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RESEARCH ARTICLE

The most highly-cited authors who published papers on the topic of health behavior: A Bibliometric Analysis

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Abstract: Background: Health behavior (HB) is an action taken by a person who pursues good health and prevents illness. Health behavior, thus, reflects a person's health beliefs and attracts, particularly, on published papers in academics. However, who is the most influential author (MIA) with highly-cited papers on HB remains unknown. Objective: The purpose of this study is to apply the authorship-weighted scheme (AWS) developed by authors to select the MIA on HB using the visual displays on Google Maps. Methods: We obtained 1,116 abstracts published between 2012 and 2016 from Medline based on the keywords of (health [Title]) and (behavior [Title] or behavior [Title]) on September 22, 2018. The author names, countries/areas, and Pubmed paper IDs were recorded. The AWS was applied to (1) select the most productive authors (MPA) using social network analysis (SNA); (2) discover the MIA using h-indexes and author impact factors (AIF) dispersed on Google Maps, and (3) display the countries/areas distributed for the x-index in geography. Pajek software was performed to determine the partition categories of clusters. Results: We found that the MPA and MIA are Matthew K Nock (US) and Erika A Waters (US) for the MPA and MIA, respectively. All visual representations that are the form of a dashboard can be easily displayed on Google Maps. The most influential countries are the US (=19.03) and Australia (=6.46) with the highest x-indexes. Readers are suggested to manipulate them on their own on Google Maps. Conclusion: Many individual researchers achievements (IRA) were determined using h-index, AIF, x-index, or other bibliometric indices without quantifying author contributions. We demonstrated visualized representations on Google Maps using the AWS developed by authors to measure authors influences in a specific discipline. The research approach using the AWS to quantify the authors contributions can be applied to measure IRA in the future.

Keywords: authorship-weighted scheme, most productive author, most influential author, Google Maps, social network analysis, health behavior

1 Introduction

Health behavior (HB) is an action taken by a person to maintain, attain, or regain good health and to prevent illness.[1,2] Many papers were published in academics each year. The most productive author (MPA) has been selected by authors[2] on the topic of HB. However, the most highly-cited authors have not been discussed in the literature.

The h-index[3] is an author-level metric that attempts to measure both the productivity and citation impact of the publications of a scientist or scholar. Although the h-index 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 co-authors in an article.[4,5] Many studies[6–8] have been conducted to investigate individual researchers achievements (IRA) in a specific discipline. However, all or which ignored the co-author contributions unequal in an article byline.[5–9] Although many authors developed schemes for quantifying author contributions in the literature,[10–16] none had been successfully used so far in academics. A general authorship-weighted scheme (AWS) is thus required to develop for use in the empirical discipline.

Besides h-index,[3] the author impact factor (AIF)[17,18] and the x-index[19] are also plagued and criticized by scholars in bibliometric fields without

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considering the author contributions in a byline.

If we consider the contribution of the scientist in the publication, the weights of author contributions should be partitioned with real numbers (i.e., with decimal digits). How to apply the author weights to calculate h-index limited by the terms of integrals remains quite challenging and needs to solve. We are going to demonstrate the AWS for quantifying author contributions used on h-index, AIF, and x-index in this study.

For this purpose, we (1) develop a scheme for quantifying author contributions used for calculating the h-index for authors, (2) explore the most productive author(MPA) using AWS, (3) highlight the most influential authors (MIA) with highly cited papers in a disciple of HB, and (4) plot the countries/areas with highly cited x-index on Google Maps to show the most influential nations on HB.

2 Methods

2.1 Data Collection

By searching the PubMed database (Pubmed.org, PMC) maintained by the US National Library of Medicine, we used the keywords of (health [Title]) and (behavior [Title] or behavior [Title]) on September 22, 2018, and downloaded 1,116 articles published between 2012 and 2016. The inclusion criteria are all downloaded abstracts based on the type of Journal Article. Ethical approval was not necessary for this study because all the data were obtained from the Medline library on the Internet.

2.2 Social network analysis and Pajek software

Social network analysis (SNA)[20] was applied to explore the pattern of entities in a system using the software of Pajek.[21] In keeping with the Pajek guidelines, we defined an author (or paper keyword) as a node that is connected to other nodes through the edge (or say the relation). Usually, the weight between two nodes is defined by the number of connections.

Centrality is a vital index to analyze the network. Any individual or keyword lies in the center of the social network will determine its influence on the network and its speed to gain information.[22–24]

2.3 The AWS for quantifying coauthor contributions

The AWS was developed referring to the Rasch rating scale model[25] for quantifying author contributions as the Equation (1):

$$W_j = \frac{exp(\gamma_j)}{\sum_{j-0}^{m} exp(\gamma_j)} = \frac{2.72^{\gamma_j}}{\sum_{j-0}^{m} 2.72^{\gamma_j}} \quad (1)$$

The sum of author weights in a byline equals 1.0 when considering the number of m+1 authors with the last being the corresponding author, see the Equation (2), whereas W_j in Equation (1) denotes the weight for an author on the ordering of author j in the article byline. The power γ_j is an integer number from m to 0 in descending order.

The sum of author weights in a byline is defined as below:

$$\sum_{j-0}^{m} \frac{exp(\gamma_j)}{\sum_{j-0}^{m} exp(\gamma_j)} \quad (2)$$

Accordingly, more importance is given to the first (= exp (m), primary) and the last (= exp (m-1), corresponding or supervisory) authors, while it is assumed that the others (the middle authors) have made smaller contributions.[26] In Equation (2), the smallest portion (= exp (0) = 1) is assigned to the last second author with the odds=1 as the basic reference.

2.4 A simple 5-year h-indexes and the AIFs

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

$$AIF(SMA) = (\sum Cited\ papers\ based\ on \times W_j\ in\ a\ given year\ and\ the\ proceeding\ 5\ yrs)/(Citable\ papers\ \times W_j\ in\ the\ given\ 5\ yrs) \quad (3)$$

A total number of 4,857 authors were collected for calculating their h-indexes, x-indexes, and AIFs in 2017 based on citable papers in PMC since 2012. All indices were located on dashboards using SNA and Google Maps.

The rule for applying author weights to calculate h-index is defined as below:
$h = cm + (h-1)/10\ for\ h\text{-}core\ if\ max(ci) < 1$ and $h = h + the\ decimal\ if\ max(ci) \geqslant 1$, where cm=the maximal proportional citation weights (i.e., max (ci) across all ci for an individual authors. The possible scenarios of AWS and the rules for calculating the h-index with real numbers were illustrated in Table 1.

Table 1. Using AWS to quantify the author contributions and to comput h-index

A: Quantifying the author contributions with scenarios

# of author	1	2	3	4	5	6	7	8	9	Ratio
Threshold	0	1	2	3	4	5	6	7	8	
The first	1	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	2.72
The 2nd		0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	2.72
The 3rd			0.1	0.1	0.1	0.1	0.1	0.1	0.1	2.72
The 4th				0	0	0	0	0	0	2.72
The 5th					0	0	0	0	0	2.72
The 6th						0	0	0	0	2.72
The 7th							0	0	0	2.72
The 8th								0	0	2.72
The 9th									0	
Sum	1	1	1	1	1	1	1	1	1	

B: Computing h-index using real nature numbers

Scenario	Script, cm=max(ci), k at h-core	h-index	1	2	3	4	5	6	7
1	=cm+(h-1)/10 if cm<1,0.5+(2-1)/10	0.6	0.5	0.3	0.1				
2	=h(k)=h index	4	10	10	10	10			
3	=h index	1	100	1					
4	=h index	1	1	1	1	1	1	1	
5	=h + decimal if cm >=1	1.6	11	1					
6	=h + decimal if cm >=1, 3+ 0.3	3.3	4.6	4	3.3	2.7			
7	=cm+(h-1)/10 if cm<1,0.9+(5-1)/10	1.3	0.9	0.8	0.7	0.6	0.5	0.4	0.3
8	=h + decimal if cm >=1. 2+0.4	2.4	8	3.4	2				
9	=h index	5	10	9	8	7	6	5	4
10	=h index	3	3	3	3	3	3	3	3

2.5 The pattern of author collaboration on health behavior

Three diagrams were plotted on Google Maps through the ways of (1) selecting the most productive authors (MPA) using SNA; (2) discovering the MIA using h-indexes and author impact factors (AIF) dispersed on Google Maps; and (3)displaying the countries/areas distributed for the x-index in geography. The bigger bubble means the most pivotal role played as a bridge in the network if the BC algorithm is performed. The wider line indicates, the stronger relations between the two (i.e., the nation or the author). Clusters separated by the algorithm of the partition communities are filled with bubbles in different colors. The study flowchart is displayed in Figure 1.

3 Results

3.1 The most productive and influential author

The MPA and MIA on the topic of HB are Matthew K Nock (US) and Erika A Waters (US), respectively, shown in Figure 2 and Figure 3. We can see the representatives with the most number of centrality degrees in each cluster. Interested readers are recommended to scan the QR-codes on Figures to see the details of information for authors on Google Maps. For instance, clicking the term of publication can be redirected to the PMC to show the publications of the specific author of interest.

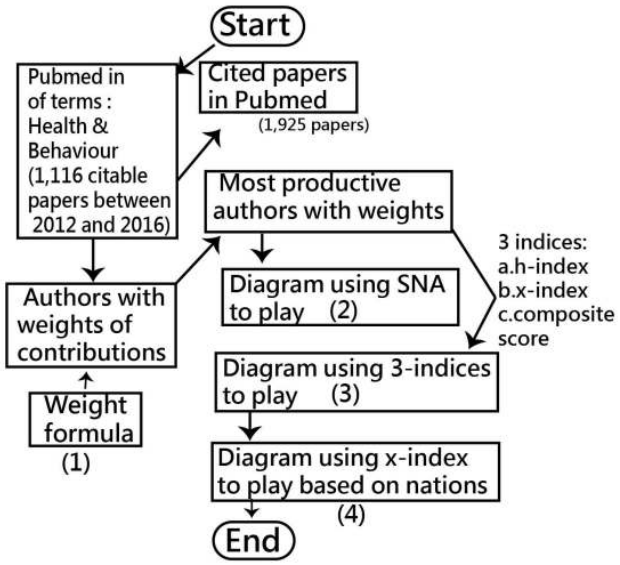

Figure 1. Study flowchart including one table and three Figures

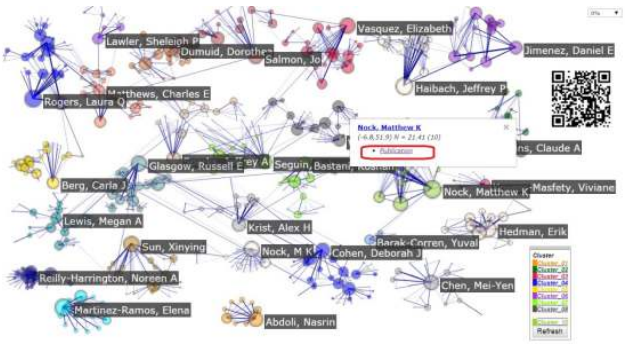

Figure 2. Dispersion of coauthor clusters based on weighted contributions

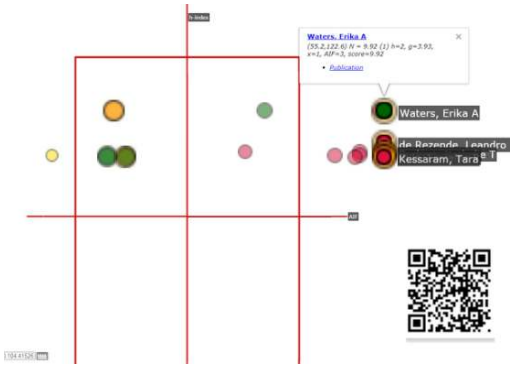

Figure 3. Dispersion of authors h-index and AIF

3.2 The most influential nations on HB

The mostly influential nation is the U.S., see Figure 4. The calculation of the algorithm is to obtain the x-index for each country/area through the way of ranking the individual author contributions to each cited paper by nations in the descending order. The maximal geometric rectangle was selected by multiplying the ascending integer number of cited papers and the descending real nature number of proportional cited weights.[19] The x-index is the root of the above-mentioned geometric rectangle which is similar and related to h-index according to the study.[19]

Figure 4. Dispersion of h-indexes for countries/areas

4 Discussion

This study found that the MPA and MIA are Matthew K Nock (US) and Erika A Waters (US) for the MPA and MIA, respectively. All visual representations that are the form of a dashboard can be easily displayed on Google Maps. The most influential countries are the US (=19.03) and Australia (=6.46) with the highest x-indexes.

Many previous types of research[20,22,23] have inspected coauthor collaboration using social network analysis. Their results were similar to this study. The difference is that we applied the AWS to quantify the author contributions in an article byline in comparison to the previous articles merely assuming all authors are equal in contributions and credits.

We showed a novel AWS method for quantifying author contributions that is a totally general model fully congruent with the category probability theory based on the Rasch rating scale model (RSM).[25] We can adjust the parameters(i.e., the base and the power) to accommodate many types of scenarios in the empirical discipline. Hence, Vavryuks combined weighted scheme[10] (or the harmonic credits[27]) is a special case of the general AWS in Eq. 2.

Traditionally, it is tough to observe the association of two or more symptoms or ties together appeared in a network at a momentary glance. The representatives in each cluster are determined by three factors: (1) the number of coauthors in a byline; the more coauthors will generate more proportional contributions in a network; (2) the number of publication outputs; and (3) the ordering of author names in a byline. The method we used in this study is superior to the previous ones[20,22,23] without considering the author contribution unequal to each other.

There are 1,084 papers with the keyword social network analysis in the paper title when searching Medline on December 21, 2017,[1,2] in which two papers[28,29] incorporated MeSH into SNA to disclose relevant knowledge to readers. However, no such papers have incorporated Google maps as a dashboard as we did in this study.

Scientific publication is one of the objective measurements to evaluate the achievements of a medical specialty or discipline.[30] It is worth combining SNA and Google Maps to disclose knowledge and information to the readers for reference in the future. Many algorithms and measures (or indicators) have been developed using SNA to graphically explore data.[31] This kind of author names should be identified and quantified for the bibliometric study. The duplicate names should be cautious when dealing with the used in discovering the MPA and MIA in the future.

5 Limitations and Future study

The interpretation and generalization of the conclusions should be cautious. First, the data were extracted from Medline. It is worth noting that any generalization should be made in the similar fields of paper contents.

Second, although the data were extracted from Medline and were carefully dealt with in every linkage as correctly as possible, the originally downloaded contexts including some errors in symbols which might affect the resulting reports in this study may be present.

Third, there are many algorithms used for SNA. We merely applied community cluster and density with weighted degrees in Figures. Any changes made along with algorithm will present different pattern and inference making.

Fourth, the social network analysis is not subject to the Pajeck software we used in this study, others such as Ucinet[32] and Gephi[33] are suggested to readers for use in the future study.

6 Conclusion

Many individual researchers achievements (IRA) were determined using h-index, AIF, x-index, or other bibliometric indices without quantifying author contributions. We demonstrated visualized representations on Google Maps using the AWS developed by authors to measure authors influences in a specific discipline. The research approach using the AWS to quantify the authors contributions can be applied to measure IRA in the future.

7 List of abbreviations

AIF: author impact factors
AWS: authorship-weighted scheme
HB: Health behavior
IRA: individual researchers achievements
MIA: most influential author
MPA: most productive author
PMC: Pubmed Center
SNA: Social network analysis

8 Competing interests

The authors declare that they have no competing interests.

9 Authors contributions

CF conceived and designed the study, TW performed the statistical analyses and were in charge of dealing with data. CC and TW helped design the study, collected information and interpreted data. WC monitored the research. All authors read and approved the final article.

References

[1] Haileamlak A. What Factors Affect Health Seeking Behavior? Ethiop J Health Sci, 2018, **28**(2): 110. https://doi.org/10.4314/ejhs.v28i2.1

[2] Chen SH, Chien TW, Su SB, *et al*. A dashboard on Google Maps to show the most influential author on the topic of health behavior: A Bibliometric Analysis. Adv Health And Behavior, 2018, **1**(1): 1-7. https://doi.org/10.25082/AHB.2018.01.004

[3] Hirsch JE. An index to quantify an individuals scientific research output. Proc Natl Acad Sci, 2005, **15**(102): 16569-16572. https://doi.org/10.1073/pnas.0507655102

[4] Etersen AM, Fortunato S, Pan RK, *et al*. Reputation and impact in academic careers. Proc Natl Acad Sci USA, 2014, **111**(43): 15316-15321. https://doi.org/10.1073/pnas.1323111111

[5] Sekercioglu CH. Quantifying coauthor contributions. Science, 2008, **322**(5900): 371. https://doi.org/10.1126/science.322.5900.371a

[6] Yuen J. Comparison of Impact Factor, Eigenfactor Metrics, and SCImago Journal Rank Indicator and h-index for Neurosurgical and Spinal Surgical Journals. World Neurosurg, 2018, (119): e328-e337. https://doi.org/10.1016/j.wneu.2018.07.144

[7] Post A, Li AY, Dai JB, *et al*. c-index and Subindices of the h-index: New Variants of the h-index to Account for Variations in Author Contribution. Send to Cureus, 2018, **10**(5): e2629. https://doi.org/10.7759/cureus.2629

[8] Ashfaq A, Kalagara R and Wasif N. H-index and academic rank in general surgery and surgical specialties in the United States. J Surg Res., 2018, (229): 108-113. https://doi.org/10.1016/j.jss.2018.03.059

[9] Jayant SV and V-index. A fairer index to quantify an individual's research output capacity". BMJ, 2005, **311**(728): 1339c1340c.

[10] Vavryuk V. Fair ranking of researchers and research teams. PLoS One, 2018, **13**(4): e0195509. https://doi.org/10.1371/journal.pone.0195509

[11] Batista PD, Campiteli MG, Kinouchi O, *et al*. Is it possible to compare researchers with different scientific interests? Scientometrics. 2006, **68**(1): 179189. https://arxiv.org/ftp/physics/papers/0509/0509048.pdf

[12] Lindsey D. Production and citation measures in the sociology of science: The problem of multiple authorship. Soc Stud Sci, 1980, **10**(2): 145162. https://doi.org/10.1177/030631278001000202

[13] Lindsey D. Further evidence for adjusting for multiple authorship. Scientometrics, 1982, **4**(5): 389395. https://doi.org/10.1007/BF02135124

[14] Egghe L, Rousseau R and Van Hooydonk G. Methods for accrediting publications to authors or countries: Consequences for evaluation studies. J Am Soc Inform Sci, 2000, **51**(2): 145157. https://doi.org/10.1002/(SICI)1097-4571(2000)51:2⟨145::AID-ASI6⟩3.0.CO;2-9

[15] Tscharntke T, Hochberg ME, Rand TA, *et al*. Author sequence and credit for contributions in multiauthored publications. PLOS Biology, 2007, **5**(1): e18. https://doi.org/10.1371/journal.pbio.0050018

[16] Waltman L. A review of the literature on citation impact indicators. Journal of Informetrics, 2015, **10**(2): 365-391. https://doi.org/10.1016/j.joi.2016.02.007

[17] Pan RK and Fortunato S. Author Impact Factor: tracking the dynamics of individual scientific impact. Sci Rep, 2014, (4): 4880. https://doi.org/10.1038/srep04880

[18] Lippi G and Mattiuzzi C. Scientist impact factor (SIF): a new metric for improving scientists' evaluation? Ann Transl Med, 2017, **5**(15): 303. https://doi.org/10.21037/atm.2017.06.24

[19] Fenner T, Harris M, Levene M, *et al*. A novel bibliometric index with a simple geometric interpretation. PLoS One, 2018, **13**(7): 19.e0200098. https://doi.org/10.1371/journal.pone.0200098

[20] Bright CF, Haynes EE, Patterson D, *et al*. The Value of Social Network Analysis for Evaluating Academic-Community Partnerships and Collaborations for Social Determinants of Health Research. Ethn Dis, 2017, (Suppl 1): 337-346. https://doi.org/10.18865/ed.27.S1.337

[21] De Nooy W, Mrvar A and Batagelj V. Exploratory Social Network Analysis With Pajek: Revised and Expanded, 2nd edn. New York, NY: Cambridge University Press, 2011. https://doi.org/10.1017/9781108565691

[22] Otte E and Rousseau R. Social network analysis: a powerful strategy, also for the information sciences. J Inform Sci, 2002, **28**(6): 441453. https://doi.org/10.1177/016555150202800601

[23] Bright CF, Haynes EE, Patterson D, *et al*. The Value of Social Network Analysis for Evaluating Academic-Community Partnerships and Collaborations for Social Determinants of Health Research. Ethn Dis, 2017, **27**(Suppl 1): 337-346. https://doi.org/10.18865/ed.27.S1.337

[24] Phan TG, Beare R, Chen J, *et al*. Googling Service Boundaries for Endovascular Clot Retrieval Hub Hospitals in a Metropolitan Setting: Proof-of-Concept Study. Stroke, 2017, **48**(5): 1353-1361. https://doi.org/10.1161/STROKEAHA.116.015323

[25] Andrich D. Relationships between the Thurstone and Rasch approaches to item scaling. Applied Psychological Measurement, 1978, **2**(3): 451-462. https://doi.org/10.1177/014662167800200319

[26] Lindsey D. Further evidence for adjusting for multiple authorship. Scientometrics, 1982, **4**(5): 389395. https://doi.org/10.1007/BF02135124

[27] Hagen NT. Harmonic allocation of authorship credit: source-level correction of bibliometric bias assures accurate publication and citation analysis. PLoS One, 2008, **3**(12): e402. https://doi.org/10.1371/journal.pone.0004021

[28] Hu SK, Huang J, Hong WD, *et al*. The 50 Most-cited Articles in Gastroenterology and Hepatology from Mainland China. Pak J Med Sci, 2017, **33**(1): 215-220. https://doi.org/10.12669/pjms.331.12286

[29] Coelho DH, Edelmayer LW and Fenton JE. A century of citation classics in otolaryngology-head and neck surgery journals revisited. Laryngoscope, 2014. **124**(6): 1358-1362. https://doi.org/10.1002/lary.24573

[30] Chang HT, Lin MH, Hwang IH, *et al*. Scientific publications in gastroenterology and hepatology in Taiwan: An analysis of Web of Science from 1993 to 2013. J Chin Med Assoc, 2017, **80**(2): 80-85. https://doi.org/10.1016/j.jcma.2016.06.006

[31] Sadoughi F, Valinejadi A and Shirazi MS, *et al*. Social Network Analysis of Iranian Researchers on Medical Parasitology: A 41 Year Co-Authorship Survey. Iran J Parasitol, 2016, **11**(2): 204-212. http://ijpa.tums.ac.ir/index.php/ijpa/article/view/1060

[32] Borgatti SP, Everett MG and Freeman LC. Ucinet for Windows: Software for Social Network Analysis. Harvard, MA: Analytic Technologies, 2002.

[33] Bastian M, Heymann S and Jacomy M. Gephi: an open source software for exploring and manipulating networks. International AAAI Conference on Weblogs and Social Media, 2009. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.172.7704&rep=rep1&type=pdf