



## Research Article

# Google Maps to Show International Co-Author Collaborations for the Journal of 'Family Medicine' and 'Primary Care'

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### Abstract

**Context:** Identifying international coauthor collaborations for journal papers is important and meaningful. However, no any paper that can combine Google map and Social Network Analysis (SNA) to present valuable information for readers.

**Aims:** Our aims were to visualize and compare the feature of international coauthor collaborations for two prominent journals and present the result on Google maps using SNA.

**Settings and Design:** Downloading 4764 articles on November 5, 2018 from Pubmed.com, we analyzed author nation and report features: (1) Nations published the most papers in Family Medicine and Primary care; (2) Indicators related to international coauthor collaboration; (3) Graphical representations to report the nation distribution for two journals.

**Methods and Materials:** Google Maps based on the coordinates of latitude and longitude were used to display results. Pajek software was performed to yield centrality measures in a network.

**Statistical analysis used:** Descriptive statistics and visual presentations.

**Results:** We found that the top nation for the two journals is similarly from U.S. accounting for 92.63% and 98.03% for Family Medicine and Primary Care, respectively. The Google maps combined with SNA to demonstrate the most frequency of author nations is shown the dominant nation from U.S., no any author collaboration with other countries or regions.

**Conclusions:** Google map combined with SNA provides wide and deep insight into the relationships among nations and coauthor collaborations. The results can be provided to readers for the submission to the journal with the aims and the scope related to Family Medicine and Primary Care.

**Keywords:** Authorship Collaboration; Family Medicine; Google Map, Primary Care; Social Network Analysis

### Introduction

Family Medicine (FM) is a specialty devoted to comprehensive health care for people of all ages [1]. Family physicians are often primary care physicians based on knowledge of the patient in the context of the family and the community [2]. The aim of family

medicine provides personal, comprehensive, and continuing care for the individual [3]. However, no such information about authors' collaborations on Family Medicine and Primary Care have been reported in literature even if we have found 4,764 papers published in journals of Family Medicine and Primary Care in Pubmed.com library at the end of 2017. A research question is thus conceived on the issue of investigating the feature of author nation collaboration for both journals of Family Medicine and Primary Care.

Social Network Analysis (SNA) [4-6] has been reported to inspect authorship collaboration because co-authorship among researchers that forms a type of social network [5]. The concept of co-occurrence can be investigated [7-9] using SNA.

Our aims are to investigate the international coauthor collaborations for two journals of Family Medicine and Primary Care with following steps: (1) What nation based on the 1<sup>st</sup> author published the most papers in past years; (2) What indicators that can be used for reporting international coauthor collaboration for journals; (3) How to show results on Google Maps and report the cluster relations among nations.

## Subjects and Methods

### Data Sources

We downloaded data including author names, author nations, and the publication journals from the PubMed database (Pubmed.org) maintained by the US National Library of Medicine, National Institutes of Health with the keyword of Family Medicine [Journal] and Primary Care [Journal] on November 5, 2017. Microsoft Excel VBA (visual basic for applications) modules were programed by authors to organize data for the use in this study. A total of 4,764 journal articles were retrieved. Only 3491 eligible papers that provide nation labels for authors are used in this study.

### Data Arrangement to Fit SNA Requirement

Before visualizing representations of research findings using SNA, we arranged data in compliance with the SNA format and guidelines using Pajek software [10]. Microsoft Excel VBA was applied to make data fitting the SNA requirement. For more information about the data format, see Pajek guideline at <http://vlado.fmf.uni-lj.si/pub/networks/pajek/>

### Graphical Representations to Report

**The most number of papers published by nations:** Many article types are categorized on Pubmed.com, we merely extracted these papers of a journal article from the library and made tables to present nations based on the 1<sup>st</sup> author that published the most in the fields of Family Medicine and Primary Care.

**Author nations and their relations:** Google Map is suitable for presenting the author-nation distribution on earth by either nation or cluster with coordinates of latitude and longitude [11]. Visual representations were generated to report the clusters of nations on a Google Map, and show international author collaborations based on the coordinates of latitude and longitude.

**Collaboration indicators between two journals:** Centrality is an important index to analyze the network. Any individual or entity lied in the center of the social network will determine its influence on the network and its speed to gain information [12].

Density was defined as the total number of unweighted relational ties (i.e., only once counted for each pair connection) divided by the total possible number of relational ties [13], which was calculated by the equation of degree centrality. The weighted degree indicates more than one times counted for each pair connection.

Collaboration Index (CI) denotes a ratio of author number

$$\text{CI} = \frac{\sum_{j=1}^k j \times f_j}{N} = \frac{\sum_{i=1}^N a_i}{N}$$

divided by the number of papers (CI

$$= 1 - \frac{f_1}{N}$$

means a ratio of the multiply author.

Gini coefficient [14] was applied to measure the inequality of published papers among the top five clusters (i.e., selecting the most number of published papers from a cluster). If a dominant power or influence exists in a network, the Gini coefficient will be higher near to 1.0.

**Statistical tools and data analyses:** SNA Pajek software [10] was used to obtain the measures of centrality. Google map was applied to display visualized representations. Author-made Excel VBA modules were prepared for organizing data and matching nations' coordinates of latitude and longitude. .

## Results

### The most number of papers published by nations

The most number of papers are shown in Table 1 (n=2021 due to some papers without specific nation labels on authors) and Table 2 (n=1472) respectively for Family Medicine and Primary Care on Pubmed.com. We can see that the top nation for the two journals is similarly from U.S. accounting for 92.63 % and 98.03% for Family Medicine and Primary Care, respectively.

No.	Nation	<-2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total	%
1	U.S.	1225	75	62	65	66	77	73	57	44	44	47	37	1872	92.63
2	Canada	34	1		5		2						1	43	2.13
3	Netherlands	10	1							1		1		13	0.64
4	Lebanon	4	1		1	1	1	1		1				10	0.49
5	Israel	7		1										8	0.40
6	Brazil	3				2		1						6	0.30
7	Norway	5						1						6	0.30
8	Germany	1				2			1		1			5	0.25
9	Japan	2		1				1				1		5	0.25
10	New Zealand	2			1							1		4	0.20
11	U.K.	0	2	1	1									4	0.20
12	Australia	1									2			3	0.15
	Others	19	3	0	2	5	2	2	2	3	0	2	2	42	2.08
	Total	1313	83	65	75	76	82	79	60	49	47	52	40	2021	100.00

**Table 1:** Top 12 nations whose papers from the Journal of Family Medicine across years based on 1<sup>st</sup> author’s nation.

Nation	<-2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total	%
U.S.	941	38	42	47	47	42	45	50	50	46	52	43	1443	98.03
Canada	11					2	1	1					15	1.02
U.K.	3		1										4	0.27
Australia	3												3	0.20
Finland	1												1	0.07
Ireland	1												1	0.07
Netherlands	1												1	0.07
Philippines	0	1											1	0.07
Portugal	0	1											1	0.07
Ukraine	1												1	0.07
Venezuela	1												1	0.07
Total	963	40	43	47	47	44	46	51	50	46	52	43	1472	100.00

**Table 2:** Top 11 nations whose papers from the Journal of Primary Care across years based on 1<sup>st</sup> author’s nation.

### Author nations and their relations

Authors’ nation clusters are distributed in Figure 1 and Figure 2 for Family Medicine and Primary Care, respectively [15,16]. We can see that the two nations of U.S. and Canada have the dominant power and influence on both journals because they published many papers on the two journals. Each nation is colored by the publications.

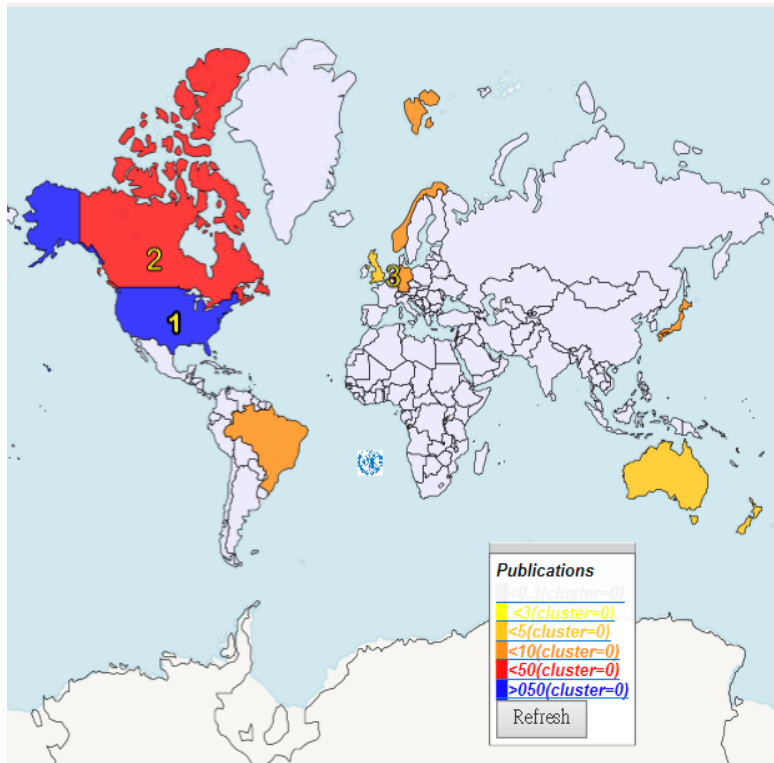


Figure 1: Cluster distribution for nations of 1<sup>st</sup> author using Pajak coordinates from the Journal of Family Medicine.

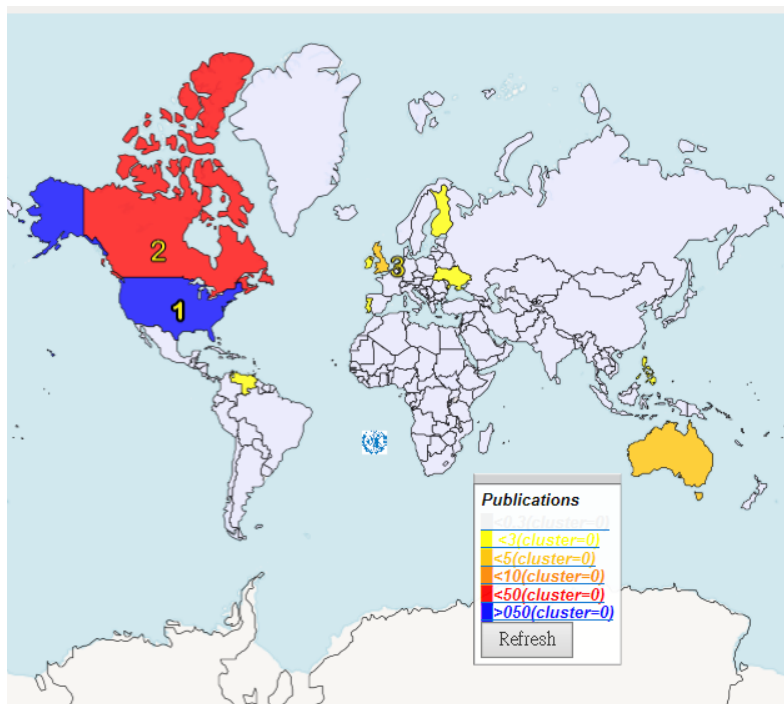


Figure 2: Cluster distribution for nations of 1<sup>st</sup> author using Google coordinates for the Journal of Primary Care.

### Comparison of collaboration indicators between two journals

We can see both journals have dominant power and influence (i.e., Gini coefficient > 0.97, see Table 3) from the U.S. on the issue of family medicine and primary care. No any author collaboration with other countries or regions was found. The Journal of Family Medicine has more nations (42) than the counterpart of the Journal of Primary Care (11). However, the Primary Care has two coauthors from other countries (i.e. Canada and Peru) in conjunction with the U.S. All papers published in Family Medicine were sole-nation-type articles. The Journal of Primary Care has an earlier publication since 1974 than the Journal of Family Medicine since 1985.

Number	1 nation		2 nations		3 nations		4 nations		≥5 nations		Total	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	CI
Family Medicine	2021	100.00	0	0	0	0	0	0	0	0	2021	1.00
Primary Care	1470	99.86	2	0.14	0	0.00	0	0.00	0	0.00	1472	1.00
Total	3491	99.94	2	0.06	0	0.00	0	0.00	0	0.00	3493	1.00
Journal	Eligible papers	Nations 1 <sup>st</sup> author	Nations Participated	Ratio (%)	Gini Co-eff.	DC %	Paper downloaded	Max. connection	Mean of degree	Degree density	Weighted density	End at 2017
Family Medicine	2021	42	42	100	0.97	0.00	2731	0	0.00	0.00%	0.00%	1985
Primary Care	1472	11	12	92	0.99	0.14	2033	2	0.18	3.03%	3.03%	1974
Total	3493	53	54	98	-	-	4764	2	0.04	0.15%	0.15%	

Note. CI =  $CI = \frac{\sum_{j=1}^k j \times f_j}{N} = \frac{\sum_{i=1}^N a_i}{N}$ , DC =  $DC = 1 - \frac{f_1}{N}$

**Table 3:** Comparisons of two journals in some indicators of nation collaboration.

## Discussion

The top nation for the two journals is similarly from U.S. accounting for 92.63 & and 98.03% for Family Medicine and Primary Care, respectively. The Google maps combined is shown the dominant nation from the U.S., no any author collaboration with other countries or regions. The Journal of Family Medicine has more nations (42) than the counterpart of the Journal of Primary Care (11).

### What This Adds to What was Known

This study combined Google map with SNA to demonstrate that the most frequency of authors is from the U.S., indicating that one picture is worth one thousand words when Google map can provide more valuable information to readers.

No, any paper has used Google Maps to show international coauthor collaborations in a dynamically effective form. In data analysis, it is very hard to detect the association of two or more entities at one time. We applied SNA to explore the relation of any two nations of their coauthors that can be shown the closest collaboration in a paper publication. Hyperlinks at references [15,16] are provided to interested readers who can manipulate the Google Maps with the functionalities of zoom-in and zoom-out to know the details of information such as network density of centrality and Gini coefficient can be shown.

### What it Implies and what should be Changed?

Papers downloaded from Pubmed.com were implemented, and a total of 4764 articles were extracted and studied. If no such Excel modules [17,18] were used, it is impossible to yield a visual presentation [15,16] used for interpreting the results of the study about the international coauthor collaboration in literature.

Many previous types of research [4-6] have investigated coauthor collaboration using SNA. However, we have not seen any that can demonstrate a concrete way to show how to conduct this exploration of informative messages to readers. We showed how easy and possible the SNA could display all possible pairs of our observed phenomena in a short time incorporating the free-charged Pajek software with Google Maps. Journal authorship collaboration can be thus compared with each other, see Figure 1 and Figure 2. We can see that the author-nation-pattern was the prevailing one which is similar to the previous study [4].

### Strengths of this Study

International collaboration in science has increased rapidly in recent decades. One driver of this development has been the efforts of the European Commission to stimulate collaboration within the European Union across sectors and nations [19]. The development also self-organizes at the global level of the United States and other advanced industrial nations for reasons driven by the demands of science. Mass data storage of electronic communications [20] with less expensive travel may also contribute the drivers and facilitators to the author collaboration in science [21]. Some governments [22] even invest purposefully

in the stimulation of “internationalization” in science to promote the international coauthor collaborations more than ever before. However, we have not seen any international collaboration in the two journals of Family Medicine and Primary Care.

Since the advent of bibliometrics, citation analysis has been widely used in many disciplines to evaluate the influence of academic articles [23-31]. It is worth using SNA, especially incorporating with Google map, to report journal or topic features in the future.

### Limitations and Future Study

There are some limitations to this study. Interpretation and generalization of the conclusions of this study should be carried out with caution. First, the data of this study were collected from Pubmed.com. It is worth noting that any attempt to generalize the findings of this study should be made in similar disciplines and domains with similar topic and the scope.

Second, although the data were extracted from Pubmed.com and carefully dealt with every linkage as correct as possible, the original downloaded text file including some errors in the name of the nation because some were not well recorded in the context of the downloaded data such as author's nation that might lead to some bias in the results. Third, there are many algorithms used for SNA. We merely applied centrality measure to present the prestigious feature.

Any changes made along with algorithm used will present different pattern and judgment. Fourth, the social network analysis is not subject to the Pajek software we used in this study, Others such as Ucinet [32] and Gephi [33] are suggested to readers for use in future.

## Conclusion

Social network analysis provides wide and deep insight into the relationships among nations, and coauthor collaborations related to the keyword of physiotherapy. The results can be provided to readers for the submission to the journal with the aims and the scope related to physiotherapy.

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