Mod Rheumatol (2003) 13:168–172

ORIGINAL ARTICLE

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Japan's contribution to research in rheumatology

Received: June 19, 2002 / Accepted: October 4, 2002

Abstract The objective of this study is to investigate the degree of Japan's contribution to the research in rheumatology in the past decade. Articles published in 1991–2000 in highly reputed journals in rheumatology and general medicine were assessed through the MEDLINE database. Then, the number of articles having an affiliation with a Japanese institution was counted and summed up as a whole and also separately for each journal with statistical time trend analysis. The proportions of randomized controlled studies (RCT), case-control/cohort studies, and case reports in articles from Japan were also determined. Of total articles in rheumatology, Japan's contribution to the research reported in journals of rheumatology was 5.7% and ranked fourth in the world; in journals of general medicine, it was 1.2% and ranked eighth. The recent increase in contribution was significant ($P = 0.01$). Compared with other countries, the proportions of RCTs (1.1%) and case-control/cohort studies (6.4%) were smaller and that of case reports similar (5.9%) among the articles from Japan. In conclusion, we should determine and remove the factors that restrain high-quality clinical research to achieve a more significant contribution of Japan to research in rheumatology.

Key words Journals · MEDLINE · Rheumatology

Introduction

It is reported that in Japan basic science research in medicine has received much more priority in terms of resource and interest compared to clinical research.[1] Japan's contributions to basic medical science journals and general medicine journals as judged from the total articles published in high-quality journals were 3.1% and 0.7%, respectively, with the ranking in the world being 4th and 14th, respectively.[2,3] However, little is known about Japan's contributions to specific clinical fields. The objectives of the current investigation were to elicit the relative contribution, quantitatively and qualitatively, of Japan to research in rheumatology in the last decade and to find the time trend over that period in this field.

Materials and methods

Seven journals related to rheumatology with the highest impact factors (*Arthritis and Rheumatism*, *British Journal of Rheumatology*, *Seminars in Arthritis and Rheumatism*, *The Journal of Rheumatology*, *Rheumatic Diseases Clinics of North America*, *Lupus*, *Annals of the Rheumatic Diseases*) were selected from the "Rheumatology" category set by the Institute for Scientific Information (ISI).[4] (As the *British Journal of Rheumatology* was renamed as *Rheumatology* from 1999, we combined retrieved data from this journal with those from *British Journal of Rheumatology* before that year.)

The MEDLINE database was searched in the last week of April 2002 to elicit the number of articles (journal articles) originating from Japanese institutions published from 1991 through 2000. Then, the proportion of Japan's contributions to each of the journals was generated and summed up to find the net contribution of Japan to the rheumatology journals and its time trend as a whole.

An analysis on the quality of Japan's contribution was also conducted. We extracted the articles of randomized controlled trials, case-control studies, or case reports, using the following search terms: randomized controlled trial in publication type, case-control study, cohort study, or case report in medical subject headings (MeSH). Then, the proportion of each study design among all articles from Japan was put into perspective.

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Additionally, in the field of general medicine and internal medicine, we evaluated Japan's contribution among the research articles related to rheumatology. Seven journals related to general medicine with the highest impact factors (*New England Journal of Medicine*, *The Lancet*, *Journal of the American Medical Association*, *Annals of Internal Medicine*, *British Medical Journal*, *Archives of Internal Medicine*, *American Journal of Medicine*) were selected from the General Medicine and Internal Medicine category set by the ISI. To retrieve published articles (journal articles) associated with rheumatology, we used the following MeSH terms related to the diseases listed in the classification criteria of American College of Rheumatology: rheumatoid arthritis, osteoarthritis, systemic lupus erythematosus, Wegener granulomatosis, polyarteritis nodosa, gout, hypersensitivity vasculitis, Schoenlein–Henoch purpura, Takayasu arteritis, temporal arteritis, fibromyalgia, Churg–Strauss syndrome, and juvenile rheumatoid arthritis.[5]

Statistical analysis

A nonparametric test for trend was performed using STATA 7.0[6] to determine any significant change of Japan's contribution over this period of time. Test of significance was two tailed, and a value of $P < 0.05$ was considered significant.

Results

In total, 12776 articles were published during 1991–2000 in the seven journals on rheumatology. Affiliation data were available for 12694 (99.4%) articles. Among these, Japan's contributions were 721 articles (5.7%), with the ranking in the world being fourth. In these journals, Japan's contribution ranged from 0.7% to 7.3% (Fig. 1). Table 1 shows 20

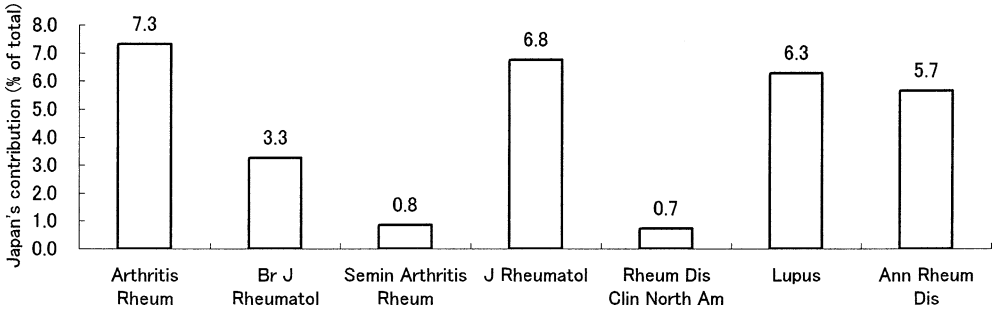


Fig. 1. Japan's contribution to selected rheumatology journals in 1991–2000. *Arthritis Rheum*, Arthritis and Rheumatism; *Br J Rheumatol*, British Journal of Rheumatology; *Semin Arthritis Rheum*, Seminars in Arthritis and Rheumatism; *J Rheumatol*, The Journal of Rheumatology; *Rheum Dis Clin North Am*, Rheumatic Diseases Clinics of North America; *Ann Rheum Dis*, Annals of the Rheumatic Diseases

Table 1. Share of articles for research on rheumatology for 20 top-ranking countries

Country	Number of articles published (% of total)		
	1991–2000 (n = 12694)	1991 (n = 1060)	2000 (n = 1514)
USA ↓	3771 (29.7)	398 (37.5)	343 (22.7)
UK ↓	2328 (18.3)	241 (22.7)	208 (13.7)
Canada	849 (6.7)	72 (6.8)	91 (6.0)
Japan ↑	721 (5.7)	27 (2.5)	108 (7.1)
Netherlands	665 (5.2)	48 (4.5)	82 (5.4)
France	576 (4.5)	29 (2.7)	61 (4.0)
Germany ↑	432 (3.4)	23 (2.2)	80 (5.3)
Italy ↑	388 (3.1)	20 (1.9)	67 (4.4)
Spain ↑	381 (3.0)	25 (2.4)	47 (3.1)
Australia	300 (2.4)	19 (1.8)	33 (2.2)
Finland	289 (2.3)	17 (1.6)	33 (2.2)
Sweden	255 (2.0)	27 (2.5)	39 (2.6)
Israel	224 (1.8)	19 (1.8)	26 (1.7)
Belgium	136 (1.1)	12 (1.1)	22 (1.5)
Mexico	129 (1.1)	11 (1.0)	12 (0.8)
Switzerland	124 (1.0)	6 (0.6)	25 (1.7)
Norway	95 (0.7)	7 (0.7)	20 (1.3)
Denmark ↑	79 (0.6)	1 (0.1)	12 (0.8)
Argentina	72 (0.6)	3 (0.3)	11 (0.7)
Greece	71 (0.6)	5 (0.5)	10 (0.7)

Ranking based on total number of articles published during 1991–2000
Data do not add up to 100% because shares of other countries are not included
↑ Share of articles went up significantly over time
↓ Share of articles went down significantly over time

top-ranking countries in terms of volume and share of total articles for each country. The United States contributed 29.7% of the total and ranked top among all the countries, followed by the United Kingdom (18.3%) and Canada (6.7%). In time-trend analysis, Japan's contribution was significantly positive ($P = 0.01$), increasing from 2.5% in 1991 to 8.2% in 1998, with some decrease to 7.3% in 1999 and 7.1% in 2000 (Fig. 2). The share of articles by the United States ($P = 0.01$) and UK ($P = 0.01$) decreased significantly. On the other hand, in addition to Japan, Germany ($P = 0.01$), Italy ($P = 0.02$), Spain ($P = 0.02$), Switzerland ($P = 0.05$), and Denmark ($P = 0.01$) showed a significantly positive trend.

The proportions of articles of RCTs, case-control/cohort studies, and case reports were 1.1%, 6.4%, and 15.9%, respectively, among those from Japanese institutions and 4.6%, 15.0%, and 16.4%, respectively, among those from all other countries (Fig. 3). The proportion of RCT articles was always larger for all other countries than that for Japan in 1991–2000. The proportion of case-control/cohort studies

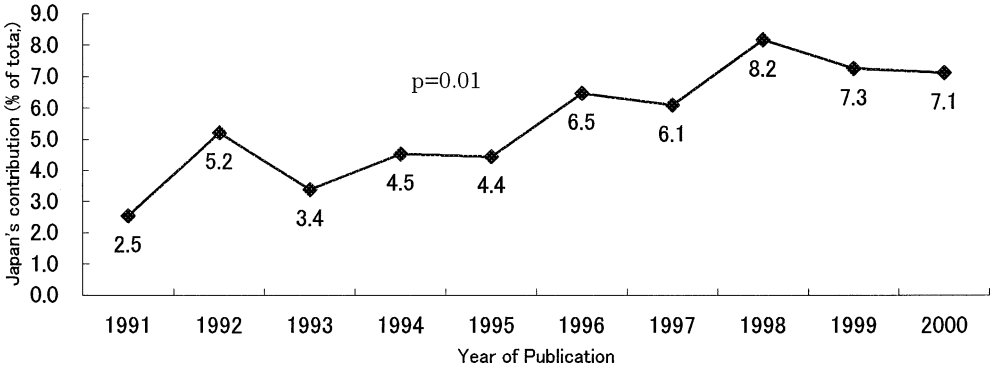
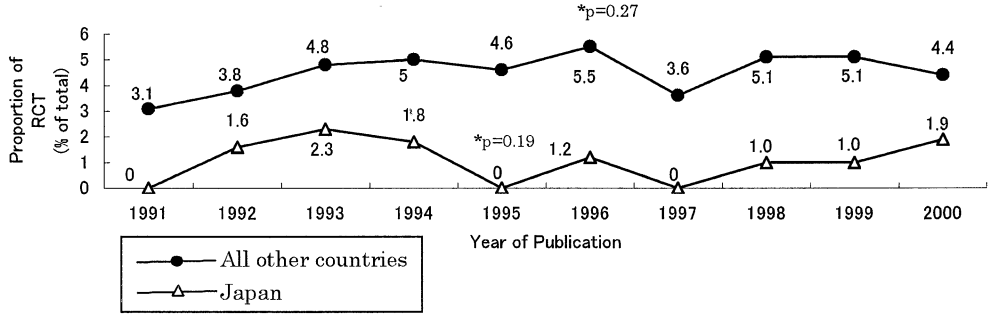
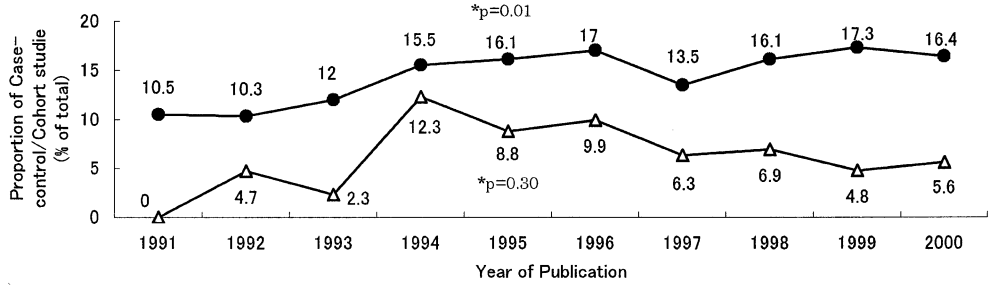


Fig. 2. Overall trend of Japan's contributions to the major rheumatology journals. *P value of test for trend





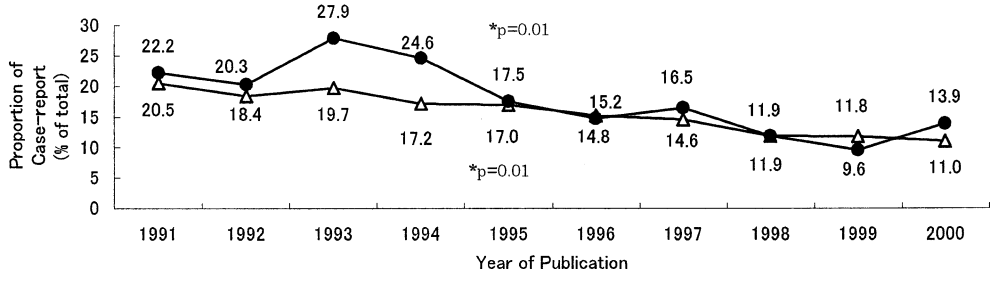


Fig. 3. The quality of Japanese contribution: time trend of the proportion of randomized controlled trials (*RCTs*), case-control/cohort studies, and case reports. *P value of test for trend

was also larger for all other countries than that for Japan, with a significant upward trend ($P = 0.01$). The proportion of case reports in the articles from Japan has decreased from 21.0% in 1991 to 12.0% in 2000 with statistical significance at $P = 0.01$, while that from all other countries remained similar over this period of time.

As for journals of general medicine and internal medicine, 656 articles related to rheumatology were published and affiliation data were available for 590 (89.0%). The United States contributed 52.2% of the total and ranked top among all the countries, followed by UK (19.2%) and Canada (5.3%), while Japan's contribution was only 1.2% and ranked eighth.

Discussion

Japan's share of articles in this field is higher (5.7%) than that in general medicine (0.7% of total, 14th in the world) and high-quality basic science (3.1%),[2,3] but lower than that in nuclear medicine (11.4% of total, 2nd in the world)[7] and orthopedics (8.3% of total, 3rd in the world).[8] These results are rather satisfactory, and the upward trend in the last decade is a promising sign observed in this respect, although the proportions of RCTs and case-control/cohort studies among articles from Japan were relatively small. Furthermore, Japan's contribution of rheumatology articles to journals of general medicine and internal medicine, containing mainly clinical research articles, was 8th and lower than that in the journals specialized in rheumatology. These results reveal that the amount of high-quality clinical research conducted in Japan is small in this field. Recent studies also documented that Japan lagged behind other developed countries in conducting high-quality clinical research.[3,9,10] The main bulk of research conducted in this field in Japan seems to be basic research on rheumatology. Because there was no way to retrieve the data from MEDLINE using MeSH and publication type, we could not quantify how much basic science articles contributed to this 5.7%.

It seems that there are some reasons why Japan's contribution in rheumatology is relatively high as a whole. First, a variety of new therapeutic modalities recently advocated in rheumatology has served to shift more research grants to this field. As a result, the numbers of institutions and researchers in rheumatology have been increasing in the last decade. Second, Japanese researchers seem to be better at doing research in a narrow specific field than in a diverse, general field. Third, the proportions of RCTs and case-control/cohort studies are relatively small among the articles from Japan, although the proportion of case reports compares well to the average. Case reports, although very important for the advancement of clinical science, can be written in a short time after an inadvertent encounter with a patient with a rare disease, whereas an RCT or analytical epidemiological study can be conducted only after large-scale preparation in terms of manpower and cost and takes years to conduct in most cases.

Although the quantity of Japan's contribution in rheumatology has dramatically increased in the past decade, there remains ample room to improve the quality of clinical research emanating from Japan. There are some barriers to conduct clinical research on rheumatology in Japan. First, the number of rheumatologists specializing in clinical research seems to be small. Second, Japan's research in medical science has been basic science oriented since the introduction of Western medicine in the late 1800s, and physicians' attitudes remain inclined toward it. Third, lack of training in clinical methodology among clinicians seems to be an obstacle to promoting clinical research in Japan.

The following strategies would be helpful to boost high-quality clinical research in Japan. First, every academic hospital in Japan should have a clinical division with specialists in rheumatology. Second, a reasonable amount of funds should be directed to the clinical department for conducting patient-oriented research in rheumatology. Finally, appropriate research methodology should be offered to medical students, residents, and postgraduate students through a well-designed curriculum. Clinical research should be prompted at all possible levels in Japan, but not at the cost of basic research.

There are some limitations in this study. First, the number of publications elicited from these journals is only a gross estimate of the proportion of Japan's contribution to the field of rheumatology. The absolute number of high-quality journal articles originating from Japan is certainly different from our findings, because there are many more journals other than the ones we covered in this study. Second, it is more difficult for Japanese researchers to submit review articles in English. In our analysis, about 50% of articles in *Seminars in Arthritis and Rheumatism* and 90% of those in *Rheumatic Diseases Clinics of North America* are review articles and the percentages of Japan's contribution to these journals were 0.8% and 0.7%, respectively, relatively small on average. Third, some studies were conducted in joint collaboration with mixed teams of local and international research and the communicating author's affiliation was reported as the origin of the research in the MEDLINE database. Thus, these current data may underestimate the contributions by Japanese researchers in terms of absolute number. However, the limitation of this study is mainly related to the proportion of basic science articles in the field of rheumatology. There are basic science articles as well as clinical science articles on human subjects in most of the rheumatology journals. Our current analysis did not take into account the proportion of basic science articles. Thus, the quality of Japan's contribution to the basic science of rheumatology has not been fully assessed.

In conclusion, Japan's contribution to the research in rheumatology is rather satisfactory. However, further efforts are necessary to promote high-quality clinical research in rheumatology in Japan.

Acknowledgments We are grateful to Prof. Tsuneyo Mimori (Department of Rheumatology and Clinical Immunology, Kyoto University Graduate School of Medicine) and Prof. Sachiko Miyagawa (Department of Dermatology, Nara Medical University) for their invaluable comments on the manuscript of this paper.

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