

# Visualization of Traditional Chinese Medicine Research in Recent 10 Years\*

Zhonghui Yin

International Office  
Hebei University of Chinese Medicine  
Shijiazhuang, China

Jingyao Zhang

International Office  
Hebei University of Chinese Medicine  
Shijiazhuang, China

Lin Miao

International Office  
Hebei University of Chinese Medicine  
Shijiazhuang, China

Jiayi Fang

International Office  
Hebei University of Chinese Medicine  
Shijiazhuang, China

**Abstract**—In this article, the authors selected researches on traditional Chinese medicine (TCM) from the Web of Science Core Collection Database between the time span of 2007 and 2016. By using CiteSpace, the authors mainly visualized published items in each year, source titles, authors, institutions, countries and keywords so as to show the most important footprints of traditional Chinese medicine and offer some reference for researchers.

**Keywords**—TCM; traditional Chinese medicine; CiteSpace

## I. INTRODUCTION

Speaking of the elements that best represent Chinese culture, 50% of the overseas respondents chose traditional Chinese medicine (TCM) [1]. In 2006, 67 Confucius Institutes dedicated their focus on traditional Chinese medicine, Chinese martial arts, etc [2]. TCM plays an important role all over the world. Most studies focus on the strategies and ways to help TCM be international. However, research should depend on a clear understanding of the problem. Few people offer an overall understanding of TCM research internationally.

This paper aims at seeking footprints of traditional Chinese medicine internationally in recent 10 years. The authors try to visualize and analyze published items in each year, source titles, authors, institutions, countries and keywords by CiteSpace.

## II. DATA AND METHODS

### A. Data Collection

In this research, we selected data from Web of Science Core Collection Database. Owing extensive databases such as Science Citation Index Expanded, Social Sciences Citation Index, Web of Science (WoS) is a good choice to collect

related studies.

The Web of Science has several ways to search for bibliographic records. We chose basic search, which includes topic, author, and several other searchable fields. Enter “TCM or ‘traditional Chinese medicine’” in Basic Search bar between the time span of 2007 and 2016. We retrieved 11,694 results from topic search. Save them to Other File Formats. Record content is “Full Record and Cited Reference”. File Format is Plain Text. When you save the file, make sure the file name starts with the word ‘download’ and the file extension is .txt. [3]

### B. Visualization Tool

CiteSpace, a visualization tool made by CHEN chaomei was applied in this research. Ibrahim Musa, Lecturer at Sudan University of Science and Technology said: CiteSpace is software for visualizing, and analyzing bibliometric data. Therefore, it is used in Domain Map Analysis, Bibliometric Analysis, and Scientometrics. It can also be used to help researchers find research topics and write their literature review. [4]. CiteSpace has become one of the most popular citation analysis and visualization software for its priorities in clarity and interpretability of visualization [5]. In this article, we used CiteSpace version of 5.1.R1.SE.5.20.2017.

## III. RESULTS AND ANALYSIS

### A. Publication Years

According to results analysis of WOS, we got record count in Each Year in "Fig. 1".

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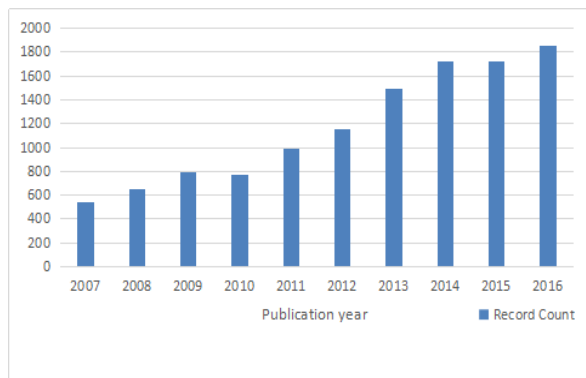


Fig. 1. Published Items in Each Year.

The results show that it is about TCM on the rise in general over the past 10 years. From 2007 to 2010, it increased in a wave-like manner. And there was an obvious growth from 2010 to 2014.

### B. Source Titles

Rank the records by source titles, analysis data from WOS shows that 11,694 papers were published in 2,219 journals. The Top 10 can be seen in "Fig. 2".

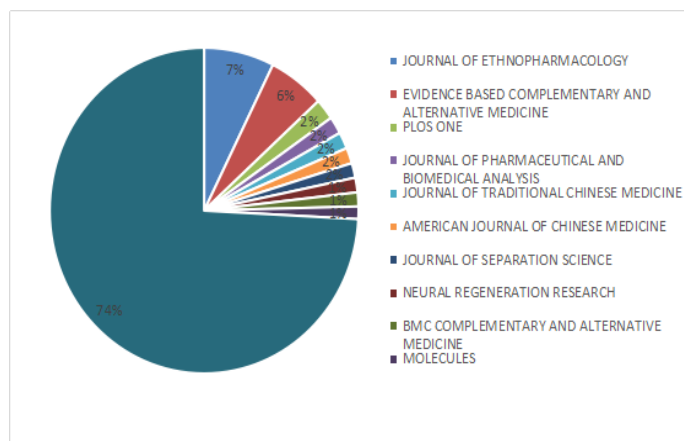


Fig. 2. TOP 10 source titles.

The top ranked source titles are JOURNAL OF ETHNOPHARMACOLOGY with records of 860 papers, account for 7.354 % of 11,694. EVIDENCE BASED COMPLEMENTARY AND ALTERNATIVE MEDICINE and PLOS ONE are the second and third journals with records of 691 and 245 respectively. The top 10 ranked source titles account for 25.832% of 11,694, with records of 3,021.

### C. Authors

Selected "Author" in the Node Types panel and unselected other node types. Set the timespan as "2007-2016" with 1-year slice. Top N=50. CiteSpace read the data files and reported its progress in the two windows on the left-hand side of the user interface. Bibliographic networks can be very dense with many links. Selected Minimum Spanning Treto method removes excessive links systematically. Chose "Visualize" when the modeling process was completed [3].The result was

N=323, E=595 in "Fig. 3", which means there are 323 authors and 595 collaborated group in this conditions.

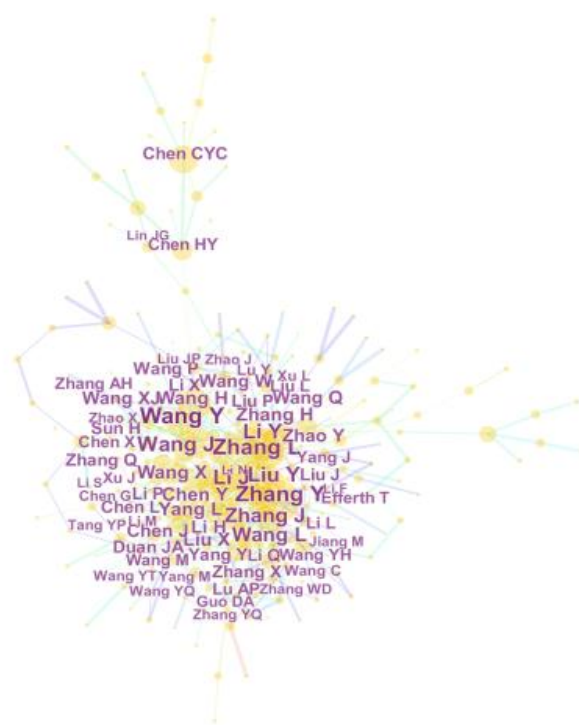


Fig. 3. Authors.

"Fig. 3" shows that authors collaborated frequently. The size of node is proportional to the record of papers. The bigger node size, the more papers the authors have. Wang Y ranks first with 244 papers. The second one is Zhang Y with 199 papers. And the third is Zhang L with 187 papers. 595 collaborations occurred.

According to Price Law ( $N=0.749 \cdot n_{\max}^{1/2}$ ) [6], N refers to core authors, and  $n_{\max}$  refers to the records count of the most productive author. So  $n_{\max}=244$ ,  $N \approx 16$ . There are totally 83 core authors.

### D. Institutions

Institution is also one important aspect of cooperation visualization. It is helpful for researchers to observe institutions with high influence by visualizing organizations. By selecting "Institution" as the node, using Minimum Spanning Treto, and pressing the Go! To start, we got 165 nodes and 376 lines, as "Fig. 4" showing.

Both of China Acad Chinese Med Sci and Chinese Acad Med Sci are the same institution. In order to combine them together, we right-clicked on the node China Acad Chinese Med Sci and selected it as the primary alias. Then right-clicked on the node Chinese Acad Med Sci and selected the secondary alias. Then we need to re-run the process to see the changes.

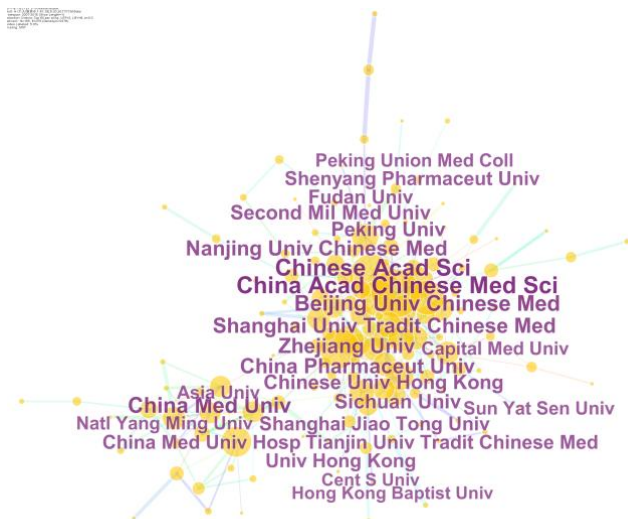


Fig. 4. Instructions.

TABLE I. TOP 10 INSTRUCTIONS

Freq	Institutions	Institutions-enhanced
636	China Acad Chinese Med Sci	Chinese Academy of Chinese Medical Sciences
564	Chinese Acad Sci	Chinese Academy of Science
399	China Med Univ	Chinese Medical University Taiwan
395	Beijing Univ Chinese Med	Beijing University of Chinese Medicine
307	Shanghai Univ Tradit Chinese Med	Shanghai University of Traditional Chinese Medicine
270	Zhejiang Univ	Zhejiang University
256	Nanjing Univ Chinese Med	Nanjing University of Chinese Medicine
248	China Pharmaceut Univ	China Pharmaceutical University
239	Peking Univ	Peking University
218	Chinese Univ Hong Kong	The Chinese University of Hong Kong

"Fig. 4" and "Table I" show that authors of different institutions collaborated frequently. There are totally 167 institutions with 376 collaborations. And all of the top 10 instructions came from China, including Taiwan and Hong Kong.

#### E. Countries

Visualizing countries help researchers understand which country studies TCM best. Select "Country" as the node

type "Fig. 5", set the timespan as "2007-2016" with 1-year slice, and apply Minimum Spanning Treto method. Top N equals to 50. We got 63 nodes and 229 lines.



Fig. 5. Countries.

In the map PEOPLES R CHINA is the biggest node and rank the first with counts of 7,483. The second country is USA with counts of 1,277. The third is PHILIPPINES with counts of 821. The 4th is GERMANY with counts of 341. The 5th is SOUTH KOREA with counts of 314. The 6th is AUSTRALIA with counts of 258. The 7th is JAPAN with counts of 255. The 8th is ENGLAND with counts of 250. The 9th is CANADA with counts of 168. The 10th is INDIA with citation counts of 164.

#### F. Keywords

Keywords visualization is often used to analyze research hotspot and research trends. The frequency of keywords shows research hotspot while betweenness centrality of keywords shows research trends. Selected "Keyword" as the node type, set the timespan as "2007 - 2016" with 1-year slice, and applied Minimum Spanning Treto method. Top N=50. We got 111 nodes and 338 lines.

In the map, the bigger a node size is, the higher frequency it is. The bigger a fode size, the higher betweenness centrality it is. Combined with frequency and betweenness centrality of keywords, we found research focs in recent 10 years (see "Fig. 6" ).

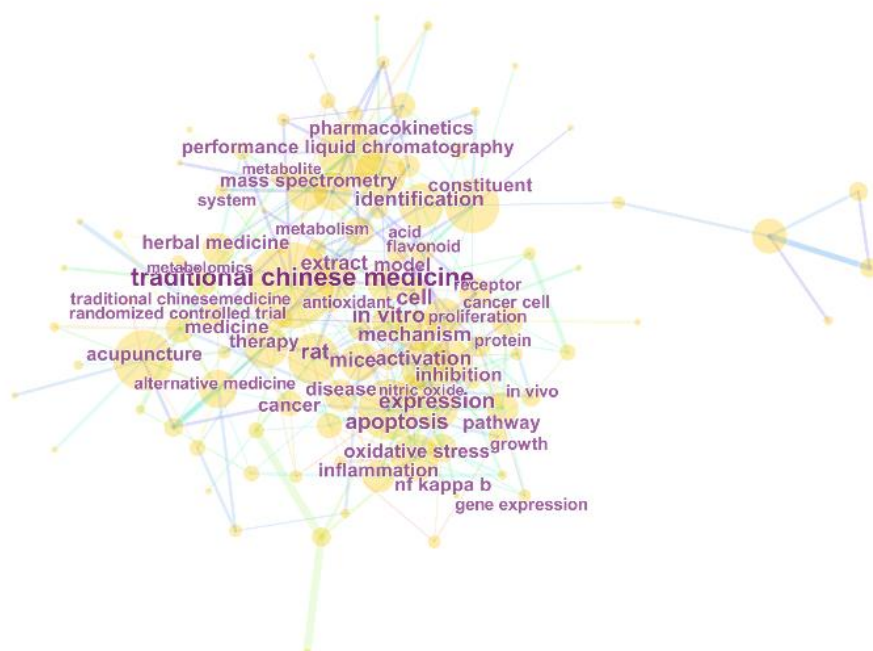


Fig. 6. Keywords.

TABLE II. TOP 20 KEYWORDS WITH HIGH FREQUENCY

Freq	Keywords	Freq	Keywords
2431	traditional Chinese medicine	429	identification
767	expression	395	oxidative stress
756	apoptosis	386	disease
729	in vitro	376	performance liquid chromatography
718	rat	375	mass spectrometry
673	cell	371	inhibition
501	activation	351	inflammation
478	mice	329	Constituent
477	extract	327	Therapy
431	mechanism	312	Acupuncture

TABLE III. TOP 20 KEYWORDS WITH HIGH CENTRALITY

Centrality	Keywords	Centrality	Keywords
0.45	traditional Chinese medicine	0.1	Oocyte
0.25	identification	0.1	Separation
0.16	performance liquid chromatography	0.09	Extract
0.15	constituent	0.09	Pharmacokinetics
0.15	acupuncture	0.08	in vitro
0.13	activation	0.08	Receptor
0.13	culture	0.07	Model
0.12	apoptosis	0.07	Proliferation
0.11	therapy	0.06	Mice
0.1	rate	0.06	oxidative stress

According to the data of keywords citations frequency and betweenness centrality, six aspects of “apoptosis, performance liquid chromatography, acupuncture, activation, oxidative stress, therapy” were the focus of TCM research. Keyword

burst is an indicator of a most active area of research. It will show you fast growing topics. TCM research trend recently can be seen as “Table IV”.

TABLE IV. TOP 10 KEYWORDS BURST

Bursts	Keywords
29.13	quality control
26.63	natural product
21.59	plasma
21.25	drug discovery
20.42	induction
19.14	hplc
18.55	separation
18.45	oocyte
18.44	fertilization
16.78	inhibitor

#### IV. CONCLUSION

Visualizing publication years, authors, organizations, keywords from 11,694 papers about TCM, we conclude with a short summary.

We found an increase on researches about TCM from 2007 to 2016. An average of 1,169 papers were written a year. JOURNAL OF ETHNOPHARMACOLOGY, EVIDENCE BASED COMPLEMENTARY AND ALTERNATIVE MEDICINE and PLOS ONE are the top three journals.

For authors, Wang Y, Zhang Y, Zhang L and other 80 authors wrote most of the papers. Most of them were Chinese. For countries, China, USA, Philippines are the top 3. For institutions, Chinese Academy of Chinese Medical Sciences, Chinese Academy of Science, Chinese Medical University Taiwan and Beijing University of Chinese Medicine made the greatest fortune. Authors of different institutions collaborated

frequently, and medical universities occupy most of the institutions. Six aspects of “apoptosis, performance liquid chromatography, acupuncture, activation, extract, oxidative stress, therapy” have been the focus of TCM research in recent 10 years, while, “quality control, natural product, plasma, drug discovery and induction” the fast growing topic.

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