

## Japan's contribution to nuclear medical research

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We investigated the degree of Japan's contribution to the nuclear medical research in the last decade. Articles published in 1991–2000 in highly reputed nuclear medical journals were accessed through the MEDLINE database. The number of articles having affiliation with a Japanese institution was counted along with publication year. In addition, shares of top-ranking countries were determined along with their trends over time.

Of the total number of articles (7,788), Japan's share of articles in selected nuclear medical journals was 11.4% (889 articles) and ranked 2nd in the world after the USA (2,645 articles). The recent increase in the share was statistically significant for Japan ( $p = 0.02$ , test for trend). Japan's share in nuclear medical research output is much higher than that in other biomedical fields.

**Key words:** MEDLINE, nuclear medicine, share of articles, research productivity

### INTRODUCTION

IT IS REPORTED that in Japan basic research in medicine has been given greater priority in terms of resources and interest than clinical research.<sup>1</sup> Japan's contributions to basic medical science journals and general medical journals were 3.1% and 0.7%, respectively, of the total number of articles published in the high quality journals.<sup>2</sup> As a result Japan's rankings in the world are 4th and 14th, respectively.<sup>3</sup> It has not been examined yet whether Japan's contribution to other specific clinical fields is similar to that to general medicine. We therefore conducted this study to determine the relative contribution of Japan to the field of nuclear medical research in the last decade and to compare it with other top-ranking countries.

### MATERIALS AND METHODS

Five journals related to nuclear medicine with the highest

impact factors [European Journal of Nuclear Medicine (3.77), Journal of Nuclear Medicine (3.62), Journal of Nuclear Cardiology (1.85), Nuclear Medicine and Biology (1.58), and Nuclear Medicine Communications (1.04)] were selected from the "Radiology, Nuclear Medicine & Medical Imaging" category of journals set by the Institute for Scientific Information<sup>4</sup> to obtain the relevant data. MEDLINE database was searched in the last week of April 2002 to elicit the number of articles (journal-articles) which originated from Japanese Institutions published from 1991 through 2000. The proportion of Japanese contributions to each of the journals was generated and summed up to determine the net Japanese contribution to the nuclear medical journals as a whole, and the proportion of contributions by each of the countries was ranked in descending order. Shares of the 20 top-ranking countries were also generated for each year (1991–2000) to examine the trend.

### STATISTICAL ANALYSIS

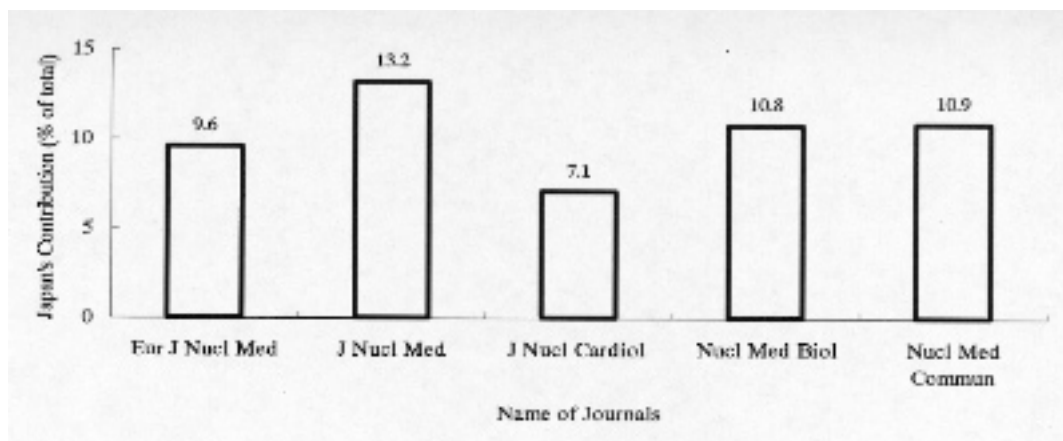
Nonparametric tests for the trend were performed with STATA 7.0<sup>5</sup> to determine any significant change in different countries' contribution during that period. Tests of significance were two-tailed and a value of  $p < 0.05$  was considered significant.

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**Fig. 1** Japan's contribution to the selected nuclear medicine journals in 1991–2000.

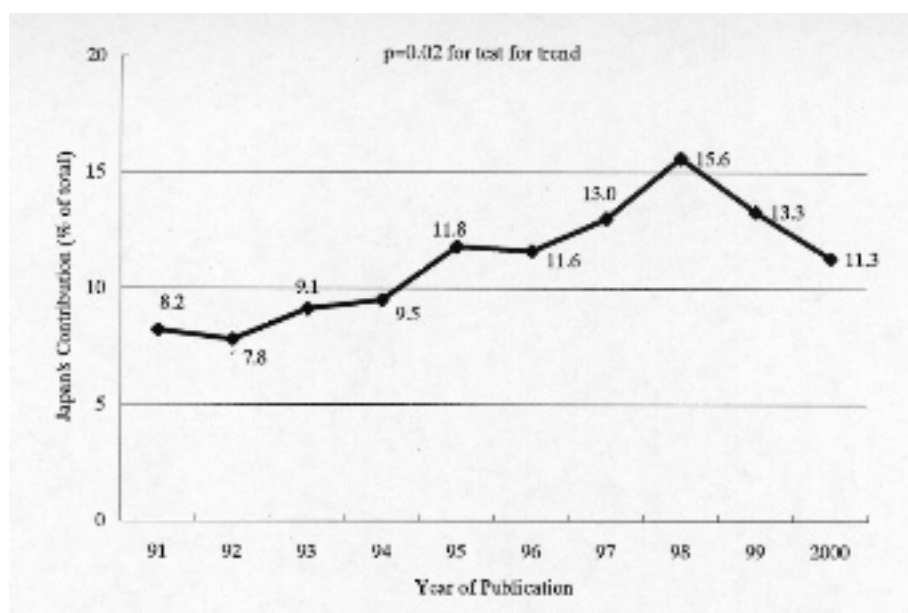
Eur J Nucl Med = European Journal of Nuclear Medicine

J Nucl Med = Journal of Nuclear Medicine

J Nucl Cardiol = Journal of Nuclear Cardiology

Nucl Med Biol = Nuclear Medicine and Biology

Nucl Med Commun = Nuclear Medicine Communications



**Fig. 2** Trend of Japan's contribution in the selected nuclear medicine journals.

## RESULTS

Altogether 7,788 articles in nuclear medical journals were published from 1991 through 2000. Among these, Japan's contributions were 889 articles (11.4%). Contributions ranged from 7.1% to 13.2% (Fig. 1) in the various journals. Japan's contribution increased from 8.2% in 1991 to 15.6% in 1998 with a decrease to 11.3% in 2000 (Fig. 2). This positive trend was statistically significant ( $p = 0.02$ ) in that period.

Table 1 shows 20 top-ranking countries in terms of

volume and share of the total number of articles for each country. The USA contributed 34.0% of the total (2,645 articles) and ranked top among all the countries followed by Japan (11.4%), UK (8.5%), Germany (5.8%), and the Netherlands (5.4%). In time trend analysis, the share of articles by USA ( $p = 0.01$ ) and UK ( $p = 0.01$ ) went down significantly in the last decade (Table 1). On the other hand, Japan ( $p = 0.02$ ), Germany ( $p = 0.02$ ), Sweden ( $p = 0.04$ ), Turkey ( $p = 0.03$ ) and South Korea ( $p = 0.01$ ) showed a significantly positive trend.

**Table 1** Share of articles in nuclear medicine for 20 top-ranking countries

Country	Number of articles published (% of total)		
	1991–2000 (N = 7,788)	1991 (N = 523)	2000 (N = 825)
USA	2,645 (34.0)	198 (37.9)	242 (29.3)
Japan	889 (11.4)	43 (8.2)	93 (11.3)
UK	661 (8.5)	69 (13.2)	58 (7.0)
Germany	453 (5.8)	27 (5.2)	60 (7.3)
Netherlands	418 (5.4)	29 (5.5)	43 (5.2)
France	376 (4.8)	20 (3.8)	40 (4.9)
Italy	345 (4.4)	13 (2.5)	36 (4.4)
Belgium	248 (3.2)	16 (3.1)	33 (4.0)
Canada	221 (2.8)	17 (3.3)	28 (3.4)
Sweden	184 (2.4)	11 (2.1)	23 (2.8)
Taiwan	136 (1.7)	4 (0.8)	17 (2.1)
Australia	134 (1.7)	12 (2.3)	9 (1.1)
Austria	121 (1.6)	7 (1.3)	15 (1.8)
Turkey	119 (1.5)	5 (1.0)	22 (2.7)
Finland	106 (1.4)	10 (1.9)	12 (1.5)
Spain	95 (1.2)	8 (1.5)	11 (1.3)
Switzerland	69 (0.9)	3 (0.6)	7 (0.9)
South Korea	61 (0.8)	0 (0)	20 (2.4)
India	54 (0.7)	1 (0.2)	9 (1.1)
Israel	50 (0.6)	4 (0.8)	5 (0.6)

Ranking based on the total number of articles published during 1991–2000.

Share of articles went up significantly over time.

Share of articles went down significantly over time.

Data did not sum up to 100 percent because shares of other countries are not included.

## DISCUSSION

The number of publications elicited from these journals is only a gross estimate of the proportion of Japan's contribution to nuclear medical research. The absolute number of high quality journal articles originating in Japan is certainly different from our findings, because there are many more journals other than the ones we dealt with in this study. Nevertheless, the proportion of contribution obtained here is likely to reflect the real situation. It is

undeniable that Japan lags behind other developed countries in conducting high quality clinical research as reported in recent studies.<sup>3,6,7</sup> For example, Japan is ranked 2nd in the world in terms of the total number of articles in medical field,<sup>8</sup> but when restricted to high quality basic and clinical science journals, Japan is only ranked 4th and 14th with contributions of 3.1% and 0.7% of articles, respectively.<sup>3</sup> Compared with these values, its contribution to nuclear medical research is satisfactory with a higher share (11.4%) and better ranking (2nd) in the world. This could be attributed to several factors unique to Japan. Firstly, it seems that the workforce in subspecialties is relatively large, compared with that in other countries. Secondly, Japan is one of the biggest producers of high technology medical instruments in the world. So it is inferred that Japan is in an advantageous position in conducting clinical research in the field of nuclear medicine.

In conclusion, Japan's contribution to nuclear medical research is much greater than that in other biomedical fields. Once the factors responsible for the excellence are elucidated, biomedical fields where Japan's contribution is not up to the mark could benefit.

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