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Research Article

The Most Cited Papers and Authors on the Topic of Neurology and Neurological Disorders in Pubmed Since 2013: A Bibliometric Study

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2. Keywords: Authorship weighted scheme; Authorship collaboration; Google Maps, Social network analysis; Pubmed central, Bibliometric index

3. Abbreviations

AIF: Author impact factor

AWS: Authorship-weighted scheme

DC: Degree centrality

IF: Impact factors

IRA: Individual research achievement

PMC: Pub med central

SNA: Social network analysis

VBA: Visual basic for application

1. Abstract

1. Background

Team work in science has been accompanied by a trend in the numbers of authors included in scientific publications. Whether citations along with publications have high research achievements remains unknown.

1.2. Objective

To evaluate individual research achievements (IRA) and collaborations on the topic of neurology and neurological disorders (NND) and report the most cited papers and authors since 2013.

1.3. Methods

Selecting 522 abstracts, author names, countries, and major medical subject headings on January 2, 2019, from Pubmed Central(PMC) on the topic ofNND in years from 2013 to 2017, we proposed an authorship-weighted scheme (AWS) for quantifying coauthor contributions and calculating their Bibliometric indices. We programmed Microsoft Excel VBA routines to extract data. Google Maps and Pajek software were used for displaying graphical representations. Bootstrapping sampling method was used for estimate 95% confidence intervals and evaluate differences in indices among author groups.

1.4. Results

We found that (1) the paper(PMID: 25186238) was cited by 172times since 2014; (2) the author Cornelis J Stamfrom Netherlands has the highest IRA(i.e.,(author impact factor=172, h-index=1, x-index=13.11); (3)the x-indexes onNND and the U.S. are 24.98 and 13.14, respectively.

1.5. Conclusions

Social network analysis provides wide and deep insight into the relationships among coauthor collaborations. The AWS can be applied to academics for computing IRA in the future.

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4. Introduction

Team science has been accompanied by a trend in the numbers of authors included in scientific publications [1]. The mean number of individuals listed as authors in articles indexed in PubMed from 1975 to 2016 has increased from 1.9 to 5.67 per article [2]. Authorship trends in research articles published in three leading general medical journals (JAMA, The Lancet, and New England Journal of Medicine) in 2005, 2010, and 2015 have also been verified [3]. The median number of authors per article was increased in all three journals from a range of 8-11 in 2005 to 11-18 in 2015. Whether the trend of author collaboration, particularly on individual research achievements (IRA), can be generalized to other journals or disciplines, such as the topic of neurology and neurological disorders (NND), is still unknown.

There are many metrics used for evaluating author IRA. The h-index The h-index [4] is a simple way to measure both the productivity and citation impact of the publications for a scientist or scholar. The h-index is defined as the maximum value of h such that the given author has published h papers that have each been cited at least h times in publications [4], see Figure 1. However, many drawbacks were proposed by authors [5-11], such as each author with equal contributions in an article and the h-index without considering the other two parts (i..e, excess and tail citations) of citations in **Figure 1**.

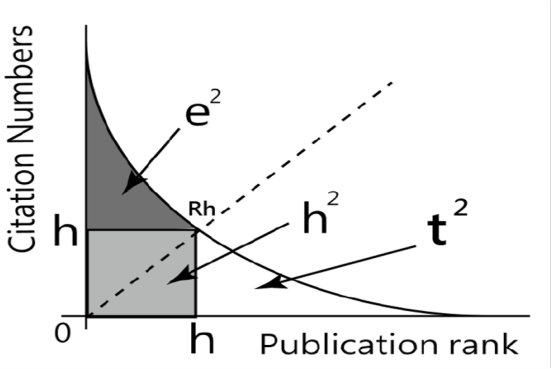

Figure 1: Three parts are divided and related to h-index.

Every June, we see millions of academic scholars paying close attention to the Journal Citation Reports (JCR) ranking the journal impact factor (JIF) for each indexed journal. However, no such author IFs (AIFs) [12,13] or bibliometric indices [4,7-10] have gained scientists' or scholars' attention as much as JIF does annually in the academia. How to apply an appropriate authorship-weighted scheme (AWS) [5,6,11] for tracking the dynamics of individual scientific impact and quantifying the coauthor contributions in scientific disciplines is worth studying.

In this study, we aimto present (1) the most cited articles and authors published on NND, (2) the dominant nations in this field, and (3) research reports on dashboards using Google Maps to display.

5. Methods

5.1 Data source

We obtained 522 abstracts based on journal article from Pubmed Central (PMC) by searching the keywords "Neurology disorders" [title] or "Neurological disorders" [title] and "2013"[Date - Publication]: "2017"[Date - Publication]. A total number of 2959 citing articles matching to the citable papers in PMC were attained. The number of427 articleswere quoted by at least onepublication in PMC. All data were downloaded from PMC, which means the study is not necessary for ethical approval according to the regulation promulgated by the TaiwanMinistry of Health and Welfare.

5.2 Four metrics proposed in this study

The h-index can be divided into three parts [8,9], see Figure 1. Many modified h-index had been suggested, such as (1) the g-index[10] ($\leq \sum_{i=1}^{g} c_i$ /g, where ci = number of citations to i-th publication); the x-index[7] ($= \sqrt{\max_i(i \times c_i)}$);the L-index[14] ($= \ln(\sqrt{\sum_{i=1}^{n} \frac{c_i}{a_i y_i}}) + 1$), whereai= number of authors of i-th publication, yi= age in years of i-thpublication, n=number of publications; the h'-index[8] (=h*rh, where rh=e/t, and le t=1 if t<1, see Figure 1, perfectionist at rh>1, prolific type at rh =1, and mass-production at rh<1).

Due to the contradiction on h'-index for theresults through the formula(=h*rh) which lets h' be greater than h+1(e.g., h=2 and rh =2 make h' be 4 greater that h+1=3). We thus propose the complemental one[i.e., h-plus=h+rh /(1+rh)] ranging h-plus between h and h+1.

5.3 The AWS for quantifying coauthor contributions

The AWS using the formula of $W_j = \frac{\exp(\gamma_j)}{\sum_{j=0}^{m}\exp(\gamma_j)} = \frac{2.2\ \hat{}\ \gamma_j}{\sum_{j=0}^{m} 2.2\ \hat{}\ \gamma_j}$, (1) for quantifying coauthor credits in an article [5,6], which is different to that coauthors in in mathematical discipline[15] with equal size for authors using ascending alphabet order on the byline list. The summation of all weights in Eq.(1) equals 1.0.

5.4 Author impact factor (AIF)

Author impact factor (AIF) used for evaluating IRA(IRA) as Eq.1[13]:

$$AIF = \frac{\sum Cited.papers.based.on.W_j.}{\sum Citable.papers.\times W_j.in.the.given.yrs}), (1)$$

The four indices of AIF, Ag(= $\sum_{i=1}^{g} c_i$ /g), x-index(= $\sqrt{\max_i(i \times c_i)}$), and h-plus=h+rh /(1+rh) were used for evaluating IRA for each author in this study.

5.5 Social network analysis using Pajek software

In keeping with the Pajek guidelines [16], we applied social network analysis (SNA) to cluster authors Usually, the relation valued by the weight is defined by the number of connections between two authors [5,6,17]. The clusters can be determined by a specific algorithm as named degree centrality.

5.6 Using bootstrapping sampling method to estimate 95% confident intervals

SNA was applied to determine the representative of each cluster. The algorithm of community partition was performed to identify the number of clusters.Each author was, in turn, assigned to the designated cluster represented by the author who owns the highest centrality degree in his/her cluster. As such, each author can be matched to his/her metrics, clusters, and even the affiliated nation by the author-made MS-Excel module.

The bootstrapping method[18]was applied to examine differences in metrics among author clusters. A total of 1000 medians retrieved from the median of the 100 random cased were used to estimate the 95% confidence intervals (CI) for a metric of a given cluster. As such, the difference can be determined by judging the two 95% CI bands separated from each other.

5.7 Creating dashboards on Google Maps

We appliedthe author-made modules in MS-Excel and the SNA in Pajek to gain the author clusters. The pages of Hyper Text Mark-upLanguage(HTML) used for Google Mapswere created. All relevant **b**ibliometric indices were linked to dashboards on Google Maps.

6. Results

6.1 TASK1: presenting the most cited article and author

The paper (PMID: 25186238) was cited by 172times since 2014; (2) the author Cornelis J Stam from the Netherlands has the highest IRA (i.e.,(author impact factor=172, h-index=1, x-index=13.11), see **Figure 2**. Interested readers are invited to scan the QR-Code in **Figure 2** to see the author's publication outputs in PMC by clicking the specific author bobble.

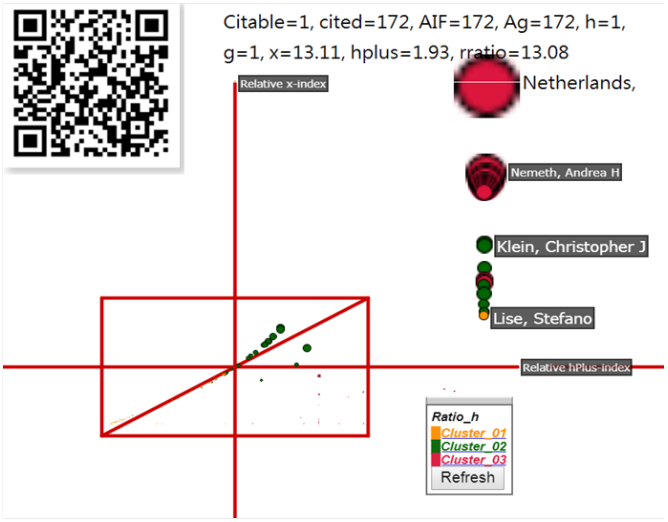

Figure 2: The most cited authors on NND.

6.2 TASK2: selecting the ten top author clusters with high degree centrality

The top 10 author clusters were separated as shown in Figure 3. The representatives with the most degree centrality (DC)are shown for each cluster. The author Derrick ABennett from the UK earns the highest DC, implying more author collations and articles exist since 2013. Interested readers are also recommended to scan the QR-coed in **Figure 3** to see the detailed information in PMC by clicking the word of publication when the specific author bubble is selected.

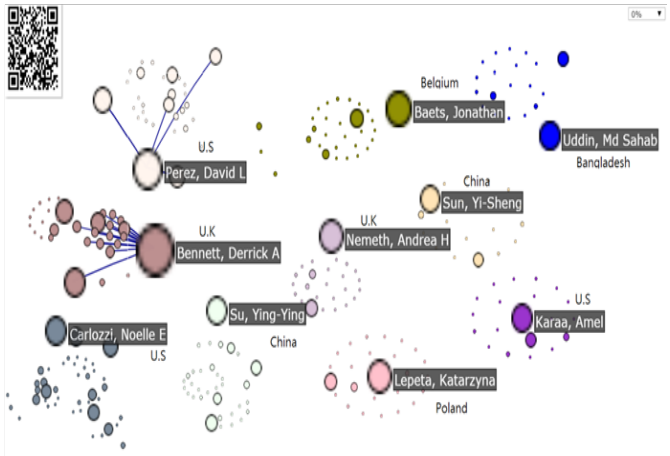

Figure 3: Cluster of author collaborations on the topic of NND.

6.3 TASK3: Comparisons of differences in metrics among clusters

The differences in metrics (i.e., x-index, h-plus, Ag, and AIF) were found (p< .05), see **Figure 4**, when any two 95% CI bands were separated from each other. We see that both author teams of David Peter and Andrea H Memethhave higher indices in comparison to other counterparts.

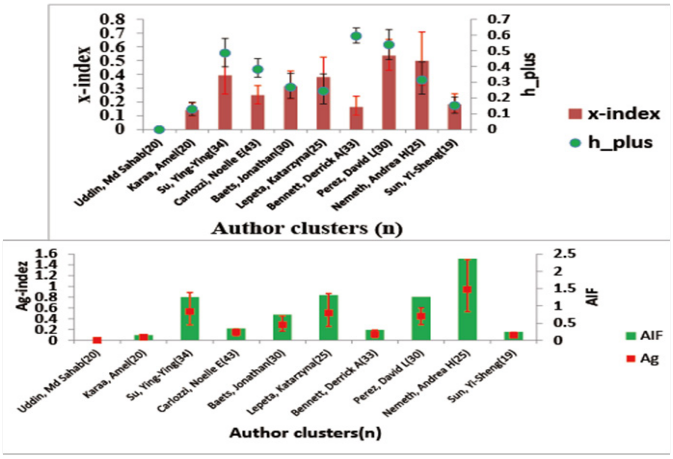

Figure 4: Comparisons of indices among author clusters.

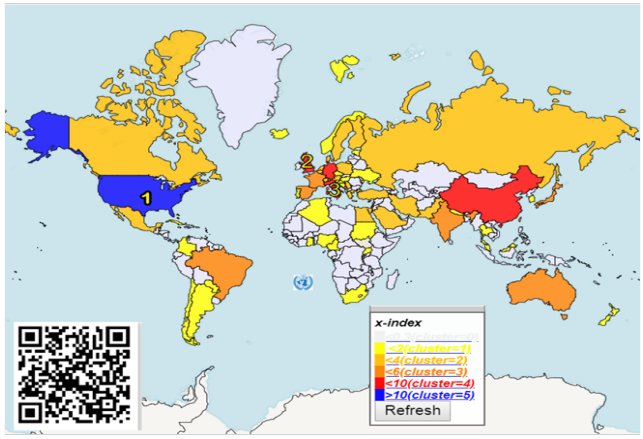

Figure 5: The x-indexes dispersed around the world.

6.4TASK4: Overall author IRA based on x-index dispersed on a dashboard

The top three counties/areas based on x-index [7] are from the US(=13.14), the UK(=7.86), and Italy (=7.04) shown in **Figure 5**. The overall x-index is 24.98 on the base of individual author x-indexes in descending order for eachnation.

7. Discussion

7.1 Main findings and implications

We found that (1)the paper(PMID: 25186238) [19] was cited by 172times since 2014; (2) the author Cornelis J Stam from Netherlands has the highest IRA(i.e.,(author impact factor=172, h-index=1, x-index=13.11); (3)the x-indexes on NND and the U.S. are 24.98 and 13.14, respectively.

Author collaborations have been accompanied by a trend in the numbers of authors included in publications [1] and the reason why the mean number of individuals listed as authors in articles has increased from 1.9 to 5.67 per article [2]. No such strong evidence that can support the phenomenon of numerous authors in an article byline with more citations.

Due to the contributions differentially shared by the ordering of author names, the author clusters separated by SNA support that differences were found in bibliometrics. The main features including (1) using SNA to cluster author related groups; (2) applying AWS to quantifying coauthor credits in an article; (3) sampling cases by the bootstraping method to estimate 95% confidence intervals are rarely seen in the literature.

Furthermore, Google Maps have provided users to capture an overall geospatial visualization in the past [5,6,17, 20]. How to apply Google Maps for reporting study results is worth studying in bibliometric analyses, like we did in this study and showed the most cited authors in Figure 2 as well as the dominant nations with higher bibliometrics on NND in Figure 5.

7.2 Limitations and future research

Although our findings based on the above analyses have been illustrated, there are several potential limitations that shouldbe overcome in the future. First, all data were linked to PMC which cannot generalize the results to other bibliometric databases and other disciplines.

Secondly, there might be some biases when matching authors' name to calculate the IRA because some different authors with the same name exist. Therefore, the result of author relationship analysis might be influenced by the inaccuracy occurred by the disparate authors with identical names.

Third, many algorithms wereused in SNA. The degree centrality used for generating Figures might be different if different algorithms were applied.

Fourth, the formula of quantifying coauthor contributions used in this study is assumed all author equal in an article. Any change for the authors we calculated in indices might present distinct results for authors.

Fifth, the data were extracted from *PMC which is* different from other authors using the citation databases—such as the Scientific Citation Index (SCI; Thomson Reuters, New York, NY, USA) and Scopus (Elsevier, Amsterdam, The Netherlands). The results of the most cited authors and nations might be disparate if other databases were applied.

Finally, many other topics besides the one of pure and applied mathematics that shouldbe further investigated on the association between thenumber of coauthors and citation probabilities in the discernable future.

8. Conclusions

Social network analysis provides wide and deep insight into the relationships among coauthor collaborations. The AWS can be applied to academics for computing IRA and showing research results on Google Maps in the future.

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