Mapping the literature of athletic training

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Purpose: This paper identifies the core literature of athletic training and determines which major databases provide the most thorough intellectual access to this literature.

Methods: This study collected all cited references from 2002 to 2004 of three journals widely read by those in the athletic training field. Bradford’s Law of Scattering was applied to the resulting list to determine the core journal titles in the discipline. Three major databases were reviewed for extent of their coverage of these core journals.

Results: Of the total 8,678 citations, one-third referenced a compact group of 6 journals; another third of the citations referenced an additional 40 titles. The remaining 2,837 citations were scattered across 1,034 additional journal titles.

Conclusions: The number and scatter of citations over a three-year period identified forty-six key journals in athletic training. The study results can inform athletic trainers of the core literature in their field, encourage database producers (e.g., MEDLINE, SPORTDiscus, CINAHL) to increase coverage of titles that are not indexed or underindexed, and guide purchasing decisions for libraries serving athletic training programs.

INTRODUCTION

The field of athletic training encompasses preventing, evaluating, and managing injuries in the athletic environment, as well as designing and supervising rehabilitation programs that enable injured athletes to return to activity [1]. The athletic trainer is a pivotal member of the sports medicine team and closely cooperates with team physicians, physical therapists, and other health care professionals. Of all the members of the sports medicine team, the athletic trainer is perhaps most intimately involved in the lives of the athletes, often traveling with teams, standing at the sidelines, and following injured athletes from emergency care, diagnosis, therapy, and return to play. Responding to athletic emergencies in sports venues is an important role of the athletic trainer, and athletic trainers frequently serve as the first contact for injured participants [1].

In the field of athletic training, the shift to incorporate research evidence more fully into clinical practice has resulted in increased emphasis on the use of the professional literature. Like all professions, athletic training has a central body of literature that serves as its knowledgebase and helps define the intellectual scope of the field. This study is the first attempt to describe the literature of this profession and identify its core journals. It is an installment in the ongoing Mapping the Literature of Allied Health Project of the Nursing and Allied Health Resources Section (NAHRS) of the Medical Library Association, first described by Schloman in 1997 [2]. In addition to providing a brief description of the profession, this paper identifies the formats and currency of literature used by authors in the athletic training field, as well as the core journal titles and the extent of their coverage by major indexes of the journal literature. The findings are particularly significant to practitioners in the field, health sciences librarians serving athletic trainers in both clinical and academic settings, and indexing and abstracting services.

Highlights

- This paper reviews the development of athletic training as a recognized health sciences profession and current issues and trends in the profession.
- This is the first published study to characterize the nature and scope of the literature of athletic training and to identify its core journal titles.
- This study identified six titles that constitute the core journal titles in athletic training and forty additional journal titles that are the next most heavily used. The citing patterns of these journals indicate that the literature of athletic training draws heavily from the fields of sports medicine, physical therapy, rehabilitation, orthopedics, and physiology.

Implications

- Comprehensive literature searches must be performed in multiple databases, as no one product covers the field of athletic training thoroughly.
- The findings serve as a guide for making journal and database purchasing decisions in academic and health sciences libraries.
- MEDLINE, SPORTDiscus, and CINAHL can add value to their products by increasing coverage of the forty-six titles identified in this study.

History of the athletic training profession

The profession of athletic training had its beginnings in the late nineteenth century with the formation of intercollegiate and interscholastic sports programs in the United States. The “athletic trainers” of this era
were largely uneducated and scantily trained, described as "persons of questionable background and experience" whose techniques consisted mostly of the application of counterirritants and the prescription of various home remedies [1]. After World War I, intercollegiate programs expanded dramatically and with them the need for a staff of competent trainers. In 1917, Samuel "Doc" Bilik, a physician practicing in the New York area, published the first major text for the field, The Trainer's Bible [3]. In the early 1920s, Chuck and Frank Cramer founded the Cramer Chemical Company in Gardner, Kansas, which started a unique industry for athletic training products, including a popular liniment for treating ankle sprains. In 1932, the Cramers started publishing The First Aider, a monthly publication designed to connect and inform members of the nascent profession [4].

In 1939, a prototypical national organization for athletic trainers was formed, and, although it folded during the difficult years of World War II, it nevertheless an important first step in creating a professional identity [5]. Following the war, various regional organizations were formed, including the Southern Conference Athletic Trainers Association in 1947 and the Eastern Conference Athletic Trainers Association in 1948. In 1950, these regional organizations joined forces to create the National Athletic Trainers Association (NATA), with Chuck Cramer named as its first national secretary [3].

As the primary organization for athletic trainers, NATA was created to establish standards for professionalism, education, certification, research, and practice settings, all hallmarks of a true profession. The constitution and bylaws were written in 1951, followed by the adoption of a code of ethics in 1957. The Journal of the National Athletic Trainers' Association, precursor to today's Journal of Athletic Training, began publication in 1956 [3]. In 1969, the American Medical Association (AMA) passed a resolution acknowledging the importance of athletic trainers, and, in June 1990, it granted official recognition of athletic training as an allied health profession, which significantly increased the stature and image of the young profession [5].

Athletic training education, accreditation, certification, and licensure

Indiana State University offered the first comprehensive curricula in athletic training: a four-year undergraduate degree in 1948 and in the following year a master's of science degree in health science with a major in athletic training. NATA developed a model curriculum for athletic training in 1959, and in 1970 the first undergraduate programs were approved at Indiana State University in Terra Haute, Lamar State College in Beaumont, Texas, Mankato State College in Mankato, Minnesota, and the University of New Mexico in Albuquerque. By 1973, the first two graduate curricula were approved at Indiana State University and the University of Arizona [3].

In 1997, the Education Council of NATA was established to determine the educational competencies and clinical proficiencies that should be taught in accredited programs. The current competencies took effect in fall 2006 and include risk management, pathology of injuries, orthopedic assessment and evaluation, acute care of injury, pharmacology, therapeutic modalities, and other skills [1]. On a parallel track, NATA's Board of Certification (BOC) identified six performance domains that define the minimum knowledgebase for an entry-level athletic trainer: prevention, clinical evaluation and diagnosis, immediate care, treatment and rehabilitation, organization and administration, and professional responsibility [1]. Together, the competencies and performance domains serve as guideposts for curriculum development.

After athletic training earned formal recognition by the AMA as an allied health profession, accreditation of athletic training programs was assumed by AMA's Committee on Allied Health Education Accreditation. In 1994, this duty was transferred to the Commission on Accreditation of Allied Health Education Programs (CAAHEP), an accreditation agency recognized by the Council for Higher Education Accreditation (CHEA). In 2006, the Committee for Accreditation of Athletic Training Education, an independent accrediting agency dedicated to this profession and affiliated with CHEA on the same level as CAAHEP, took over accreditation responsibilities [1]. In 2006, there were 328 accredited undergraduate programs in the United States and 13 accredited master's degree programs.

The NATA BOC was established in 1970, followed by administration that year of the first certification exam in Waco, Texas. The initials ATC have been used since then to designate the certified athletic trainer. Prior to January 1, 2004, the BOC accepted an internship route in lieu of graduation from an accredited program as an option to gain eligibility to sit for the certification exam. After that date, one could only become eligible to take the certification exam through successful completion of an accredited entry-level program in athletic training [6].

As of January 2005, thirty-nine of the fifty states regulate athletic trainers in some way, via licensure, state certification, or registration [1]. State certification is not the same as being certified as an athletic trainer by the BOC, although many states use the BOC exam as a criterion for granting state certification.

Issues and trends in athletic training

Currently, NATA represents over 30,000 members, of which 24,000 are certified athletic trainers. More than 50% of NATA's certified athletic trainers are employed outside of school athletic settings. Some of these settings include physician offices, rural and urban hospitals, ambulatory care centers, military hospitals, physical therapy clinics, occupational and industrial settings, and professional sports teams [7]. Although sports medicine clinics were once considered a non-traditional work setting for athletic trainers, today more of them work there than in any other setting. A typical work day for an athletic trainer in these clinics might consist of seeing patients with sports-related in-
juries in the morning, followed by contract work to local high schools or colleges in the afternoon [1].

While many athletic trainers continue to work primarily with athletes, the scope of the profession has expanded to encompass all groups of the physically active population, defined by Prentice as those who "engage in athletic, recreational or occupational activities that require physical skills and utilize strength, power, endurance, speed, flexibility, range of motion, or agility" [1]. In situations in which their patient populations overlap, athletic trainers and physical therapists may be in competition for clients. However, whereas physical therapists treat a wide variety of patient populations with a broad range of injuries, athletic trainers focus on treating the physically active population [1]. Their knowledge of first aid and their understanding of the motivation and psychology of performance are further distinguishing characteristics of the athletic trainer [8]. In many situations, athletic trainers work side by side with physical therapists and other health care professionals in a cooperative effort to provide quality health care to physically active people.

Currently, an issue of great importance to the profession is the need to secure third-party reimbursement. Moving toward evidence-based practice is considered critical to achieving this goal. Leaders in the field have begun to call for greater engagement in outcomes research with increased application of results to practice [9, 10]. They further recommend that faculty include accelerated research training in undergraduate and graduate athletic training curricula so that students may gain the skill to interpret, evaluate, and apply new research [9] and ultimately contribute to the body of evidence in the field.

Purpose of study

Throughout its development, the profession of athletic training has generated a unique body of literature. Publications such as the Journal of Athletic Training serve as a vital outlet for research in the field and as a means to communicate with, connect, and inform practitioners. To date, no published studies identify the core journals of the profession. Even including the broader discipline of sports medicine, studies of the literature have been few and very limited in scope. Two studies have focused on the content or methodologies published in a single journal title [11, 12]. Other studies have analyzed content, test subjects, instruments, or methodology across several journals and over several years.

Three journals were identified by the authors that fit the above criteria for a source journal: the Journal of Athletic Training, Athletic Therapy Today, and the Journal of Sport Rehabilitation. Athletic Therapy Today, published since 1966 by Human Kinetics, is a peer-reviewed publication focused on providing practical information to sports health care providers. The Journal of Sport Rehabilitation, launched in 1992 and also published by Human Kinetics, provides peer-reviewed articles on the latest research in the rehabilitation of sport and exercise injuries.

A database was created containing all cited references from all articles, including editorials and review articles, in the three source journals from the years 2002, 2003, and 2004. An Internet-accessible database, created by the Information Technology Department at Norwich University, enabled real-time, remote entry by both authors through a secure uniform resource lo-
The distribution of citations among the 5 format types is shown in Table 1. The bulk (81.4%; 8,678/10,657) of the references from the 3 source journals were to journal articles, with books constituting 14.5% (1,549/10,657) of the citations, leaving the remaining 4.1% (430/10,657) to be divided among the other 3 formats. Athletic Therapy Today had notably different citation patterns than the other 2 journals. The Journal of Athletic Training had 83.3% (5,267/6,320) of the citations coming from journal articles and 12.0% (756/6,320) from books, and the Journal of Sport Rehabilitation had a similar breakdown with 84.4% (1,997/2,365) from journal articles and 14.5% (342/2,365) from books. In contrast, 71.7% (1,414/1,972) of the citations in Athletic Therapy Today came from journal articles and 22.9% (451/1,972) from books. However, it should be noted that as a publication, Athletic Therapy Today evolved substantially over the 3-year study period.

RESULTS

A total of 10,657 references were cited by 438 articles in the 3 source journals in 2002, 2003, and 2004. The Journal of Athletic Training, a quarterly publication, had the greatest number of citations at 6,320, for 59.3% of the total. The Journal of Sport Rehabilitation, also a quarterly publication, contributed 2,365 citations, for 22.2% of the total. Athletic Therapy Today, published 6 times a year, added 1,972 citations, for 18.5% of the total. The Journal of Athletic Training had 165 articles in the 3-year period, for an average of 38.3 citations per article. The Journal of Sport Rehabilitation had 80 articles in the same time frame, for an average of 29.6 citations per article, and Athletic Therapy Today had 193 articles, for 10.1 citations per article.

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Table 1

| Cited format type | Athletic Therapy Today | Journal of Athletic Training | Journal of Sport Rehabilitation | Totals |
|-------------------|------------------------|----------------------------|--------------------------------|--------|
|                   | No.        | %         | No.        | %         | No.        | %         | No.        | %         |
| Journal articles  | 1,414      | 71.7      | 5,267      | 83.4      | 1,997      | 84.4      | 8,678      | 81.4      |
| Government publications | 20  | 1.0      | 78  | 1.2      | 4  | 0.2      | 102  | 1.0      |
| Books             | 451        | 22.9      | 756        | 12.0      | 342        | 14.5      | 1,549      | 14.5      |
| Websites (nongovernmental) | 72  | 3.6      | 78  | 1.2      | 6  | 0.2      | 156  | 1.5      |
| Miscellaneous     | 15         | 0.8       | 141        | 2.2       | 16         | 0.7       | 172        | 1.6       |
| Total             | 1,972      | 100.0     | 6,320      | 100.0     | 2,365      | 100.0     | 10,657     | 100.0     |

Cited format types by source journal and total frequency
The total number of citations increased from 496 in 2002 to 826 in 2004, with a concomitant increase in the number of citations to journal articles from 69% to 75%.

The currency of the cited material is displayed in Table 2. Using the year ranges of pre-1960, 1960 to 1969, 1970 to 1979, 1980 to 1989, 1990 to 1994, 1995 to 1999, and 2000 to 2005 including in press materials, it is evident that the vast majority (91.3%; 9,734/10,657) of the total citations were to materials dated 1995 to 2000. Over half of the total citations were to materials published in the last 10 years, while more than 81% (8,678/10,657) of the total citations, heavily on the journal article, which accounted for more than 81% (8,678/10,657) of the total citations, with books as the next largest category at a far distant 14.5% (1,549/10,657). Over half of the total citations were to materials published in the last 10 years, while a relatively small percentage of materials older than 25 years were cited. The use of government documents had an even greater increase, with the number of citations increasing from 6 in 1995 to 1999 to 54 in 2000 to 2005. The nature of the journal titles in Zones 1 and 2 clearly indicates that the source of knowledge for this burgeoning field derives heavily from sports medicine, physical therapy, orthopedics, and physiology. General

The literature of athletic training was found to rely heavily on the journal article, which accounted for more than 81% (8,678/10,657) of the total citations, with books as the next largest category at a far distant 14.5% (1,549/10,657). Over half of the total citations were to materials published in the last 10 years, while a relatively small percentage of materials older than 25 years were cited. The use of government documents in the 2000-to-2005 time period dramatically increased, no doubt driven by the widespread availability of government-issued materials via the Internet.

The nature of the journal titles in Zones 1 and 2 clearly indicates that the source of knowledge for this burgeoning field derives heavily from sports medicine, physical therapy, orthopedics, and physiology.

## Table 2

| Cited format type | Publication year (range) | Journal articles | Government documents | Books | Internet (nongovernmental) | Miscellaneous | All formats |
|-------------------|--------------------------|------------------|----------------------|-------|---------------------------|---------------|-------------|
| No. | % | No. | % | No. | % | No. | % | No. | % |
| 2000–2005* | 1,478 | 17.0 | 54 | 52.9 | 311 | 20.1 | 136 | 87.2 | 46 | 26.7 | 2,025 | 19.0 |
| 1995–1999 | 2,718 | 31.3 | 6 | 5.9 | 515 | 33.2 | 20 | 12.8 | 77 | 44.8 | 3,336 | 31.3 |
| 1990–1994 | 1,885 | 21.7 | 12 | 11.8 | 371 | 23.9 | 0 | 0 | 28 | 16.3 | 2,296 | 21.5 |
| 1980–1989 | 1,802 | 20.8 | 13 | 12.8 | 248 | 16.0 | 0 | 0 | 14 | 8.1 | 2,077 | 19.5 |
| 1970–1979 | 507 | 5.9 | 11 | 10.8 | 69 | 4.5 | 0 | 0 | 4 | 2.3 | 591 | 5.6 |
| 1960–1969 | 199 | 2.3 | 3 | 2.9 | 15 | 1.0 | 0 | 0 | 1 | 0.6 | 218 | 2.0 |
| Pre-1960 | 89 | 1.0 | 3 | 2.9 | 20 | 1.3 | 0 | 0 | 2 | 1.2 | 114 | 1.1 |
| Total | 8,678 | 100.0 | 102 | 100.0 | 1,549 | 100.0 | 156 | 100.0 | 172 | 100.0 | 10,657 | 100.0 |

* Includes in press materials

## Table 3

| Zone | Cited journals | Cited journal references | Cumulative total |
|------|----------------|--------------------------|------------------|
|      | No. | %  | No. | %  |                          |                  |
| 1    | 6   | 0.6| 2,993 | 34.5 | 2,993                      |
| 2    | 40  | 3.7| 2,831 | 32.6 | 5,824                      |
| 3    | 1,034 | 95.7 | 2,854 | 32.9 | 8,678                      |
| Total| 1,080 | 100.0 | 8,678 | 100.0 | 8,678                      |
interest medical publications such as *JAMA* and *BMJ* ranked in the middle of Zone 2, pointing to the somewhat narrow focus of this field. The top-ranking journal, the *American Journal of Sport Medicine*, far outscored the lowest-ranking Zone 1 journal by more than three times, reflecting the heavy influence of this particular publication. The high rank of the *Journal of Athletic Training* as the second-most heavily cited title might reflect both the increasing maturity of the profession and the pivotal role the profession’s central publication has played in disseminating research in the field. Two of the three source journals ranked in Zone 1, while the third ranked in the middle of Zone 2.

The evolution of the source journal *Athletic Therapy Today* is worth noting. Its dramatic increase in the total number of citations and concomitant increase in the proportion of journal citations over the course of the three years may be a sign of diminished reliance on secondary and tertiary forms of literature and increased usage of the primary literature. If the study were repeated in a few years, it is possible that its citation pattern will approach that of the other two source journals.

**CONCLUSION**

This study followed the methodology developed specifically for the Mapping the Literature of Allied Health Project [2]. As with the previous studies in this series, the primary limitation of this study lay in selecting source journals, because that factor dictated the body of citations analyzed. Besides the three journals selected as source journals, the authors were not aware of any other publications that met the stated criteria for a source journal.

This study indicates that the field of athletic training...
draws heavily from the literature of several closely related disciplines. Athletic trainers seeking to remain abreast of trends in the field should focus their scan of the literature on those journals in Zone 1 and to a lesser degree those in Zone 2. Because this study identifies the core journal titles for the entire discipline, individual practitioners may find that the ranking of the journals differs from their own list of favorites.

Librarians employed in college and university settings can use these data to make wise journal and database purchasing decisions. In an era of dwindling budgets and skyrocketing journal prices, they can now identify those journals that are most critical to this field, thereby maximizing their institutions’ purchasing power. Reference librarians can use the data to direct patrons to the core journal titles in the field for browsing and current awareness. Comprehensive literature searches performed by librarians or end users should be performed in multiple databases to cover the largest number of relevant publications. Librarians serving as liaisons to academic departments and campus sports therapy clinics can provide advice to faculty and students on which publications are most critical to their research and practice.

Database producers can use the information from this study to increase coverage of core athletic training journal titles that are currently either not indexed or are indexed only selectively. CINAHL could increase its level of indexing of the titles in Zone 2 to more comprehensively serve the field. MEDLINE does well in covering the titles that are central to medicine but could improve its indexing of titles specific to athletic training. SPORTDiscus could improve its indexing of titles specific to athletic training. MEDLINE does well in covering the titles that are central to medicine but could improve its indexing of titles specific to athletic training. SPORTDiscus could improve its good but somewhat spotty coverage, perhaps by focusing on improving its use of controlled vocabulary.

While the findings of this study, like the others in the NAHRS Mapping the Literature of Allied Health Project, are vital to health sciences librarians, they are perhaps of greater value to the practitioners in the individual disciplines studied. The open access policy of the journal of the Medical Library Association and the ever-improving access to the biomedical literature via PubMed combine to ensure that these findings will make their way into the hands of those who need them most, the health care professionals themselves.

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