cases, none at all [4].

Interest in drug resistance is clearly evident at the UW–Madison. Evaluators have identified over 150 faculty and researchers in over twenty-five different schools and departments, including medicine, pharmacy, biochemistry, bacteriology, molecular virology, and veterinary medicine, who have conducted research on the problem within the last five years.

METHODOLOGY

Librarians have used several well-established methods to evaluate collections, including shelflist measurement to count titles, comparisons with benchmark libraries, bibliography and standard list checking, citation analysis, user surveys, and circulation and in-house use studies. Evaluators examined each of these methods to determine its feasibility given the limitations imposed by the libraries' environment and the subject area under evaluation. In many instances, evaluators found it necessary to alter and, in certain cases, forego traditional methods of evaluation.

1. Title count

Traditional collection assessment methods, for example, the Research Libraries Group (RLG) conspectus [5], have organized both quantitative and qualitative evaluation of subject collections around discrete classification ranges. The subject of drug resistance, however, has no specifically assigned place in either the National Library of Medicine (NLM) or the Library of Congress (LC) classification schemes, despite its clear conceptual representation in their respective subject heading schemes. Rather, materials are classified according to the type of drug encountering resistance, such as antibiotics, or the type of condition showing resistance, such as neoplasms. This lack of a discrete classification range precluded shelflist measurement, which in its traditional, manual form has already become obsolete in many automated environments. Quantifying collection strength, therefore, necessitated the use of either controlled vocabulary or natural language searches of MadCat, the UW–Madison libraries' online catalog, to identify relevant materials.

In order to avoid false drops produced by natural language searches, evaluators searched MadCat using the appropriate NLM and LC subject headings to identify relevant titles in all formats. Because of the rapid rate of development in the subject area, evaluators placed emphasis on current materials (those titles published between 1993 and 1997). Although this subject heading-based approach deviated from tradition, it offered some advantages compared to classification-based measurement. Because their assignment was equally subjective, neither classification numbers nor subject headings offered a more reliable basis for measurement. One advantage of using subject headings as a basis for measurement, however, was that items might be assigned more than one subject heading. Thus, evaluators were better able to identify all materials relevant to the subject area. Another advantage was that not all online catalogs permit classification number searches. By using subject headings, evaluators were able to search different online catalogs using consistent terminology.

2. Comparisons with benchmark libraries

Collection assessment data tend to be ambiguous outside of a context of comparison. Evaluators therefore have considered comparisons with benchmark libraries to be essential. The institutions of the Committee on Institutional Cooperation (CIC), which comprises the Big Ten Universities and the University of Chicago, were the primary benchmarks for comparison. Not only do their sizes and missions closely match the UW–Madison's, the CIC Virtual Electronic Library promises to increase interlibrary lending and cooperative collection development among CIC libraries. Also, these institutions' health sciences libraries constitute almost one-third of the resource libraries for the Greater Midwest Region (GMR) of the National Network of Libraries of Medicine (NN/LM). For a benchmark outside the region, evaluators chose the University of California at San Francisco based on the reputation of its pharmacy and medical schools. The comprehensive collection of the National Library of Medicine was used as a standard against which to compare all other collections.

3. Bibliography and standard list checking

List-checking of health sciences collections is complicated by a relative scarcity of recommended lists other than the Brandon-Hill lists [6]. The specific nature of the subject area under analysis further complicated this situation. Evaluators located one bibliography on drug resistance, but most citations were to older journal articles published prior to 1993 [7]. Bibliographies from texts on the subject primarily cited journal literature, as well. Evaluators decided to use the recent holdings of the National Library of Medicine and other benchmark libraries to create a standard list of mono-

Table 1
Selected list of drug resistance monographs*

1.	*Alternative Mechanisms of Multidrug Resistance in Cancer,* Kellen JA, ed., 1995	est. $85.00
2.	*Antibiotic Resistance: From Molecular Basics to Therapeutic Options,* Amabile-Cuevas CF, ed., 1996	$89.50
3.	*Antibiotic Resistance: Origins, Evolution, Selection and Spread,* Chadwick DJ and Goode J, eds., 1997 (*CIBA Foundation Symposium,* no. 207)	$90.00
4.	*Antibiotic Resistance Transfer in the Mammalian Intestinal Tract,* Salyers AA, 1995	$69.00
5.	*Anticancer Drug Resistance: Advances in Molecular and Clinical Research,* Goldstein LJ and Ozols RF, eds., 1994 (*Cancer Treatment and Research, v. 73*)	$221.50
6.	*Antimicrobial Resistance: A Crisis in Health Care,* Jungkind DL et al., eds., 1995 (*Advances in Experimental Medicine and Biology,* v. 390)	$79.50
7.	*Antiviral Drug Resistance,* Richman DD, ed., 1996	$94.95
8.	*Breakout: The Evolving Threat of Drug Resistant Disease,* Lappe M, 1995	$14.00
9.	*Chemosensitivity Testing in Gynecologic Malignancies and Breast Cancer,* Koechli OR, Sevin BU, and Haller U, eds., 1994	$186.25
10.	*Diabetes, Obesity, and Hyperlipidemias V: The Plurametabolic Syndrome,* Crepaldi G, Tiengo AK, and Manzato E, eds., 1993	$211.25
11.	*Dietary Lipids and Insulin Action,* Klimes I, ed., 1993 (*Annals of the New York Academy of Sciences,* v. 683)	est. $93.50
12.	*Drug and Hormonal Resistance in Breast Cancer: Cellular and Molecular Mechanisms,* Dickson RB and Lippman ME, eds., 1995	$95.00
13.	*Drug Resistance,* Hait WN, ed., 1996 (*Cancer Treatment and Research,* v. 87)	$347.00
14.	*Drug Resistance in Oncology,* Bernal SD, ed., 1997 (*Basic and Clinical Oncology,* no. 13)	est. $195.00
15.	*Drug Transport and Resistance in Antimicrobial and Anticancer Chemotherapy,* Georgopapadakou NH, ed., 1995 (*Infectious Disease and Therapy,* v. 17)	$195.00
16.	*Impacts of Antibiotic Resistant Bacteria,* U.S. Office of Technology Assessment, 1995	N/A†
17.	*Insulin Resistance,* Moller DE, ed., 1993	$225.00
18.	*Insulin Resistance in Human Disease,* Kuh KB, Shinn SH, and Kaneko T, eds., 1993	$218.00
19.	*Mechanism and New Approach on Drug Resistance of Cancer Cells,* Miyazaki T, Takaku F, and Sakurada K, eds., 1993 (*International Congress Series,* no. 1026)	$166.75
20.	*Multidrug Resistance in Cancer Cells: Molecular, Biochemical, Physiological and Biological Aspects,* Gupta S and Tsuro T, eds., 1996	$106.95
21.	*Origin, Evolution and Spread of Antibiotic Resistance Genes,* Amabile-Cuevas CF, 1993	$94.00
22.	*PCR Protocols for Emerging Infectious Diseases: A Supplement to Diagnostic Medical Microbiology,* Persing DH, ed., 1996	$34.95
23.	*Plague Makers: How We Are Creating Catastrophic New Epidemics and What We Must Do to Avert Them,* Fisher JA, 1994	$23.00
24.	*Preclinical and Clinical Modulation of Anticancer Drugs,* Tew KD, Houghton PJ, and Houghton JA, 1993	$129.00
25.	*Understanding Antibacterial Action and Resistance,* Russell AD and Chopra I, 1996	$73.00
	Total cost for all 25 titles	$3,137.10
	Average cost per title	$130.70

* These were the twenty-five most commonly held titles. Prices are publishers' prices from *Books in Print PLUS,* February 1998, except where indicated.
† Available at http://www.wws.princeton.edu/~ota/disk1/1995/9503.html.

graphs. The online catalogs of the respective libraries were searched using the appropriate NLM and LC headings, and results were limited to the dates 1993 to 1997 in order to focus on currency. Titles held by two or more libraries were selected to produce a list of thirty-eight titles (Table 1).

4. Citation analysis

Because of the importance of journal literature in the health sciences, evaluators were especially interested in identifying core journals for the subject area. Two journals, *Drug Resistance Weekly* and *Microbial Drug Resistance,* were identified in the subject search of MadCat. Other journal titles in the subject area were not so easy to identify. The subject of drug resistance did not fit neatly into the broad subject categories of the *List of Journals Indexed in Index Medicus* [8] or *Journal Citation Reports* [9]. Furthermore, research in the subject area was highly interdisciplinary, so publication was scattered widely throughout the journal literature of both the clinical and basic sciences.

To overcome this problem, evaluators adapted a method to identify the most productive journals in the subject area from D. F. Sittig's article, "Identifying a Core Set of Medical Informatics Serials: An Analysis Using the MEDLINE Database" [10]. A form of citation analysis, the method involved searching a recent date range of MEDLINE using the MeSH heading "drug resistance" exploded and restricted to focus (i.e., "exp *drug resistance"). The results were saved as a text file and a relational database was used to count the number (n) of citations indexed in the subject area from each journal. The total number (t) of articles indexed from each journal was then identified by performing a journal name search in the same date range of MEDLINE. The percentage (*P*) of each journal's articles indexed in the subject area was calculated using spreadsheet software to divide the number of articles indexed

in the subject area by the total number of articles indexed ($P = n/t$). A ranking index (r) that weighted each measure of productivity equally was then calculated for each journal using the spreadsheet to multiply the number of articles indexed in the subject area by the percentage of articles indexed in the subject area ($r = nP$). Evaluators selected the thirty most productive journals to use as a standard list (Table 2).

5. Interlibrary loan/document delivery analysis

The HSL interlibrary loan and document delivery departments do not collect data regarding specific subjects. However, the interlibrary loan department does track requests for articles in recent journal issues in order to comply with United States copyright laws. These data show that of the core journals not owned on campus, none had been requested within the past year. No data were available for document delivery among campus libraries.

6. Circulation and in-house use studies

As online circulation systems improve in their ability to collect data and create reports, manual methods to gauge use of materials increasingly become obsolete. The UW–Madison libraries' current NOTIS circulation system can only provide absolute numbers for circulation and in-house use of monographs and cannot show use during a specific date range, use by type of user, or average use. Evaluators used six-month journal circulation reports to determine recent circulation and in-house use of core journals at the three libraries, but they were once again unable to determine use by type of user or to make comparisons to average use. More extensive information might have been obtained by manual data collection, but the lack of a discrete classification range for the subject area and the limited amount of staff resources allocated for the project prohibited a manual use study.

7. User surveys

Evaluators did not consider a general survey of library users to be constructive given the narrow subject area and limited staff resources. Selected faculty were interviewed informally regarding their use of collections in the subject area. These faculty indicated general satisfaction with the quality and scope of the HSL collections.

RESULTS

Clearly, the UW–Madison Health Sciences Libraries are the primary resource centers on the campus for the subject area of drug resistance, owning roughly 90% of the campus' materials in the subject area. Comparisons with benchmark libraries show that HSL holdings in the subject area, supplemented by the relatively small holdings of other campus libraries, are almost as strong as those at the NLM and compare favorably to those of the four strongest peer institutions. At the time of evaluation, the HSL owned 156 titles (all formats) in the subject area, approximately twice the number that the average peer institution's libraries owned. This disparity may reflect differences in cataloging practices at the different institutions, especially with regard to cataloging of analyzed journal titles. However, the HSL own twenty-four of the thirty-eight standard monograph titles, second only to the NLM. The UW–Madison libraries also own twenty-six of the thirty core journals, with only the NLM and the University of Minnesota owning more (Table 3).

CONCLUSIONS

This project had several beneficial outcomes for the Health Sciences Libraries. Evaluators' efforts provided staff with a better understanding of the relative strength of the libraries' collections in the subject area both on campus and in the region. They identified for selectors a number of monographs to purchase to further strengthen those collections and two journal subscriptions to consider for cancellation because of unwarranted duplication. They also confirmed a problem already recognized by librarians at the UW–Madison, that of data collection and analysis. The lack of sufficient circulation and interlibrary loan data was the greatest impediment to a more complete picture of the libraries' collections. Fortunately, planners have addressed the problem of circulation data collection and analysis in the request for proposal (RFP) for a new University of Wisconsin System-wide integrated library management system to be purchased within the next year [11].

Most importantly, evaluators have developed a methodology to guide future collection assessment projects at the HSL that provides strategies to overcome some of the problems encountered in the application of traditional collection assessment methods. This general methodology can be summarized as follows:

1. Use subject classification or subject heading searches of the online catalog to quantify collections in the subject area.
2. Select benchmark libraries (those with a similar environment, user group, etc.) for purposes of comparison. Use the same search criteria as used in step one to quantify benchmark library collections in the subject area.
3. Check local and benchmark library monograph holdings against bibliographies and standard lists. In the absence of suitable bibliographies or standard lists, create a standard list of monograph titles commonly held among benchmark libraries.

Table 2
Core journals for the subject of drug resistance: citations in MEDLINE, 1993–September 1997*

Title (n > 7)	Number (n) of citations in subject	Total # (t) indexed	Percentage (*P* = n/t) of articles in subject	Rank index (*r* = n**P*)
Microbial Drug Resistance	47	140	33.57%	15.77857
Antimicrobial Agents & Chemotherapy	160	2,428	6.59%	10.54366
Journal of Antimicrobial Chemotherapy	104	1,510	6.89%	7.16291
Japanese Journal of Antibiotics	56	508	11.02%	6.17323
Diabetes	86	1,228	7.00%	6.02280
Metabolism: Clinical & Experimental	81	1,234	6.56%	5.31686
Diabetologia	68	1,100	6.18%	4.20364
European Journal of Clinical Microbiology & Infectious Diseases	59	980	6.02%	3.55204
Journal of Hospital Infection	47	625	7.52%	3.53440
Kansenshogaku Zasshi—Journal of the Japanese Association for Infectious Diseases	49	705	6.95%	3.40567
Cytotechnology	27	228	11.84%	3.19737
Diagnostic Microbiology & Infectious Disease	39	476	8.19%	3.19538
Oncology Research	26	272	9.56%	2.48529
Journal of Chemotherapy	33	484	6.82%	2.25000
Bulletin du Cancer	35	618	5.66%	1.98220
Infection Control & Hospital Epidemiology	34	649	5.24%	1.78120
Journal of Clinical Microbiology	72	3,187	2.26%	1.62661
Clinical Infectious Diseases	69	2,965	2.33%	1.60573
Anticancer Research	59	2,223	2.65%	1.56590
International Journal of Cancer	64	2,779	2.30%	1.47391
British Journal of Cancer	58	2,382	2.43%	1.41226
Journal of Clinical Endocrinology & Metabolism	65	3,027	2.15%	1.39577
Journal of Economic Entomology	11	87	12.64%	1.39080
American Journal of Hypertension	36	1,023	3.52%	1.26686
Cancer Research	72	4,603	1.56%	1.12622
Diabetic Medicine	31	909	3.41%	1.05721
Plasmid	16	252	6.35%	1.01587
Journal of Bacteriology	69	4,813	1.43%	0.98920
Chemotherapy	17	326	5.21%	0.88650
European Journal of Cancer	43	2,178	1.97%	0.84894

* These were the thirty most productive journals, based on the number and percentage of articles published in the subject area.

Table 3
Holdings of UW–Madison and benchmark institution libraries, October 1997: subject of drug resistance

	Total # of titles owned (all formats)	# of titles owned, 1993–	# of standard monographs owned (of 38)	# of core journals owned (of 30)
UW–Madison Health Sciences Libraries	156	56	24	23
UW–Madison*†	175	60	27	26
National Library of Medicine	240	54	32	30
Indiana University	55	13	11	23
Michigan State University†	62	10	9	19
Northwestern University†	76	13	9	17
Ohio State University*†	73	25	22	24
Pennsylvania State University	37	9	7	20
Purdue University*	49	13	12	16
University of California–San Francisco*†	67	15	12	19
University of Chicago†	54	17	16	21
University of Illinois–Chicago*†	76	19	16	24
University of Illinois–Urbana	42	8	7	9
University of Iowa*†	50	6	6	24
University of Michigan*†	82	20	17	24
University of Minnesota*†	101	36	21	29

* School of pharmacy on main campus.
† Medical school on main campus.

4. Check local and benchmark library journal holdings against bibliographies, standard lists, or subject lists in *List of Journals Indexed in Index Medicus* or *Journal Citation Reports.* In the absence of such lists, create a list of core journals using the citation analysis method described in the Methodology section.
5. Analyze available interlibrary loan, document delivery, and circulation data to determine use of materials in the subject area.
6. Survey users, either formally or informally, as resources allow.

Evaluators at one of the project's benchmark libraries are currently testing this collection assessment methodology. Their findings will be used to determine its effectiveness for evaluation of other subject areas and for use at other institutions.

The project's larger implications for the HSL are difficult to determine. The primary limitation of an evaluation such as this one is that the information gathered is essentially ambiguous, especially without bases of comparison to other subject areas and to the collections as a whole. More extensive, useful data may have been collected by conducting longitudinal use studies, performing other types of citation analysis, or administering surveys to primary user groups. Nonetheless, there simply is no completely objective way to determine the quality of library collections. These judgments must always rest on subjective interpretations of performance measures, an understanding of the library's and the institution's policies and priorities, and the opinions of library users.

The project's larger implications for the campus and the region were clearer, however. The resulting methodology would have great potential for use in cooperative collection development, especially at a large research university, where interdisciplinary research could result in unnecessary duplication of materials among libraries with otherwise distinct collection development goals. The application of collection assessment methodologies to cooperative collection development efforts within library networks was by no means a new idea; GMR libraries completed a conspectus project aimed at coordinated collection development in the late 1980s [12]. The HSL project affirmed the benefit of such evaluations. Quantitative analysis of collections at the UW–Madison and at CIC libraries showed clearly which libraries were stronger and which were weaker in the subject area. Identification of holdings of specific titles gave an even more accurate picture of collection strengths. As material budgets continue to shrink, libraries engaged in cooperative efforts may want to re-examine the cost-benefit of collection evaluation in order to divide collection development responsibilities more rationally, to avoid unnecessary duplication, and to develop more efficient interlibrary loan and document delivery pathways.

ACKNOWLEDGMENT

The authors would like to thank Karen Dahlen, director of the University of Wisconsin–Madison Health Sciences Libraries, for her many valuable suggestions throughout the course of the project and the writing of this article.

REFERENCES

1. RICHARDS DT, EAKIN D. Collection development and assessment in health sciences libraries. Lanham, MD: Medical Library Association and Scarecrow Press, 1997:184. (Current Practices in Health Sciences Librarianship, v.4).
2. CARLSON BA. Collection development assessment of biomedical serials collections. Serials Libr 1993;23(3–4):290.
3. Medical subject headings—tree structures. Bethesda, MD: United States Department of Health and Human Services, Public Health Service, National Institutes of Health, National Library of Medicine, 1997:739.
4. JUNGKIND DL, MORTENSEN JE, FRAIMOW HS, CALANDRA GB, EDS. Antimicrobial resistance: a crisis in healthcare. New York, NY: Plenum Press, 1995:vii. (Advances in Experimental Medicine and Biology, v. 390).
5. REED-SCOTT J. Manual for the North American inventory of research library collections. Rev. ed. Washington, DC: Association of Research Libraries, 1988.
6. CARLSON, op.cit., 291.
7. ULINCY LD, GOTTESMAN MM. Multidrug resistance: January 1988 through September 1992: 2,250 citations. Bethesda, MD: United States Department of Health and Human Services, Public Health Service, National Institutes of Health, National Library of Medicine, 1992. (Current Bibliographies in Medicine, no. 92-9).
8. List of journals indexed in Index Medicus. Bethesda, MD: United States Department of Health and Human Services, Public Health Service, National Institutes of Health, National Library of Medicine, 1997.
9. SCI journal citation reports on CD-ROM: 1996 science edition. [CD-ROM]. Philadelphia, PA: Institute for Scientific Information, 1997.
10. SITTIG DF. Identifying a core set of medical informatics serials: an analysis using the MEDLINE database. Bull Med Libr Assoc 1996 Apr;84(2):200–4.
11. UNIVERSITY OF WISCONSIN SYSTEM, DIVISION OF PROCUREMENT. Request for proposal (RFP) for University of Wisconsin System integrated library and information access system. [Web document]. Madison, WI: State of Wisconsin, University of Wisconsin System, 1997. [rev. 22 Dec 1997; cited 8 Apr 1998]. Available from Internet: <http://www.library.wisc.edu:4000/RFP/>.
12. MILLSON-MARTULA CA. The Greater Midwest Regional Medical Library Network and coordinated cooperative collection development: the RLG conspectus and beyond. Ill Libr 1989 Jan;71(1):31–9.

Received April 1998; accepted July 1998