
Mapping the literature of physical therapy

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Physical therapy is a fast growing profession because of the aging population, medical advances, and the public's interest in health promotion. This study is part of the Medical Library Association (MLA) Nursing and Allied Health Resources Section's project to map the allied health literature. It identifies the core journals in physical therapy by analyzing the cited references of articles in two established physical therapy journals, *Physical Therapy* and *Archives of Physical Medicine and Rehabilitation*, during the period 1991 through 1993. This bibliometric analysis also determines the extent to which these journals are covered by the primary indexing sources, Allied and Alternative Medicine (AMED), the Cumulative Index to Nursing and Allied Health Literature, EMBASE, and MEDLINE. In this study, fourteen journals were found to supply one-third of all references studied. Ninety-five journals provided an additional third of the references. MEDLINE rated the highest as the indexing tool of choice for these 109 journals. The study results can assist in collection development decisions, advise physical therapists as to the best access to their core literature, and influence database producers to increase their coverage of the literature important to physical therapy.

INTRODUCTION

According to *Mosby's Medical, Nursing, and Allied Health Dictionary*, physical therapy is "the treatment of disorders with physical agents and methods, such as massage, manipulation, therapeutic exercises, cold, heat (including shortwave, microwave, and ultrasonic diathermy), hydrotherapy, electric stimulation, and light to assist in rehabilitating patients and in restoring normal function after an illness or injury. Also called physiotherapy" [1].

Physical therapy has been described as being around since the beginning of time, yet modern physical therapy was born in World War I. The Division of Special Hospitals and Physical Reconstruction was established in the Surgeon General's Office in 1917 as a result of a study of formal reconstruction programs in English and French hospitals for injured persons in either military or civilian life. This division was concerned with the physical reconstruction programs for the war injured (physical therapy and occupational therapy), educational programs, and vocational programs. In 1918, Mary McMillan became the first phys-

ical therapist appointed by the United States Army. She was placed in charge of the largest training course for physical therapists (then known as reconstruction aides) at Reed College in Eugene, Oregon [2]. Physical therapists in the United States formed their first professional organization in 1921, called the American Women's Physical Therapeutic Association, of which Mary McMillan was the first president. By the end of the 1930s, this organization of physical therapists changed its name to the American Physiotherapy Association and admitted men. In the late 1940s, the association again changed its name to the American Physical Therapy Association [3].

Physical therapy is projected to be one of the fastest growing professions through the year 2005. Demands for physical therapy services are escalating because of the aging population, medical advances, and high interest in health promotion. Physical therapists practice in hospitals, but more than 70% practice in private offices, community and industrial health centers, sports and rehabilitation centers, nursing homes, home health agencies, schools, research institutions, and universities. Some physical therapists are involved in

treating an extensive range of problems and others specialize in clinical electrophysiology, pediatrics, geriatrics, orthopedics, sports medicine, neurology, and cardiopulmonary physical therapy [4].

A review of the literature produced a few bibliometric studies defining the core journals for physical therapy by Bohannon and Gibson [5], Bohannon [6], and Bohannon and Tiberio [7] in the late 1980s. Other studies have also looked at the indexing coverage of the core journals. One previous study that used the Current Awareness Topics Services, British Library (CATS), the Cumulative Index to Nursing and Allied Health Literature (CINAHL), *Excerpta Medica*, and MEDLINE found the coverage of the core journals of rehabilitation and related topics (physiotherapy journals) to be very selective [8]. Another study using CINAHL, *Excerpta Medica*, *Index Medicus*, *Physiotherapy Index*, and *Science Citation Index* determined that the coverage of journals cited in five physiotherapy journals was neither complete nor consistent, that CINAHL was not as thorough as the other indexes, and that the most comprehensive coverage was provided by pairs of indexes: CINAHL and *Excerpta Medica*, *Physiotherapy Index* and *Excerpta Medica*, and *Science Citation Index* and *Physiotherapy Index* [9]. A third study indicated that MEDLINE had excellent coverage for the supplementary material, but was not the best source for core physiotherapy journals [10].

This study is part (Phase 1) of a larger project sponsored by the Nursing and Allied Health Resources Section of the Medical Library Association (MLA) to map the allied health literature. The purpose of this mapping project is to add to the knowledge of previous studies that identified the core journal literature of physical therapy and the extent to which the core literature was indexed. This citation analysis can better prepare librarians in collection development decisions, advise physical therapists as to the best access to their core literature, and influence database producers to increase coverage of physical therapy literature. Providing information to database producers is unique to the Mapping the Literature of the Allied Health project.

METHODOLOGY

A common methodology, described in the project overview, was followed to investigate the literature of physical therapy. Variations from the project methodology are noted where appropriate.

Three sources were employed to identify the source journals for this project: the 1994 Brandon/Hill allied health list [11], a 1986 citation analysis study that generated a list of core journals for physical therapy [12], and a 1992 bibliometric analysis of the *Archives of Physical Medicine and Rehabilitation* [13]. It was determined from these three sources that two well-established journals in the field should be used: *Physical Therapy*

and *Archives of Physical Medicine and Rehabilitation*. *Physical Therapy* is the official journal of the American Physical Therapy Association, and has been published since 1921. *Archives of Physical Medicine and Rehabilitation* is the official journal of the American Congress of Rehabilitation Medicine and the American Academy of Physical Medicine and Rehabilitation, and has been published since 1920. *Physical Therapy* has undergone a number of title changes. It was first published as *PT Review*, then changed successively to *Physiotherapy Review*, *Physical Therapy Review*, *Journal of the American Physical Therapy Association*, and in 1964 to *Physical Therapy*. *Archives of Physical Medicine and Rehabilitation* began as *Archives of Physical Medicine*, changing to its current title in 1953. For the purpose of this study, all citations to these source journals were listed under the most current title.

References listed in *Physical Therapy* (from articles, commentaries, author responses, letters, and lectures) and in *Archives of Physical Medicine and Rehabilitation* (from articles, commentaries, letters, lectures, study guide articles, and special issue articles) from 1991 through 1993 were used to record the frequency with which items were cited. For each cited item, the format type and publication year were recorded. The journal title was also noted for journal citations.

Four format types were used to identify the materials cited in the two source journals: books, government documents (state, federal, any government entity), journal articles (government serials were grouped into this category), and miscellaneous (dissertations, abstracts, personal communications, interviews, laws, presentations, tests, technical reports, editorials, newspapers, manuals, pamphlets, unpublished materials, guides, policies, courses).

Journals were ranked in descending order according to the number of times they were cited. Cited journals with varying titles were combined under the most current title as of 1993. Bradford's Law of Scattering was used to divide the ranked cited journals into three zones. Zone 1 constitutes the core literature of physical therapy. Zone 2 is the next most productive literature. Zone 3 is the least relevant literature.

Since another aspect of this project was to determine how best to access the core literature of physical therapy, the indexing coverage of Zone 1 and 2 journals was examined. Allied and Alternative Medicine (AMED), CINAHL, EMBASE, and MEDLINE were found to be the primary indexing tools of Zone 1 and 2 journals. Following the common methodology of the project, total article counts (for 1994) were established for each cited journal. These titles were searched in AMED, CINAHL, EMBASE, and MEDLINE to determine how many articles were indexed (in 1994). For the four databases, the number of articles indexed was compared to the total number published to arrive at a percentage of total articles listed by each index. This

Table 1
Cited format types by source journal and frequency of citations

Cited format type	No. citations in source journals		Citations	
	AP	PT	No.	Frequency (%)
Journal articles	11,891	5,783	17,674	77.0
Books	2,386	1,782	4,168	18.2
Government documents	121	46	167	0.7
Miscellaneous	591	345	936	4.1
Total	14,989	7,956	22,945	100.0

AP = Archives of Physical Medicine and Rehabilitation, PT = Physical Therapy.

percentage was used to assign a coverage level of 0 to 5 (negligible to full) for each cited journal by each indexing service.

RESULTS

There were 1,020 articles from the two source journals during the three-year period from 1991 through 1993. These articles had a total of 22,945 cited items, distributed as follows: 17,674 or 77.0% of the citations were to journals; 4,168 or 18.2% of the cited items were books, including proceedings; 936 or 4.1% were miscellaneous formats; and 167 or 0.7% were government documents. These results are shown in Table 1.

Table 2 highlights the age of citations by format type. Government documents, although the least cited overall (0.7%), were the most current, with 26.3% having publication dates from 1990 through 1993. Of the other formats, 22.4% of miscellaneous materials, 13.0% of books, and 12.9% of journal articles had publication dates from 1990 through 1993. For all cited references, regardless of format type, 13.4% were published in the most recent period of 1990 through 1993. More than half of the citations (59.4%) were published from 1980 through 1989, including 62.8% of the books, 59.9% of miscellaneous materials, 58.6% of journal articles, and 55.1% of government documents.

Using Bradford's Law of Scattering, this bibliometric analysis found that fourteen journals constitute the core journal literature for physical therapy. These fourteen journals constitute the first, or nuclear, zone, which contains a small number of highly productive journals and one-third of the cited journal articles. *Archives of Physical Medicine and Rehabilitation* and *Physical Therapy* supplied 48% of the citations for Zone 1. Zone 2, containing the second one-third of the most frequently cited journal articles, has ninety-five journals. The outer zone, or Zone 3, with 1,694 journals, contains the larger number of less productive journals. The zone breakdown for physical therapy is shown in Table 3.

The journals identified in Zones 1 and 2 were checked to determine the extent of access provided by

Table 2
Cited format types by publication year periods

Publication year	Books (%)	Government documents (%)	Journal articles (%)	Miscellaneous (%)	Total citations (%)
1990-1993*	13.0	26.3	12.9	22.4	13.4
1980-1989	62.8	55.1	58.6	59.9	59.4
1970-1979	17.0	13.8	18.1	9.0	17.5
1960-1969	4.9	3.0	6.0	4.6	5.7
Pre-1960	2.3	1.2	4.4	3.2	4.0
Not available	0.0	0.6	0.0	0.9	<0.1

* Includes materials in press.

the major indexing and abstracting services. Table 4 lists the journal titles for Zones 1 and 2, and the indexing coverage by AMED, CINAHL, EMBASE, and MEDLINE. Only MEDLINE ranked a 5 (95%-100% coverage) for all fourteen journals of Zone 1. AMED, CINAHL, and EMBASE ranked only a 5 for one journal of the fourteen Zone 1 journals. Of the nine journals in Zone 2 that MEDLINE ranked 0 in coverage, CINAHL provided "some" coverage for seven, EMBASE for six, and AMED for five. There was only one journal in Zone 2 for which none of the indexing services provided coverage (*Journal of Prosthetics and Orthotics*). MEDLINE had a 5 or highest level of coverage for ninety-three of the journals in Zones 1 and 2. EMBASE was next with thirty-eight journals, followed by CINAHL with six, and AMED with one. It follows that MEDLINE rated the highest as the overall indexing tool of choice for Zone 1 and 2 journals when the sums of the coverage scores for each service are compared. MEDLINE had a total indexing coverage score of 492, out of a possible 545.

CONCLUSION

As expected, the journal literature was heavily cited (77.0%) in the field of physical therapy. Books constituted the next category at 18.2%. Miscellaneous materials accounted for 4.1% of cited items; government documents represented only 0.7% of the cited material. In relation to currency, the order was reversed. Gov-

Table 3
Distribution by zone of cited journals and references

Zone	Cited journals		Cited journal references	
	No.	%	No.	%
Zone 1	14	0.7	5,960	33.7
Zone 2	95	5.3	5,875	33.2
Zone 3	1,694	94.0	5,842	33.0
Total	1,803	100.0	17,677	99.9

Table 4
Distribution and indexing coverage of cited journals in Zones 1 and 2

Cited journal	No. of citations	A-MED	CIN-AHL	EM-BASE	MED-LINE
Zone 1					
1. Arch Phys Med Rehabil	1,654	3	5	4	5
2. Phys Ther	1,205	4	4	3	5
3. J Bone Joint Surg Am	372	1	0	4	5
4. Spine	323	1	2	5	5
5. Clin Orthop	323	1	1	4	5
6. J Neurol Neurosurg Psychiatry	300	0	0	4	5
7. Paraplegia	261	2	0	4	5
8. JAMA	249	0	1	4	5
9. Neurology	235	1	0	4	5
10. J Appl Physiol	228	1	0	0	5
11. Scand J Rehabil Med	226	5	4	4	5
12. N Engl J Med	222	0	1	3	5
13. Am J Phys Med Rehabil	189	4	4	3	5
14. Muscle Nerve	173	1	0	4	5
Zone 2					
15. Arch Neurol	168	0	0	4	5
16. Pain	166	1	0	5	5
17. Med Sci Sports Exerc	159	2	0	4	5
18. Lancet	150	0	1	4	5
19. Brain	146	0	0	5	5
20. J Neurosurg	131	0	0	4	5
21. J Physiol (London)	129	0	0	5	5
22. Dev Med Child Neurol	128	1	0	1	5
23. J Biomech	127	3	0	4	5
24. J Orthop Sports Phys Ther	125	4	5	4	5
25. Stroke	121	1	0	4	5
26. Psychol Bull	108	0	0	0	3
27. BMJ	103	0	1	5	5
28. Am J Sports Med	100	2	3	5	5
29. J Bone Joint Surg Br	100	1	0	5	5
30. Ann Neurol	99	0	0	5	5
31. Orthopedics	92	0	0	4	5
32. Ann Intern Med	90	0	5	5	5
33. J Am Geriatr Soc	87	1	1	3	5
34. Physiotherapy	87	3	4	5	0
35. Am J Occup Ther	86	4	4	0	5
36. J Head Trauma Rehabil	84	3	4	5	0
37. Am J Physiol	83	0	0	4	5
38. Physiother Can	81	4	5	1	0
39. J Urol	80	0	0	0	5
40. Eur J Appl Physiol Occup Med	77	2	0	4	5
41. J Neurophysiol	77	0	0	4	5
42. Brain Res	74	0	0	4	5
43. J Gerontol	69	0	0	5	5
44. Neurosurgery	66	0	0	4	5
45. Science	66	0	0	5	4
46. J Pediatr Orthop	64	0	0	4	5
47. Exp Neurol	62	0	0	4	5
48. J Consult Clin Psychol	61	0	0	4	5
49. Electroencephalogr Clin Neurophysiol	60	0	0	2	5
50. Exp Brain Res	60	0	0	5	5
51. IEEE Trans Biomed Eng	60	0	0	5	5
52. Orthop Clin North Am	59	0	3	5	4
53. J Rehabil Res Dev	56	0	0	5	4
54. Arch Intern Med	55	0	2	5	5
55. Brain Inj	55	1	0	5	5
56. Epilepsia	55	0	0	5	5
57. J Chronic Dis (cont'd by J Clin Epidemiol)	55	0	0	5	5
58. Chest	53	1	0	4	5
59. Med Care	51	0	0	0	5
60. Pediatrics	51	0	0	4	5
61. Acta Orthop Scand	50	1	0	5	5
62. Am Rev Respir Dis (cont'd by Am J Respir Crit Care Med)	49	1	1	4	5
63. Circulation	48	0	0	4	5
64. Nature	48	0	0	5	4

Table 4
Continued

Cited journal	No. of citations	A-MED	CIN-AHL	EM-BASE	MED-LINE
65. Radiology	47	0	0	4	5
66. Electromyogr Clin Neurophysiol	45	0	0	4	5
67. J Clin Exp Neuropsychol	45	0	0	4	5
68. J Motor Behav	45	2	0	5	0
69. Acta Physiol Scand	44	1	0	4	5
70. Am J Psychiatry	44	0	0	4	5
71. J Pediatrics	43	0	0	5	5
72. Age Ageing	42	1	0	2	5
73. Am J Med	42	0	0	5	5
74. Arthritis Rheum	42	0	0	4	5
75. Clin Sports Med	42	3	4	5	5
76. Neuropsychologia	39	0	0	4	5
77. J Neurosci	38	0	0	4	5
78. Physician Sportsmed	37	1	4	5	0
79. Am J Surg	36	0	0	4	5
80. J Am Paraplegia Soc (cont'd by J Spinal Cord Med)	36	0	0	0	5
81. Res Q Exerc Sports	36	3	0	0	5
82. South Med J	35	0	0	4	5
83. Acta Neurol Scand	34	1	0	5	5
84. Acta Orthop Scand Suppl	34	0	0	3	5
85. Aust J Physiother	34	0	4	5	0
86. J Trauma	34	0	1	5	5
87. Ann Rheum Dis	33	1	0	4	5
88. J Nerv Mental Dis	33	0	0	5	4
89. Med Biol Eng Comput	33	1	0	4	5
90. Phys Med Rehabil State Art Rev	33	0	5	0	0
91. Percept Motor Skills	32	0	5	0	0
92. Am J Cardiol	31	0	0	4	5
93. Ann Surg	31	0	0	4	5
94. Cortex	31	0	0	5	5
95. J Hand Surg Am	31	0	0	5	5
96. J Occup Med (cont'd by J Occup Med Environ Med)	31	0	0	4	5
97. J Orthop Res	31	1	0	4	5
98. Arch Gen Psychiatry	30	1	0	3	5
99. Geriatrics	30	1	2	5	5
100. AJR: Am J Roentgenol	29	0	0	4	5
101. Int J Sports Med	29	2	0	5	5
102. Mayo Clin Proc	29	0	0	4	5
103. Am J Public Health	28	0	1	4	5
104. Diabetes	28	0	0	4	5
105. J Biomed Eng (cont'd by Med Eng Physics)	28	1	0	5	4
106. J Neurol Sci	28	0	0	5	5
107. J Prosthet Orthot	28	0	0	0	0
108. Prosthet Orthot Int	27	3	0	3	5
109. Am J Dis Child (cont'd by Arch Pediatr Adolesc Med)	26	0	0	4	5
Total indexing coverage score		83	87	417	492
Indexing coverage scale: 5 (95%–100%); 4 (75%–94%); 3 (50%–74%); 2 (25%–49%); 1 (1%–24%); 0 (<1%).					

ernment documents had the most recent currency with 26.3%. Miscellaneous materials were next with 22.4%. Books followed with 13.0%. Oddly enough, journal articles were the least current (12.9%). From this study, librarians should be comfortable suggesting that MEDLINE be searched for current journal articles, especially considering that, of the four indexing services, MEDLINE is the most readily available.

The journal literature of physical therapy is quite diverse, as shown in Table 4. Perhaps an explanation

for this diversity is the multidisciplinary nature of the field. Another reason could be that the physical therapy profession and its knowledge base is still developing [14]. In regard to core journal list availability, physical therapy is one of the most fortunate allied health fields in that it has been covered in the Brandon/Hill allied health list since the first edition [15]. Librarians need to consider more than just titles specific to physical therapy as presented in this and other bibliometric studies when evaluating a journal collection for physical therapists that will reflect developments in research and practice. Even though MEDLINE did quite well in indexing coverage of Zone 1 and 2 journals, consulting another index for the physical therapy literature is advisable for comprehensive coverage, as was noted by Bohannon and Tiberio [16]. Until the database producers are influenced to increase their coverage of literature important to physical therapy, a search of two indexing services will be beneficial.

An interesting continuation of this study might include a citation analysis of "newer" physical therapy journals (*Journal of Orthopaedic and Sports Physical Therapy*, *Pediatric Physical Therapy*, and *Physical and Occupational Therapy in Geriatrics*) that are less established than *Physical Therapy* and *Archives of Physical Medicine and Rehabilitation*, to determine whether different trends are reflected in the literature cited. The following journals have already been studied by Bohannon: *Physical Therapy*, *Physiotherapy*, *Physiotherapy Canada*, *Physiotherapy Practice*, and *Australian Journal of Physiotherapy* [17-19].

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