Mainstream Productivity of SCI Korean Medical Papers by Medical Specialty: 1980-1990*

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Contents

1. Introduction

In our earlier paper (Lee, Yoon & Chi 1994), we have measured the number of papers published in Science Citation Index (SCI) Medical journals between 1980 and 1989 by authors at Korean institutions for each of 47 medical specialties by publication year. The overall mainstream publication output of Korean medicine was insignificant, and showed a great variability among various medical specialties. A total of 1,236 mainstream medical papers, an average of two or three papers a year for each medical specialty, were published during the ten-year study period. About one half of the specialties (24/47) contributed less than 20 SCI paper in ten years. Not a single SCI paper was published by Korean medical doctors in the decade of the 1980s in four medical specialties. Only four specialties contributed more than 100 paper in ten year. The largest number of papers, 153 papers, was contributed by pharmacology & pharmacy.

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Knowing that the number of mainstream Korean medical papers published in SCI journals during the 1980s was very small, one of our interests is to estimate the proportion of Korean paper among all SCI papers (i.e., percentage share of Korean papers among SCI papers) of each specialty. According to Braun et al's data (1987a, b, c 1988a, b, c)[1], 103 life science[2] papers were published in SCI journals between 1978 and 1980, and 271 such papers were published beween 1981 and 1985. These numbers are ony about one five thousandth (0.017% and 0.024% respectively) of all SCI life science papers published worldwide during the same period.

The scientific activity at an international level as measured by publication output in mainstream journals to be indiscriminately used as an indicator of "quality" of Korean medicine. Thus, we often conclude that those fields with, for example, more than 100 papers are "quality" medical specialties among Korean medicine. In the academic environment where international papers by Korean medical researchers are rare commodity, publication output in SCI journals represent, to a certain degree, the capability of a field to do research of international standard.

However, a caution is required to make a statement simply based on the publication output counts that a certain medical field is superior than anther. Similarly, it is misleading to say that a researcher with a higher number of SCI papers is better than the other. It is because a bias can exist in the analysis of the data in this way. One specialty area may be more productive in publishing research reports than the others, not only in Korea but also worldwide. For instance, the research paper production rate per scientist of biotechnology and applied microbiology would be much higher than that of microbiology. Apparently, the medical fields for which Korean researchers produced zero papers in eleven years, for instance, legal medicine or substance abuse, abuse, are rather narrowly

1) The data are summarized in Table 2 of our earlier paper (Lee, Yoon & Chi 1994).

2) Braun et al. grouped clinical medicine, biomedical research and biology into life sciences. However in the present study, clinical medicine and biomedical research are defined as medicine.

defined medical areas compared to internal medicine or surgery. The number of researcher who specialize in these fields will be much smaller not only in Korea but also woridwide. In addition, the number of journals covered by SCI varies a great deal depending on specialties. In fact, a fewer number of journals are indexed in the database for legal medicine (5) or substance abuse (8) than those for internal medicine (121) or surgery(83).

In the presented study, two scientific publication activity indicators are measured in order to see the extent of contribution from Korea to international mainstream and to determine medical specialties which showed superior mainstream publication activities. First, the percentage contribution from Korea to SCI for each specialty is measured. Such information, specifically dealing with Korean medical papers, is not available in the relevant literature. For instance, Braun's data are not subdivided by each medical specialty. Second, the productivity ratio representing relative quantity of Korean mainstream papers of a specialty in proportion to the relative quantity of total mainstream medical papers of the specialty is calculated. It is because we cannot simply equate mainstream publication activity with the quantity of a specialty's publication output: an equal number of papers producrd by Korean researchers in two different specialties results in a different percentage contribution from Korea to SCI by each medical specialty. That is, the degree of mainstream publication activity of each specialty should be rated proportionally.

2. Materials and Methods

The present study concentrated on Korean medical papers published in SCI journals between 1980 and 1990.[3] A medical paper is defined as a paper in any of

3) The present study includes papers for one extra year, 1990. Our previous study used papers published between 1980 and 1989. This explains the difference in the number of papers reported here in Table 1 from those in Table 3 of the previous paper. For instance, the number of pharmacology and pharmacy papers is 179 in Table 1, and 153 in Table 3 of our previous study as cited in the first paragraph of the current paper.

the 47 scientific subfields listed under clinical medicine (32) or under biomedial reaearch (15) for the tabulation of science literature indicators in Science and Engineering Indication of science literature indicators in *Science and Engineering Indicators* (NSB 1973-). Each subfield corresponds to a Subject Category (SC) code used in SCI database (ISI 1989). A Korean paper is defined as a paper written by researchers, at least one of whom has an address in Korea.

In order to obtain the number of SCI medical papers and SCI Korean medical papers for each specialty, SCISEARCH database was searched through DIALOG. The first step in searching the SCISEARCH is identification of papers in each medical subfield. This is a rather complicated process in SCI, because each of 47 SC codes must be individually searched. The next step is identification of all the Korean papers in the database. It is straightforward with the SCI database, because the Geographic Location (GL) field identifies the county of the authors. The field is derived from the Corporate Source (i.e., address) field, and covers every author, not just the first author of a paper. The **GL=SOUTH KOREA** is therefore a very comprehensive and powerful search statement that retrieves all papers contributed from institutions located in Korea.[4] Korean medical papers in each medical subfield are identified by the intersection of the two sets: all the Korean papers and all the papers in a medical subject category.

Based on the number of posting resulting from the DIALOG search of SCI medical papers and SCI Korean medical papers, the following two mainstream publication activity indicators are computed for each medical specialty. First, contribution from Korea to SCI database is computed by simply dividing the number of SCI Korean medical papers of a medical specialty by the number of SCI medical papers of the medical specialty. Second, the productivity ratio (R) is computed using the proportion of Korean papers published in a specialty area

4) This search statement will also retrieve papers written by authors at foreign institutions located in Korea, such as US Air Force Hospital in Osan, Korea. However, the number of such records will be exremely small, so that we may ignore them.

among total Korean mainstream papers divided by the proportion of worldwide papers in that specialty among total worldwide mainstream papers.

$$\frac{\text{Korean papers/ Total Korean mainstream papers in a specialty}}{\text{Worldwide papers/Total worldwide mainstream papers in the specialty}} = R$$

Therefore, a productivity ratio larger than one implies that Korean researchers in the specialty area have produced more papers than expected, i.e., a higher proportion than all researchers in the same specialty produced as a share of total mainstream papers. The productivity ratio behaves the same as the percentage contribution from Korea to a specialty, yet the productivity ratio is useful to determine medical specialties which produced more papers than expected.

3. Results

The proportion of Korean medical papers in SCI for the 1980-1990 period by medical specialty is presented in Table 1. The Table includes, for each medical specialty, the number of SCI Korean papers and the proportion of these papers among all SCI Korean medical papers; total SCI medical papers and the proportion of these papers among all SCI medical papers; the productivity ratio; percentage contribution from Korea to SCI.

As explained in Introduction, even if an equal number of papers is produced by Korean researchers in two different specialties, percentage contribution from Korea to SCI by medical specialty would be different depending on the size of world literature of a specialty. According to 〈 Table 1 〉, six papers each were retrieved from SCI for ophthalmology and for parasitology. The percentage share of these papers among total Korean SCI papers is the same 0.33%. Hower, the percentage share of worldwide SCI papers of each specialty among total SCI papers is quite different (1.28% and 0.60%), since different number of papers are published in SCI

〈Table 1〉 PROPORTION OF KOREAN MEDICAL PAPERS IN SCI, 1980-1990, BY SPECIALTY

		Korea [a]	Total [b] SCI	Productivity Ratio [c]	Percentage Contribution from Korea
	Clinical Medicine				
1	Allergy	17 (0.93%)	18,460 (0.52%)	1.80	0.092%
2	Andrology	2 (0.11%)	4,194 (0.12%)	0.93	0.048%
3	Anesthesiology	1 (0.06%)	30,614 (0.86%)	0.06	0.003%
4	Cardio vascular system	28 (1.54%)	158,588 (4.44%)	0.34	0.018%
5	Dermatology & venereal diseases	83 (4.55%)	53,926 (1.51%)	3.02	0.154%
6	Endocrinology & metabolism	20 (1.10%)	90,469 (2.53%)	0.43	0.022%
7	Gastroenterology	43 (2.36%)	83,745 (2.34%)	1.01	0.051%
8	Geriatrics & gerontology	0 (0.00%)	11,201 (0.31%)	0.00	0.000%
9	Hematology	18 (0.99%)	85,007 (2.38%)	0.41	0.021%
10	Immunology	41 (2.25%)	135,590 (3.79%)	0.59	0.030%
11	Medicine, general & internal	21 (1.15%)	323,121 (9.04%)	0.13	0.006%
12	Medicine, legal [d]	0 (0.00%)	672 (0.02%)	0.00	0.000%
13	Medicine, miscellaneous	13 (0.71%)	43,141 (1.21%)	0.59	0.030%
14	Neurosciences	56 (3.07%)	218,687 (6.12%)	0.50	0.026%
15	Obstetrics & gynecology	30 (1.64%)	57,643 (1.61%)	1.02	0.052%
16	Oncology	53 (2.91%)	83,835 (2.35%)	1.24	0.063%
17	Ophthalmology	6 (0.33%)	45,798 (1.28%)	0.26	0.013%
18	Orthopedics	26 (1.43%)	29,389 (0.82%)	1.73	0.088%
19	Otorhinolaryngology	11 (0.60%)	24,442 (0.68%)	0.88	0.04[illegible]%
20	Pathology	37 (2.03%)	72,053 (2.02%)	1.01	0.051%
21	Pediatrics	23 (1.26%)	89,489 (2.50%)	0.50	0.026%
22	Pharmacology & Pharmacy	179 (9.81%)	238,195 (6.67%)	1.47	0.075%
23	Psychiatry	16 (0.88%)	53,414 (1.50%)	0.59	0.030%
24	Public health	16 (0.88%)	36,101 (1.01%)	0.87	0.044%

25	Radiology & nuclear medicine	129	(7.07%)	110,417	(3.09%)	2.29	0.117%
26	Respiratory system	11	(0.60%)	51,856	(1.45%)	0.42	0.021%
27	Rheumatology	0	(0.00%)	20,780	(0.58%)	0.00	0.000%
28	Substance abuse	0	(0.00%)	6,444	(0.18%)	0.00	0.000%
29	Surgery	74	(4.06%)	140,696	(3.94%)	1.03	0.053%
30	Toxicology	41	(2.25%)	34,551	(0.97%)	2.32	0.119%
31	Tropical medicine	12	(0.66%)	14,571	(0.41%)	1.61	0.082%
32	Urology & nephrology	109	(5.98%)	61,260	(1.71%)	3.49	0.178%
	Biomedical Research						
33	Anatomy & morphology	11	(0.60%)	25,760	(0.72%)	0.84	0.043%
34	Biochemistry & molecular biology	178	(9.76%)	330,368	(9.24%)	1.06	0.054%
35	Biophysics	62	(3.40%)	97,807	(2.74%)	1.24	0.063%
36	Biotechnology & applied microbiology	163	(8.94%)	20,213	(0.57%)	15.63	0.806%
37	Cytology & histology	27	(1.48%)	103,610	(2.90%)	0.51	0.026%
38	Developmental biology	14	(0.77%)	17,601	(0.49%)	1.56	0.080%
39	Engineering, biomedical	48	(2.63%)	25,048	(0.70%)	3.75	0.191%
40	Genetics & heredity	51	(2.80%)	82,865	(2.32%)	1.21	0.062%
41	Medicine, research & experimental	37	(2.03%)	145,067	(4.06%)	0.50	0.026%
42	Microbiology	55	(3.02%)	107,424	(3.00%)	1.01	0.051%
43	Microscopy	4	(0.22%)	16,036	(0.45%)	0.49	0.025%
44	Nutrition & dietetics	11	(0.60%)	36,014	(1.01%)	0.60	0.030%
45	Parasitology	6	(0.33%)	21,521	(0.60%)	0.55	0.028%
46	Physiology	31	(1.70%)	107,385	(3.00%)	0.56	0.029%
47	Virology	13	(0.71%)	30,676	(0.86%)	0.83	0.042%
	Total	1,824	(100.00%)	3,573,737	(100.00%)		0.051%

a) Percentage share of a specialty out of the total number of papers published by Korean researchers is provided in ( ).
b) Percentage share of a specialty out of the total number of papers published by world's researchers is provided in ( ).
c) Ratio is the percentage share of Korea divided by the percentage share of total SCI.

journals of each specialty (45,798 and 21,521). Thus, the percentage contribution from Korea to each specialty is also different (0.013% and 0.028%). Similarly, the productivity ratio of the two medical specialties is different (0.26 and 0.55). In other words, the Korean scientists in ophthalmology produced approximately one fourth (0.33%/1.28%) of the number of papers they would be expected to produce if they were to publish papers in the same proportion as all ophthalmology specialists in the word published among all mainstream medical papers. On the other hand, the Korean scientists in parasitology produced approximately one half (0.33%/0.66%) of the number of papers they would be expected to produce if they were to publish papers in the same proportion as all parasitology specialists published among all mainstream medical papers. The productivity ratios of these two medical specialties are, by no means, high.

4. Discussions

4.1 Percentage Contribution from Korea to SCI by Medical Specialty

The overall percentage contribution from Korea to SCI for medicine is 0.051%.[5] No Korean medical specialties contributed one percent or more to the world literature of that specialty 〈 Table 2 〉. Percentage contribution from Korea was the highest, by far, in biotechnology & applied microbiology with 0.806%. The next highest was biomedical engineering with 0.191%. There are only six medical specialties in which Koreans contribute more than 0.1% of SCI literature, among 47 medical specialties used in the study. They are dermatology & venereal diseases (0.154%), radiology & nuclear medicine (0.117%), toxicology (0.119%), urology & nephrology (0.178%), inaddition to biotechnology & applied microbiology, and

5) In comparison, the percentage for chemistry is 0.305% during the same study period: if the Bulletin KCS is excluded, 0.145%.

〈Table 2〉

NUMBER OF MEDICAL SPECIALTIES BY PERCENTAGE CONTRIBUTION TO SCI

Percentage contribution	Productivity Ratio (R)	No. of medical specialties
1.00 > % >= 0.15	R >= 3.00	4
0.15 > % >= 0.10	3.00 > R >= 2.00	2
0.10 > % >= 0.09	2.00 > R >= 1.80	1
0.09 > % >= 0.08	1.80 > R >= 1.60	3
0.08 > % >= 0.07	1.60 > R >= 1.40	1
0.07 > % >= 0.06	1.40 > R >= 1.20	3
0.06 > % >= 0.05	1.20 > R >= 1.00	6
0.05 > % >= 0.04	1.00 > R >= 0.80	5
0.04 > % >= 0.03	0.80 > R >= 0.60	4
0.03 > % >= 0.02	0.60 > R >= 0.40	10
0.02 > % >= 0.01	0.40 > R >= 0.20	2
0.01 > % >= 0.00	0.20 > R >= 0.00	2
% = 0.00	R = 0.00	4

engineering, biomedical. The percentage contribution of pharmacology and pharmacy field, which produced the largest number of SCI Korean papers, and that of biochemistry & molecular biology which came second, are less than 0.1%; they contributed 0.075% and 0.054% respectively.

4.2 Mainstream Productivity Ratio by Medical Specialty

Simple figures such as the absolute number of papers, or the percentage share of Korean SCI papers in a specialty among total Korean SCI papers, is high for pharmacology & pharmacy, radiology & nuclear medicine, biochemistry & molecular biology, and biotechnology & applied microbiology. However, if productivity ratio of the percentage share of a specialty by Korean scientists in

relation to that by world's scientists is computed, a somewhat different result is produced. The productivity ratios of pharmacology & pharmacy, and biochemistry & molecular microbiology are slightly larger than one. That is, their mainstream productivity is not as impressive as might be indicated by the absolute number of mainstream papers published, or by percentage share.

By definition, the productivity ratio larger than one implise that Korean researchers in the specialty performed better in the mainstream than expected. There are 20 specialties, including all four mentioned above, with a productivity tatio larger than one.

One specialty, biotechnology & applied microbiology, shows an extreamely outstanding mainstream productivity. Korean scientists in this specialty produced 15.7 times of the percentage share achieved by world's scientists. Biomedical engineering is next with the productivity ratio of 3.75, and dermatology & venereal diseases is the third with 3.02.

The productivity ratio of urology and nephrology was quite high with 3.49, yet it was not considered as a medical field with superior mainstream productivity since more than three fourths of the Korean urology and nephrology papers found in SCI database during the 1980s was records for meeting abstracts (Lee, Yoon & Chi 1994, 147).

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초 록

Science Citation Index (SCI)에 수록된 한국 의학논문들의 의학분야별 실적평가: 1980-1990*

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지금까지 국내 연구자들이 SCI 학술지에 발표한 의학논문의 수가 아주 미미하기 때문에 전세계 학자들이 발표한 SCI 전체논문 중 한국논문이 차지하는 비중은 지극히 낮은 것으로 보인다. 따라서, 본 연구에서는 1980년부터 1990년 사이에 국내에 있는 의학 관련기관의 연구자들이 SCI 학술지에 발표한 논문이 SCI 전체 논문 중 차지하는 비중(Percentage Contribution from Korea to SCI Database)을 47개 의학분야별로 조사하였다. 또한, 본 연구에서는 "국제적으로 영향력있는 학술연구 활동실적(i.e., Mainstream Productivity)"이 타분야보다 뛰어난 한국의 의학분야를 밝히기 위하여, SCI 학술지에 발표된 모든 한국 의학논문 중 한 분야의 논문이 자치하는 몫(Percentage Share)을 SCI 전체 논문 중 그 분야의 논문이 차지하는 몫으로 나누어 그 상대적 크기를 분석함으로써, 우리나라 학자들의 Mainstream Productivity Ratio(R)를 각 분야별로 측정하였다. (R=1은 SCI 의학 학술지에 발표된 모든 논문 중에서 어떤 한 분야의 논문이 차지하는 비율만큼 한국에서도 그 분야의 논문이 SCI 학술지에 투고되었다는 의미이다.) 1980년에서 1990년 사이에 한국 학자들에 의하여 SCI에 발표된 의학논문이 SCI 전체 의학논문 중에서 차지하는 비율은 0.051%였다. 각 의학 분야별로는, Biotechnology & applied microbiology의 기여도가 0.8%를 차지하여 한국 최고를 기록하였다. 전세계 문헌의 1% 이상을 생산한 의학 분야는 없었다. 전 세계 문헌의 0.1% 이상을 SCI 학술지에 게재한 의학분야는 47개 중 6개인데, 위에 언급한 Biotechnology & applied microbiology를 제외하면 0.1%에서 0.2% 사이의 기여도를 보였다. 최다 편수의 논문을 낸 Pharmacology & Pharmacy(0.075%)나 두번째로 논문수가 많았던 Biochemisty & molecular biology(0.054%)의 기여도는 0.1%에 미치지 못하

였다. 조사대상이 된 47개 의학분야 중 27개 분야에서 예상된 것보다 상대적으로 적은 수(R<1)의 한국 논문이 SCI 학술지에 게재되었다. Mainstream Productivity Ratio가 3보다 큰 분야는 4개인데, 그 중 Biotechnology & applied microbiology는 R=15.63으로 아주 월등한 논문 발표실적을 올렸다. Dermatology & venereal diseases(3.02)와 Engineering, biomedical(3.75)도 국제적으로 영향력있는 학술지에 논문 발표실적이 뛰어난 의학분야이다.

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