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Chinese academic contribution to burns: A comprehensive bibliometrics analysis from 1985 to 2014

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ABSTRACT

Objective: The objective of this study was to conduct a survey of the academic contribution and influence of Chinese scholars in the field of burns.

Method: The PubMed database was searched to obtain literature items originating from various countries and Chinese provinces from 1985 to 2014. The citation data were collected through the Google Scholar engine.

Results: A total of 1037 papers published in 256 journals were included in this survey. China was second only to the USA in the number of publications on burns since 2010. In addition, the annual number of papers has increased significantly since 2001. The journal *Burns* published the most number of articles, but its proportion has been decreasing. Of the papers included in the survey, 58.34% were published in journals with a 5-year impact factor between 1 and 2, whereas only 3.66% were published in journals with an impact factor >5. Both total citations and citations per paper have decreased in the past decade. Randomized controlled trials or systematic reviews merely accounted for a small proportion. Twenty-nine provinces including 64 cities contributed one paper at least. The publications from Taiwan, Beijing, Chongqing, Shanghai, and Guangdong were high in both quantity and quality.

Conclusion: The Chinese academic contribution to the field of burns is now on a rise. Although the quality of papers is lagging behind quantity, scholars and academies are dedicated to improving China's academic level.

1. Introduction

Burns are the fourth most common type of injury [1]. Since the successful treatment of the first patient with burns covering 87% of the total body surface area (TBSA) in 1958 in Shanghai, burn surgery, as an independent medical specialty, has seen great progress in both clinical practice and experimental research in China [2,3]. Nearly 60 years have seen Chinese academic contributions to the field of burn care and research

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from domestic reports to international articles published in top journals [4,5].

On 29 July 2014, the Essential Science Indicators database published the updated version of Journal Citation Reports (JCR), which revealed that China was already second only to USA in the number of scientific research papers published annually [6]. However, Chinese scholarly publications on burns have not been reported. To evaluate the quantity and quality of Chinese articles on burns at both the international and domestic levels, a bibliometrics study was conducted, based on PubMed records from 1985 to 2014.

2. Materials and methods

2.1. Data sources

The PubMed database was searched to obtain the publication volume of different countries worldwide and in different regions of Greater China from 1 January 1985 to 31 December 2014 (including the mainland, the Hong Kong Special Administrative Region (SAR), and the Taiwan Area). The 5-year average impact factor (IF) data and title abbreviation of journals involved in the research were collected from the JCR 2014 (Thomson Reuters). The global citation of each paper was obtained using the Google Scholar engine [7].

2.2. Search strategy

A computerized publication search was conducted independently using the PubMed database for the date 30 April 2015. For a better profile of the literature on burns, the Medical Subject Headings (MeSH) term ''burns'' was chosen and the language was restricted to English with a publication date from I January 1985 to 31 December 2014. ''United States of America,'' ''United States,'' ''USA,'' or ''US'' was considered as publications affiliated with the USA. ''United Kingdom,'' ''UK,'' or ''England'' was identified as literature originating from the UK. ''China,'' ''Taiwan,'' or ''Hong Kong'' was classified as having originated from China. All citable literature, including articles, reviews, meta-analyses or systematic reviews, comments or letters, and editorials, met the inclusion requirements except papers that were written in Chinese with an English-language abstract. Articles with the first author's affiliation were identified as research originating from these countries and provinces of China. Furthermore, the searches were conducted independently by the authors (XiaoMing Fan, Ying Gao, and Bing Ma), who reached a consensus after discussion in the case of discrepancies in titles, authors, abstracts, and full texts, if necessary.

2.3. Statistical analysis

This study was conducted to describe trends and structures rather than to raise and test hypotheses on the relative contributions among nations or provinces. Therefore, statistical description (sum, average, percentage, and outlier) was used instead of statistical inference.

3. Results

3.1. Affiliations

The past 30 years have witnessed a significant increase in the number of annual publications from 600 in 1985 to >1200 in 2014. A total of 24,174 articles on burns were published from 1985 to 2014 worldwide. Among them, 5904 articles originated from the United States of America, which accounted for 24.42%, followed by the United Kingdom (1301, 5.38%), Greater China (1152, 4.77%), Japan (761, 3.15%), Germany (540, 2.23%), Canada (513, 2.12%), India (457, 1.89%), France (354, 1.46%), and Italy (310, 1.28%). Compared with other countries, China has seen a significant increase in the total number of publications, surpassing the United Kingdom after 2010. However, the number of publications in 2014 apparently decreased, as many articles had not been included in PubMed. The trend of the publication sum of nine countries is shown in Fig. 1.

Of the total of 1152 items published by Chinese authors, 1037 papers were included in this study, allowing detailed analysis under the criteria of journals indexed by JCR 2014 use. Fig. 2 presents a rapid increase since 2000 with 204 papers in the first 15 years and 833 papers in the second 15 years (1:4.08). A total of 969 articles originate from hospitals, accounting for 93.44% of a total of 1037 items, including 380 articles from military hospitals.

3.2. Journals

A total of 1037 papers were published in 256 different journals with an IF indexed by JCR 2014. It is evident that the journal *Burns* (5-year IF = 1.91) has been preferred by Chinese scholars, with 375 papers published in the past three decades, accounting for 36.16% of all papers, followed by the *Journal of Burn Care & Research* (5-year IF = 1.624) with 49 papers. Journals that published 10 papers at least from China during the past 30 years have been listed in Table 1. Furthermore, 163 journals published only one paper dating back to 1985, which accounted for 63.67% of all indexed journals. Fig. 3 shows that the percentage of papers published in *Burns* and the *Journal of Burn Care & Research* has decreased, indicating that Chinese authors publish their findings in other journals.

3.3. IF and citation

Only two articles published in journals had a 5-year IF >10. This was noted in 1998 (*Lancet*) and 2000 (*New England Journal of Medicine*) with 148 and 862 total citations, respectively, thus leading to two peaks in the trend of average IF (Fig. 4), total citations (Fig. 5 A), and average citation (Fig. 5 B). Of 1037 papers, 36 (3.47%) were published in journals with a 5-year IF ranging between 5 and 10. Journals with a 5-year IF between 1 and 2 published a total of 605 papers, which ranked first, accounting for 58.34% of all chosen papers.

The average IF of papers published during the past three decades was 2.45, which was slightly lower than the average of 2.46 in the later 15 years and slightly greater than the average of 2.41 in the former 15 years. The minimum IF was 1.51 in 1985 and the maximum IF was 4.32 in 2000, and the updated average IF in 2014 was 2.53.

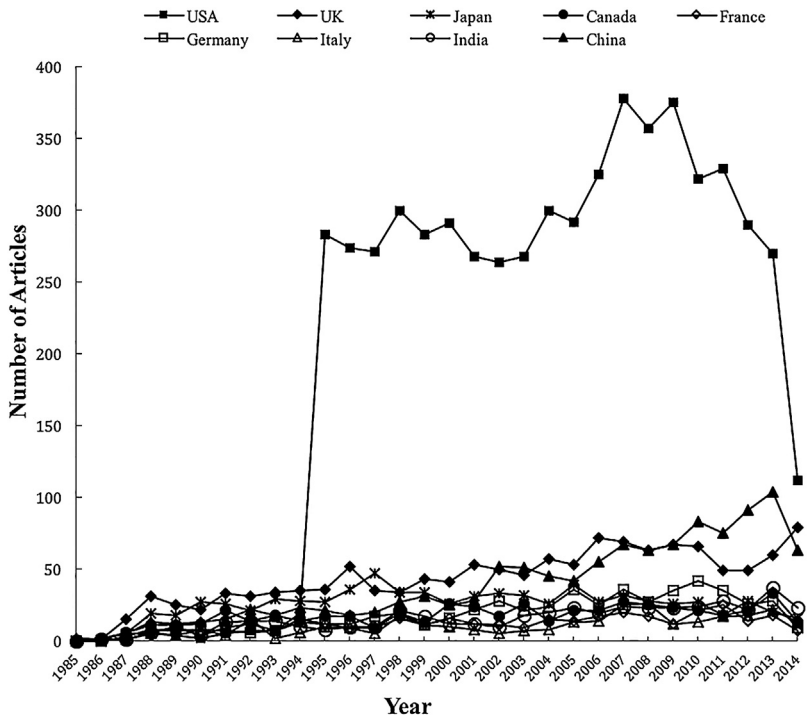

Fig. 1 – The number of articles from United States of America, United Kingdom, Japan, Canada, France, Germany, Italy, India, and China from 1985 to 2014.

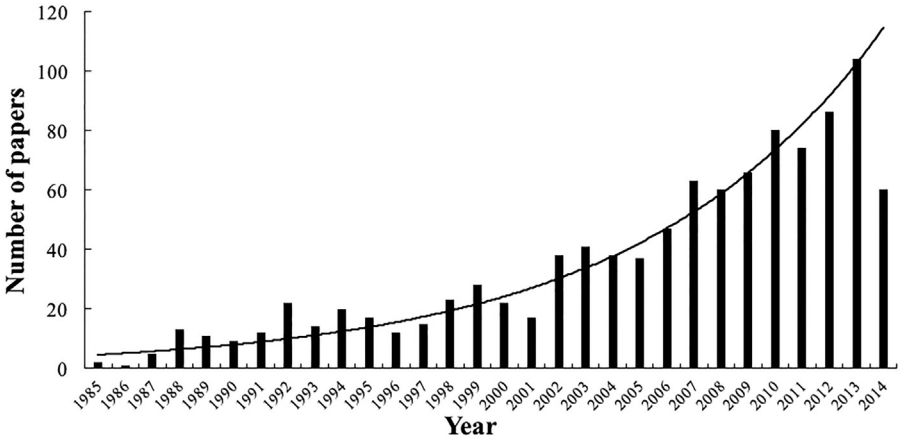

Fig. 2 – The number of articles originating from China during the past three decades.

The total number of papers published after 2001 has increased rapidly; however, both total citations and citations per article have decreased (Fig. 5).

3.4. *Provincial-level districts*

Twenty-nine out of 34 provinces and provincial-level districts in Greater China, including 64 cities, published at least one paper on burns during the past 30 years. Taiwan (304, 29.32% of Chinese output), Beijing (143, 13.79%), Chongqing (130, 12.54%), Shanghai (119, 11.48%), and Guangdong (79, 7.62%) together accounted for 74.73% of the total publications on burns originating from Greater China. The majority of articles (78.4%) originated from major cities in China, including provincial capitals, municipalities, and SAR.

Along with the total number of papers, Taiwan (807.96, 6466), Beijing (378.81, 3286), Chongqing (304.53, 2351), Shanghai (268.84, 1383), and Guangdong (190.84, 1160) occupied the first five positions in terms of both total IFs and total citations. Nevertheless, Sichuan (2.74), Fujian (2.73), and Zhejiang (2.70) replaced Taiwan (2.66, ranked fourth), Beijing (2.65, ranked fifth), and Chongqing (2.34, ranked 10th) in terms of average IFs per article, although they only published nine, five, and 28 articles separately. Guangdong occupied the ninth position with 2.42 and Shanghai lagged behind with 2.26. In terms of average citations per article, Inner Mongolia published only

Table 1 – Journals that have published at least 10 papers written by Chinese authors from 1985 to 2014.

Rank	Journal	Number of papers	Percentage	5-year IF
1	BURNS	375	36.16%	1.91
2	J BURN CARE RES	49	4.73%	1.624
3	CHINESE MED J-PEKING	35	3.38%	1.077
4	J TRAUMA ACUTE CARE	24	2.31%	3.204
5	PLAST RECONSTR SURG	23	2.22%	3.57
6	ANN PLAS SURG	21	2.03%	1.51
7	J PLAST RECONSTR AES	21	2.03%	1.697
8	SHOCK	21	2.03%	2.811
9	PLoS One	20	1.93%	4.015
10	WOUND REPAIR REGEN	16	1.54%	3.778
11	CRIT CARE MED	14	1.35%	6.404
12	WORLD J GASTROENTERO	12	1.16%	2.633
13	ANN THORAC SURG	11	1.06%	3.973
14	INVEST OPHTH VIS SCI	10	0.96%	3.754

J BUNR CARE RES, Journal of Burn Care & Research; CHINESE MED J-PEKING, Chinese Medical Journal; J TRAUMA ACUTE CARE, Journal of Trauma and Acute Care Surgery; PLAST RECONSTR SURG, Plastic and Reconstructive Surgery; ANN PLAS SURG, Annals of Plastic Surgery; J PLAST RECONSTR AES, Journal of Plastic Reconstructive and Aesthetic Surgery; WOUND REPAIR REGEN, Wound Repair and Regeneration; CRIT CARE MED, Critical Care Medicine; WORLD J GASTROENTERO, World Journal of Gastroenterology; ANN THORAC SURG, Annals of Thoracic Surgery; INVEST OPHTH VIS SCI, Investigative Ophthalmology & Visual Science.

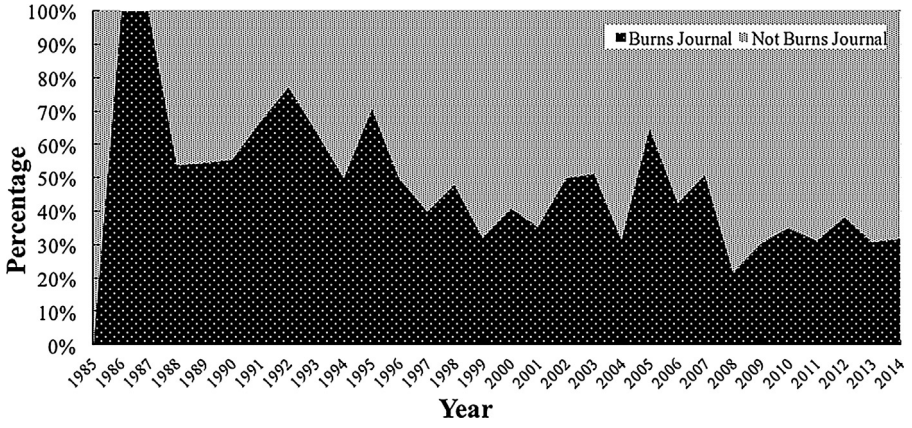

Fig. 3 – The trend of articles published in professional burns journals (*Burns* and *Journal of Burn Care & Research*) and non-burns professional journals based on 1037 papers on burns originating from China from 1985 to 2014.

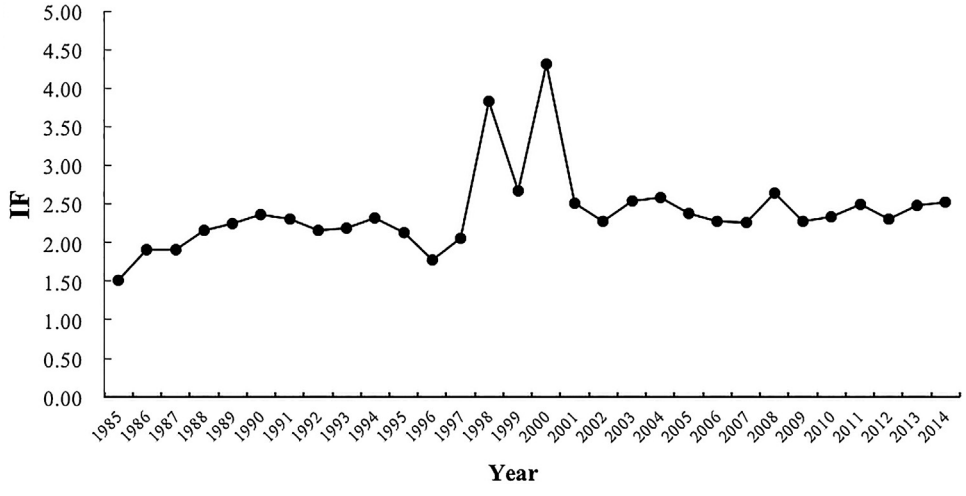

Fig. 4 – Trend of average IF during the past three decades according to 1037 papers on burns originating from China from 1985 to 2014.

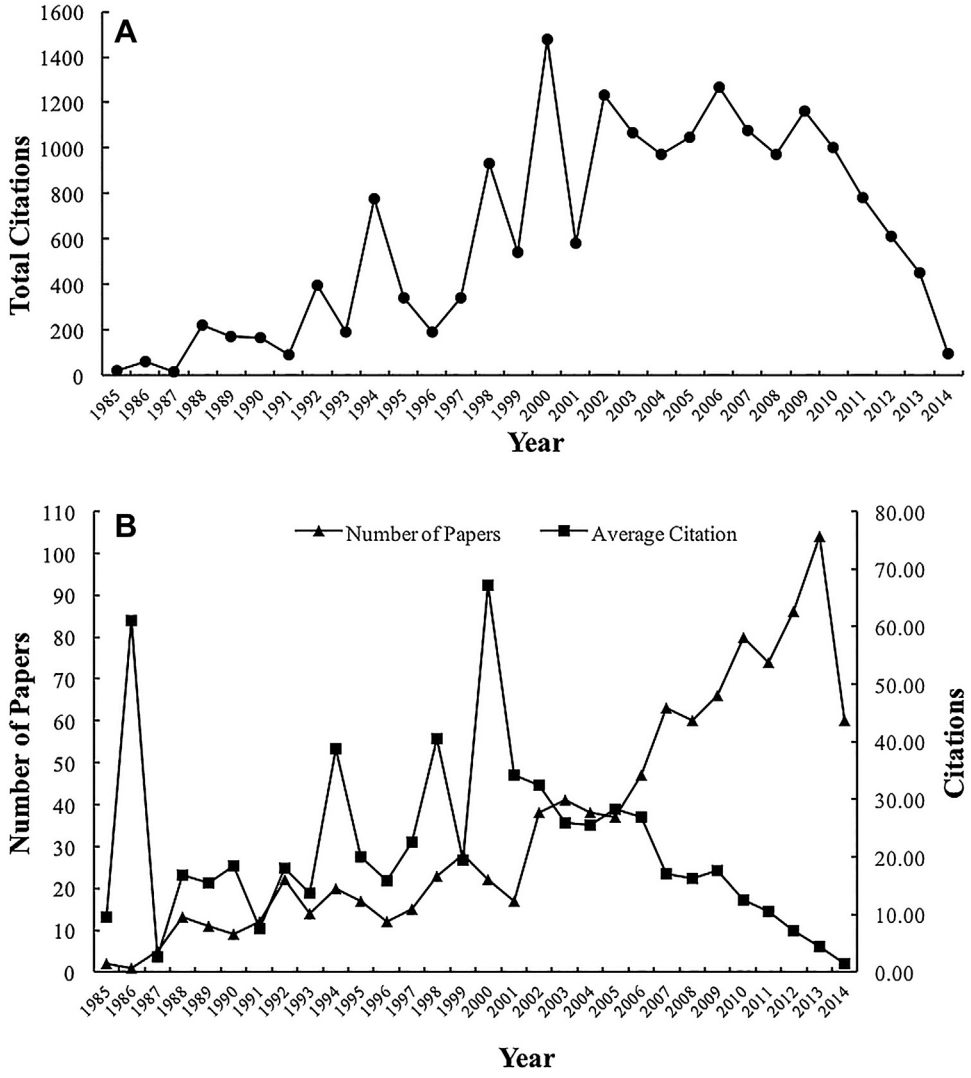

Fig. 5 – The total citations (A), total number of papers and average citation (B) of 1037 papers on burns originating from China from 1985 to 2014.

one article in a journal with a 5-year IF of 1.11, which was cited 42 times and thus ranked first, followed by Hong Kong (23.55), Beijing (22.98), Gansu (22.00), and Taiwan (21.97). Compared to Chongqing (18.08) ranking seventh, Guangdong (14.68) ranked 14th and Shanghai (11.62) ranked 19th (see Table 2).

Overall, the proportion of basic science (nonhuman) research works (40.5%), clinical observations (30.57%), or even case reports (21.79%) was far more than that of reviews (2.60%), randomized controlled trials (RCTs)/controlled clinical trials (CCTs) (3.57%), or comments/letters (0.96%). To assess the correlation between article types and their qualities, the top 10 provinces in terms of the total number of papers published were chosen to compare the paper structure type among each other and with China as a whole. Fig. 6 shows that Taiwan tended to publish more case reports than the others did, while Beijing, Chongqing, Guangdong, Shaanxi, and Jiangsu performed more basic science research. Shanghai, Liaoning, and Hong Kong were found to focus on clinical observations. Zhejiang preferred RCTs/CCTs and communication with international scholars. Reviews/systematic reviews only accounted for a small proportion of the paper structure.

4. Discussion

Along with the booming economy and increasing expenditure on research and development (R&D), China has made several advancements in its scientific output [8]. In 2013, the ratio of total citable publications in China to USA was 1:1.23, with China surpassing the UK to rank second globally. However, among the top 50 countries in terms of the number of citable documents, China fell to the 45th place in citation per paper [9]. It follows then that many journals have published articles analyzing the quantity and quality of papers in different disciplines, but little is known heretofore in the field of burns. For the first time, this research offers a ''bird's-eye'' view of the academic contributions and influences of Chinese doctors and researchers in the field of burns.

Table 2 – Comparison of total number of papers, papers from provincial capitals, total IFs, total citations, average IF, and average citation of provinces involved in the research.

Province	Number of papers	Percentage	Number of papers from provincial capital	Percentage of papers from capital in a province	Total IFs	Total citations	Average IF	Average citation
Taiwan	304	29.32%	161	52.96%	807.96	6466	2.66	21.27
Beijing	143	13.79%	143	100%	378.81	3286	2.65	22.98
Chongqing	130	12.54%	130	100%	304.53	2351	2.34	18.08
Shanghai	119	11.48%	119	100%	268.84	1383	2.26	11.62
Guangdong	79	7.62%	64	81.01%	190.84	1160	2.42	14.68
Shaanxi	35	3.38%	35	100%	92.12	520	2.63	14.86
Jiangsu	28	2.70%	12	42.86%	67.69	442	2.42	15.79
Zhejiang	28	2.70%	17	60.71%	75.48	393	2.70	14.04
Liaoning	24	2.31%	11	45.83%	49.85	338	2.08	14.08
Hong Kong	22	2.12%	22	100%	47.41	518	2.16	23.55
Shandong	22	2.12%	9	40.91%	49.42	198	2.25	9.00
Anhui	19	1.83%	17	89.47%	38.97	191	2.05	10.05
Jiangxi	12	1.16%	12	100%	22.81	183	1.90	15.25
Hubei	12	1.16%	11	91.67%	21.78	86	1.82	7.17
Sichuan	9	0.87%	9	100%	24.66	100	2.74	11.11
Heilongjiang	6	0.58%	2	33.33%	11.84	88	1.97	14.67
Jilin	6	0.58%	6	100%	9.30	48	1.55	8.00
Hebei	6	0.58%	3	50%	11.56	31	1.93	5.17
Fujian	5	0.48%	4	80%	13.67	79	2.73	15.80
Tianjin	5	0.48%	5	100%	11.22	64	2.24	12.80
Hunan	5	0.48%	5	100%	9.50	41	1.90	8.20
Gansu	4	0.39%	4	100%	8.93	88	2.23	22.00
Henan	4	0.39%	4	100%	7.75	29	1.94	7.25
Qinghai	2	0.19%	2	100%	3.82	41	1.91	20.50
Hainan	2	0.19%	2	100%	3.02	32	1.51	16.00
Yunnan	2	0.19%	2	100%	4.89	30	2.44	15.00
Guangxi	2	0.19%	1	50%	2.54	6	1.27	3.00
Inner Mongolia	1	0.10%	0	0%	1.11	42	1.11	42.00
Guizhou	1	0.10%	1	100%	2.04	0	2.04	0

With funds from the Ministry of Science and Technology (MOST), National Natural Science Foundation of China (NSFC), Chinese Academy of Sciences (CAS), Ministry of Education (MOE), and other financial aids, the recent years have seen a continuous increase in article output [10,11]. Since 2010, China has surpassed the UK in the total number of papers on burns and is fast approaching the USA. Apart from research funds, promotions, skills in English writing, better educational background, and a passion for clinical problem solving have led to this improvement. An almost fourfold increase in the later 15 years reflects the present capacity and future potential of the Chinese scientific community in the field of burns. Nevertheless, considering the relative size of its population, China has much to achieve, notwithstanding the IF and citations.

Despite certain drawbacks of the IF, the most commonly used bibliometrics measure, it is still the best choice to evaluate journals and article quality worldwide [12,13]. China misuses IF as the primary indicator evaluating a scholar's academic influence to award promotions, overlooking the genuine differences across all medical disciplines. The IFs of professional journals related to burns, including *Burns* and *Journal of Burn Care & Research*, are <2, which has led some authors to publish their important findings in nonprofessional journals on burns with a higher IF for more citations and for personal profit. Moreover, the Chinese Burn Association and the Chinese Burn Care and Rehabilitation Association have issued a new English-version journal *Burns & Trauma* as the official journal to expand China's academic influence. If the increase in publications since 2001 is seen as the first turning point of Chinese research on burns, the issue of *Burns & Trauma* can be seen as the second, although the journal has not been indexed by JCR yet.

The majority of papers originate from most economically developed provinces that house some prestigious burn care hospitals or burn institutes, such as Taiwan, Beijing, Shanghai, Chongqing, Guangzhou, and Shaanxi. Those provincial-level districts or municipalities on the mainland also act as centers, thus attracting the best doctors and researchers and providing terminal medical services for burn care. In addition, the government tends to allocate funds and make long-term development blueprints for these centers. Well-known hospitals and institutions – such as the First Hospital affiliated to the General Hospital of People's Liberation Army and Beijing Jishuitan Hospital affiliated to the Peking University in Beijing, Changhai Hospital affiliated to the Second Military Medical University and Ruijin Hospital affiliated to School of Medicine Shanghai Jiaotong University in Shanghai, Nanfang Hospital affiliated to the Southern Medical University and Guangzhou Red Cross Hospital affiliated to the Jinan University in Guangdong, Xijing Hospital affiliated to the Fourth Military Medical University in Shaanxi, Southwest Hospital affiliated to the Third Military Medical University in Chongqing, the Prince of Wales Hospital affiliated to the Chinese University of Hong

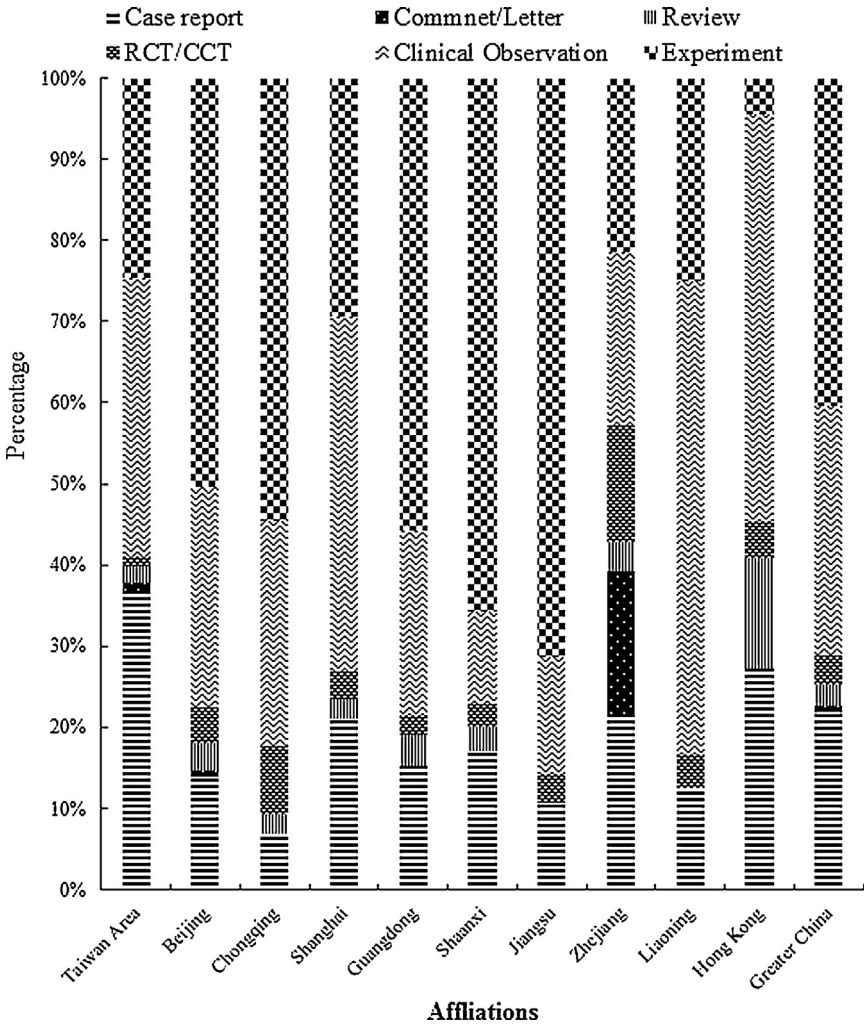

Fig. 6 – Paper types from top 10 provincial-level districts compared to the whole country.

Kong, and the Chang Gung Memorial Hospital Linkou Branch in Taiwan area – have emerged as the burn centers of these major areas and currently lead the academic research and clinical practice in China.

However, the quantitative output has not necessarily reflected the quality of these publications. Of all the papers involved, large-scale, long-term, multicenter RCTs or CCTs and high-quality systematic reviews or meta-analyses only account for a small proportion, let alone conducting integrated and well-performed basic science research. Due to ineffective research design, the experimental conditions, scattered medical resources, protectionism of medical records, an isolated hospital information system, and even author signature issues, Chinese academic articles on burns do not meet the standards, as revealed in our study. Both total citations and citations per article have decreased in the literature on burns. However, these limitations have not hindered China from realizing that a more interactive, intellectual environment with fair and open funding opportunities is crucial for the development and improvement of basic and clinical research [14,15]. Currently, the government encourages institutes and academies to explore novel ways of evaluating, supporting, and guiding the next generation of medical research [16,17]. The president of the NSFC Wei Yang is devoted to accomplishing three goals for advancing science research in China: to produce original breakthroughs, to advance research based on discoveries made elsewhere, and to gain global recognition [18]. Essentially, these goals and measures are intended to offer better services to burn patients.

We could not obtain the full text of all 1037 articles in this research, due to the restricted information offered by the PubMed web database and limited access to full-text academic databases. As a result, some related information, such as fund support, is not provided in this article.

5. Conclusions

In summary, articles by Chinese researchers in the field of burns, especially after 2001, are promising. Although the quality of papers is lagging behind quantity, scholars and academies are dedicated to improving China's academic levels.

Conflict of interest statement

None declared.

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REFERENCES

[1] Zhanzeng F, Yurong Z, Chuangang Y, Yunyun J, Xingang W, Zhaofan X, et al. Basic investigation into the present burn care system in China: burn units, doctors, nurses, beds and special treatment equipment. Burns 2015;41:279–88. http://dx.doi.org/10.1016/j.burns.2014.06.003.

[2] Shen Z. A brief review of the development of Burns in China. Chin J Burns 2014;30(1):1–2. http://dx.doi.org/10.3760/cma.j.issn.1009-2587.2014.01.001 [in Chinese].

[3] Chen J, Li-Tsang CW, Yan H, Liang G, Tan J, Yang S, et al. A survey on the current status of burn rehabilitation services in China. Burns 2013;39:269–78. http://dx.doi.org/10.1016/j.burns.2012.06.016.

[4] Tsai RJ, Li LM, Chen JK. Reconstruction of damaged corneas by transplantation of autologous limbal epithelial cells. New Engl J Med 2000;343:86–93. http://dx.doi.org/10.1056/nejm200007133430202.

[5] Fu X, Shen Z, Chen Y, Xie J, Guo Z, Zhang M, et al. Randomised placebo-controlled trial of use of topical recombinant bovine basic fibroblast growth factor for second-degree burns. Lancet 1998;352:1661–4. http://dx.doi.org/10.1016/s0140-6736(98)01260-4.

[6] China's Absorptive State: Research, innovation and the prospects for China-UK collaboration. Nesta; 2013 [Internet] Available from: http://researchanalytics.thomsonreuters.com/m/pdfs/China's_Absorptive_State [accessed 15.05.10].

[7] Bakkalbasi N, Bauer K, Glover J, Wang L. Three options for citation tracking: Google Scholar, Scopus and Web of Science. Biomed Digit Libr 2006;3:7. http://dx.doi.org/10.1186/1742-5581-3-7.

[8] Qiu J. China goes back to basics on research funding. Nature 2014;507:148–9.

[9] Wang YX, Li T. A long way ahead to improve the cost-effectiveness of biomedical research in China. J Thorac Dis 2015;7:E62–4. http://dx.doi.org/10.3978/j.issn.2072-1439.2015.02.17.

[10] Xu G, Zhang Z, Lv Q, Li Y, Ye R, Xiong Y, et al. NSFC health research funding and burden of disease in China. PLOS ONE 2014;9:e111458. http://dx.doi.org/10.1371/journal.pone.0111458.

[11] Sun Y, Cao C. Research funding. Demystifying central government R&D spending in China. Science 2014;345:1006–8. http://dx.doi.org/10.1126/science.1253479.

[12] Oosthuizen JC, Fenton JE. Alternatives to the impact factor. Surgeon 2014;12:239–43. http://dx.doi.org/10.1016/j.surge.2013.08.002.

[13] Ending the tyranny of the impact factor. Nat Cell Biol 2014;16(1):1. http://dx.doi.org/10.1038/ncb2905.

[14] Yao X, Li D, Pei G. In focus: molecular and cell biology research in China. Nat Rev Mol Cell Biol 2013;14:600–6. http://dx.doi.org/10.1038/nrm3638.

[15] Wang C, Liu Q. A turning point for clinical research in China? Lancet 2013;382:835–6. http://dx.doi.org/10.1016/s0140-6736(13)61804-8.

[16] Cao X. Innovating research in China. Science 2014;346:1035. http://dx.doi.org/10.1126/science.1262117.

[17] Holmes D. Xuetao Cao: reforming medical research in China. Lancet 2013;381:1977. http://dx.doi.org/10.1016/s0140-6736(13)61188-5.

[18] Yang W. Research integrity in China. Science 2013;342:1019. http://dx.doi.org/10.1126/science.1247700.