October, 2007

Public health citation patterns: An analysis of the American Journal of Public Health, 2003-2005

Melissa L. Rethlefsen, *Mayo Clinic*
Lisa C. Wallis, *Northeastern Illinois University*

Public health citation patterns: an analysis of the *American Journal of Public Health*, 2003–2005 EC

Melissa L. Rethlefsen, MLS; Lisa C. Wallis, MSPH, MS

See end of article for authors' affiliations.

DOI: 10.3163/1536-5050.95.4.408

Objectives: The research sought to determine the publication types cited most often in public health as well as the most heavily cited journal titles.

Methods: From a pool of 33,449 citations in 934 articles published in the 2003–2005 issues of *American Journal of Public Health*, 2 random samples were drawn: one (n = 1,034) from the total set of citations and one (n = 1,016) from the citations to journal articles. For each sampled citation, investigators noted publication type, publication date, uniform resource locator (URL) citation (yes/no), and, for the journal article sample, journal titles. The cited journal titles were analyzed using Bradford zones.

Results: The majority of cited items from the overall sample of 1,034 items were journal articles (64.4%, n = 666), followed by government documents (n = 130), books (n = 122), and miscellaneous sources (n = 116). Publication date ranged from 1826–2005 (mean = 1995, mode = 2002). Most cited items were between 0 and 5 years old (50.3%, n = 512). In the sample of 1,016 journal article citations, a total of 387 journal titles were cited.

Discussion: Analysis of cited material types revealed results similar to citation analyses in specific public health disciplines, including use of materials from a wide range of disciplines, reliance on miscellaneous and government documents, and need for older publications.

Highlights

- Public health relies on resources from many disciplines, particularly medicine and its specialties. Over half of the journals cited in *American Journal of Public Health* were from disciplines other than public health.
- The 1,016 sampled journal article citations represented 387 journal titles; 14 journals were Zone 1 titles.
- Books were used far less than government documents and miscellaneous items.

Implications

- Public health practitioners publishing in *American Journal of Public Health* utilize a wide range of traditional and nontraditional materials and require access to older as well as current materials.
- Using ISI Web of Science data for performing citation analyses should be viewed with caution because it may omit a significant number of citations, particularly in disciplines citing nontraditional resources.
- Performing citation analyses with sampled data is a useful alternative to working with massive data sets, though for journal article citations, not enough spread may be present to delineate journals into accurate zones.

EC A supplemental part of Table 4 is available with the online version of this journal.

INTRODUCTION AND LITERATURE REVIEW

Public health is an extremely diverse discipline, encompassing myriad occupations such as epidemiologist, engineer, licensing and inspection specialist, public health nurse, microbiologist, health economist, statistician, health educator, and toxicologist. The approximately 450,000 public health professionals employed in federal, state, and local public health agencies in the United States are joined in contributing to the public's health by well over 3 million staff, volunteers, and other personnel outside of government agencies [1]. Like other multidisciplinary fields, public health has a literature difficult to map and analyze, especially as public health spans medicine, social science, and other fields [2].

One strategy librarians have employed in other multidisciplinary fields is citation analysis [3, 4]. Citation analyses and bibliometric studies of public health have largely focused on two factors: impact factors and authorship trends [5–8].

Public health's subdisciplines have undergone more extensive bibliometric analysis than the general field of public health. Several recent studies have measured various countries' output in virology [9], microbiology [10], parasitology [11], and infectious diseases [12, 13]. Other bibliometric investigations have considered the public health subdisciplines of prevention research [14], health education [15], occupational health [16], tropical medicine [17, 18], epidemiology [19], public health nursing [20], and health care management [21].

The current project was inspired by the work of the Task Force on Bibliographic Access for the Allied Health Literature, which published a series of papers starting in 1997 in the *Journal of the Medical Library As-*

sociation (formerly, *Bulletin of the Medical Library Association*), using a common methodology noting publication types, dates, and journal titles cited in source allied health journals. To date, no one has done similar work in the general area of public health, a broad interdisciplinary field that might be expected to yield unique citation analysis results. This study differed slightly from the task force work in that only one source journal, the *American Journal of Public Health (AJPH)*, was analyzed and a sample of cited items was drawn from that journal. The purpose of this study was to determine the publication types cited most often in a public health sample as well as the most commonly cited journal titles.

METHODOLOGY

The researchers elected to examine the citations from a single journal, *AJPH*, which is the general (as opposed to specialty) public health journal with the highest impact factor and total number of citations in the ''Public, Environmental, and Occupational Health'' category in both the Science and Social Science Editions of the 2004 Journal Citation Reports (JCR), with the exception of the *Annual Review of Public Health* [22, 23]. The researchers decided that the *Annual Review*, while an important resource in the field, might have an artificially inflated impact factor because it is published only once a year and includes only review articles. *AJPH* is also the official journal of the American Public Health Association, the primary professional organization founded ''to represent all disciplines and specialties in public health'' [24].

At the start of this research, the researchers downloaded ISI Web of Science data for all journal issues of the *AJPH* published in 2003–2005. This initial download resulted in 1,299 citing items, of which 908 were designated ''articles'' or ''review'' articles by ISI, as the authors decided to omit letters, editorials, and historical pieces. These 908 articles yielded 30,695 cited items according to the ISI data. On closer inspection, however, the researchers discovered that a large number of cited items were missing from the data, in particular ''unusual'' publication types such as Web resources and court cases. Due to these omissions, the researchers instead manually built a data set of all qualifying articles by hand-counting and sequentially numbering the citations in each article.

The manual review of all 37 issues of the *AJPH* from 2003–2005 resulted in 934 citing articles that yielded 33,499 cited items. Letters, editorials, editor's choice, other departments, ''Faces of Public Health,'' ''Images of Health,'' and ''Voices from the Past'' articles from *AJPH* were not included in the pool of citing articles. These categories were excluded for a variety of reasons. For example, the researchers felt that letters to the editor and editorials, because they often self-cite, could skew the results. ''Voices from the Past'' are article reprints, generally from the 1960s or earlier, and thus did not reflect current public health information needs.

Of the overall pool of cited items, 21,397 (63.9%) were journal articles. Because of the dual purpose of this study—to determine the publication types cited most often in public health as well as the most influential journal titles—the researchers next drew 2 samples. The first, a sample drawn from the overall pool of 33,499 cited items, was intended to yield data regarding the most frequently cited publication types and their age at time of citation. The second, a sample drawn from the 21,397 cited journal articles, was intended to provide data describing the most often cited journal titles and the breadth of journals consulted in public health research. Upon consultation with a statistician and using a sample size generator, it was determined that to achieve a 95% confidence level with a $\pm 3\%$ confidence interval, 1,034 items would be sampled from the complete cited item set; a second sample of 1,016 items was drawn from the set of cited journal articles [25]. Items were drawn from each sample randomly using an online random number generator [26]. Because each sample was drawn randomly without reference to the other, journal article citations had a random chance of being selected for both samples.

Collected data included publication type, publication date, and uniform resource locator (URL) citation (yes/no) for the cited item data set. Publication types were categorized as journal articles, books, government documents, or miscellaneous, the four categories Schloman used in her study of the health education literature [15], a public health specialty. Government serials, except for statistical publications such as the National Center for Health Statistics' *Vital and Health Statistics Series*, were coded as journals. Miscellaneous data included public laws, court cases, conference proceedings, and dissertations, among other things. Websites without a print-equivalent book, journal, or government publication were also coded as miscellaneous.

Cited item age was calculated by subtracting the cited item publication date from the citing article publication date. Data from the cited journal article sample included only the full journal title and the publication date. In all cases, the most current title of a journal was used for analysis; older title data were updated to current titles. All data were analyzed with SPSS software using cross-tabulations and the chi-square statistic with a P-value threshold of 0.05.

The journal titles in the cited journal article sample were also analyzed according to Bradford zones using the methodology utilized by the Mapping the Literature of Nursing Project [27]. For each journal title cited two or more times, the subject discipline was recorded. Subject discipline categories were determined by using the first subject listed for each title in the 2005 Science and Social Science portions of the JCR database's categorizations [28, 29]. For the ten titles that had no listing in either the Science or Social Science JCR, a subject discipline was assigned based on scope and material using similar titles as a guide. The thirty-six identified categories were merged into ten broader categories. For example, JCR categories ''Allergy'' and ''Obstetrics and Gynecology'' were included in the broad category ''Medicine and Medical Disciplines.''

Table 1
Cited format types by frequency of citations, overall cited item sample (n = 1,034)

Cited format type	Citations	
	No.	%
Journal article	666	64.4
Government document	130	12.6
Book	122	11.8
Miscellaneous	116	11.2
Total	1,034	100.0

RESULTS

Overall cited item sample (n = 1,034)

As in the original cited item population that the samples were drawn from, journal articles represented around 64% (64.4%, n = 666) of the total cited item sample (Table 1). Government documents were the next most frequently cited publication type (12.6%, n = 130), though they were cited only slightly more often than either books (11.8%, n = 122) or miscellaneous items (11.2%, n = 116). Only 69 cited items (6.7%) included a URL.

Table 2 indicates the age of cited items at time of citation by publication type. Cited item dates ranged from 1826–2005, with a mean date of 1995, median date of 1997, and a mode of 2002. Sixteen items did not have a reliable date of publication, primarily because they were Web resources without a publication or last updated date. One journal article was cited while in press. Among the remaining 1,017 cited items, half (50.3%, n = 512) were anywhere from 0–5 years old at the time they were cited. A statistically significant association ($P < 0.001$) was observed between cited item age and publication type, with cited books more likely to be older at time of citation than any of the other publication types.

Cited journal article sample (n = 1,016)

The 1,016 citations in the cited journal article sample came from 387 journals. Analysis of the journal article sample showed that approximately 14 journals cited in *AJPH* accounted for one-third of the literature. These 14 could be considered the core Zone 1 journals, accounting for the greatest number of citations, in general public health (Table 3). It was difficult to draw conclusions beyond that zone, however, because a sample was analyzed. The remaining cited journal titles did not have enough of a spread to clearly identify distinct zones. That is, the second third (Zone 2) of cited articles was located somewhere among the journals receiving 2 citations.

Table 3
Top cited journal titles, cited journal article sample (n = 1,016) (Bradford Zone 1 titles)

Journal title	Times cited	Percent of total	Cumulative percent
Am J Public Health	87	8.6	8.6
JAMA	48	4.7	13.3
N Engl J Med	25	2.5	15.7
Am J Prev Med	23	2.3	18.0
MMWR Morb Mortal Wkly Rep	21	2.1	20.1
BMJ	20	2.0	22.0
Pediatrics	20	2.0	24.0
Soc Sci Med	19	1.9	25.9
Am J Epidemiol	18	1.8	27.7
Tob Control	16	1.6	29.2
Lancet	13	1.3	30.5
Public Health Rep	13	1.3	31.8
Arch Pediatr Adolesc Med	12	1.2	33.0
J Epidemiol Community Health	12	1.2	34.2

All remaining journal titles were cited 11 times or less.

Cited journals' disciplines varied greatly. Examining all journals cited 2 or more times (Table 4), public health titles accounted for 46.3% (n = 352) of citations, followed closely by general medical and medical specialty titles (36.5%, n = 278). Though there were fewer citations to medical and medical specialty journals than to public health journals, slightly more unique medical and medical specialty titles (35.3%, n = 48) were cited than unique public health titles (33.8%, n = 46), indicating a smaller spread of publications in public health. Other disciplines included social sciences, demography, statistics, and health policy and services (Table 5).

DISCUSSION

Analysis of cited material types showed results similar to citation analyses in specific public health disciplines, namely public health nursing and health education, as well as to a local citation analysis of public health practitioners [15, 20, 21, 30]. In these studies, as well as the present study, journal articles accounted for the majority of citations, ranging from 62%–66% of the total citations. Differences were more accentuated for citation of other formats. For example, this study showed far less use of books and more than twice the use of government publications than studies of narrower public health disciplines [15, 20].

Table 2
Cited item age by publication type, overall cited item sample (n = 1,034)

Cited item age	Books n (%)	Government documents n (%)	Journal articles n (%)	Miscellaneous n (%)	Total n (%)
0–5 years	44 (36.4)	67 (55.8)	340 (51.1)	61 (55.5)	512 (50.3)
6–10 years	36 (29.8)	25 (20.8)	196 (29.4)	22 (20.0)	279 (27.4)
11–15 years	11 (9.1)	11 (9.2)	74 (11.1)	12 (10.9)	108 (10.6)
16–20 years	10 (8.3)	4 (3.3)	27 (4.1)	4 (3.6)	45 (4.4)
More than 20 years	20 (16.5)	13 (10.8)	29 (4.4)	11 (10.0)	73 (7.2)

Table 4
Journals cited two or more times, cited journal articles sample (n = 1,016)*

Journal title	Times cited	Percent cited	Cumulative percent (starting after Zone 1 titles)
Prev Med	11	1.1	35.2
Arch Intern Med	11	1.1	36.3
Med Care	7	0.7	37.0
Health Aff (Millwood)	7	0.7	37.7
J Natl Med Assoc	7	0.7	38.4
Int J Epidemiol	7	0.7	39.1
J Gen Intern Med	6	0.6	39.7
Milbank Q	6	0.6	40.3
J Adolesc Health	6	0.6	40.8
Eval Rev	6	0.6	41.4
Ethn Dis	6	0.6	42.0
AIDS	6	0.6	42.6
J Am Diet Assoc	6	0.6	43.2
J Acquir Immune Defic Syndr	6	0.6	43.8
J Urban Health	6	0.6	44.4
Psychiatr Serv	6	0.6	45.0
Int J Obes	5	0.5	45.5
Bull World Health Organ	5	0.5	46.0
Health Educ Behav	5	0.5	46.5
Am J Respir Crit Care Med	5	0.5	46.9
Am J Health Promot	5	0.5	47.4
Am J Ind Med	5	0.5	47.9
Inj Prev	5	0.5	48.4
Stat Med	5	0.5	48.9
Annu Rev Public Health	5	0.5	49.4
Diabetes Care	5	0.5	49.9
J Consult Clin Psychol	5	0.5	50.4
Health Serv Res	5	0.5	50.9
Am J Psychiatry	5	0.5	51.4
J Stud Alcohol	4	0.4	51.8
Subst Use Misuse	4	0.4	52.2
J Fam Pract	4	0.4	52.6
Perspect Sex Reprod Health	4	0.4	53.0
J Rural Health	4	0.4	53.3
Drug Alcohol Depend	4	0.4	53.7
Ann Intern Med	4	0.4	54.1
Epidemiology	4	0.4	54.5
Health Promot Int	4	0.4	54.9
Med Sci Sports Exerc	4	0.4	55.3
Demography	4	0.4	55.7
J Natl Cancer Inst	4	0.4	56.1
J Health Polit Policy Law	4	0.4	56.5
Addiction	4	0.4	56.9
J Community Health	4	0.4	57.3
Int J Health Serv	4	0.4	57.7
Am Psychol	4	0.4	58.1
Fam Med	3	0.3	58.4
Am J Clin Nutr	3	0.3	58.7
J Public Health Policy	3	0.3	59.0
Arch Fam Med	3	0.3	59.3
Ann Epidemiol	3	0.3	59.5
Regul Toxicol Pharmacol	3	0.3	59.8
Addict Behav	3	0.3	60.1
J Health Soc Behav	3	0.3	60.4
Spine	3	0.3	60.7
Psychol Aging	3	0.3	61.0
Environ Health Perspect	3	0.3	61.3
Environ Res	3	0.3	61.6
J Allergy Clin Immunol	3	0.3	61.9
J Public Health Manag Pract	3	0.3	62.2
J Sch Health	3	0.3	62.5
Psychol Med	3	0.3	62.8
Arch Gen Psychiatry	3	0.3	63.1
Obstet Gynecol	3	0.3	63.4
Women Health	3	0.3	63.7
J Marriage Fam	3	0.3	64.0
J Am Stat Assoc	3	0.3	64.3
Eur J Clin Nutr	3	0.3	64.6
J Infect Dis	3	0.3	64.9

* Table 4 continues in the online version of this journal.

Table 5
Cited journals by subject discipline, cited journal article sample (n = 1,016)

Subject discipline	Journal titles n (%)	Citations n (%)
Allied health sciences	5 (3.7)	16 (2.1)
Demography	2 (1.5)	8 (1.1)
Health policy and services	10 (7.4)	41 (5.4)
Industrial relations and labor	1 (0.7)	2 (0.3)
Medicine and medical disciplines	48 (35.3)	278 (36.5)
Multidisciplinary sciences	1 (0.7)	2 (0.3)
Public, environmental, and occupational health	46 (33.8)	352 (46.3)
Statistics and probability	2 (1.5)	5 (0.7)
Substance abuse	7 (5.1)	23 (3.0)
Social sciences	14 (10.3)	34 (4.5)

Subject discipline categorization based on first listing in Social Science Index and/or Social Science Citation Index and modified to collapse medical and social science disciplines.

The cited items ranged widely in age, though most citations were from the most recent 5 years. Comparing this result to other citation analyses was difficult due to the wide variance in how citation analyses report citation age, but Rethlefsen's local citation analysis of Minnesota Department of Health (MDH) publications showed an even larger percentage of citations to materials from the most recent 5 years [30]. Though recent materials were favored, there was still some reliance on the past; over 7% of citations were 20 years old or more. For books and government documents, this trend was stronger: over 10% of citations to these formats were more than 20 years old.

Interestingly, relatively few citations (n = 69, 6.7%) included URLs. It should be noted that no journal article citations listed an URL, most likely due to standard reference format conventions regardless of delivery method. Certainly more than 69 cited items have an online equivalent when journal articles are included, yet this figure is strikingly dissimilar to the results from Rethlefsen's 2003–2004 local citation analysis, in which 13% of citations were for Websites [30]. Alpi and Adams's public health nursing study revealed an even smaller amount of Web citations, 1.4%, though their study examined citations from an earlier time period (1998–2000) when Web citations might not have been as prevalent [20]. Taylor et al.'s 2002–2004 health care management citation analysis revealed a similarly small percentage of Web materials (3.4%), however [21]. This finding is noteworthy because librarians and public health agencies continue to develop new Web resources for public health practitioners. Practitioners may be relying more on the published journal literature and print materials than freely available Web sources when preparing publications. Physical resources may thus continue to be critical to this community.

Cited journals also displayed patterns similar to other published citation analyses. A few titles garnered a large amount of citations, while a large number of titles were cited. Zone 1 journals included journals from public health (n = 8) and general medicine (n = 6). Other public health citation analyses have also shown

Table 6
Comparison of Zone 1 titles from published public health–related citation analyses

Zone 1 journal title	Rethlefsen and Wallis, 2007	Rethlefsen, 2007 [30]	Alpi and Adams, 2007 [20]	Schloman, 1997 [15]	Taylor et al., 2007 [21]	Hasbrouck et al., 2003 [19]
Am J Clin Nutr						X
Am J Epidemiol	X					X
Am J Health Educ				X		
Am J Prev Med	X					
Am J Public Health	X	X	X	X		X
Ann Intern Med						X
ANS Adv Nurs Sci			X			
Antimicrob Agents Chemother		X				
Arch Pediatr Adolesc Med	X					
BMJ	X					X
Circulation						X
Diabetes Care		X				
Gerontologist			X			
Health Affairs					X	
Health Educ Behav				X		
Health Serv Res					X	
Inquiry					X	
Int J Epidemiol						X
J Adv Nurs			X			
J Am Coll Health				X		
J Am Diet Assoc				X		
J Clin Epidemiol						X
J Community Health Nurs			X			
J Consult Clin Psychol				X		
J Epidemiol Community Health	X					
J Food Protect		X				
J Gerontol A & B			X			
J Infect Dis		X				
J Natl Cancer Inst						X
J Nurs Scholarship			X			
J Sch Health			X	X		
JAMA	X	X	X	X	X	X
Lancet	X					X
Med Care					X	
MMWR Morb Mortal Wkly Rep	X	X	X			
N Engl J Med	X	X	X	X	X	X
Nurs Outlook			X			
Nurs Res			X			
Pediatrics	X		X	X		
Perspect Reproduct Sexual Health				X		
Prev Med				X		
Public Health Nurs		X	X			
Public Health Rep	X		X	X		
Res Nurs Health			X			
Soc Sci Med	X		X			
Tob Control	X					

Zone 1 titles were extrapolated for the Hasbrouck et al. [19] article based on tables in the published article.

that general medicine titles are important to public health research. For example, *JAMA* and *New England Journal of Medicine* have also appeared in the Zone 1 lists for public health nursing, health education, health care management, and epidemiology and the MDH citation analysis [15, 19, 20, 21, 30]. Of the Zone 1 titles, all were identified by the Core Public Health Journals project, version 2.0, as core titles for public health, although only eleven were designated Essential Core titles [31]. Though there were similarities between this research and other public health citation analyses, unique differences were visible in Zone 1 titles. Table 6 lists the Zone 1 titles in the current study, as well as Alpi and Adams's public health nursing [20], Schloman's health education [15], Rethlefsen's health department [30], Taylor et al.'s health care management [21], and Hasbrouck et al.'s epidemiology [19] citation analyses. All studies show marked variation in Zone 1 titles, particularly by degree of specialty publications appearing in Zone 1.

Over half of cited journal articles were from journals in fields other than public health. This finding echoed earlier studies of public health subdisciplines [16, 17, 19]. Others have noted that searching multiple databases is necessary to cover critical public health specialty journals [15, 20, 32]. Indeed, even the Zone 1 titles in this study show that searching multiple databases and even hand-searching is necessary; for instance, *MMWR* is not fully indexed by any common biomedical literature database, including PubMed, Science Citation Index, or CINAHL [20]. Based on coverage findings from the Mapping the Literature of Nursing Project, for the Zone 1 titles alone, PubMed and Science Citation Index provide the best, albeit incomplete, coverage [22, 33]. The multidisciplinary nature of public health research, its dependence on lit-

erature from disciplines outside public health, and its heavy use of government documents and gray literature all make comprehensive searching in public health complicated and resource intensive.

This study's results are based on a randomly drawn sample from an initial sample of public health literature, *AJPH* articles from 2003 to 2005. Citation analysis based on one to five core journals from a discipline or specialty is a common practice, but drawing a sample is uncommon in bibliometric studies, which often rely on hand-counting and manual entry of vast amounts of data into spreadsheets or databases. Sampling has been done in studies of citations culled from theses and databases [34–37], however.

In this study, even though sampling made dividing the journal article citation results into zones difficult, the samples did correlate with the larger set. The observed ratio between cited journal articles and total citations matched the expected ratio using a chi square goodness-of-fit test with a significance level of 0.001. The samples drawn for this study, though planned to provide a statistically accurate result, did place restrictions on the analysis of cited journal titles. Most importantly, because of the small set, it was not possible to delineate accurately between Zone 2 and 3 titles in a Bradford distribution.

One of the more interesting observations of this study was the finding that ISI Web of Science data were incomplete for many types of cited material, including legal citations and Websites. Without these citations, the results would have been skewed toward journal articles and books and away from gray literature sources. Using automated data sources for bibliometric analysis, particularly in gray literature–dependent fields, should thus be viewed with great skepticism.

Because only one journal title was used in the citation analysis, the generalizability of the data may be limited. However, many other citation analyses have been done using single journal titles [19, 38–43], so this methodology is in the bounds of normal practice. Nevertheless, a certain level of bias may be present in the results. In particular, *AJPH* received almost double the citations of any other journal in the sample (n = 87), a prominence that was potentially an artifact of the methodology. Whether this prominence is due to the true importance of that journal to the field, a natural tendency for authors to submit their work to journals they read and reference frequently, an artifact of publishers attempting to game the impact factor system by encouraging citations to work in their journals [44], or a combination is unclear. A trend for source journals to be the most heavily cited is apparent in the Mapping the Literature of Nursing Project studies published in the April 2006 *JMLA* supplement. Eleven of fifteen articles in that issue found one of the source journals to be the top cited journal, and both of the studies that used a single source publication found that title to be the top cited journal [33].

CONCLUSION

Public health is a complex subject area—it is at once a conglomerate of myriad specialties and a discipline in its own right. Identifying exactly which information sources public health practitioners use and need is challenging due to this array of specialties, made even more complex by the huge variety in funding, access to resources, and job responsibilities across international, federal, state, and local governments; academia; nonprofit organizations; and more. Applying citation analysis methodology to such a large, nebulous field is difficult, especially to identify source publications that will give reasonable numbers of citations with which to work and that apply to all fields of public health and levels of public health practitioners.

The Core Public Health Journals Project, version 2.0, lists 31 journals just in the Essential Core portion of its Key Journals for All Public Health list [31]. The JCR lists 99 titles in the Science edition's Public, Environmental, and Occupational Health category [28], 28 of which an earlier citation analysis by Soteriades and Falagas counted as ''public health'' [8]. Using so many source titles produces an overwhelming amount of citations to examine, particularly because the traditional online source of bibliometric information, ISI Web of Science, may not always give accurate citation counts, much less accurate citations. Examining the results of this study and the other public health citation analyses displayed in Table 6 shows that only 2 titles were included in Zone 1 in every study: *JAMA* and *New England Journal of Medicine*, neither of which is a public health journal.

This study contributes to the body of information known about public health information use and is intended to be a starting point for citation analysis of this subject area. As indicated by the comparison of the results of this analysis with other citation analyses of public health subdisciplines and the local citation analysis performed at MDH, core journals in public health will likely vary based on local needs and specialties. A great deal of further research is needed, not only to analyze the literature of public health disciplines, but also to examine differences in academic- versus field-oriented publications. The authors hope that this preliminary research will inspire others to continue bibliometric research in public health. Sampling large data sets makes such citation analysis more manageable, though using Bradford zones is not as clear-cut. Larger analyses are more likely to have more clearly delineated zones. In this smaller analysis, the break between Zone 2 and Zone 3 would have been arbitrary as the second third of citations ended in the middle of titles receiving two citations. However, even larger analyses struggle with establishing accurate zones and often must arbitrarily pick a zone for ''border'' titles and create less than equal percentages of citations between zones.

Despite core lists of journals available for public health and its specialties, many public health professionals do not have access to a library, and those who do may have very few titles or little funding. Knowing which titles are the most critical can help decision making in smaller libraries or help librarians develop collections for public health professionals, and the Zone 1 titles in the current study may serve as one

useful aid for informing and substantiating such decision processes.

ACKNOWLEDGMENTS

The authors thank Mayo Clinic statistician Felicity Enders for her advice regarding drawing the samples used in this study.

REFERENCES

1. Center for Health Policy, Columbia University School of Nursing, Gebbie K. The public health work force: enumeration 2000. [Web document]. Washington, DC: Bureau of Health Professions, National Center for Health Workforce Information and Analysis, 2000. [cited 1 Jul 2004]. <ftp://ftp.hrsa.gov//bhpr/nationalcenter/phworkforce2000.pdf>.
2. Porta M. The bibliographic ''impact factor'' of the Institute for Scientific Information: how relevant is it really for public health journals? J Epidemiol Community Health 1996 Jun; 50(6):606–10.
3. Kelsey P, Diamond P. Establishing a core list of journals for forestry: a citation analysis from faculty at southern universities. Coll Res Libr 2003 Sep;64(5):357–77.
4. Burright MA, Hahn TB, Antonisse MJ. Understanding information use in a multidisciplinary field: a local citation analysis of neuroscience research. Coll Res Libr 2005 May; 66(3):198–210.
5. Lopez-Abente G, Munoz-Tinoco C. Time trends in the impact factor of public health journals. BMC Public Health 2005;5(1):24. DOI: 10.1186/1471-2458-5-24.
6. Porta M, Copete JL, Fernandez E, Alguacil J, Murillo J. Mixing journal, article, and author citations, and other pitfalls in the bibliographic impact factor. Cad Saude Publica 2003 Nov–Dec;19(6):1847–62. DOI: 10.1590/S0102-311X2003000600030.
7. Porta M, Fernandez E, Murillo J, Alguacil J, Copete JL. The bibliographic ''impact factor,'' the total number of citations and related bibliometric indicators: the need to focus on journals of public health and preventive medicine. Soz Praventivmed 2004 Jan;49(1):15–8. DOI: 10.1007/s00038-003-0031-4.
8. Soteriades ES, Falagas ME. A bibliometric analysis in the fields of preventive medicine, occupational and environmental medicine, epidemiology, and public health. BMC Public Health 2006;6:301. DOI: 10.1186/1471-2458-6-301.
9. Falagas ME, Karavasiou AI, Bliziotis IA. Estimates of global research productivity in virology. J Med Virol 2005 Jun;76(2):229–3. DOI: 10.1002/jmv.20346.
10. Vergidis PI, Karavasiou AI, Paraschakis K, Bliziotis IA, Falagas ME. Bibliometric analysis of global trends for research productivity in microbiology. Eur J Clin Microbiol Infect Dis 2005 May;24(5):342–6. DOI: 10.1007/s10096-005-1306-x.
11. Falagas ME, Papastamataki PA, Bliziotis IA. A bibliometric analysis of research productivity in parasitology by different world regions during a 9-year period (1995–2003). BMC Infect Dis 2006;6:56. DOI: 10.1186/1471-2334-6-56.
12. Ramos JM, Gutierrez F, Masia M, Martin-Hidalgo A. Publication of European Union research on infectious diseases (1991–2001): a bibliometric evaluation. Eur J Clin Microbiol Infect Dis 2004 Mar;23(3):180–4. DOI: 10.1007/S10096-003-1074-4.
13. Bliziotis IA, Paraschakis K, Vergidis PI, Karavasiou AI, Falagas ME. Worldwide trends in quantity and quality of published articles in the field of infectious diseases. BMC Infect Dis 2005;5(1):16. DOI: 10.1186/1471-2334-5-16.
14. Franks AL, Simoes EJ, Singh R, Sajor Gray B. Assessing prevention research impact: a bibliometric analysis. Am J Prev Med 2006 Mar;30(3):211–6. DOI: 10.1016/j.amepre.2005.10.025.
15. Schloman BF. Mapping the literature of health education. Bull Med Libr Assoc 1997 Jul;85(3):278–83.
16. Gehanno JF, Thirion B. How to select publications on occupational health: the usefulness of Medline and the impact factor. Occup Environ Med 2000 Oct;57(10):706–9. DOI: 10.1136/oem.57.10.706.
17. Schoonbaert D. Citation patterns in tropical medicine journals. Trop Med Int Health 2004 Nov;9(11):1142–50. DOI: 10.1111/j.1365-3156.2004.01327.x.
18. Hua Y. The feature of papers and citation analysis of eleven journals in tropical medicine indexed by Science Citation Index Expanded. Mem Inst Oswaldo Cruz 2005 Nov; 100(7):805–10. DOI: 10.1590/S0074-02762005000700023.
19. Hasbrouck LM, Taliano J, Hirshon JM, Dannenberg AL. Use of epidemiology in clinical medical publications, 1983–1999: a citation analysis. Am J Epidemiol 2003 Mar;157(5): 399–408. DOI: 10.1093/aje/kwf218.
20. Alpi KM, Adams MG. Mapping the literature of public health and community nursing. J Med Libr Assoc 2007 Jan; 95(1):E6–9.
21. Taylor MK, Gebremichael MD, Wagner CE. Mapping the literature of health care management. J Med Libr Assoc 2007 Apr;95(2):E58–65. DOI: 10.3163/1588-9439.95.2.E58.
22. Thompson ISI. 2004 JCR science edition. [Web document]. Stamford, CT: Thompson ISI, 2006. [cited 1 May 2007]. <http://portal.isiknowledge.com/portal.cgi?DestApp=JCR>.
23. Thompson ISI. 2004 JCR social science edition. [Web document]. Stamford, CT: Thompson ISI, 2006. [cited 1 May 2007]. <http://portal.isiknowledge.com/portal.cgi?DestApp=JCR>.
24. About the journal. [Web document] Washington, DC: American Public Health Association, 2006. [rev. 16 Aug 2006; cited 22 Mar 2007]. <http://www.ajph.org/misc/about.shtml>.
25. Sample size calculator. [Web document]. Petaluma, CA: Creative Research Systems, 2003. [cited 1 May 2007]. <http://www.surveysystem.com/sscalc.htm>.
26. Haahr M. Random.org. [Web document]. Dublin: Trinity College, 2007. [cited 1 May 2007]. <http://www.random.org>.
27. Task Force on Mapping the Nursing Literature, Nursing and Allied Health Resources Section, Medical Library Association. Task force on mapping the nursing literature 2006. [Web document]. The Section. [cited 2006 Nov 29]. <http://nahrs.library.kent.edu/activity/mapping/nursing>.
28. Thompson ISI. 2005 JCR science edition. [Web document]. Stamford, CT: Thompson ISI, 2006. [cited 1 May 2007]. <http://portal.isiknowledge.com/portal.cgi?DestApp=JCR>.
29. Thompson ISI. 2005 JCR social science edition. [Web document]. Stamford, CT: Thompson ISI, 2006. [cited 1 May 2007]. <http://portal.isiknowledge.com/portal.cgi?DestApp=JCR>.
30. Rethlefsen ML. Needs analysis at a state health department library: citation analysis of official and extramural publications. Presented at: MLA '06, 106th Annual Meeting of the Medical Library Association; Phoenix, AZ; 21 May 2006.
31. Public Health/Health Administration Section, Medical Library Association. Core public health journals—version 2.0. [Web document]. Chicago, IL: The Section, 2006. [cited 6 Oct 2006]. <http://publichealth.yale.edu/phlibrary/phjournals/v2/>.
32. Revere D, Turner AM, Madhavan A, Rambo N, Bugni PF, Kimball A, Fuller SS. Understanding the information needs of public health practitioners: a literature review to inform information design of an interactive digital knowledge management system. J Biomed Inform 2007:forthcoming. DOI: 10.1016/j.jbi.2006.12.008.

33. Allen MP, Jacobs SK, Levy JR, eds. Symposium: mapping the literature of nursing. J Med Libr Assoc 2006 Apr;94(2 suppl):206–20; E43–151. [cited 1 May 2007]. <http://www.pubmedcentral.nih.gov/tocrender.fcgi?iid=131065>.
34. Georgas H, Cullars J. A citation study of the characteristics of the linguistics literature. Coll Res Libr 2005 Nov; 66(6):496–515.
35. Kushkowski JD, Parsons KA, Wiese WH. Master's and doctoral thesis citations: analysis and trends of a longitudinal study. Portal Libr Acad 2003 Jul;3(3):459–79. DOI: 10.1353/pla.2003.0062.
36. Ortega L, Antell K. Tracking cross-disciplinary information use by author affiliation: demonstration of a method. Coll Res Libr 2006 Sep;67(5):446–62.
37. Smith ET. Assessing collection usefulness: an investigation of library ownership of the resources graduate students use. Coll Res Libr 2003 Sep;64(5):344–55.
38. Allison MM. Mapping the literature of nephrology nursing. J Med Libr Assoc 2006 Apr;94(2 suppl):E74–9.
39. Biradar BS, Mathad S. Bibliometric analysis of ecological literature. SRELS J Inform Manage 2000;37(3):199–214.
40. Crawley-Low J. Bibliometric analysis of the American Journal of Veterinary Research to produce a list of core veterinary medicine journals. J Med Libr Assoc 2006 Oct;94(4): 430–4.
41. Knievel JE, Kellsey C. Citation analysis for collection development: a comparative study of eight humanities fields. Libr Q 2005 Apr;75(2):142–68. DOI: 10.1086/431331.
42. Moorbath P. A study of journals needed to support the Project 2000 nursing course with an evaluation of citation counting as a method of journal selection. Aslib Proc 1993 Feb;45(2 suppl):39–46.
43. Spasser MA, Weismantel A. Mapping the literature of rehabilitation nursing. J Med Libr Assoc 2006 Apr;94(2 suppl):E137–42.
44. Cameron BD. Trends in the usage of ISI bibliometric data: uses, abuses, and implications. Portal Libr Acad 2005 Jan;5(1):105–25. DOI: 10.1353/pla.2005.0003.30.

AUTHORS' AFFILIATIONS

Melissa L. Rethlefsen, MLS, mlrethlefsen@gmail.com, Education Technology Librarian, Mayo Clinic Libraries, Mayo Clinic, 200 First Street SW, Rochester, MN 55905; **Lisa C. Wallis, MSPH, MS,** l-wallis@neiu.edu, Web Services Librarian, Ronald Williams Library, Northeastern Illinois University, 5500 North St. Louis Avenure, Chicago, IL 60625

Received March 2007; accepted May 2007