



# The Most Cited Author Who Published Papers in Psychiatry from 2012 to 2016: A Bibliometric Study

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## Abstract:

### Background

Individual research achievements (IRA) are determined by the number of publications and citations using bibliometric indices to display. The h-index is the most popular index but has been criticized without quantifying author contributions. The objective of this study is to apply a scheme for quantifying author contributions which can be used for calculating the author IRAs in a discipline.

### Methods

We obtained 833 abstracts from Medline by searching the keywords of "Front Psychiatry"[Journal] and the years from 2012 to 2016. An exponential-type authorship-weighted scheme (AWS) was used for quantifying coauthor contributions. The number of citations on article topics was analyzed using bibliometric indices (x-index, author impact factor (AIF), L=weighted citations and Ag=mean on core articles for g-index). We plotted the clusters, including (i) most-cited authors, (ii) article types classified by social network analysis (SNA), and (iii) journals citing Front Psychiatry using SNA to present. Visual dashboards were shown on Google Maps.

### Results

This study found that (i) the most cited author is Rick A Adams from the UK (PMID=23750138 cited 100 times) with high metrics (x=7.98, AIF=100, L=63.64, Ag=63.64); (ii) the top three topics are schizophrenia, depression, and addiction; (iii) the most citing journal is *Front Psychiatry*.

### Conclusion

The AWS-based x-index can be applied to other disciplines for understanding the most highly cited authors.

**Keywords:** Pubmed center; authorship-weighted scheme; social network analysis; Google Maps; x-index.

## 1. INTRODUCTION

The publication of scientific research is the mainstay for knowledge dissemination. The research achievements is an essential criterion of scientists' evaluation for recruiting funds and career progression [1,2]. In tradition, the individual scientific output should be assessed by using objective science metrics, which would allow reliable benchmark and fair comparison among peers. The most widespread approach includes the use of the so-called h-index [3], the author impact factor (AIF)[2, 4], and others(i.e., g-index[5], x-index[6], and L-index[7]) by referring both individual number of citations and the publications.

Those metrics mentioned above have some deficiencies that do not take into account the unequal coauthor contributions in an article byline [8-10]. Numerous articles [8,9] have applied systematic review methods to explore useful knowledge using citation analyses. Many concepts of author impact factor (AIF) have been proposed in the past [10-15]. However, no empirical study had effectively solved the problem of quantifying coauthor contributions[5,15] in scientific disciplines.

As of July 1, 2019, over 100 article titles comprise “most cited” journals or papers. The psychology is defined as (i) the science of mind and behavior, (ii) the mental or behavioral characteristics of an individual or group, and (iii) the study of mind and behavior about a particular field of knowledge or activity [16]. The research on individual researchers' achievements (IRA) is required for studying on authors instead of journals and articles in tradition.

If we consider the real contribution of the scientist in the publication (i.e., the ordering of author names [17]), the author contributions should be weighted. Although many counting schemes were proposed for quantifying coauthor contributions [5,18-21], the application of author weights remains quite challenging and needs to solve soon. Furthermore, whether the impact factors (IFs) or bibliometric indices can be predicted by article topics [22] remains unclear.

For this purpose, we (1) investigate the most cited author published papers in a given journal using authorship-weighted scheme (AWS); (2) selecting the top topics related to journal impact factor (JIF); (3) cluster the influential journals citing most articles to a given journal.

## 2. METHODS

### 2.1. Data Source

We obtained 833 abstracts from Medline by searching the keywords of "Front Psychiatry"[Journal]) and the years from 2012 to 2016. A total number of 5562 citing articles were successfully matched to the 621 cited papers in PubmedCenter (PMC), see Multimedia 1.

### 2.2. A General AWS for Quantifying Coauthor Contributions

An Exponential-type authorship-weighted scheme (AWS) was based on the Rasch rating scale model[23] for quantifying author contributions and letting the sum equals 1, see Equation(1) and (2).

The sum of author weights in a byline equals 1.0. 
$$W_m = \frac{\exp(\theta_m)}{\sum_{m=0}^m \exp(\theta_m)} = \frac{(2.27)^{\theta_m}}{\sum_{m=0}^m (2.27)^{\theta_m}}, \quad (1)$$

Whereas  $\gamma_j$  denotes an integer number from  $m$  to  $0$  in descending order.  $W_m$  in Eq. 1 denotes the weight for an author on the order  $m$  in the article byline,  $m-1$  equals the author number. The last is defined as the corresponding author ( $\gamma_m = m-1$ ) and the weight for the first author when  $\gamma_m = m-1$ . Accordingly, more importance is given to the first ( $=\exp(m-1)$ , primary) and the last ( $=\exp(m-2)$ , while it is assumed that the others (the middle authors) own smaller contributions [18]. The smallest portion ( $=\exp(0)=1$ ) is assigned to the second last author with the odds=1 as the basic reference [17,24].

### 2.3. A Simple 5-year Moving Average AIFs

The AIF of an author  $A$  for a given the year (e.g, 2017) can be defined in Eq.3:

$$AIF = \frac{\sum \text{Cited.papers.based.on.} \times W_j \text{ in.a.given.year.and.the.proceeding.5.yrs}}{\text{Citable.papers.} \times W_j \text{ in.the.given.5.yrs}} \quad (3)$$

A total number of 3466 authors were collected for calculating their metrics and AIFs based on citable papers in PMD from 2012 to 2016, see Multimedia 2. All metrics and AIFs were located on dashboards using social network analysis (SNA) and Google Maps to display, see the next two sections.

### 2.4. Social Network Analysis Using Pajek Software

In keeping with the Pajek guidelines [25] using SNA, we defined an author as a node (or an actor) that is connected to another counterpart at another node through the edge of a line. Usually, another weight is defined by the number of connections between two nodes.

Three main centrality measures (i.e., degree, closeness, and between's) are frequently used to evaluate the influence (or power) momentum of an entity (e.g., the author or keyword) in a network [26,27]. Centrality is an important index to analyze the network. Any individual authors lie in the center of the social network will determine its influence on the network and its speed to gain information [28]. In this study, the between's centrality was applied to explore the key role for keywords and citing journals, see Multimedia 3.

### 2.5. Article Topics based on Author-Defined Keywords

SNA was applied to classify the author-defined keywords of articles in Front Psychiatry. The algorithm of community partition was performed to identify and separate the clusters.

Each article was, in turn, assigned to a specific keyword cluster through the maximum likelihood estimation [i.e., selecting the highest weighted summation score from all the possible clusters ( $k$ ),

whereas in the weighted summation score for keyword ( $i$ ) in a given cluster ( $k$ ) =  $\sum_{i \in k}^n W_i$ ,  $W_i$  is the

degree centrality of keyword ( $i$ ) in the journal network]. As such, each article was classified as one of the keyword clusters. Each keyword cluster can be characterized by bibliometric indices which internal consistency (IC) can be examined by Kendall's coefficient of concordance ( $W$ ) [29] across keyword clusters. If the agreement is accepted by the statistical alpha level ( $<0.05$ ) [30].

The keyword clusters were also presented on Google Maps, see Additional file 1 and 2. The  $x$ -indexes

for all regions(i.e., countries/areas) were computed using the formula  $(= \sqrt{\max_i(i \times c_i \times W_{ij})})$ , where  $W_{ij}$  denotes the author (j) weight on a specific article (i).

### 2.6. The Unique Tool for Creating Google Maps with SNA

The centrality measures are computed by SNA algorithm in Pajek. We imported them into an author-made Excel module and then created a page of Hyper Text Mark-upLanguage(HTML) used for Google Maps.

## 3. RESULTS

### 3.1. TASK1: Presenting the Most Cited Author in Front Psychiatry

The most cited authors is Rick A Adams from the UK(PMID=23750138 cited 100 times[31] until 2018) with high metrics( $x=7.98$ ,  $AIF=100$ ,  $L=63.64$ ,  $Ag=63.64$ ). Interested readers are invited to scan the QR-Code in Figure 1 to examine the author’s publication outputs in PMC by clicking the specific author bobble.

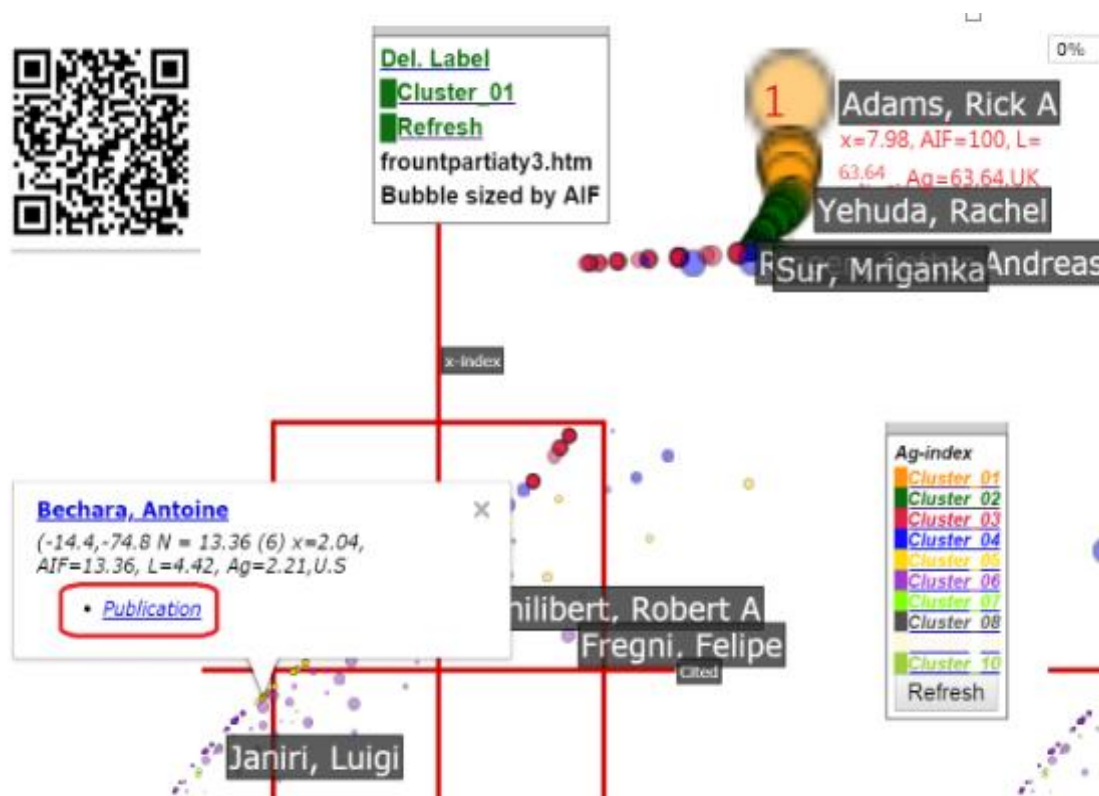


Figure1. The most cited authors dispersed on a dashboard

### 3.2. TASK2: Selecting the Top Topics Related to Journal Impact Factor(JIF)

The top 10 keyword clusters were separated as shown in Figure 2. The representative terms with the most between’s degree of centrality are shown for each cluster. The interested readers are recommended to scan the QR-coed in Figure 2 to see the detailed information in PMC by clicking the word of publication when the specific keyword bubble is selected. The top three topics are schizophrenia, depression, and addiction.



Figure2. Cluster analysis of keyword terms on the topics of Front Psychiatry

### 3.3. TASK3: Analysis of Kendall’s Wand Topics with High IF

Table 1 at the top shows the counts of citable, cited articles and metrics across the keyword clusters. Keyword impact factors have relatively-weak relations with other metrics at the middle panel in Table 1. Kendall’s W is 0.92 ( $\chi = 49.92$ ,  $df = 9$ ,  $p < 0.001$ ), indicating a strong IC (at the bottom in Table 1). If the IF was excluded, the W reaches 0.96 based on the other five metrics.

Table1. Relations between keyword clusters and bibliometric indices

Keyword	Output	Cited	IF	h	g	Ag	x	L
schizophrenia	262	1866	7.12	21	30	30.20	25.10	43.20
depression	106	853	8.05	17	22	22.95	18.33	29.21
addiction	67	485	7.24	11	17	17.24	14.00	22.02
ADHD	23	58	2.52	4	6	6.00	5.74	7.62
alcohol	27	151	5.59	7	10	10.10	8.49	12.29
hippocampus	21	151	7.19	8	11	11.55	8.49	12.29
major depressive disorder	19	117	6.16	6	9	10.56	7.07	10.82
alzheimer	10	49	4.90	4	5	9.40	5.29	7.00
epigenetics	35	409	11.69	12	19	20.11	13.75	20.22
cannabis	19	100	5.26	6	9	9.33	7.35	10.00
Mean	58.9	423.9	6.572	9.6	13.8	14.744	11.361	17.467
Correlation								
IF			1.00					
h			0.57	1.00				
g			0.62	0.99	1.00			
Ag			0.64	0.98	0.99	1.00		
x			0.53	0.99	0.99	0.98	1.00	
L			0.49	0.99	0.98	0.98	1.00	1.00
Kendall's W	0.92							
$\chi =$	49.92							
df	9							
p	<0.001							

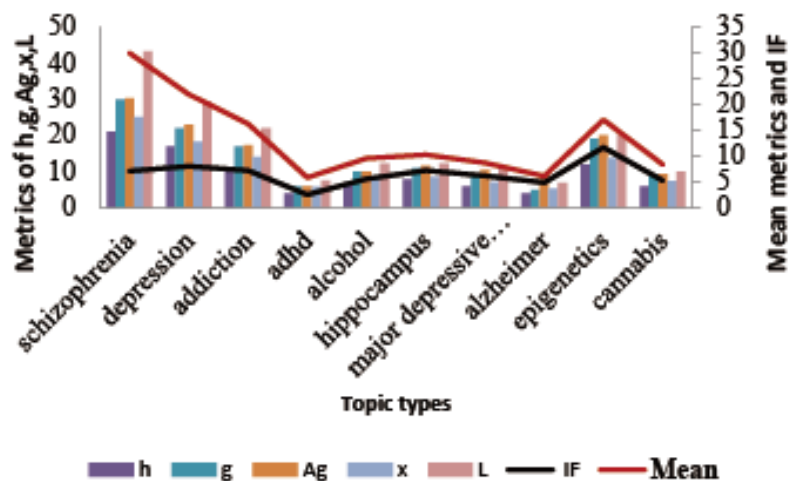


Figure3. Distinct differences among article topics

In Figure 3, we can see that the topic of epigenetics earns the highest IF(=11.69=409/35) compared to other counterparts. Alternatively, the topic of schizophrenia owns the highest metrics if author-level indices were applied.

### 3.4. TASK4: Analysis of Kendall’s W and Topics with High IF

Figure 4 displays the top 10 clusters of citing journals to *Front Psychiatry*. The representatives with the highest degree of centrality for each cluster are highlighted with the journal names. The largest bubble size is the journal of *Front Psychiatry*, followed by *PloS One* and *Neuropsychopharmacology*, indicating that *Front Psychiatry* plays the most significant influential role in the network of citing journals using the algorithm of between’s centrality.

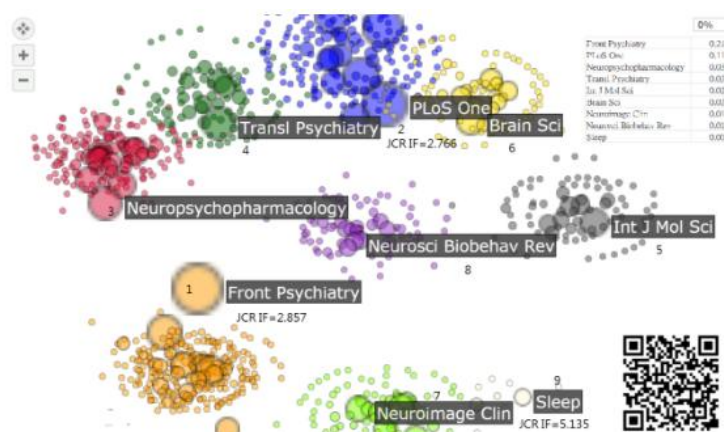


Figure4. The 10 clusters of citing journals to *Front Psychiatry*

### 3.5. TASK5: X-Indexes Applied to Journal and Authors’ Countries/Areas

The  $\chi$ -indexes for *Front Psychiatry*, the U.S., and Germany are 75.03, 23.23, and 11.38, respectively. The results in Table 2 show that the number of publications might yield high citations and x-indexes. The U.S. (261, 31%) and Germany (77, 9%) rank as the top two published papers on *Front Psychiatry* in the years from 2012 to 2016. The trends for regions show that those Israel, Singapore, and Germany are increasing in publications in *Front Psychiatry*

**Table2.** Plication outputs of Front Psychiatry across regions and over the years

Region	2012	2013	2014	2015	2016	Total	%	Growth	x-index
AFRICA		1	2	1	4	8	0.01	0.83	
Nigeria			1		3	4	0.00	0.73	1.59
South Africa		1		1	1	3	0.00	0.58	1.6
Egypt			1			1	0.00	0.00	
ASIA	2	9	5	13	16	45	0.05	0.89	
Japan		5	1	4	7	17	0.02	0.71	5.57
Israel				3	4	7	0.01	0.89	1.38
India	1	1	3			5	0.01	-0.39	2.76
Singapore		1		1	3	5	0.01	0.77	3.43
China		1		2	1	4	0.00	0.57	2.76
Others	1	1	1	3	1	7	0.01	0.35	
EUROPE	35	50	100	75	98	358	0.43	0.83	
Germany	13	13	18	15	18	77	0.09	0.76	11.38
U.K.	3	6	17	8	11	45	0.05	0.53	8.72
Italy	9	3	10	5	17	44	0.05	0.53	8.71
Switzerland	1	4	7	13	16	41	0.05	0.99	6.67
Netherlands	2	6	12	8	8	36	0.04	0.61	7.21
Others	7	18	36	26	28	115	0.14	0.72	
N. AMERICA	64	82	56	62	61	325	0.39	-0.41	
U.S.	47	69	46	47	52	261	0.31	-0.20	23.23
Canada	16	13	10	13	9	61	0.07	-0.80	10.04
Mexico	1			2		3	0.00	0.00	2.12
OCEANIA	5	9	13	5	17	49	0.06	0.61	
Australia	5	9	11	5	14	44	0.05	0.57	8.89
New Zealand			2		3	5	0.01	0.67	4.01
S. AMERICA	4	11	5	20	7	47	0.06	0.36	
Brazil	4	6	3	14	7	34	0.04	0.51	5.96
Chile		5	1	6		12	0.01	0.05	6.32
Argentina			1			1	0.00	0.00	2.09
Total	110	162	181	176	203	832	1.00	0.91	75.03

#### 4. DISCUSSION

This study found that (i) the most cited authors is Rick A Adams from the UK(PMID=23750138 cited 100 times [31] until 2018) with high metrics( $x=7.98$ ,  $AIF=100$ ,  $L=63.64$ ,  $Ag=63.64$ ); (ii) the top three topics are schizophrenia, depression, and addiction; (iii) the most citing journal is Front Psychiatry as expected that the phenomenon of self-citation exists in many scientific journals[32,33].

Although the h-index [3], a popular author-level metric, can measure both the productivity and citation

impact of the publications of a scientist, one of its shortcomings is the assumption of equal credits for all coauthors in an article[8-10]. Many concepts of author impact factor(AIF) has already proposed before[10-15], but we are not aware of any empirical study that can successfully solve the problem of quantifying coauthor contributions[6] in the empirical discipline.

Even Vavryčuk [34] proposed a combined weighted counting scheme in 2018; the weighted mathematical scheme is complex and not applicable compared to the one in Eq. 1. The most worth-noting feature in this study is the general AWS fully congruent with the category probability theory based on the Rasch rating scale model (RSM)[ 23]. We can adjust the parameters (i.e., the base and the power) to accommodate many types of situations or scenarios in practice. Hence, Vavryčuk's combined weighted scheme [34] (or the harmonic credits[35]) is a special case of the general AWS in Eq. 2. Another feature of this study is about the keyword clusters classified by the SNA and assigned by the maximum likelihood estimation through the equation for a given cluster (k)  $= \sum_{i \in k}^n W_i$ . With which, the relations between IF and the article topics can be inferred, like epigenetics with the highest IF (=11.69=409/35) compared to others.

Besides the author Rick A Adams (as the 1<sup>st</sup> author) has an article in 2013[31] with 100 citations until 2018, the calculation of metrics can be applied to AIF=100(=63/0.63 for the weighted citations and publications), h=1, g=1, Ag= 63.64, x=7.98(=sqrt(63.64), and L=total citations=63.64. The most cited articles are PMID=23750138(100 times)[31], 23914176(73)[36], 23097644(73)[37], 23015792(73)[38], 23847550(69)[39], 25071612(61)[40], 24098286(51)[41]. The topic clusters denoted by the representative author-defined keywords are schizophrenia, prefrontal cortex, transcranial direct current stimulation, transcranial direct current stimulation, schizophrenia, depression, and epigenetics, respectively. .

The second feature is the intrinsic dynamic character of the simple 5-year moving average AIFs, like the JCR locating JIF each year in June, to examine the change of author's AIF (or h-index). Unlike the h-index, which is a growing measure taking into account the whole career path [4].

We provided several MP4 videos for interested readers to understand the process and main contents of this study. The hyperlinks for Figures are provided in Multimedia 4.

### 5. STUDY LIMITATIONS

Although findings are based on the above analysis, there are still several potential limitations that may encourage further research efforts. First, all data were linked to the Pub Med database. There might be some biases of understanding the matched authors because some different authors with the same name or abbreviation exist, who are affiliated with different institutions. Therefore, the result of author relationship analysis would be influenced by the accuracy of the indexing author.

Second, many algorithms have been used for SNA. We merely applied the algorithm of degree centrality in the Figures. Any changes in the algorithm used in this study might present a different pattern and judgment to the results. Similarly, the formula, Eq.1, used in this study is also a special case of the general AWS model. Any change for the parameters might present a different AIF or other metrics and judgment to the results.



Third, the assumption of corresponding (or supervisory) authors being the last authors might be challenged, especially in computing AIFs. Any parameters changed in our proposed formula will affect the author contribution weights and the AIFs(or h-index) in results.

Fourth, the data extracted from *PMC* cannot be generalized to other major citation databases—such as the Scientific Citation Index (SCI; Thomson Reuters, New York, NY, USA) and Scopus (Elsevier, Amsterdam, The Netherlands). Such as the most cited authors are determined by the paper selections on Pubmed.

## **6. CONCLUSION**

The AWS-based x-index can be applied to other academic fields for understanding the most highly cited authors in a discipline. The author-defined keywords should be replaced by Medical subject headings (MESH) in the future to make the article topics objective and accurate.

## **LIST OF ABBREVIATIONS**

AIF:author impact factor, AWS: authorship-weighted scheme, BC: Betweenness centrality, IC: internal consistency, IF: impact factors, MESH: medical subject headings, PMC: PubMed Central, SNA: Social network analysis, VBA: visual basic for application

## **ACKNOWLEDGMENT**

We thank Enago ([www.enago.tw](http://www.enago.tw)) for the English language review of this manuscript. All authors declare no conflicts of interest.

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**Citation:** Tsair-Wei Chien, et al, (2019). "The Most Cited Author Who Published Papers in Psychiatry from 2012 to 2016: A Bibliometric Study". *International Journal of Scientific and Innovative Mathematical Research (IJSIMR)*, 7(9), pp. 12-22. <http://dx.doi.org/10.20431/2347-3142.0709004>

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