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Original Article

Scientific publications in gastroenterology and hepatology in Taiwan: An analysis of Web of Science from 1993 to 2013

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Abstract

Background: Scientific publications are important for evaluating the achievements of a medical specialty or discipline. Gastroenterology and Hepatology is a medical specialty in great demand in Taiwan, therefore, this study aimed to analyze the Gastroenterology and Hepatology publications from 1993 to 2013 in Taiwan, using the Web of Science (WoS) database.

Methods: Scientific publications from departments/institutes of gastroenterology and hepatology were retrieved and analyzed from the WoS database, which included articles published in the Science Citation Index Expanded and Social Science Citation Index journals from 1993 to 2013.

Results: Among 229,030 articles published from departments/institutes of gastroenterology and hepatology worldwide during 1993−2013, 5061 (2.21%) were published in Taiwan, ranking the country 13th in the world. In total, 4759 articles from Taiwan were selected for further analysis, excluding meeting abstracts and corrections. During these two decades, the number of gastroenterology and hepatology publications increased rapidly. There were 440 articles published during 1993−1997, 646 articles during 1998−2002, 1211 articles during 2003−2007, and up to 2462 articles during 2008−2013. However, the mean number of articles cited decreased from 25.35 to 27.25 to 20.64 to 7.28, and the mean impact factor of publishing journals decreased from 5.0 to 4.20 to 4.13 to 4.03 during 1993−1997, 1998−2002, 2003−2007, and 2008−2013, respectively. Most of those publications belong to the subject category gastroenterology and hepatology (2346 articles, 49.30%), followed by surgery (677 articles, 14.23%), medicine, general and internal (358 articles, 7.52%), oncology (316 articles, 6.64%), and pharmacology pharmacy (286 articles, 6.01%). The *Journal of Gastroenterology and Hepatology* published the most papers (326 articles, 6.9%), followed by *World Journal of Gastroenterology* (201 articles, 4.2%), *Hepato-Gastroenterology* (165 articles, 3.5%), *Gastrointestinal Endoscopy* (159 articles, 3.3%), and *Hepatology* (146 articles, 3.1%).

Conclusion: Scientific publications from departments/institutes of gastroenterology and hepatology in Taiwan increased rapidly from 1993 to 2013. However, there were decreasing trends in the number of articles cited and journal impact factors.

Keywords: citations; gastroenterology and hepatology; H-index; impact factor; publications; Web of Science

Conflict of interest: The authors declare that they have no conflicts of interest related to the subject matter or materials discussed in this article.

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1. Introduction

Gastroenterology and Hepatology has become a specialty medical discipline. The Gastroenterology Society of Taiwan was established in 1970 in Taiwan. In 2014, the Gastroenterology Society of Taiwan had 1881 members and 1551 certified specialists. The main missions of gastroenterology and hepatology in Taiwan are to improve clinical practice and research.

Scientific publication is one of the objective measurements by which to evaluate the effects and achievements of research, especially publication in peer-reviewed journals. Sorrentino et al[1] screened and reviewed the top 40% of journals for liver/gastroenterology publications during 1992−1996 to compare publications from Western Europe, USA, and Japan. The results revealed that the UK had the highest total impact factor and the highest number of papers among nations in Europe, and that the total impact factors of USA-produced papers exceeded that of papers from Europe by 20%.[1] Gao et al,[2] comparing the scientific publications in gastroenterology and hepatology journals from Chinese authors by retrieving data from the PubMed database, found that the number of articles increased significantly from 1996 to 2005, and the accumulated impact factor of the articles from Taiwan was higher than that from Mainland China or Hong Kong.

Web of Science (WoS) is an official powerful research database provided by the Thomson Scientific and Health Care Corporation since 2004. The WoS database provides affiliation of all authors, citation numbers of published articles, and access to Thomson Reuter's multidisciplinary databases of bibliographic information such as the Science Citation Index Expanded (SCI-E), Social Sciences Citation Index (SSCI), the Arts and Humanities Citation Index, and Journal Citation Report (JCR).[3−5]

To date, no study has analyzed the academic achievements of departments/institutes of gastroenterology and hepatology in Taiwan, thus, the aim of this study was to analyze the scientific publications from departments/institutes of gastroenterology and hepatology in Taiwan from 1993 to 2013 using the WoS database.

2. Methods

The WoS database was accessed through the Taipei Veterans General Hospital Library, Taipei, Taiwan website on December 10, 2014. In the first stage, international comparison of research outputs by departments/institutes of gastroenterology and hepatology worldwide was done. Publications in the SCI-E and SSCI with authors' addresses containing "gastroenterology or digestive or hepatology or liver", including all article types, from January 1, 1993 to December 31, 2013, were searched. The number of publications from each country/area worldwide was obtained. In the second stage, publications from the departments/institutes of gastroenterology and hepatology in Taiwan in the same study period (1993−2013) and data sources from SCI-E and SSCI were searched. The types of publications included articles, letters, reviews, proceedings papers, editorials, and notes. Meeting abstracts and corrections were not included. All published annual research output, research output in 1993−1997, 1998−2002, 2003−2007, and 2008−2013, WoS subject category, authors (including all authors), organization/institute which published articles, and name of journal in which articles were published were analyzed.

In order to analyze the citation number of published articles and the impact factors of published journals, we also obtained the citation number of each paper from WoS and impact factor of published journals from the 2013 JCR. To compare the research output among different gastroenterology/hepatology institutes in Taiwan, we obtained not only the number of published papers, total and mean citation numbers, cumulative and mean impact factors of each institute, but also the H-index, which measures both the productivity and citation impact of the publications of an institute. Publications from the National Yang-Ming University included publications from its major teaching hospital, Taipei Veterans General Hospital, without double counting. Linkage of WoS citation number and JCR impact factors was performed using Microsoft SQL Server 2008 (Microsoft Corporation, Redmond, WA, USA).

Results from the first and second stages were expressed as descriptive data (count, percentage, range, mean, and standard deviation). Analysis of variance, Student t test, and χ^2 test were used to assess the significant differences in mean citation numbers and impact factors among different study periods. The trends in number of publications and mean impact factor by different time period were analyzed by Jonckheere−Terpastra test and analysis of variance test, respectively (SPSS version 20.0; SPSS Inc., Chicago, IL, USA). A two-tailed p value < 0.05 was considered statistically significant.

This study was conducted according to ethical principles for medical research in the Declaration of Helsinki.

3. Results

By searching the WoS database, including articles published in SCI-E and SSCI journals, we found 229,030 articles published in gastroenterology and hepatology worldwide during 1993−2013. Table 1 shows the top 15 prolific country/areas producing articles published worldwide. Taiwan published 5061 articles (2.2%) and was ranked 13th during 1993−2013. Annual totals of articles published from departments/institutes of gastroenterology and hepatology in Taiwan increased rapidly from 49 articles in 1993, to 191 articles in 2003, and 518 in 2013 (Fig. 1).

According to the WoS subject categories, 2346 (49.3%) articles were published in gastroenterology and hepatology, followed by surgery (677 articles, 14.2%), medicine, general and internal (358 articles, 7.5%), oncology (316 articles, 6.6%), and pharmacology and pharmacy (286 articles, 6.0%; Table 2).

For journals in which articles were published from the departments/institutes of gastroenterology and hepatology in Taiwan, 326 (6.9%) articles were published in the *Journal of Gastroenterology and Hepatology*, followed by *World Journal of Gastroenterology* (201 articles, 4.2%), *Hepato-Gastroenterology* (165 articles, 3.5%), *Gastrointestinal Endoscopy* (159

Table 1
Fifteen most prolific countries/areas that published articles from departments/institutes of gastroenterology and hepatology in 1993–2013.[a]

Country/area	Articles published	%
USA	65,409	28.56
Japan	24,702	10.79
France	22,252	9.72
Italy	16,675	7.28
UK	16,611	7.25
China	15,898	6.94
Germany	15,264	6.67
Spain	14,210	6.20
The Netherlands	10,104	4.41
Canada	7,990	3.49
Australia	6,353	2.77
Belgium	5,590	2.44
Taiwan	5,061	2.21
Turkey	4,756	2.08
South Korea	4,408	1.93

[a] In total, 229,030 articles were searched from the Web of Science database, including articles published in Science Citation Index Expanded and Social Science Citation Index journals.

Table 2
Taiwan gastroenterology and hepatology articles published in different research fields according to Web of Science subject category.

Web of Science subject category	Articles published	%
Gastroenterology & hepatology	2,346	49.30
Surgery	677	14.23
Medicine, general & internal	358	7.52
Oncology	316	6.64
Pharmacology & pharmacy	286	6.01
Immunology	243	5.11
Transplantation	208	4.37
Medicine research, experimental	195	4.10
Infectious diseases	171	3.59
Virology	164	3.45
Radiology, nuclear medicine imaging	130	2.73
Biochemistry & molecular biology	111	2.33
Microbiology	98	2.06

articles, 3.3%), and *Hepatology* (146 articles, 3.1%; Table 3). Two journals, *Journal of the Formosan Medical Association* and *Journal of the Chinese Medical Association*, the offices of which are located in Taiwan, published 104 papers and 88 papers, respectively.

There was a significant trend toward an increase in the number of articles published from 1993 to 2013, with 440 (9.2%) articles published during 1993–1997, 646 (13.6%) during 1998–2002, 1211 (12.8%) during 2003–2007, and 2462 (51.7%) during 2008–2013 ($p < 0.001$). However, there was a significant trend toward a decrease in the mean numbers of citations of articles published from the departments/institutes of gastroenterology and hepatology in Taiwan from 1993 to 2013, with the mean citation numbers of 25.4 ± 34.6, 27.3 ± 73.8, 20.6 ± 53.6, and 7.3 ± 19.4 during 1993–1997, 1998–2002, 2003–2007, and 2008–2013, respectively ($p < 0.001$; Table 4).

The mean impact factors of published journal articles from the departments/institutes of gastroenterology and hepatology in Taiwan were 5.0 ± 3.50, 4.20 ± 4.29, 4.13 ± 3.56, and 4.03 ± 3.91 during 1993–1997, 1998–2002, 2003–2007, and

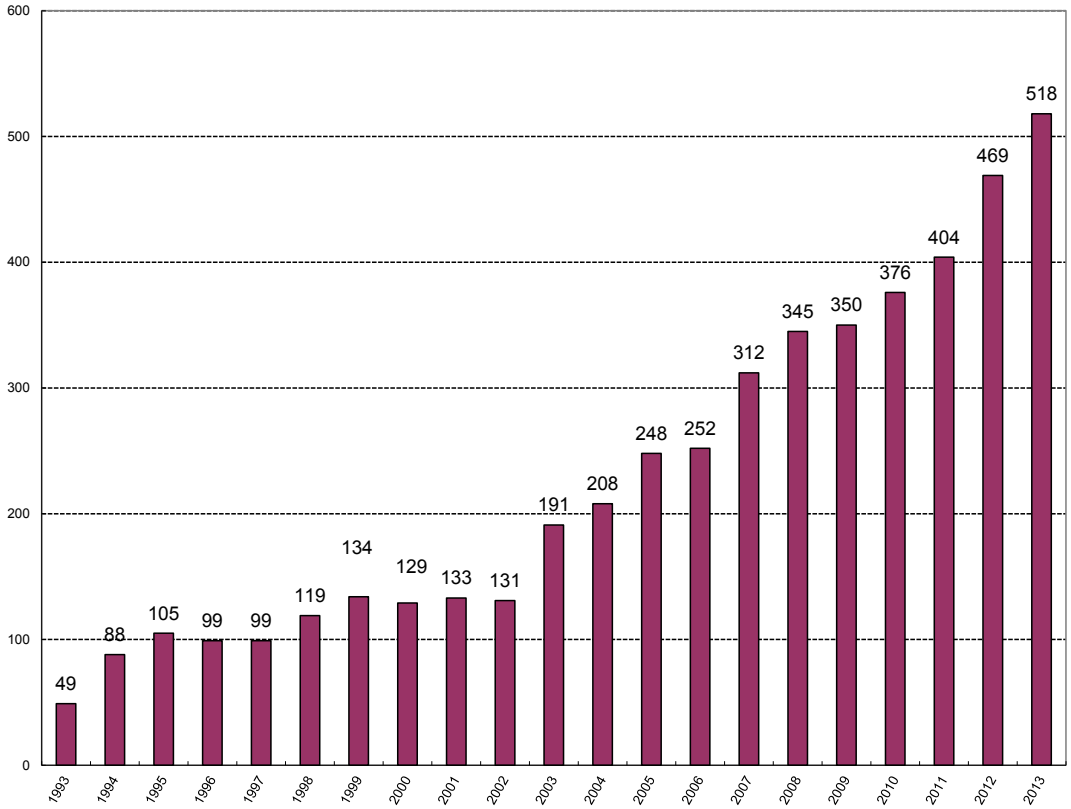

Fig. 1. Annual total number of publications from the departments/institutes of gastroenterology and hepatology in Taiwan increased rapidly from 1993 to 2013.

Table 3
Top journals that published papers from departments/institutes of gastroenterology and hepatology in Taiwan in 1993–2013.

Journal name	Papers published	%
Journal of Gastroenterology and Hepatology	326	6.85
World Journal of Gastroenterology	201	4.22
Hepato-Gastroenterology	165	3.47
Gastrointestinal Endoscopy	159	3.34
Hepatology	146	3.07
American Journal of Gastroenterology	131	2.75
Gastroenterology	121	2.54
Transplantation Proceedings	113	2.37
Journal of the Formosan Medical Association[a]	104	2.19
Endoscopy	102	2.14
Digestive Diseases and Sciences	101	2.12
Journal of Hepatology	97	2.04
Journal of the Chinese Medical Association[a]	88	1.85

[a] Journals with editorial office in Taiwan.

2008–2013, respectively (Table 5). There was a significant trend toward a decrease in mean impact factor by different year period ($p < 0.001$; Table 5).

The top five institutes that published the most gastroenterology and hepatology articles in Taiwan were National Yang-Ming University (Veterans General Hospital), which published 1465 papers with a mean citation number of 15.9 and H-index of 62; followed by Chang Kung University, which published 1433 papers with a mean citation number of 23.3 and an H-index of 78; Kaohsiung Medical University, which published 578 papers with a mean citation number of 13.0 and H-index of 40; and National Taiwan University, which published 544 papers with a mean citation number of 28.5 and H-index of 58. There was a significant difference in the number of articles published among the top five institutes ($p < 0.001$; Table 6).

4. Discussion

The annual number of scientific publications from the departments/institutes of gastroenterology and hepatology in Taiwan increased rapidly from 1993 to 2013. Most (49.30%) of the articles were published in the WoS category of gastroenterology and hepatology. A majority (6.85%) of the articles were published in the *Journal of Gastroenterology and Hepatology*, with an impact factor of 3.627 in 2013. Although there was a trend toward an increasing number of published articles, there were trends toward a decrease in citation number of articles and average journal impact factors from 1993 to 2013.

The results of our study showed that most of the publications were from university departments or university-affiliated teaching hospitals that were responsible for teaching, conducting research, and providing clinical services. Scientific publications in peer-reviewed journals are one of the objective methods to evaluate academic achievement or accomplishment in medical specialties or disciplines.[1,2] Although the results of our analyses revealed a trend toward an increased number of published articles, the citation numbers decreased gradually from 1993 to 2013. It is desirable to maintain the quality of scientific publications while making efforts to improve the quantity of publications.

Nowadays, because of advancements in electronic publishing systems, we can obtain information about academic publications from a medical specialty/discipline through the worldwide web, and can make international or domestic comparisons of research productivity among countries/institutes, so as to realize the achievements and to understand the future direction of academic investigations. 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 or detailed co-authors' affiliations are provided in PubMed. Scopus, developed by Elsevier, in The Netherlands, Google Scholar developed by Google in the USA, and Web of Science developed by Thomson Scientific and Health Care Corporation in the USA can all provide powerful literature searches and citations of publications.[3–6]

Comparisons of research achievement among different institutes are complex. The research manpower, basic laboratory support, and research funding of an institute can all affect its scientific publications. Both numbers of published papers and the impact of papers have been included in bibliometric measures to evaluate the research accomplishments of authors, journals, and institutes.[7] Citation count of papers received is the simplest measure of publication impact. However, it can be confounded by the time span during which citations have accrued. Impact factor in JCR, developed by Thomson Scientific and Health Care Corporation, has received attention in recent years as a measure of journal quality, but its impact on academia is seldom demonstrated.[8–12] The H-index is defined

Table 4
Mean CN of published articles from the departments/institutes of gastroenterology and hepatology in Taiwan.

Publication year	No. of articles*	Mean CN**	CN < 19*** (%)	CN = 20–49 (%)	CN = 50–99 (%)	CN ≥ 100 (%)
1993–1997	440	25.35 ± 34.59	281 (63.9)	99 (22.5)	45 (10.2)	15 (3.4)
1998–2002	646	27.25 ± 73.75	445 (68.9)	125 (19.3)	47 (7.3)	29 (4.5)
2003–2007	1211	20.64 ± 53.58	866 (71.5)	246 (20.3)	71 (5.9)	28 (2.3)
2008–2012	2462	7.28 ± 19.41	2247 (91.3)	160 (6.5)	40 (1.6)	15 (0.6)
1993–2013	4759	15.32 ± 42.87	3839 (80.7)	630 (13.2)	203 (4.3)	87 (1.8)

* Jonckheere–Terpstra test for trend of number of articles: $p < 0.001$.
** Analysis of variance: $p < 0.001$.
*** χ^2 test: $p < 0.001$.
CN = citation number.

Table 5
IF of journal-published articles from departments/institutes of gastroenterology and hepatology in Taiwan.

Publication year	No. of articles*	Mean IF**	IF < 2*** (%)	IF = 2−5 (%)	IF = 5−10 (%)	IF ≥ 10 (%)
1993−1997	414	5.00 ± 3.50	63 (15.2)	214 (51.7)	77 (18.6)	60 (14.5)
1998−2002	635	4.20 ± 4.29	167 (26.3)	333 (52.4)	75 (11.8)	60 (9.4)
2003−2007	1202	4.13 ± 3.56	220 (18.3)	735 (61.1)	143 (11.9)	104 (8.7)
2008−2012	2435	4.03 ± 3.91	668 (27.4)	1244 (51.1)	281 (11.5)	242 (9.9)
1993−2013	4686	4.17 ± 3.85	1118 (23.9)	2526 (53.9)	576 (12.3)	466 (9.9)

* ANOVA test for trend of mean IF: $p < 0.001$.
** ANOVA: $p < 0.001$.
*** χ^2 test: $p < 0.001$.
ANOVA = analysis of variance; IF = impact factor.

Table 6
Comparison of gastroenterology and hepatology publications from different institutes in Taiwan.

	No. of papers*	Mean/total citations	H-index	Mean/cumulative impact factor
Yang-Ming University (Veterans General Hospital)	1469	15.86/23,435	62	4.30 ± 3.63/6180.83
Chang-Gang University	1433	23.25/33,381	78	4.23 ± 4.16/6014.57
Kaohsiung Medical University	578	12.97/7497	40	3.86 ± 3.32/2193.90
National Taiwan University	544	28.54/15,525	58	5.73 ± 5.71/3078.88
Taipei Medical University	308	7.17/2209	20	3.37 ± 3.14/1006.54
China Medical University	300	10.17/3052	28	4.11 ± 3.89/1229.0
Mackay Memorial Hospital	245	7.77/1904	23	3.79 ± 5.22/895.52
Tzu Chi University	222	14.32/3179	25	4.67 ± 4.78/1037.06
National Defense Medical Center	212	17.88/3790	31	4.19 ± 4.58/864.04
Chung-Shan Medical University	164	11.61/1904	25	3.15 ± 2.41/517.04
National Cheng-Kung University	154	34.44/5304	34	4.84 ± 5.46/735.34
Chang Hua Christian Hospital	148	7.16/1060	16	4.42 ± 4.05/654.73
I-Shou University	125	9.43/1179	17	4.77 ± 5.44/587.17
Chi-Mei University	116	9.28/1077	18	3.58 ± 2.38/409.08

* Jonckheere−Terpstra test for trend of numbers of articles among top five institutes: $p < 0.001$.

as a scholar with an index of *h* has published *h* papers, each of which has been cited in other papers at least *h* times.[13] H-index, originally an author-level metric that measured both the productivity and citation impact of a scientist or scholar's publications, has now been applied to evaluate the productivity and impact of a journal as well as that of a group of scientists in a department, a university, or a country.[14−16] In Table 6, Chang-Gang University had the highest H-index for gastroenterology and hepatology publications in Taiwan, followed by Yang-Ming University (Taipei Veterans General Hospital) and National Taiwan University.

The limitations of this study included that we only used the key words "gastroenterology", "digestive", "hepatology," and "liver" in searching authors' affiliation address. Numbers of articles published might have been underestimated because articles from the department or institutes with names of general or internal medicine or practice were not included. For example, one famous hepatologist, publish 534 papers in the field of gastroenterology and hapatology during 1993−2013, but was not included in this analysis because his affiliation was in the department of medicine.

In conclusion, the number of publications in journals from the departments/institutes of gastroenterology and hepatology in Taiwan significantly increased from 1993 to 2013. However, the decreasing trends in citation number of articles and journal impact factor deserve our attention.

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