



Using Google Maps to Show the Pattern of International Co-Author Collaboration in Pharmaceutics

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Abstract

Objective: To understand international co-author collaboration in pharmaceutics and to visualize results by Google maps and social network analysis (SNA).

Methods: Selecting 311 abstracts from the Medline based on keyword pharmaceutics [journal], we reported following features of pharmaceutics: (1) nation distribution across continents; (2) main keywords frequently displayed in papers; (3) the eminent author in pharmaceutics. We programmed Microsoft Excel VBA for extracting data from Medline. Google Maps and SNA Pajek software show graphical representations of pharmaceutics.

Results: We found that (1) the most number of papers in nations are from U.S.(81, 16.05%) and Japan(34, 10.93%); (2) the most linked keywords are Pharmacokinetics and drug delivery; (3) the eminent authors are Muhammad Sohail Arshad(UK) and Takeshi Yokoo(Japan).

Conclusion: Social network analysis provides wide and deep insight into relationships of entities we interested. The results drawn from Google maps can provide more information to future studies in academics.

Keywords: Authorship Collaboration; Google Maps; Social Network Analysis; Medline

Introduction

Google Maps provide an overall view of geospatial visualization with coordinates of latitude and longitude dispersed on a map for our interesting entities [1-2]. However, few papers appear in Medline library in search of keyword Google map [Title] on November 22, 2017. Many papers [3-6] have studied on co-author collaboration in academics but failed to display results using graphical representation on Googlemaps.

The co-author relation is similar to the comorbid co-occurred with one another in medicine. Many studies have made efforts to explore the association of two or more entities (or drugs) such as lipid Nano carriers related to their ability to improve skin hydration [7] and micro emulsions (ME) and Nano emulsions (NE) considerable opportunities for targeted drug delivery to and via the skin [8]. The pattern of international co-author collaboration in pharmaceutics remains unclear and worthwhile to study in academics. It is hard using traditional statistics to observe the association between symptoms co-occurred at once even social network analysis (SNA) [9] has been launched to explore the pattern of elements in a system. SNA incorporated with Google maps is rare and substantially required to report research results in academics.

An apocryphal story often told to introduce the concept of co-occurrence is about beer and diaper sales. Both (e.g., beer and diaper) sales have a strong correlation [10-12] in a convenient store, especially on each Friday. All possible pairs we observed in a system can be counted using advanced computer techniques such as SNA. However, none introduce how to select the possible pairs co-occurred in an observed system.

Social Network Analysis (SNA)

Social network analysis (SNA) [13-15] has been used on authorship collaboration in bibliometrics. Co-authorship among researchers can form a type of social network, called co-author network [16]. 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 in the European Union across sectors and nations [17]. Mass data storage of electronic communications [18] with less expensive travel may also contribute the drivers and facilitators to the author collaboration in science [19]. We are thus interested in applying SNA to investigate the most number of authors and keywords related to pharmaceutics.

Aims of the study

We aim to investigate patterns of international collaborations in pharmaceutics in following representations: (1) nation distribution across continents; (2) main keywords frequently presented in papers; (3) the prominent author of pharmaceutics.

Methods

Data sources

We programmed Microsoft Excel VBA (visual basic for applications) routine for extracting abstracts and their co-author names on November 31, 2017, from Medline library. We included those abstracts published in the journal of pharmaceutics and labeled with Journal Article. A total of 311 eligible abstracts were from Medline since 2010.

Data arrangement to fit SNA requirement

We analyzed all eligible papers. Before visualize representations using SNA, we organized data in compliance with the SNA format and guidelines using Pajek software [20]. Microsoft Excel VBA was used to organize data for fitting the SNA requirement.

Graphical representations to report

(1) Author nations and their relations

A cross-table (i.e. columns for publication years and rows for the 1st author nations) was for presenting the distribution of nations and continents regarding pharmaceuticals. The bigger bubble means, the number of the nodes (i.e., nations, authors in this study). The wider line indicates, the stronger relations between two nodes. Clusters were classified and filled with different colors in bubbles.

(2) Popular keywords and prominent authors to present the research domain

Keywords defined by authors and research domain are highlighted by the relation between the pair of two keywords using SNA. The presentation of the bubble and line is interpreted similarly to the previous section.

Statistical tools and data analyses

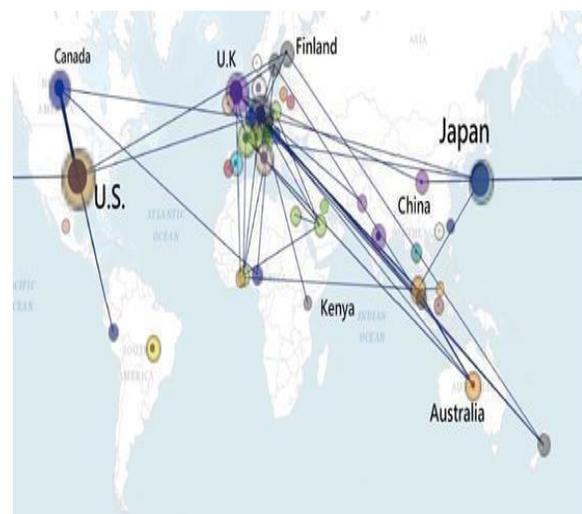
Google Maps [21] and SNA Pajek software [20] were used to present graphical representations for papers published in pharmaceuticals. We used author-made Excel VBA routines to organize data.

Results

Author nations and their relations

A total of 311 eligible papers with complete information were in Table 1. We can see that the most number of nations are from U.S.(81, 16.05%) and Japan(34, 10.93%). The trend across years on continents and counties is present in the column of growth in Table 1. The diagram (shown by SNA and Google maps) in Figure 1 displays author collaboration among nations. The highest productive nations are from U.S. and Japan placing a top role. It is worth noting that two nations (Egypt and Indonesia) have an increasing trend. In contrast, the US and Europe have a decreasing trend (table 1). Any nation collaborated with other nations are shown with a blue line (Figure 1). Interested authors are recommended to click the bubble of interest to see details on a website at reference [22].

Figure (1): International coauthor collaboration in pharmaceuticals



Using Google maps to show the pattern of International Co- Author Collaboration in Pharmaceuticals,

Table (1): Nation distribution based on the 1st author for papers regarding pharmaceuticals

Nation/ Continent	2010	2011	2012	2013	2014	2015	2016	2017	Total	%	Ranks	Growth	Ranks
Africa			1		1	1	1	3	7	2.25	6	0.79	1
Egypt							1	2	3			0.74	
Kenya								1	1			0.58	
Nigeria			1		1	1			3			0.06	
Asia	5	5	9	7	4	16	9	11	66	21.2	3	0.59	2
Brunei							1		1			0.41	
China			1	1	1			1	4			0.22	
Hong Kong			1		1				2			-0.13	
India	1	1	1			1	2	2	8			0.46	
Indonesia							1	1	2			0.76	
Japan	3	3	3	6	2	13	1	3	34			0.12	
Kuwait								1	1			0.58	
Malaysia	1		1				4	1	7			0.37	
Pakistan								2	2			0.58	
Singapore		1							1			-0.41	
Taiwan						1			1			0.25	
Thailand			2			1			3			-0.12	
Europe	10	32	16	13	13	12	12	10	118	37.9	1	-0.45	6
Austria		1		1					2			-0.38	
Belarus		1							1			-0.41	
Belgium		1							1			-0.41	
Croatia							1		1			0.41	
Denmark		1	3	1	2		2		9			-0.08	
Finland	2	1	1				1		5			-0.67	
France	1	2	3	2	1		3		12			-0.29	
Germany	2	4	4	1	3	3	2	1	20			-0.44	
Hungary		1							1			-0.41	
Ireland		2				1		1	4			0	
Italy	1	2	2	3		2		4	14			0.17	
Lithuania			1						1			-0.25	
Netherlands		2		1	1	1			5			-0.27	
Norway				1	1				2			0	
Portugal					2				2			0.08	
Spain		6							6			-0.41	

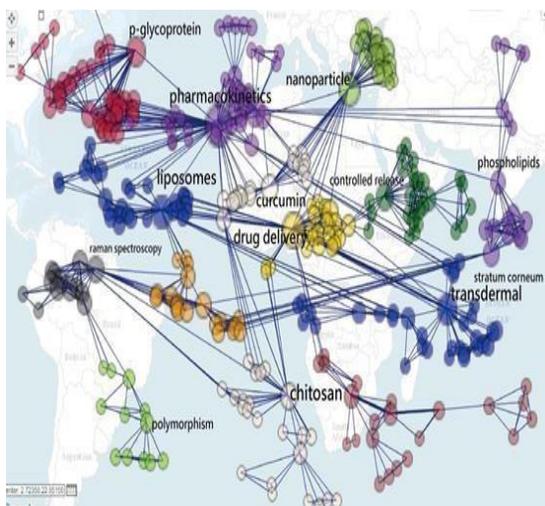
Using Google maps to show the pattern of International Co- Author Collaboration in Pharmaceutics,

Sweden					1	1			2			0.25	
Switzerland	1	2	1	1					5			-0.82	
U.K	3	6	1	2	2	4	3	4	25			0.02	
N. America	10	14	11	13	13	6	11	23	101	32.5	2	0.37	3
Canada	1		1	1	1			15	19			0.54	
Mexico		1							1			-0.41	
U.S	9	13	10	12	12	6	11	8	81	26.1		-0.36	
Oceania	3		1	1	2		1	3	11	3.54	4	0.07	4
Australia			1	1	2		1	2	7			0.59	
New Zealand	3							1	4			-0.38	
S. America		1	4		2	1			8	2.57	5	-0.25	5
Brazil		1	4		2	1			8			-0.25	
Total	28	52	42	34	35	36	34	50	311	100		0.16	

Keywords to present the feature of research domain

The most linked keywords are Pharmacokinetics and drug delivery, see Figure 2 or click it on the reference [23]. We can see that several bubbles are with keywords in (Figure2).

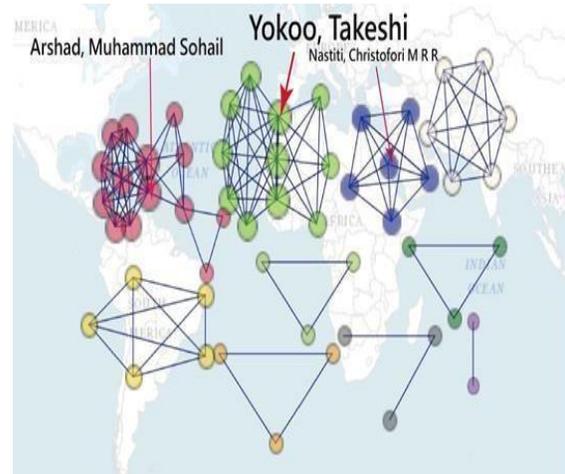
Figure (2): Keywords in papers regarding pharmaceutics



Prominent authors selected by SNA

The most eminent authors are shown in (Figure 3) or click it on the reference [24]. We can see that the two bigger bubbles are of Muhammad Sohail Arshad (UK) and Takeshi Yokoo (Japan) in two clusters on the top left in Figure 3. After clicking any bubble, we can see the author in more detail with connected lines to co-authors, see (Figure 4).

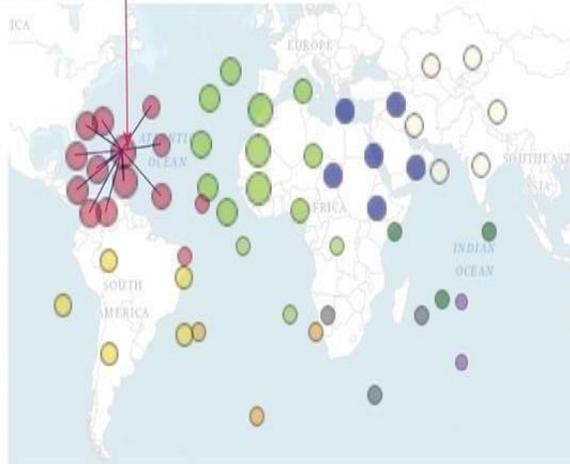
Figure (3): Prominent authors in papers of Pharmaceutics



Using Google maps to show the pattern of International Co- Author Collaboration in Pharmaceutics,

Figure (4): Research domain for an author (Muhammad Sohail Arshad) and the co-authors in pharmaceutics

Arshad, Muhammad Sohail



Discussion

We used SNA techniques to report that (1) the most number of papers are from U.S. (81, 16.05%) and Japan (34, 10.93%); (2) the most linked keywords are Pharmacokinetics and drug delivery; (3) the prominent authors are Muhammad Sohail Arshad(UK) and Takeshi Yokoo(Japan).

What This Adds to What Was Known

An apocryphal story is related to co-occurrence about beer and diaper sales in a virtual scenario [10-12]. It is hard to display all possible pairs of our observed phenomena at one time. In literature, no such examples but studies [3-6] investigated coauthor collaboration using SNA. We further incorporated SNA with Google maps to present informative knowledge to readers, which is novel more than previously published papers ever in academics.

Journal authorship collaboration can be compared with each other using SNA and Google Maps. We can see that many links connected with nations that can indicate a collaboration behavior [3]. The researchers published a huge international author collaborations in pharmaceutics which is inconsistent with the previous studies which

investigated scientific collaboration of Iranian Psychology and Psychiatry Researchers [25,26].

There are two papers [27,28] incorporated MeSH with social network analysis to explore interesting information. However, none incorporated SNA with Google maps to show more valuable representation to readers. The way we illustrated is promising in future.

What It Implies and What Should Be Changed?

Scientific publication is one of the objective measurements to evaluate the achievements of a medical specialty [29]. It is worth noting that using SNA and Google Maps is a way to report journal features or author research domains in future.

Several algorithms have used SNA to develop programs. If we investigated whether author domains or paper keywords are fitting the features of a journal, the centrality measures using SNA could be applied [3]. It means that the core entity can be analyzed using the centrality measure [30] yielded by SNA.

Strengths of This Study

The way we incorporated SNA with Google Maps is unique, which is rare in previous papers. Another strength in the current study is that we applied Google Maps to interested readers who can practice it in their ways by clicking the links in references [22-24]. The national distribution in Figure 1 is easy to understand. One picture is worth ten thousand words. We hope following studies can report more such kinds of Google Maps to readers [31].

Limitations and Future study

The interpretation and generalization of the conclusions of the current study should be substantially cautious. First, the data of this study were from Medline. It is worth noting that any attempt to generalize the

findings should be cautious just in the similar journal domain with similar topic and scope or contexts.

Second, although the data were extracted from Medline and carefully dealt with every linkage as correct as possible, the original downloaded text file might have some errors in symbols such as period and comma in author address that leads to some bias in the resulting nation distribution.

Third, there are many algorithms used for SNA. We merely used the one of Pajeck software. Any changes made with algorithm appropriately used will cause different pattern and inference making.

Fourth, the social network analysis is not subject to the Pajeck only we used in the current study, Others such as Ucinet [32] and Gephi [33] are recommended to readers for use in future.

Conclusion

Social network analysis offers a wide and deep insight into the relationships among entities. The results drawn from Google maps provide readers a way to present information in future.

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