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Original Article

Family medicine publications in Taiwan: An analysis of the Web of Science database from 1993 to 2012

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Abstract

Background: Academic publications are important for developing a medical specialty or discipline. Since family medicine is a rapidly growing medical specialty in Taiwan, this study aimed to analyze family medicine publications from 1993 to 2012 in Taiwan using the Web of Science database.

Methods: Published academic articles submitted from departments/institutes of family medicine were retrieved and analyzed from the Web of Science database, which includes articles published in the Science Citation Index–Expanded and Social Science Citation Indexed journals from 1993 to 2012.

Results: Among 33,073 published articles submitted from the departments/institutes of family medicine worldwide during the years 1993–2012, 1552 articles (4.69%) were submitted from Taiwan, ranking fourth in the world after the USA, Canada, and Sweden. In total, 1409 articles from Taiwan, excluding meeting abstracts and corrections, were selected for further analyses. During these two decades, family medicine publications increased rapidly. There were 60 articles published during 1993–1997, 180 articles during 1998–2002, 334 articles during 2003–2007, and up to 836 articles during 2008–2012. However, the mean citation number of articles decreased from 19.0 to 17.7, 15.1, and 3.8, and the mean impact factor of published journals decreased from 3.41 to 3.15, 2.78 and 2.82 during the periods 1993–1997, 1998–2002, 2003–2007, and 2008–2012, respectively. Most articles belonged to the subject category of the Medicine, General and Internal category (194 articles, 13.8%), followed by Public Environmental Occupational Health (144 articles, 10.2%), Oncology (126 articles, 9.2%), Endocrinology Metabolism (111 articles, 7.9%), Geriatrics Gerontology (99 articles, 7.0%), and the Gastroenterology Hepatology category (85 articles, 6.0%). However, only six articles (0.4%) were published in the Primary Health Care category.

Conclusion: Publications from departments/institutes of family medicine in Taiwan increased rapidly from 1993 to 2012. However, the trends of decreased citation number of articles and journal impact factor, as well as the small amount of articles published in the Primary Health Care Category, deserve further attention and effort.

Keywords: family practice; journal impact factor; primary health care; publications; Web of Science

1. Introduction

Family medicine became an official specialty of the medical discipline in Taiwan in 1988. Currently, the family medicine specialty has more than 5000 certified specialists, and constitutes the second largest medical association in Taiwan. Because the main mission of family medicine is in primary health care,

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and most specialists work as general practitioners in primary care clinics, the advancement of family medicine academies may confront difficulties compared with other specialties.[1–6] Even in the United States, where family medicine is popular among medical practices, a decrease in publications by family medicine faculty members was reported.[7,8]

Taiwan's Institute for Scientific Information publications in clinical medicine increased from 315 articles in 1990 to 2636 articles in 2004.[9] According to two previous reports, published articles submitted from departments/institutes of family medicine in Taiwan increased slowly from 1979 to 1990, but increased more rapidly from 1991 to 2003.[10,11] However, these two reports retrieved articles published in MEDLINE, and only the affiliation of the first author or the corresponding author was cataloged. Thus, the publications of family medicine faculty members were underestimated. Many interdisciplinary collaborative research articles with family medicine participation would not be given due credit because the affiliations of coauthors were not provided in MEDLINE-indexed articles.

Web of Science (WoS) is a strong powerful research database officially inaugurated in 2004 by the Thomson Scientific and Health Care Corporation. The WoS database contains not only the affiliations of all authors, but also provides the citation numbers of published articles. WoS provides access to the Thomson Reuter's multidisciplinary databases of bibliographic information such as the Science Citation Index–Expanded (SCI-E), the Social Sciences Citation Index (SSCI), the Arts and Humanities Citation Index, and the Journal Citation Report (JCR).[12–14] WoS is a powerful web interface providing access to the citation databases. In addition, WoS established a subject category, *Primary Health Care*, in the JCR in 2011 to encourage the publication of research from family medicine, primary care, and general practice.[15–17] The aim of this study was to analyze the family medicine publications from 1993 to 2012 in Taiwan using the WoS database.

2. Methods

The WoS database was accessed through the Taipei Veterans General Hospital Library website on June 6, 2013. In the first stage, an international comparison of research outputs by departments and institutes of family medicine worldwide was carried out. Publications in SCI-E and SSCI, with the authors' address containing *family medicine*, including all article types, from January 1, 1993 to December 31, 2012 were searched. The number of publications from a country/area worldwide was obtained. In the second stage, publications from the departments/institutes of family medicine in Taiwan (AD = family medicine SAME Taiwan) during the same study period (1993–2012) and data sources from SCI-E and SSCI were searched. The types of publications included articles, letters, reviews, proceedings papers, editorial materials, and notes, but not meeting abstracts or corrections. All of the yearly research output, research output within the 5-year intervals from 1993 to 2012, WoS subject category, authors (including all authors), organization/institute that submitted published articles, and the names of journals publishing articles were analyzed.

In order to analyze the citation numbers of publishing articles and impact factors of published journals, we also obtained the citation number of each paper from WoS and impact factors of publishing journals from the 2012 JCR. H-index indicates the citation number of published articles greater than 20. Linkage of the WoS citation number and JCR impact factors were performed using the SQL Server 2008 (Microsoft, Redmond, WA, USA).

Results from the first and second stages were expressed as descriptive data (count, percentage, range, mean, and standard deviation). The ANOVA, Student t, and χ^2 tests were used to assess the statistically significant differences of mean citation numbers and impact factors among different study periods (SPSS version 17.0; SPSS Inc., Chicago, IL, USA). A p value <0.05 was considered statistically significant (2-tailed test).

This study was exempted from review by the Institutional Review Board because data were obtained from the public open domain of the Taipei Veterans General Hospital Library website.

3. Results

On searching the WoS database, including articles published in SCI-E and SSCI journals, we found a total of 33,073 published articles submitted from departments/institutes of family medicine worldwide during the period 1993–2012. Table 1 lists the top 10 most prolific countries/areas from which published articles were submitted. Taiwan published 1552 articles (4.69%) and was ranked as number four during 1993–2012, behind the USA, Canada, and Sweden. There were in total 1409 articles, excluding meeting abstracts and corrections, involved for further analyses. Articles were the most common publication type (94.3%), followed by letters (3.2%), reviews (1.4%), proceedings papers (1.1%), editorial materials (0.8%), and notes (0.3%).

The annual total of published articles submitted from the departments/institutes of family medicine in Taiwan increased rapidly, from seven articles in 1993 to 222 articles in 2012 (Fig. 1). Articles published in SCI-E journals increased more rapidly than articles published in SSCI. There were 836

Table 1
Top 10 most prolific countries/areas for published articles submitted from departments/institutes of family medicine from 1993 to 2012.

Country/area	Articles published, *n*	%
USA	19,877	60.10
Canada	4120	12.48
Sweden	1563	4.73
Taiwan	1552	4.69
Singapore	1053	3.18
South Korea	1045	3.16
People's Republic of China	987	2.98
England	925	2.80
South Africa	909	2.75
Israel	907	2.74

In total, 33,073 articles were found on the Web of Science database, including articles published in the Science Citation Index–Expanded (SCI-E) and Social Science Citation Index (SSCI) journals.

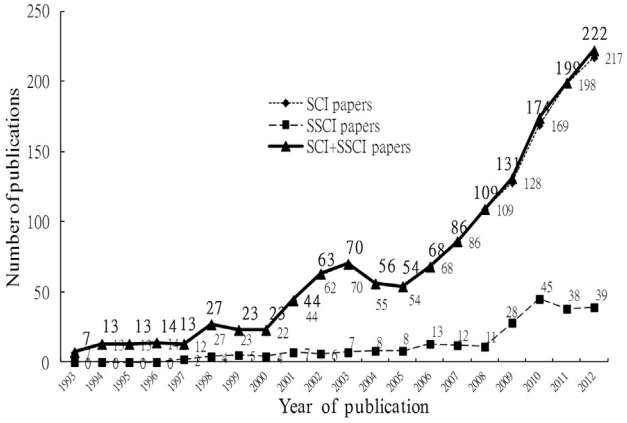

Figure 1. Annual total number of published articles submitted from departments/institutes of family medicine in Taiwan increased rapidly from 1993 to 2012. SCI = Science Citation Index; SSCI = Social Science Citation Index.

(59.3%) articles published during 2008–2012, which is much higher than the 334 papers (23.7%) during 2003–2007, 180 articles (12.8%) during 1998–2002, and 60 articles (4.3%) during 1993–1997.

According to the WoS subject categories, 193 articles (13.8%) were published in the category of Medicine, General and Internal, followed by Public Environmental Occupational Health (144 articles, 10.2%), Oncology (126 articles, 8.9%), Endocrinology Metabolism (111 articles, 7.9%), Geriatrics Gerontology (99 articles, 7.0%), and the Gastroenterology Hepatology category (85 articles, 6.0%; Table 2). Only six articles (0.4%) were published in the Primary Health Care category. For international comparisons, we also performed family medicine publications analyses in the USA and Canada. Results showed that 4105 (20.7%) of 19,877 published family medicine articles from the USA and 949 (23.0%) of 4120 published family medicine articles from Canada were in the Primary Health Care category during the same study period (Table 3).

The National Taiwan University and its affiliated hospital submitted the most published articles (423, 30.0%), followed by the China Medical University (335 articles, 23.8%) (Fig. 2). The National Yang-Ming University, combined with its major teaching hospital (Taipei Veterans General Hospital), had 307 articles (21.8%) published. Medical universities and/or their affiliated (teaching) hospitals ranked in the top 10 had the most publications. All of the 15 most prolific authors were family medicine faculty members in medical universities (Table 4).

Table 2
Number of articles published in different research fields according to the Web of Science subject category.

Web of Science subject category	Articles published, *n*	%
Medicine, General and Internal	194	13.8
Public Environmental Occupational Health	144	10.2
Oncology	126	8.9
Endocrinology Metabolism	111	7.9
Geriatrics Gerontology	99	7.0
Gastroenterology Hepatology	85	6.0
Health Care Sciences Services	76	5.4
Pharmacology Pharmacy	64	4.5
Medical Research Experimental	54	3.8
Nutrition Dietetics	49	3.5

Table 3
Number of articles published in the Primary Health Care category from the USA, Canada, and Taiwan from 1993 to 2012.

Journal name	USA	Canada	Taiwan	Total
Ann Fam Med	30	5	0	37
Scand J Prim Health	0	0	0	5
J Am Board Fam Med	400	16	1	424
Br J Gen Pract	1	0	0	7
BMC Fam Pract	14	21	0	85
Am Fam Physician	1101	9	0	1109
Fam Pract	7	4	2	24
Can Fam Physician	15	821	0	854
Fam Med	924	23	1	969
Eur J Gen Pract	3	0	0	41
Physical Sports Med	74	7	0	81
Primary Care	312	1	0	312
Aust Fam Physician	3	10	0	39
J Fam Pract	1216	30	2	1257
Aust J Prim Health	0	0	0	1
Subtotal	4105	949	6	5263

Am = American; Ann = Annals; Aust = Australian; Br = British; Can = Canadian; Eur = European; Fam = Family; Gen = General; J = Journal; Med = Medicine; Pract = Practice; Prim = Primary; Scand = Scandinavian.

Table 5 lists the top 10 journals that published family medicine articles. The *Journal of the Formosan Medical Association* and *Archives of Gerontology and Geriatrics* published the most family medicine articles (44 articles each, 3.1%), followed by the *Journal of the Chinese Medical Association* and *BMC Public Health* (21 articles each, 1.5%).

The mean citation number of published articles submitted from the departments/institutes of family medicine in Taiwan during 1993–2012 was 8.88 ± 15.14 (range, 0–179). The mean citation number of articles published during 2008–2012 was 3.76 ± 6.23 (range, 0–52), significantly less than 15.08 ± 16.36 (range, 0–91) during 2003–2007, 17.73 ± 21.61 (range, 0–148) during 1998–2002, and 19.03 ± 32.59 (range,

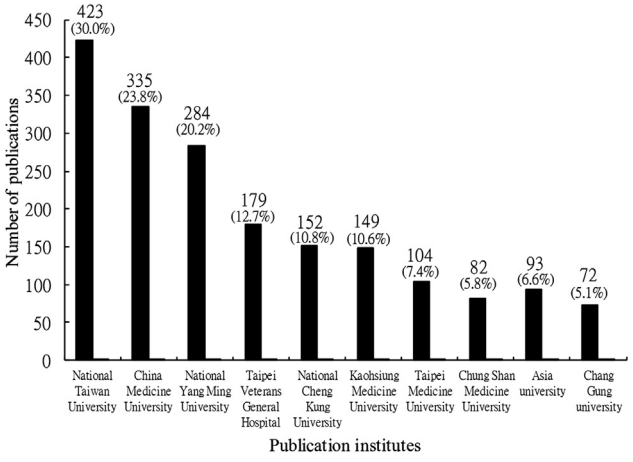

Figure 2. Number of published articles submitted from different departments/institutes of family medicine in Taiwan from 1993 to 2012.

Table 4
The most prolific published authors who submitted articles from the departments/institutes of family medicine in Taiwan from 1993 to 2012.

Author's name	Articles published, *n*	%
Lin CC	194	13.8
Hwang SJ	108	7.7
Chen CY	101	7.2
Chen TJ	76	5.4
Wu MT	75	5.3
Chang CJ	72	5.1
Liu CS	72	5.1
Huang KC	69	4.9
Chen LK	68	4.8
Lee CC	63	4.5
Chen YC	56	4.0
Li TC	55	3.9
Lin WY	53	3.8
Chiu TY	46	3.3
Wu CH	45	3.2

Table 5
Top 10 journals publishing articles from departments/institutes of family medicine in Taiwan, 1993 to 2012.

Journal name	Papers published, *n*	%
Journal of the Formosan Medical Association[a]	44	3.1
Archives of Gerontology and Geriatrics	44	3.1
Journal of the Chinese Medical Association[a]	21	1.5
BMC Public Health	21	1.5
World Journal of Gastroenterology	20	1.4
Anti-Cancer Research	20	1.4
International Journal of Gerontology[a]	20	1.4
PLOS ONE	18	1.3
Journal of Occupational and Environmental Medicine	13	0.9
Metabolism: Clinical and Experimental	13	0.9

[a] Journals with editorial office in Taiwan.

0–179) during 1993–1997, respectively (Table 6). The mean impact factor of journal-published articles submitted from the departments/institutes of family medicine in Taiwan during 1993–2012 was 2.88 ± 2.65 (range, 0.051–38.278). The mean impact factor of articles were 3.41 ± 4.86 (range, 0.610–35.532), 3.15 ± 3.21 (range, 0.634–35.532), 2.78 ± 1.71 (range, 0.184–11.462), and 2.82 ± 2.63 (range: 0.051–38.278) during 1993–1997, 1998–2002, 2003–2007, and 2008–2012, respectively (Table 7). The mean impact factor of published journals in the first decade (1993–2002) was 3.21 ± 3.66 (range, 0.610–35.532), significantly higher than 2.81 ± 2.41 (range, 0.051–38.278) in the second decade (2003–2012).

Table 7
Impact factors (IF) of journals publishing articles submitted by the departments/institutes of family medicine in Taiwan, 1993–2012.

Year published	Mean IF*	IF < 2**	IF = 2–5	IF = 5–10	IF ≥ 10
1993–1997	3.41 ± 4.86	24 (40.0%)	28 (46.7%)	6 (10.0%)	2 (3.3%)
1998–2002	3.15 ± 3.21	59 (33.0%)	100 (55.9%)	16 (8.9%)	4 (2.2%)
2003–2007	2.78 ± 1.71	123 (36.8%)	180 (53.9%)	30 (9.0%)	1 (0.3%)
2008–2012	2.82 ± 2.63	357 (42.8%)	409 (49.0%)	56 (6.7%)	12 (1.4%)
1993–2012	2.88 ± 2.65	563 (40.0%)	717 (51.0%)	108 (7.8%)	19 (1.4%)

* ANOVA: $p = 0.193$.
**χ^2 test: $p = 0.085$.

4. Discussion

Academic publication is an important key factor in the successful development of a medical specialty/discipline. The aim of medicine is to provide safe, effective, efficient, timely, patient-centered, and equitable care. Therefore, to strengthen primary care for people and to improve the health care system are important in reaching this goal. Family medicine is a key discipline of primary care. The World Organization of Family Doctors (Wonca) Conference in 2003 recommended that research achievements in family medicine should be shown to policy makers, health (insurance) authorities, and academic leaders to improve health care for people globally.[4] Despite the decrease in published articles by family medicine faculties in the USA,[5,7,8] our results show a rapid increase of family medicine publications in Taiwan, indicating a sizable growth in family medicine research during these two decades. Most importantly, the research outputs of family medicine in Taiwan, ranked fourth in the world, deserve to be affirmed by the government. The increased number of family medicine faculties is one of the reasons for the rapid increase in publications. There were 69 family medicine training programs with 264 faculties in 1998. In 2012, the training programs increased to 83, and the number of faculties increased to 501 (data from the Taiwan Association of Family Medicine).

Nowadays, because of electronic publishing systems, we can easily obtain information on academic publications from a medical specialty/discipline through the World Wide Web, and can make international or domestic comparisons of research productivity among countries/institutes, so as to realize the

Table 6
Citation number (CN) of published articles submitted from departments/institutes of family medicine in Taiwan from 1993 to 2012.

Year published	Mean CN*	CN < 19**	CN = 20–49	CN = 50–99	CN ≥ 100	H-index
1993–1997	19.03 ± 32.59	44	11	3	2	0.36
1998–2002	17.73 ± 21.61	126	42	10	2	0.43
2003–2007	15.08 ± 16.36	243	73	18	0	0.37
2008–2012	3.76 ± 6.23	807	27	1	0	0.03
1993–2012	8.88 ± 15.14	1220	153	32	4	0.16

* ANOVA: $p < 0.001$.
**χ^2 test: $p < 0.001$.

future direction of academic research. PubMed, developed by the National Center for Biotechnology Information and National Library of Medicine in the USA, is a free, online, and widely used system for literature searches. However, no citations of publications and coauthors' affiliations are provided in PubMed. Scopus, developed by Elsevier in The Netherlands, Google scholar, developed by Google Inc. in the USA, and WoS, developed/created by Thomson Scientific and Health Care Corp. in the USA, can all provide strong powerful literature searches and citations of publications.[12–14,17] Impact factor in JCR, developed by Thomson Scientific and Health Care Corp, has received attention in recent years as a measure of journal quality, but its impact on academia is seldom demonstrated.[18–22] Thus, we used the WoS database and the impact factors of journals from JCR to evaluate the family medicine publications in this study to bridge JCR's deficiency.

Our results show that, in spite of the annual increase of published family medicine articles in Taiwan, the mean citation numbers of published articles decreased gradually. One reason for this is the time effect on citations, by which recently published articles have less chance of being cited. However, we also showed a trend of decreased impact factor of publishing journals in the last 10 years. It is important to maintain both increased quantity and quality of published articles, which calls for further endeavor by family medicine faculties in Taiwan.

According to our results, family medicine faculties published articles in multiple medical disciplines including medicine, public health, oncology, endocrinology, geriatrics, gastroenterology, and health care science (Table 2). That is somewhat different from Leung and Chen's report that family practice, community medicine, preventive medicine, geriatrics and medical education accounted for the major research areas of publications in Taiwan from 1998 to 2003.[21] In 2011, WoS introduced a new subject category *Primary Health Care* in its database to recruit 14 major journals regarding family medicine and general practice. However, only six out of 1409 family medicine publications (0.4%) from Taiwan were involved in this category. The figure is very small when compared with 20.7% from the USA and 23.0% from Canada. Our results indicate that family medicine faculties in Taiwan should submit more articles to journals listed in the Primary Health Care category in the future in order to be recognized by family medicine peers worldwide, so as to increase the chances of citation and to improve academic appointments and promotions. Our results also show that the local SCI-E journals [*Journal of the Formosan Medical Association* (44 articles), *Journal of the Chinese Medical Association* (21 articles), *International Journal of Gerontology* (20 articles), *Kaohsiung Journal of Medical Science* (11 articles), and *Chinese Journal of Physiology* (7 articles)] accounted for 103 published articles (7.7%). This figure is small if compared with that of Australia's general practice researchers, who submitted 52% of the articles published in their domestically established SCI journals (*Australian Family Physician* and the *Medical Journal of Australia*).[23] Family medicine faculties in Taiwan should submit more articles to domestic SCI-E journals to gain domestic academic visibility.

Bibliographic analyses of publications have been used to value the scientific status of disciplines, research institutes, and scientists. Our results show that most of the family medicine articles published were submitted from university departments or university affiliated/teaching hospitals that were responsible for teaching, research, and clinical services roles. However, dimensions of family medicine and primary care research also widely include epidemiology, health promotion, disease screening, prevention, natural history and clinical presentation, patients and care-seeking behavior, doctor-patient relationship and clinical decision-making, and health care (insurance) policy and system. We encourage family medicine faculties to collaborate with primary care physicians, other medical specialists, and public health specialists, and conduct or participate in clinical interventional studies on common diseases in a primary care setting or community.[16,23,24]

Our study confronted a limitation in that we only used the keyword *family medicine* in searching for authors' affiliation addresses. The number of publications might be underestimated because articles from the departments or institutes with the names of community medicine, general practice, and general practitioners were not included. However, we believe the bias is acceptable because family medicine stands as the first official medical specialty/discipline in the Department of Welfare and Health, Executive Yuan, Taiwan. In addition, we did not include papers published in two local family medicine journals that are not included in SCI/SSCI.

In conclusion, published articles submitted from the departments/institutes of family medicine in Taiwan increased rapidly from 1993 to 2012. However, the trends of a decrease in the citation number of articles and journal impact factor, as well as the small number of articles published in the Primary Health Care Category, deserve further attention.

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