

Arthritis and Rheumatism Are Neglected Health Priorities: A Bibliometric Study

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ABSTRACT. Objective. To investigate the frequency of publications about arthritis and rheumatic diseases relative to other diseases and to examine which topics received most attention.

Methods. Available health statistics were used to quantify the burden of illness due to musculoskeletal (MSK) conditions. Next, a bibliographic analysis of MEDLINE was performed comparing disease categories using the MeSH tree structure for 1991 and 1996. Diseases were ranked according to the frequency of citations attributable to them and further analyses were performed for journal categories, MeSH subheadings, and the frequency of citations for specific types of arthritis and rheumatic diseases.

Results. Compared with 9 other causes, MSK diseases are leading contributors to health professional consultations, total health costs, chronic ill health, and disability. In contrast, MSK diseases ranked ninth among twelve major MEDLINE disease categories in 1996 and 1991. These rankings were similarly low across journal categories reflecting basic science research and clinical application. Radiography, rehabilitation, history and embryology were the most frequently used subheadings for MSK diseases. In 1996, there were 16,603 citations for MSK diseases, led by bone diseases (7304 citations), joint diseases (4987), muscular diseases (4236), arthritis (3555), and rheumatic diseases (3195). Among arthritic and rheumatic diseases, rheumatoid arthritis had the largest number of citations (2004), followed by systemic lupus erythematosus (927) and osteoarthritis (793).

Conclusion. Arthritis and rheumatic diseases receive far less attention in the scientific literature than is warranted by their enormous and growing disease burden. Both research and dissemination are lacking and more adequate resources for these activities are indicated. (*J Rheumatol* 2001;28:706–11)

Key Indexing Terms:

BURDEN OF ILLNESS

ARTHRITIS
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RESOURCE ALLOCATION

There is a perception that arthritis and rheumatic diseases in general have had a lower priority on the health care agenda than conditions such as cancer, heart disease, or diabetes. This lower priority, if true, contrasts with the current reality that arthritis and rheumatic diseases are leading causes of health care visits, medication use, and disability and are among the most prevalent health conditions^{1,2}. A dramatic rise in the prevalence of arthritis and rheumatic diseases is expected over the next 3 decades³. Contributing to this lower priority could be the beliefs that arthritis and

rheumatic diseases are inevitable consequences of aging, that most people with these conditions have minor aches and pains, and that there are few therapies of real benefit available. All of these beliefs are strongly contradicted by existing evidence⁴⁻⁸.

The attention directed to arthritis and rheumatic diseases relative to other health conditions is measurable in several ways. Possible approaches include measuring the amount of research funding, time allotment in the undergraduate medical curriculum and postgraduate training of primary care specialists, specialty and subspecialty training spots dedicated to musculoskeletal (MSK) conditions, and media reports. A different approach would be to examine the publication of information about arthritis and rheumatic diseases in the scientific realm relative to other conditions. We have chosen to pursue the latter approach since it reflects a more downstream outcome than training or research resources, it is readily quantifiable and verifiable, and trends over time can be tracked. A clear understanding of the degree and type of attention directed to arthritis and rheumatic diseases should help organizations, practitioners, and researchers advocate for raised awareness and augmented resources for the management of these conditions.

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We wanted to quantify in the health care literature the publication of papers about arthritis and rheumatic diseases relative to other health conditions and to examine which topics received most attention. We also sought to investigate trends over time and to examine journal types reflecting both original research activity and dissemination.

MATERIALS AND METHODS

In order to estimate their relative burden of illness, we ranked 10 major disease categories according to mortality, hospitalization, health professional consultations, consumer drug costs, total health costs, prevalence, and disability using available North American information.

The remainder of our study made use of MEDLINE, an online bibliographic database of approximately 3900 international medical and health-related journals that is maintained by the National Library of Medicine (NLM) in Bethesda, Maryland. The indexers for the NLM classify material with a controlled vocabulary of thesaurus items known as the Medical Subject Headings (MeSH). MeSH is divided at the top into 15 tree structures including Diseases, which covers the broad area of disease types and body system diseases. Diseases are further subdivided into 23 categories, one of which is MSK Diseases (Table 1). Since these major disease categories can be readily compared with each other, they were the object of further analyses by number of citations, journal type, subheadings and year.

Among 23 disease categories, 12 with the largest number of citations in 1996 were compared according to the number of citations in 1991 and 1996. The frequency of citations for diseases was generated by exploding each in order to gain the greatest number of citations related to each discrete term. In order to be counted, a disease MeSH term needed to appear but not necessarily as the main focus of the article.

In order to understand both basic and clinical research and application of information about MSK diseases to different audiences, we examined 5 categories of health care journals: basic science; general medicine; geriatrics; family medicine; and public health. Basic science journals were felt to represent basic science research while the remaining journal categories

were felt to represent clinical research and clinical application of new knowledge. Up to 10 journals in each category were included if they were indexed in MEDLINE in 1991 and 1996. Where more than 10 choices were available, we included the journals with the highest impact factor as measured by the 1995 Journal Citation Reports of the Science Citation Index⁹. The journals included in each category are found in Table 2. To determine which areas of inquiry were most often cited in MEDLINE, we further examined 37 broadly applicable subheadings for the diseases under study.

Finally, we examined in more detail the major categories of citations included under MSK Diseases to determine which of these relate most closely to arthritis and rheumatic diseases and which diseases were most frequently cited.

RESULTS

Compared with 9 other causes, MSK diseases are leading contributors to health professional consultations, total health costs, chronic ill health, and disability. They are relatively infrequent causes of mortality and hospitalization and rank in the middle for consumer drugs costs (Table 3).

In terms of citations, MSK diseases ranked ninth among 12 disease categories with 16,603 and 15,424 citations, respectively in 1996 and 1991 (Figure 1) with only hematologic and lymphatic diseases, sensory organ diseases, and stomatognathic diseases ranked lower. This low ranking was also the case for basic science journals (ninth out of 12 disease categories) as well as those in general medicine (tenth), family medicine (ninth), and public health (tenth) in 1996. MSK diseases ranked fourth in geriatrics journals in 1996. There was very little change in these rankings between 1991 and 1996.

The rankings for subheadings attributed to MSK diseases were also low. Radiography and rehabilitation ranked third, history and embryology ranked fourth, and all other subheadings ranked fifth or lower among 12 disease categories. Subheadings of major clinical relevance such as therapy, drug therapy, diagnosis, prevention and control all ranked eighth or lower. This means that these subheadings were attributed to other disease categories much more frequently than to MSK diseases. There were no major changes between 1991 and 1996.

The most frequently cited MSK diseases in 1996 were bone diseases (7304 citations), joint diseases (4987), muscular diseases (4236), arthritis (3555), and rheumatic diseases (3195) (Table 4). Connective Tissue Diseases is not itself a major MeSH disease category but is included in the category Skin and Connective Tissue Diseases. When Connective Tissue Diseases are considered alone, they had 4,714 citations in 1996, but this included the 3,195 citations for rheumatic diseases. Under the MeSH classification, some conditions appear in more than one category. For this reason, connective tissue diseases account for only 1519 citations that were not already included in MSK diseases.

Among all arthritic and rheumatic diseases in 1996, rheumatoid arthritis had the largest number of citations in 1996 (2004), followed by systemic lupus erythematosus (927) and osteoarthritis (793) (Table 4).

Table 1. Diseases subcategories in MEDLINE®.

Category C. Diseases

- C1. Bacterial Infections and Mycoses
- C2. Virus Diseases
- C3. Parasitic Diseases
- C4. Neoplasms
- C5. Musculoskeletal Diseases
- C6. Digestive System Diseases
- C7. Stomatognathic Diseases
- C8. Respiratory Tract Diseases
- C9. Otorhinolaryngologic Diseases
- C10. Nervous System Diseases
- C11. Eye Diseases
- C12. Urologic and Male Genital Diseases
- C13. Female Genital Diseases and Pregnancy Complications
- C14. Cardiovascular Diseases
- C15. Hemic and Lymphatic Diseases
- C16. Neonatal Diseases and Abnormalities
- C17. Skin and Connective Tissue Diseases
- C18. Nutritional and Metabolic Diseases
- C19. Endocrine Diseases
- C20. Immunologic Diseases
- C21. Injuries, Poisonings, and Occupational Diseases
- C22. Animal Diseases
- C23. Symptoms and General Pathology

Table 2. Journal categories.

Geriatrics	
Journal of the American Geriatrics Society	Maturitas
Journal(s) of Gerontology	Drugs and Aging
Age & Ageing	Gerontology
Mechanisms of Ageing and Development	Aging
Experimental Gerontology	Geriatrics
Family Medicine/General Practice	
British Journal of General Practice	Postgraduate Medicine
Journal of Family Practice	American Family Physician
Family Practice	Practitioner
Postgraduate Medical Journal	
Medicine, General and Internal	
New England Journal of Medicine	BMJ
Lancet	Archives of Internal Medicine
Annals of Internal Medicine	American Journal of Medicine
JAMA	Medicine
World Health Organization Technical Reports	Annual Review of Medicine
Public Health	
Epidemiological Reviews	Epidemiology
American Journal of Epidemiology	Archives of Environmental Health
American Journal of Public Health	Drug Safety
Annual Review of Public Health	Genetic Epidemiology
Medical Care	Therapeutic Drug Monitoring
Basic Science	
Nature	Scientific American
Science	Experientia
FASEB Journal	Naturwissenschaften
Proceedings of the National Academy of Sciences of the United States of America	Annals of the New York Academy of Sciences
	Endeavour

Table 3. Measures of burden of illness by major disease category and rank.

Disease	Mortality*	Hospital Discharges**	Health Professional Consultations***	Consumer Drug Cost†	Total Health Cost†	Chronic Condition‡	Disabling Condition#
Cardiovascular	1	1	3	1	1	1	2
Neoplasms	2	4	—	8	4	—	6
Respiratory	3	6	2	2	5	2	3
Injury	4	3	—	9	3	—	—
Digestive	5	2	4	3	7	—	7
Endocrine	6	9	5	4	8	6	4
Nervous	7	8	6	6	6	5	5
Urogenital	8	5	8	7	9	4	—
Musculoskeletal	9	7	1	5	2	3	1
Immune/Hemic	10	10	7	10	10	7	—

*Statistics Canada. Causes of death, 1995. Ottawa: Statistics Canada, 1997.

**Elixhauser A, Andrews RM, Fox S. Clinical classifications for health policy research: discharge statistics by principal diagnosis and procedure. AHCPR Publications No. 93-0043. Rockville, MD: Agency for Health Care Policy and Research, 1993.

***Ontario Health Survey, 1990: highlights. (Toronto): Ontario Ministry of Health, 1992.

†Health Canada. Economic burden of illness in Canada, 1993. (Ottawa): Health Canada, 1997.

‡National Center for Health Statistics. Current estimates from the National Health Interview Survey, 1994. Series 10: Data from the National Health Survey No. 193. Hyattsville, MD: U.S. Department of Health and Human Services, 1995.

#Statistics Canada. Report of the Canadian Health and Disability Survey, 1983-1984. Ottawa: Statistics Canada, 1986.

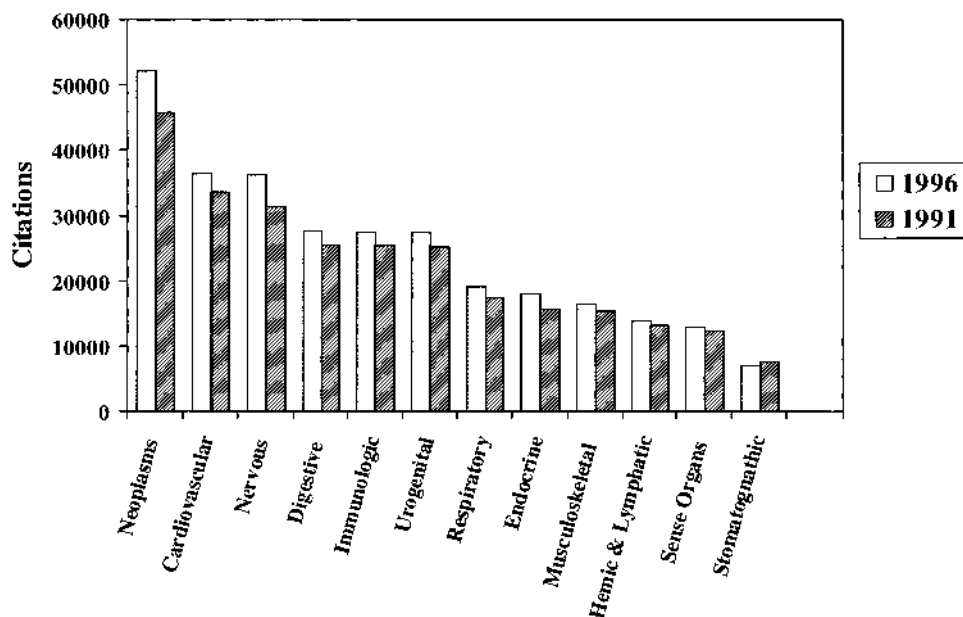


Figure 1. Citations attributable to diseases and relative ranking, MEDLINE®, 1996 and 1991.

Table 4. Major categories included in Musculoskeletal Diseases and Connective Tissue Diseases, MEDLINE, 1996 and 1991.

Major Musculoskeletal Diseases Category	No. of Citations, 1996	No. of Citations, 1991
Bone	7304	6682
Joint	4987	5011
Arthritis	3555	3464
Arthritis, Rheumatoid	2004	1947
Osteoarthritis	793	709
Arthritis, Infectious	245	306
Rheumatic Fever	162	192
Arthritis, Adjuvant	134	116
Gout	108	119
Arthritis, Psoriatic	85	74
Chondrocalcinosis	39	36
Reiter's Disease	22	41
Periarthritis	13	21
Muscular	4236	3900
Rheumatic*	3195	3043
Fibromyalgia	136	74
Polymyalgia Rheumatica	56	50
Hyperostosis, Sternocostoclavicular	12	5
Major Connective Tissue Diseases Category**	No. of Citations, 1996	No. of Citations, 1991
Neoplasms, Connective Tissue	1683	1584
Lupus Erythematosus, Systemic	927	932
Scleroderma, Systemic	299	302
Collagen Diseases	285	247
Mucinoses	185	153
Cellulitis	154	123
Dermatomyositis	118	98

*Includes arthritis, rheumatoid; osteoarthritis; rheumatic fever; gout.

**Includes rheumatic diseases.

DISCUSSION

Bibliometric methods have been used to examine published articles for journal type¹⁰, health disciplines¹¹, specific topic areas¹², sociopolitical issues in health¹³, and international comparisons¹⁴. We are not aware, however, of its previous use to investigate the relative position of arthritis and rheumatic diseases, nor the subject area of journal articles being published about these conditions.

Under the disease tree structure in MeSH, MSK diseases receive very little attention relative to their burden of illness. Although the leading cause of disability in developed countries and a major cause of health care utilization, MSK diseases rank ninth out of 12 major disease categories. They fare no better among specific journal categories reflecting original research and dissemination. The only exception is geriatrics, but even there they reach only fourth position. Among subheadings, MSK diseases also ranked very low, reaching no higher than third place even for rehabilitation and radiography.

The most common specific disease entities within the MSK diseases were bone diseases, which occupy almost half of all MSK disease citations. Among specific arthritic and rheumatic diseases, rheumatoid arthritis was most frequently cited, followed by systemic lupus erythematosus and osteoarthritis. Although more arthritis disability in the general population is attributable to osteoarthritis than to any other cause, less than a quarter of arthritis citations were related to this condition. The multisystem complexity and immune system involvement of the inflammatory arthritides and connective tissue diseases are likely explanations for the preponderance of citations for these conditions versus degenerative arthritis. Inflammatory arthritides may also

hold more interest than degenerative arthritis for specialty readers. These findings suggest, however, that osteoarthritis is a relatively neglected condition within the relatively neglected realm of MSK diseases.

These findings need to be interpreted cautiously for several reasons. Only a single database, MEDLINE, was used for this study. Even though it is the mostly commonly used database of its kind in North America, there are other such databases available. The training and supervision of coders at the National Library of Medicine helps to assure a degree of consistency of coding, but as with any classification scheme, inconsistencies and inaccuracies are to be expected. We did not examine articles in detail to determine their methods, for instance whether they were case studies or randomized trials, nor did we assess whether they were reporting new findings or summarizing existing knowledge. Each article in MEDLINE can be coded under many headings and subheadings, so none of the counts we list can be considered exclusive of each other. It would have been ideal to compare arthritis and rheumatic diseases with other specific diseases such as diabetes or stroke. Unfortunately, such approaches are open to bias in aggregating disease entities. For example, the decision whether to compare rheumatoid arthritis with stroke or all arthritis with all thrombotic diseases could be motivated by the desired outcome. While the existing MeSH tree structure is somewhat arbitrary, it was designed for uses other than the present one and is therefore less open to this type of bias. We did not examine Systems in detail, which are based on anatomy under the MeSH tree structure and include subjects such as bone, muscle, and joint.

The disease categories used in this study are not necessarily of clinical relevance nor do they necessarily correspond with all of the conditions commonly seen by rheumatologists. The categories used, however, are those provided by the MeSH tree structure. Precisely because these categories were designed for coding and retrieval and not for clinical or policy purposes, they provide a different perspective on dissemination of health care information than can be found in other sources.

Some readers would choose different diseases for study and different journal categories than we did, but we expect that their findings in terms of relative rankings would not differ greatly from our own. Since no major shifts in ranking were apparent between 1991 and 1996, the choice of year to study does not appear to greatly influence the results. Readers today performing the same searches as we did would find the number of citations to be slightly different since the National Library of Medicine continuously revises its databases, including earlier years.

Several additional factors may have contributed to these findings. The number of journals dedicated to MSK diseases, relative to journals dedicated to other health conditions would have influenced these results, as would the rela-

tive proportion of MSK papers published in specialized versus general medical journals. The preferences of article reviewers and journal editors would also be expected to have influenced these results.

The contribution of these bibliometric data should be judged against the difficulty of obtaining accurate information on research funding or other measures of relative priority in health care. For example, a recent report based on research funding by the National Institutes of Health included 29 health conditions in its analyses but neither arthritis nor any other MSK condition was included¹⁵.

We conclude that arthritis and rheumatic diseases receive far less attention in the scientific literature than is warranted by their enormous and growing disease burden. We anticipate that our findings will be of interest to the many scientists, clinicians, members of the public, and organizations working to secure greater resources to combat arthritis and rheumatic diseases.

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REFERENCES

1. Badley EM, Rasooly I, Webster GK. Relative importance of musculoskeletal disorders as a cause of chronic health problems, disability, and health care utilization: findings from the 1990 Ontario Health Survey. *J Rheumatol* 1994;21:505-14.
2. Spitzer WO, Harth M, Goldsmith CH, et al. The arthritic complaint in primary care: prevalence, related disability, and costs. *J Rheumatol* 1976;3:88-99.
3. Badley EM, Wang PP. Arthritis and the aging population: projections of arthritis prevalence in Canada 1991 to 2031. *J Rheumatol* 1998;25:138-44.
4. Badley EM, Webster GK, Rasooly I. The impact of musculoskeletal disorders in the population: are they just aches and pains? Findings from the 1990 Ontario Health Survey. *J Rheumatol* 1995;22:733-9.
5. Minor MA, Hewett JE, Weibel RR, Anderson SK, Kay DR. Efficacy of physical conditioning exercise in patients with rheumatoid arthritis and osteoarthritis. *Arthritis Rheum* 1989;32:1396-405.
6. Superio-Cabuslay E, Ward MM, Lorig KR. Patient education interventions in osteoarthritis and rheumatoid arthritis: a meta-analytic comparison with nonsteroidal antiinflammatory drug treatment. *Arthritis Care Res* 1996;9:292-301.
7. Rau R, Herborn G, Menninger H, Sangha O. Progression in early erosive rheumatoid arthritis: 12 month results from a randomized controlled trial comparing methotrexate and gold sodium thiomalate. *Br J Rheumatol* 1998;37:1220-6.
8. Weinblatt ME, Kremer JM, Bankhurst AD, et al. A trial of etanercept, a recombinant tumor necrosis factor receptor:Fc fusion protein, in patients with rheumatoid arthritis receiving methotrexate. *N Engl J Med* 1999;340:253-9.
9. Institute for Scientific Information. 1995 Science citation index JCR journal citation reports: a bibliometric analysis of science journals in the ISI database. Philadelphia: ISI; 1996.
10. Singer AJ, Homan CS, Stark MJ, Werblud MC, Thode HC, Hollander JE. Comparison of types of research articles published in emergency medicine and non-emergency medicine journals. *Acad Emerg Med* 1997;4:1153-8.
11. Wakiji EM. Mapping the literature of physical therapy. *Bull Med Library Assoc* 1997;85:284-8.

12. Lopez-Munoz F, Boya J, Marin F, Calvo JL. Scientific research on the pineal gland and melatonin: a bibliometric study for the period 1966-1994. *J Pineal Res* 1996;20:115-24.
13. Raftos M, Mannix J, Jackson D. More than motherhood? A feminist exploration of 'women's health' in papers indexed by CINAHL 1993-1995. *J Adv Nurs* 1997;26:1142-9.
14. Adams J. Benchmarking international research. *Nature* 1998;396:615-8.
15. Gross CP, Anderson GF, Powe NR. The relation between funding by the National Institutes of Health and the burden of disease. *N Engl J Med* 1999;340:1881-7.