A bibliometric analysis of acupuncture research in Taiwan from 1988 to 2017

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Abstract

Background: Since Taiwan's national health insurance system provides residents with easy and affordable access to clinical acupuncture treatment, this study sought to analyze trends in the publication of acupuncture-related research in Taiwan from 1988 to 2017, using a bibliometric method.

Methods: Data on the scholarly literature from 1988 to 2017 were retrieved through Web of Science searches for the keywords acupunct*, acupoint*, electroacupunct*, electro-acupunct*, acupre*, auricular acupunc*, and auricular needle* in study titles.

Results: A total of 539 acupuncture-related articles published from 1988 to 2017 were identified and analyzed. The articles had an h-index of 38 and were cited in subsequent studies 7250 times, meaning that Taiwan ranked sixth in the production of such publications among countries/regions globally. Among those articles, 99 (18.4%) had no subsequent citations, six (1.1%) were highly cited (over 100 citations), and 141 (26.1%) were cited 4 to 10 times. The highly cited articles discussed the possible pathways of acupuncture stimulation and efficacy, and received 1103 (15.2%) of the citations.

Conclusion: The China Medical University in Taichung, Taiwan, was the most active educational institution in Taiwan in terms of acupuncture-related research. Professor Lin Jaung-Geng was the leading acupuncture-related researcher, having the most publications, citations, and the highest h-index value. These results provided a context for analyzing the strengths of the existing research and informing prospective strategies for further studies.

Keywords: Acupuncture; Bibliometric method; H-index; Traditional Chinese medicine; Web of Science

1. INTRODUCTION

Acupuncture is one of the forms of complementary and alternative medicine commonly categorized as a manipulative therapy.[1] Due to its low cost, relative safety, prompt efficacy, and limited number of side effects, acupuncture has gained increasing popularity among patients worldwide and has been integrated into the primary health care systems of many countries.[2,3] Acupuncture is believed to have originated in China and was thereafter continuously developed and codified in texts over the subsequent centuries, gradually becoming one of the standard therapies used in China and other parts of the world.[4] The manipulation of acupuncture treatment consists of the insertion of thin needles into specific points on the body with the aim of rebalancing the Qi flow in the meridian system and restoring or balancing the functions of the inner organs. The methodology of acupuncture method is guided by oriental philosophical theories such as Yin-Yang duality, the five elements, and the Qi-blood circulating pathways (i.e., the meridian system).[5] In modern times, acupuncture has been developed to include various manipulation methods and devices, including thin needle insertion, electroacupuncture, auricular acupuncture, acupressure, cupping suction, and nonsmoke moxibustion.[6–9]

Following the World Health Organization's recommendation of acupuncture as an effective alternative therapy for 43 different disorders, acupuncture attracted considerable public interest and various studies regarding its effectiveness and action mechanisms, as well as the structure and characteristics of the acupoints/meridians, were conducted. Official support and organization on the part of the governments of various countries also gave major impetus to such acupuncture-related research. Moreover, such research affected several aspects of biomedicine, including the expansion of scientific and clinical knowledge and the development of study designs for clinical trials regarding chronic pain, connective tissues, and placebo effects.[10]

Situated in the western Pacific off the coast of Mainland China, Taiwan is a small multicultural collection of islands with a total area of 36 193 km^2 and a population of 23 million, the ancestors of whom mainly immigrated from China in the early seventeenth century.[11] The national health insurance (NHI) program of Taiwan was started in 1995, and currently covers 99.9% of Taiwan's inhabitants.[12] Traditional Chinese Medicine (TCM) treatments, which include herbal medicines and acupuncture treatments, have been paid for by this universal program since 1996, and 75.5% to 86.9% of adults used at least one traditional medicine modality in 2012; however, Western medicine still constitutes the main form of health care in Taiwan, accounting for 82% of the annual NHI budget in comparison to only 3.9% for TCM.[13,14] The elderly, women, and people with chronic diseases tend to integrate or combine TCM with Western medicine, and medical beliefs and culture identity are an important influence on the utilization of health care in

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Taiwan.[15,16] In summary, Taiwanese can easily and affordably receive clinical acupuncture treatments under the nation's health insurance system. All of these conditions have resulted in the abundant utilization of acupuncture, as well as large amounts of acupuncture-related research, in Taiwan.

Bibliometrics, the application of mathematical and statistical analysis to publications, can be used to monitor the trends and others aspects of research regarding a given medical topic.[17,18] Previous bibliometric studies, for example, have explored the trends in acupuncture publication activity by analyzing acupuncture-related articles indexed in the MEDLINE database and the Science Citation Index Expanded (SCI-E) database.[18–22] However, an analysis of the citation impacts of acupuncture-related studies as well as the performance and trends in such research over the last few decades in Taiwan has not yet been reported.

This study thus aimed to analyze the studies on acupuncture published from 1988 to 2017, using a bibliographic analysis of articles indexed in the Web of Science, with citation data and the Hirsch index (h-index) being used as bibliometric tools to determine the performances of the research output.

2. METHODS

We analyzed any study related to the basic principles and/or applications of acupuncture. So, in this article, the term "acupuncture" refers to various forms of acupuncture, including manual acupuncture, electroacupuncture, auricular acupuncture, and acupoint pressure. The Web of Science is maintained by Thomson Scientific and plays a major role in the field of academic references, mainly due to its assignment of annual journal impact factors. For citation index studies and bibliometric research, the Web of Science is the preferred database and was thus used in this study. The data regarding the scholarly literature that was analyzed in this study were taken, however, from a number of databases, including the Web of Science, MEDLINE, BIOSIS Previews, KCI-Korean Journal, Russian Science Citation Index, and SciELO Citation Index databases. To identify documents on acupuncture, the keywords acupunct*, acupoint*, electroacupunct*, electro-acupunct*, acupre*, auricular acupunc*, and auricular needle* were used to search title words in the SCI Expanded database, including all article types. This study restricted the time span for the searches for the period from 1988 to 2017, refined the country or territory to Taiwan, and retrieved the available articles in all languages. The date of the data collection was February 26, 2018.

This study included an analysis of the types and languages of the published documents, as well as their research areas and institutional affiliations, the most productive authors, the total number of citations, and the most-cited articles.[23] In addition, the study also presents the time trends of acupuncture publications. The quality of research productivity was measured using the h-index, the average citations per paper (CPP), and impact factor. The h-index is used to characterize the quantity and quality of publications per a given unit, such as per country, per institution, or per author.[24] The definition of the h-index stipulates that an individual has an h-index of x, if x of his or her papers have been cited at least x times to date.[25] The average numbers of CPP can be used to assess the impact of publications for publication years, countries, institutes, and authors. The formula for CPP is "$\text{CPP} = \text{Total Citations} \div \text{Total Papers}$".

3. RESULTS

3.1. The performance of acupuncture-related publications in Taiwan

The number of documents published from 1988 to 2017 retrieved from all the databases in the ISI Web of Science using the methodology stated and without specifying any country was 20 650. After specifying the country of Taiwan, 539 documents were retrieved. Taiwan was the sixth most productive country overall (accounting for 2.6% of the 20 650 articles) with 7250 total papers (TP), an average of 13.45 CPP, and an h-index of 38 (ranking eighth among the 10 most productive countries in that regard). The leading countries in acupuncture research were the People's Republic of China (with 4340 or 21.0% of the total articles), followed by the United States of America (2524 or 12.2%), South Korea (1182 or 5.7%), England (773 or 3.7%), and Germany (611 or 3.0%) (Table 1).

The USA had the highest h-index and total citation numbers, followed by England, China, and Germany. China published a large number of high-quality articles and was the most productive country overall, but it ranked ninth in terms of CPP. From China, 1162 of the articles were published in Chinese, and 617 of these articles were published by local journals in China in 2017, which is probably what led to China's relatively low CPP rank.

The annual global productivity of acupuncture-related research increased steadily from the early 1990s, with a particular increase in the variety and amount of such research occurring from 2009 to 2010. In Asia specifically, the annual number of published studies from China, South Korea, and Taiwan remained relatively consistent, whereas the number of studies from Japan over the past 5 to 6 years was noticeably reduced. For non-Asian countries, the annual number of published studies from the USA, Australia, and Brazil remained relatively consistent, whereas the number of studies from England and Germany was noticeably reduced in the past 3 to 4 years (Fig. 1).

3.2. Databases, types, languages, and research areas of the published acupuncture-related documents from Taiwan

Five hundred thirty-nine documents were retrieved from all of the databases of the ISI Web of Science, and the numbers of those documents found in each of the databases were 526 (97.59%) for the Web of Science database, 390 (72.36%) for

Table 1

Top ten most productive countries/regions in terms of acupuncture-related studies (1988 to 2017)

Countries/regions	TP (R)	% of total 20 650	SCP (R)	% of SCP	TC (R)	CPP (R)	CPY (R)	h-index (R)
China (mainland)	4340 (1)	21.0	3570 (1)	82.3 (4)	34 475 (2)	7.94 (9)	1112.10 (2)	63 (3)
USA	2524 (2)	12.2	1755 (2)	69.5 (7)	42 261 (1)	16.74 (4)	1363.26 (1)	92 (1)
South Korea	1182 (3)	5.7	925 (3)	78.3 (5)	11 870 (5)	10.04 (7)	423.93 (5)	48 (5)
England	773 (4)	3.7	496 (4)	64.2 (8)	15 710 (3)	20.32 (3)	523.67 (3)	65 (2)
Germany	611 (5)	3.0	375 (7)	61.4 (9)	13 006 (4)	21.29 (2)	464.50 (4)	58 (4)
Taiwan	539 (6)	2.6	450 (5)	83.5 (2)	7250 (6)	13.45 (5)	250.00 (6)	38 (8)
Japan	511 (7)	2.5	422 (6)	82.6 (3)	6614 (8)	12.94 (6)	213.35 (8)	39 (7)
Australia	347 (8)	1.7	205 (10)	59.1 (10)	2943 (9)	8.48 (8)	105.11 (9)	27 (9)
Brazil	340 (9)	1.6	307 (8)	90.3 (1)	1828 (10)	5.38 (10)	83.09 (10)	20 (10)
Sweden	288 (10)	1.6	207 (9)	71.9 (6)	6979 (7)	24.23 (1)	240.66 (7)	48 (5)

Equal numbers receive the same ranking number, and then a gap is left in the ranking numbers.

CPP = citations per paper; CPY = citations per year; h = h-index; R = rank; SCP = single country papers; TC = total citation; TP = total papers; % of SCP = percent of SCP of TP.

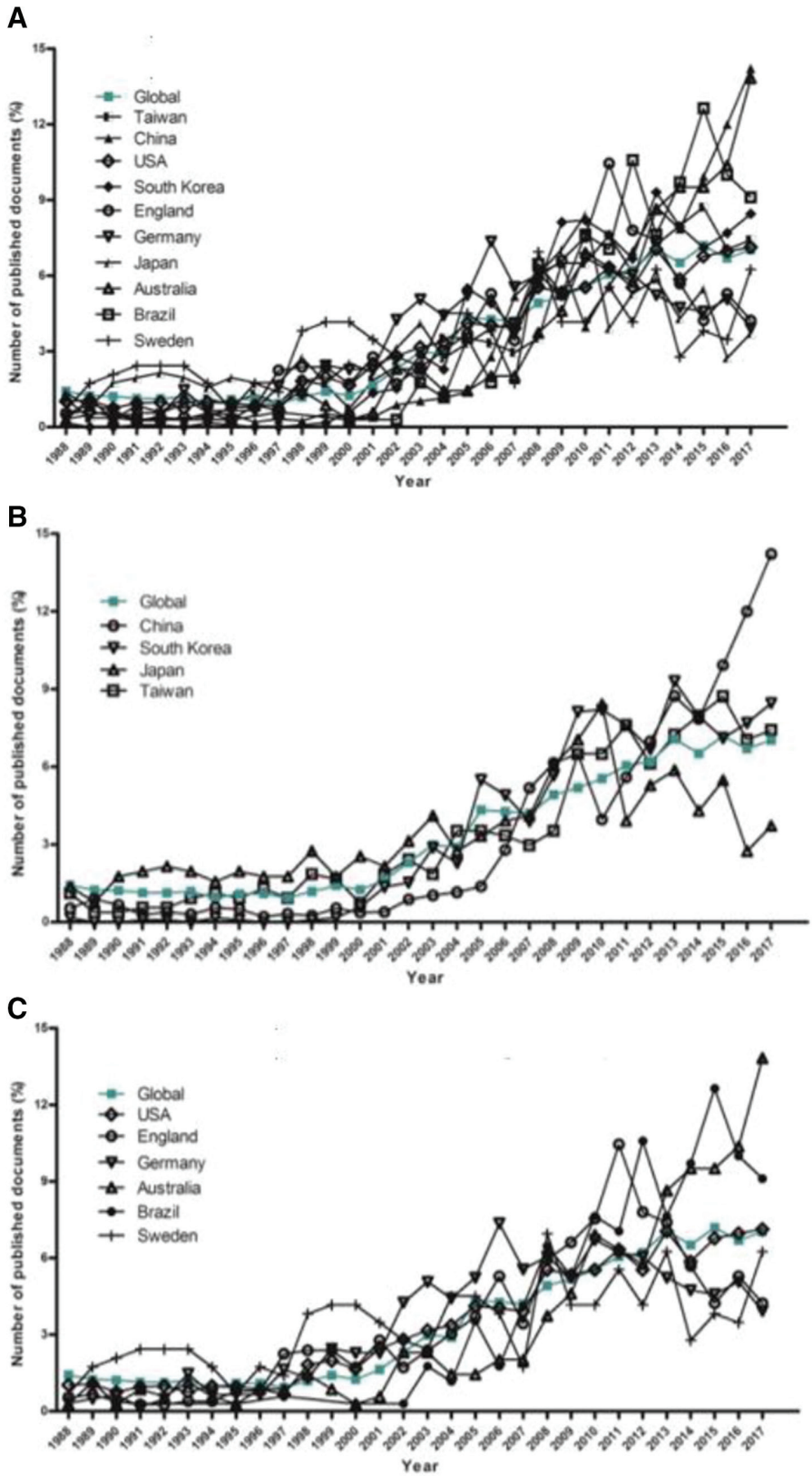

Fig. 1. The growth in acupuncture-related publications from the top ten most productive countries/regions compared with the growth in global acupuncture-related research from 1988 to 2017. Each growth percentage indicates the number of publications per year over the total number of published acupuncture-related studies for the given region. (a) The top ten most productive countries/regions; (b) The Asian countries/regions in the top ten most productive countries/regions; (c) The non-Asian countries/regions in the top ten most productive countries/regions.

the MEDLINE database, 251 (46.57%) for the BIOSIS Previews database, and 6 (1.11%) for the KCI-Korean Journal Database. Most of the acupuncture documents from Taiwan were original articles (479, 88.87%), followed by others (207, 38.40%), clinical trials (155, 28.76%), review articles (48, 8.91%), and case reports (36, 6.68%). The primary language of the retrieved

articles was English (538, 99.81%), followed by unspecified (5, 0.93%), Chinese (4, 0.74%), Thai (2, 0.37%), Korean (1, 0.19%), and French (1, 0.19%).

The research areas, or SCI subject categories, of the articles are listed in Table 2. Totals of 139 and 91 research areas were identified for the articles published globally and those published in Taiwan, respectively. The results showed that the acupuncture articles in the fields of integrative and complementary medicine, neurology, anesthesiology, and science and technology were generally more impressive in terms of having higher h-indexes. Among these fields, the acupuncture publications from Taiwan maintained top ten positions. Meanwhile, Taiwan was also active in the relatively unpopular categories of acupuncture-related research, such as women's studies (3 of the total 17 articles or 17.64% of the total global publications), linguistics (1 of the total 7 articles or 14.3%), biotechnology applied microbiology (4 of the total 33 articles or 12.12%), and nursing (36 of the total 315 articles or 11.43%).

3.3. The number of citations and the most highly cited articles

As shown in Table 1, the total number of citations for the articles from Taiwan was 7250, with the average number of citations per document being 13.45. From all of the databases in the ISI Web of Science, 9251 (44.8% of 9254 articles) of the articles published from 1988 to 2017 globally had no citations, including 1238 (13.4% of 9254 articles) and 847 (9.2% of 9254 articles) articles published in 2017 and 2016, respectively. Fifteen percent of the no-citation articles were published in the journal Zhongguo Zhen Jiu ("Chinese Acupuncture and Moxibustion"), a Chinese acupuncture journal that began publishing in 1981. About 6.8% of the no-citation articles were published in the journal Evidence-based Complementary and Alternative Medicine, which began publishing in 2004.

Fig. 2a shows that 99 (18.4% of 539 articles) of the acupuncture-related articles from Taiwan published from 1988 to 2017 had no citations, with 28 (5.2% of 539 articles) and 14 (2.6% of 539 articles) of those articles being published in 2017 and 2016, respectively. Six (1.1% of 539) articles from Taiwan published from 1988 to 2017 were highly cited (over 100 citations), with the largest percentage of the articles from Taiwan (141 or 26.1% of 539 articles) being cited 4 to 10 times. For the top two most productive countries, meanwhile, the largest percentages of articles were cited 0 times (29.7% of 4340 articles and 2524 for China and the USA, respectively), followed by those with 4 to 10 citations (23.5% and 17.0% for China and the USA, respectively). In addition, 5.6% (2 of the 36 globally very highly cited articles, i.e., those cited over 200 times), 13.9%, and 55.6% of the highly cited documents were from Taiwan, China, and the USA, respectively (Fig. 2b). Table 3 lists the characteristics of the highly cited articles (i.e., those with over 100 citations) among the acupuncture-related research articles published from 1988 to 2017. Citations received by these highly cited articles accounted for 1103 (15.2%) of the total citations.

3.4. Most active authors and the performances of different institutions in terms of acupuncture research

Professor Lin Jaung-Geng ranked first for researchers in Taiwan in terms of the number of publications with 109 articles (20.2% of 539 articles), in addition to having the most citations (1894, 26.1% of the total citations) and being ranked first in h-index (Table 4). Four of the top five most active authors work at China Medical University (CMU) in Taichung, Taiwan, while one works at the National Taipei University of Nursing and Health Science in Taipei, Taiwan.

Table 5 details the performances of the top five most productive institutions in Taiwan. According to Table 5, the CMU ranked first with 229 articles, followed by the Chang Gung Memorial Hospital and University with 78 articles and the National Taiwan University (NTU) with 75 articles. Generally, of the top five most productive institutions, the number of acupuncture-related articles increased gradually, and there was a higher growth rate for CMU than for the other institutions in acupuncture-related research (Fig. 3).

4. DISCUSSION

This study analyzed the acupuncture-related documents from Taiwan from 1988 to 2017 in terms of their performance and citation impacts using bibliometric methods. The data were retrieved from the world's scholarly literature found in all the databases accessed by Web of Science searches, in order to make sure that these indicators were analyzed more comprehensively.

Following the global trend in acupuncture-related research, the publication of acupuncture-related research in Taiwan was found to have grown year by year both in this study and others.[18,22] China and the USA were the top two countries in terms of the production of high-quality acupuncture-related articles (Table 1). Taiwan published 539 acupuncture-related documents from 1988 to 2017 and 450 of those 539 (83.5%) articles published exclusively by authors from Taiwan. This result was consistent with that of a previous study completed in 2012, which reported that the percentage of international collaborative articles involving researchers in Taiwan was less than 3%.[18] However, in this study, China and the USA were found to be the top two countries in terms of publishing articles without international collaboration from 1988 to 2017. This result was different from that of a previous study which indicated that the USA and China published the most international collaborative acupuncture-related articles.[18] The previous study from 2012 analyzed the acupuncture-related documents of the SCI-E database of the Web of Science from 1980 to 2009, whereas the data sources for this study were all of the databases in the Web of Science from 1988 to 2017. On the contrary, Australia and Sweden were the

Table 2

Rankings of acupuncture-related publications from Taiwan in terms of the top ten research areas/subject categories globally (1988 to 2017)

Research areas	Global TP	% of 20 650	Taiwan TP	% of 20 650	% of 539	Rank[a]	h-index
Integrative and complementary medicine	13 715	66.4	400	2.9	74.2	6	36
Neuroscience and neurology	7788	37.7	263	3.4	48.8	7	35
Anesthesiology	4223	20.5	215	3.4	39.9	5	25
General internal medicine	4150	20.1	151	3.1	28.0	6	16
Health care sciences services	3591	17.4	145	6.0	26.9	5	31
Pharmacology and pharmacy biochemistry	3088	15.0	141	3.6	26.2	5	27
Biochemistry molecular biology	3068	14.9	128	3.6	23.7	5	22
Cardiovascular system and cardiology science	2665	12.9	113	4.2	21.0	5	22
Science technology other topics	2620	12.7	111	5.4	20.6	5	23
Behavioral sciences	2513	12.2	110	3.1	20.4	7	22

[a]Global rank in the numbers of such acupuncture-related publications.

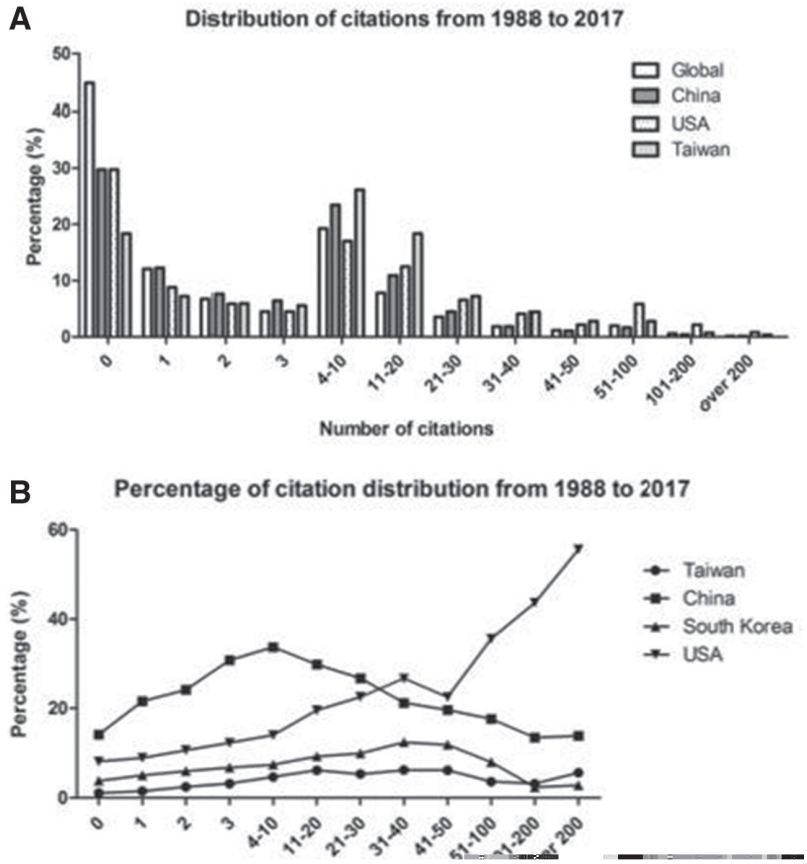

Fig. 2. Distribution of acupuncture articles published from 1988 to 2017 in terms of the number of citations. (a) Distribution of citations for articles published in China, the USA, Taiwan, and globally. (b) Percentage of citation distribution of articles published in China, the USA, South Korea, and Taiwan over the global distribution from 1988 to 2017.

last two countries in terms of single-country articles, with such studies accounting for 59.1% and 71.9% of their total publications, respectively (Fig. 1).

Table 2 shows that the global and Taiwan acupuncture-related articles were mainly published in the fields of integrative and complementary medicine, neuroscience and neurology, and anesthesiology. This analysis further indicated that pain, especially chronic pain, is the leading indicator for acupuncture-related studies with strong evidence-based approaches, as revealed in surveys from the United States and Europe.[10,26] Furthermore, acupuncture neuroimaging research has identified a clear brain-based pathway for pain control and other acupuncture indications. Following the trend of global acupuncture-related research, nearly half of the acupuncture-related articles and the three most-cited articles from Taiwan were in the neuroscience research area (Tables 2 and 3).

From 1988 to 2017, 18.4% of the acupuncture-related articles from Taiwan had no citations, while the percentage of no-citation articles globally, in China, and the USA were 44.8%, 29.44%, and 29.7%, respectively. These results showed that the documents produced in Taiwan were relatively frequently cited. Citations received by the highly cited articles (i.e., those with over 100 citations) from Taiwan accounted for 1103 (15.2%) of the total citations, while the largest percentage of documents from Taiwan (141 or 26.1% of 539 articles) were cited 4 to 10 times (Fig. 2).

Table 3

Most-cited acupuncture documents (>100 citations) from Taiwan (1988 to 2017)

Document	Journals	Year	Authors	TC
Central nervous pathway for acupuncture stimulation: localization of processing with functional MR imaging of the brain – Preliminary experience	Radiology	1999	Wu, MT; Hsieh, JC; Xiong, J; Yang, CF; Pan, HB; Chen, YCI; Tsai, GC; Rosen, BR; Kwong, KK	318
Neuronal specificity of acupuncture response: a fMRI study with electroacupuncture	Neuroimage	2002	Wu, MT; Sheen, JM; Chuang, KHS; Yang, PC; Chin, SL; Tsai, CY; Chen, CJ; Liao, JR; Lai, PH; Chu, KA; Pan, HB; Yang, CF	230
Activation of the hypothalamus characterizes the acupuncture stimulation at the analgesic point in human: a positron emission tomography study	Neuroscience Letters	2001	Hsieh, JC; Tu, CH; Chen, FP; Chen, MC; Yeh, TC; Wu, YT; Liu, RS; Ho, LT	151
Acupuncture analgesia: a review of its mechanisms of actions	American Journal of Chinese Medicine	2008	Lin, JG; Chen, WL	149
The effect of high and low frequency electroacupuncture in pain after lower abdominal surgery	Pain	2002	Lin, JG; Lob, MW; Wen, YR; Hsieh, CL; Tsai, SK; Sun, WZ	134
Randomized, blinded, Sham-controlled trial of acupuncture for the management of aromatase inhibitor-associated joint symptoms in women with early-stage breast cancer	Journal of Clinical Oncology	2010	Crew, KD; Capodice, JL; Greenlee, H; Brafman, L; Fuentes, D; Awad, D; Tsai, WY; Hershman, DL	121

Table 4

Top five most active authors in terms of acupuncture-related publications in Taiwan (1988 to 2017)

Author	TP	% of 539	TC	CPP	h-index
Lin Jaung-Geng (LIN JG)	109	20.2	1894	17.38	24
Most-cited article	Acupuncture analgesia: a review of its mechanisms of actions (2008) (TC:149)				
Hsieh Ching-Liang (HSIEH CL)	61	11.3	872	14.3	15
Most-cited article	The effect of high and low frequency electroacupuncture in pain after lower abdominal surgery (2002) (TC:134)				
Chen Yi-Hung (CHEN YH)	23	4.3	135	5.87	8
Most-cited article	The benefit of combined acupuncture and antidepressant medication for depression: a systematic review and meta-analysis (2015) (TC:24)				
Yeh Mei-Ling[13]	22	4.1	175	7.95	9
Most-cited article	Comparing effects of auricular acupressure with and without an Internet-assisted program on smoking cessation and self-efficacy of adolescents (2006) (TC:34)				
Lin Yi-Wen (LIN YW)	21	3.9	131	6.24	7
Most-cited article	Electroacupuncture at Baihui (GV20) reverses behavior deficit and long-term potentiation through N-methyl-D-aspartate and transient receptor potential vanilloid subtype 1 receptors in middle cerebral artery occlusion rats (2010) (TC:22)				

The two most-cited articles were related to the functional magnetic resonance imaging (fMRI) study of acupuncture mechanisms (Table 3). The third most-cited article used PET scanning to elucidate the role of the hypothalamus in mediating analgesic efficacy.[27] Those scientists engaging in neuroimaging studies of acupuncture, such as Vitaly Napadow in the USA and Lijun Bai in China, cited these articles most frequently to support their own studies. At present, neuroimaging studies remain a hot topic for future investigations of clinically relevant outcomes associated with physiological responses to acupuncture stimulation.[28]

The fourth and the fifth most-cited articles from Taiwan discussed the pathways and mechanisms of acupuncture analgesia and were authored by Professor Lin Jaung-Geng from CMU. Founded in 1958, CMU was the first academic institution to provide both Chinese medicine and pharmacy programs to medical students in Taiwan. The Graduate Institute of Chinese Medical Science was set up in 1975, and a doctoral program has been provided since 1988. In 1989, they published their first two acupuncture-related articles in the American Journal of Acupuncture[29] and the Japanese Journal of Pharmacology.[30] In 2005, CMU established the Graduate Institute of Acupuncture Science, the first specialized acupuncture research institute in Taiwan, which has been regarded as a major impetus for acupuncture research in Taiwan. Since then, CMU has remained the top producer of acupuncture-related research in Taiwan (Fig. 3).

In 1996, given the experiences of CMU, the school of Traditional Chinese Medicine at Chang Gung University (CGU) was established.[11] However, the Chang Gung Memorial Hospital published its first acupuncture-related article in 1988 in the Journal of Urology.[31] The predecessor of National Taiwan University was Taihoku (Taipei) Imperial University (TIU), which was founded by the Japanese government in 1928. After World War II and Taiwan's retrocession to Chinese Sovereignty in 1945, the school was reorganized and renamed "National Taiwan University (NTU)." While being the most prestigious university in Taiwan, NTU does not have a traditional medical institute/college. NTU has, however, participated in many acupuncture-related studies and published their first acupuncture article in1988 in the field of animal science.[32]

National Yang-Ming University (NYMU) and Taipei Veterans General Hospital (TVGH) are cooperative partners in TCM research, such that their acupuncture-related documents were counted together in this article. They introduced a master's program in 1991 and a doctoral program in 1998. In 1992, NYMU published its first acupuncture-related article in the Journal of Urology.[33] However, TVGH published its first acupuncture-related article in 1988 in the American Journal of Acupuncture,[34] and published its first clinical study about needle fainting in 1990.[35]

Taipei Medicine University (TMU), also known as Taipei Medical College (TMC), was founded in 1960. No specific acupuncture research institute was established at the institution, but TMU did have a doctoral program in Chinese herbal medicine. TMU has three affiliated hospitals, which have departments of Chinese medicine and are actively engaged in the acupuncture-related research. They published their first acupuncture-related article in 2004 about the application of acupoints (sanfuji) in the American Journal of Chinese Medicine.[36]

Table 5

Top five most productive institutions in terms of acupuncture-related research in Taiwan (1988 to 2017)

Institution	TP	% of 539		Year 1988-1997	Year 1998-2007	Year 2008-2017	TC	CPP	CPY	h-index
China Medical Universityand Hospital Taiwan	229	42.5	Papers	13	47	169	2985	13.03	102.93	27
			Citations	210	1234	1541				
			h-index	8	20	19				
Chang Gung Memorial Hospital and University	78	14.5	Papers	7	18	53	1437	18.42	51.32	20
			Citations	138	856	443				
			h-index	5	14	13				
National Taiwan University	75	14.0	Papers	4	20	51	1250	16.67	44.64	18
			Citations	95	795	360				
			h-index	3	14	12				
National Yang Ming University	75	13.2	Papers	9	28	38	1959	26.12	72.56	24
			Citations	214	1291	454				
			h-index	6	18	14				
Taipei Medical University	48	8.9	Papers	0	5	43	392	8.17	32.64	11
			Citations	0	85	307				
			h-index	0	5	10				

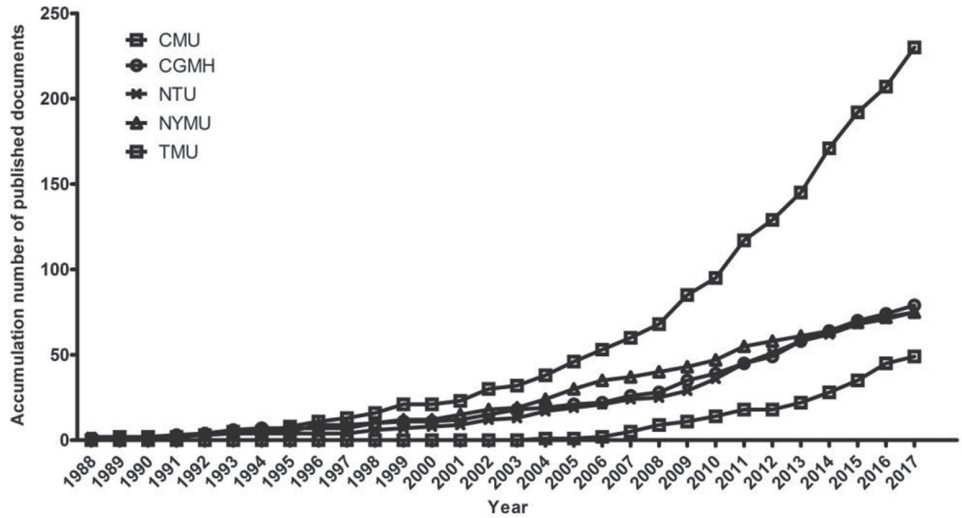

Fig. 3. Comparison of the publication growth trends of the top five most productive institutions in Taiwan from 1988 to 2017.

There were various limitations to this study. The Web of Science database began collecting citation information in 1988, and therefore articles published before 1988 were not included in this study. Moreover, while the Web of Science offers comprehensive biomedical literature databases, the numbers and citations of medical journals from various countries are still limited.

In conclusion, Taiwan has been active in the publication of acupuncture-related research, with the number of such publications increasing gradually over the years; however, researchers in Taiwan should engage in more international cooperation. The results of the present study provide a context for analyzing the strengths of existing acupuncture-related research and informing prospective strategies for further studies.

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