



Article

Using bibliometric analysis to evaluate the publications in Taiwan during the entire year of 2020: An Observation Study

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Abstract: Many Taiwan authors published their articles every year in Pubmed. However, which research topics fitting to their articles are unclear. We downloaded publications authored by Taiwan researchers in 2020 in Pubmed. A total of 15,480 articles with first authors come up with Taiwan of origin were collected. Top ten journals and clusters in article topics denoted by medical subject headings (MeSH terms) were analyzed using traditional counting scheme and social network analysis (SNA), respectively. A strategy diagram was used to present the features of top-10 clusters on Google Maps. We found that (1) top three journals are Sci Rep (550, 3.5%), J Formos Med Asso (441, 2.85%), and Int J Environ Res Public Health (387, 2.5%). Top three MeSH terms in clusters are metabolism, methods, and chemistry. The top-10 journals and clusters in MeSH terms were presented using visualizations that can be applied to other bibliographical studies making data easily and clearly understood.

Citation: Chien TW. Using bibliometric analysis to evaluate the publications in Taiwan during the entire year of 2020. *J Bibliographical Analyses in Statistics* 2021; 18(3): 1-3.

Received: 2 July 2021

Accepted: 12 July 2021

Published: 2021/07/21

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Keywords: Pubmed; MeSH terms; SNA; Taiwan, strategy diagram

Introduction

Many Taiwan authors published their articles every year in Pubmed. However, which research topics fitting to their articles are unclear. Although bibliometric analysis can explore the feature of articles, visualizations are still lacking without involving the strategy diagram [1-4] and absolute advantage coefficient (AAC) [5] to describe the characteristics of article.

The aims of this study are to investigate the top 10 journals and article topics associated with Taiwan authors using the strategy diagram to interpret their characteristics.

Methods

2.1 Data source

We downloaded publications authored by Taiwan researchers in 2020 in Pubmed. A total of 15,480 articles with first authors come up with Taiwan of origin were collected. Medical subject headings (MeSH terms) in articles were extracted for clustering the article topics. The AAC was used to measure the strength of the top one entity dominant against the next two in hegemony of the field.

Two major parts were separated in this study, including (1) top 10 journals and (2) top 10 clusters of article topics denoted by MeSH terms displayed on a strategy diagram.

2.2 Strategic map

Another analysis method is the strategic diagram of cluster density and centrality[1-3]. The density of each cluster indicates the internal cohesion of a particular theme, and the centrality of each cluster shows how close each cluster comes to being a component of the central field. Each theme begins at low centrality and density, in the Chaos/Unstructured quadrant. As it gains in centrality, the theme shifts into the Bandwagon quadrant. When the theme’s internal cohesion becomes mature, the theme moves into the Mainstream quadrant. Finally, the theme moves to the Ivory Tower quadrant when it loses its centrality [4]. A schematic strategic diagram is illustrated in Fig. 1.

Many papers in the field of co-word analysis have used keyword clustering and strategic diagramming for data mapping and data analysis. This paper employed keyword(i.e., MeSH term) clustering and a strategic diagram for the research in this study. Centrality was replaced with the EI-index[6] that is computed by the formula(=external connections – internal connections) ÷(external connections + internal connections). In contrast, the density was calculated using Eq. 1

$$D_L = \frac{2E}{N(N - 1)} \tag{1}$$

Where D_L states the density of community L wherein E is the total number of edges in L and N is the total number of nodes in L.

Nodes that centrality degree(CD) for a node equals the total number of direct connections related to a node. Greater centrality for a specific keyword shows that the keyword is used more frequently in research. Also, network density (D) is the proportion between the actual amount of links and the maximum possible number of links that can be obtained from the network shown in Eq.1.

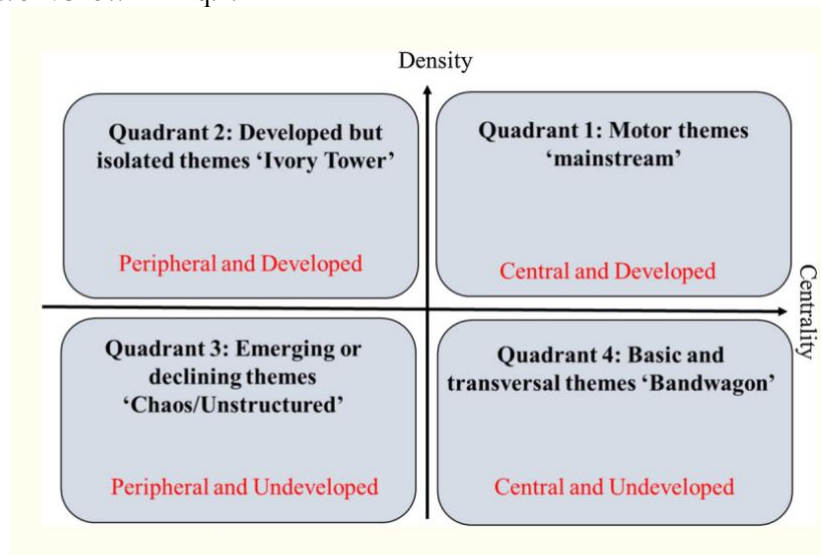


Figure 1 Strategic diagram of density and centrality

2.3 CD equals the total number of article in a study

When coauthors share equal weights in an article, the weighted CD is yielded in Eqs. 2 and 3. I. If Eqs 1 to 6 are applied, the number of CD in a network equals the number of articles in total.

Weights with an equal share at beginning= $W_i = W_j = 1/L$, (2)

Where L is the number of coauthors in an article, but L=2 if a single author exists.

Weights for Author i = $WCD_i = W_i \div (L-1) \div \text{single}$, (3)

Whereas single=1 for a single author; otherwise single=2. When equal weights is assigned to an article, $W_i=W_j$; otherwise, $W_i < W_j$.

The common weights assigned to authors i and $j = WCD_{ij}=(WCD_i+WCD_j)$, (4)

Where WCD_{ij} = the weights assigned in Pajek software[7]. For instance, $A \leftrightarrow B$ is the relationship with the weight=1(= TCD_{ij}) for a single-author article, both A and B are assigned with the weight =1 and the relationship is replaced with $A \leftrightarrow B = 1$ in Pajek[7].

The total weights in authors I and $j= TCD_{ij} = WCD_{ij} \times (L-1)$, (5)

Where $L= 2$ if a single author exists; Otherwise, L =the number of authors. For instance, $TCD_{ij} = W_i = W_j = 1/ L=0.5$, as described in Eq.(2) °

$CD_k = TCD_i \times L = 1.0$, (6)

Where L =the number of authors in an article. When a single author, $L=2$. K is the total number of articles in a study. As such the DC_k equals k in counts; see Table 1.

Table 1 CD_k equals the number of articles in a study

	A	B	C	D	E	F	G
Authros(L)	W_i	(L-1) single	WCD_i	WCD_{ij}	TCD_{ij}	CD	
Single =2	0.50	1	1	0.50	1.00	1.00	1.00
2 authors=2	0.50	1	2	0.25	0.50	0.50	1.00
3	0.33	2	2	0.08	0.17	0.33	1.00
4	0.25	3	2	0.04	0.08	0.25	1.00
5	0.20	4	2	0.03	0.05	0.20	1.00
6	0.17	5	2	0.02	0.03	0.17	1.00
7	0.14	6	2	0.01	0.02	0.14	1.00
8	0.13	7	2	0.01	0.02	0.13	1.00
9	0.11	8	2	0.01	0.01	0.11	1.00
10	0.10	9	2	0.01	0.01	0.10	1.00

Note° L =author number; A =Eq.2; D =Eq. 3; E =Eq.4; F =Eq.5; G =weight for an article = 1.0

The total number of TCD is always equal to 1.0 shown in Table 1 and Eq. 6. If a single author in an article via Pajek regulation, the weight will be assigned once(=one of weight in W_i or W_j in Eq.2) to TCD_i , accordingly.

$$TWDC_i = \sum_{k=1}^n [\sum_{i=1}^{L-1} \sum_{j=i+1}^L (WCD_{ij})], (7)$$

Where n is the number of articles in total and L is the number of authors in an article.

It is worth noting that the weight will not affect the density or EI-index in counts in the strategy diagram mentioned above in Fig.1.

2.4 Creating dashboards on Google Maps

We applied the author-made modules in Microsoft Excel and the SNA in Pajek[7] (1) to obtain the CD of each actor and (2) to cluster article topics in MeSH terms. The pages of Hypertext Markup Language used for Google Maps were created. All relevant information was linked to the dashboards laid on Google Maps.

Results

We found that (1)top three journals are Sci Rep(550,3.5%), J Formos Med Asso (441, 2.85%), and Int J Environ Res Public Health(387, 2.5%);see Table 2. Top three MeSH terms in clusters are metabolism. methods, and chemistry; see Fig.2 and Table 3.

Table 2 Top 10 of frequently observed articles authored by Taiwan in 2020

Journal No.	Journal	Count	%
		15480	100
1	Sci Rep	550	3.55
2	J Formos Med Assoc	441	2.85
3	Int J Environ Res Public Health	387	2.50
4	Int J Mol Sci	365	2.36
5	PLoS One	282	1.82
6	Sensors (Basel)	196	1.27
7	J Chin Med Assoc	195	1.26
8	Medicine (Baltimore)	186	1.20
9	J Microbiol Immunol Infect	159	1.03
10	Polymers (Basel)	150	0.97

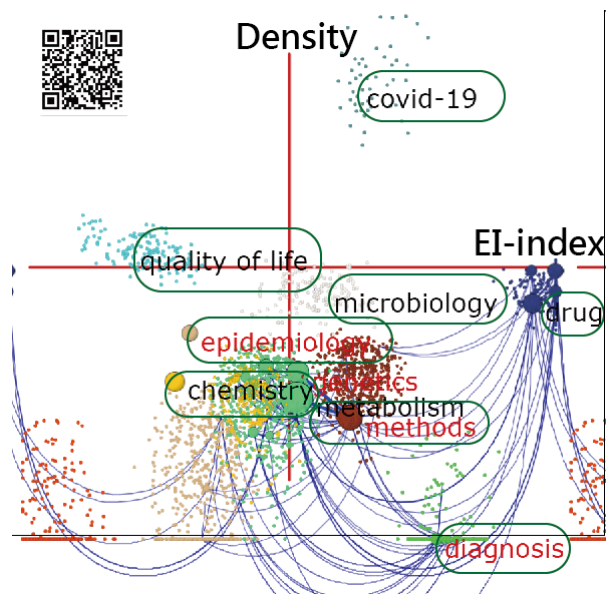


Figure 2 Top ten clusters on Strategy diagram for Taiwan authors' MeSH terms

Table 3 Cluster analysis of article topic

Topic	WCD	Ratio	AAC
metabolism	604.57	1.29	1.02
methods	468.38	1.26	0.51
chemistry	371.77		
drug therapy	364.28		
epidemiology	304.95		
diagnosis	199.88		
microbiology	56.79		
quality of life	28.42		
lung neo-plasms	27.77		
covid-19	25.94		

Discussions and conclusion

Many Taiwan authors published their articles every year in Pubmed. However, which research topics fitting to their articles are unclear. Although bibliometric analysis can explore the feature of articles, visualizations are still lacking without involving the strategy diagram [1-4] and absolute advantage coefficient (AAC) [5] to describe the characteristics of article. In this study, we demonstrated strategy diagram and AAC involved in a bibliographical study that was never seen before in the literature.

Although only Taiwan authors who published in Pubmed 2020 were examined, other types of disciplines and topics or countries of orient are encouraged to investigate their characteristics of articles in the future. The major limitations to the study is how to arrange the coordinates of clusters onto Google Maps based on the two axes of density and EI-index that should be overcome via a series of details on making dashboard with MP4 video introduced to reader or researchers. Through which, making the strategy diagram would be possible and viable in the future bibliometric analysis.

The top-10 journals and clusters in MeSH terms were presented using visualizations that can be applied to other bibliographical studies making data easily and clearly understood.

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