

Using Google Maps to Show the Pattern of International Author Collaboration: A Study Based on Nurse Burnout Articles



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Abstract

Objective: To investigate research patterns of international author collaboration in nursing and burnout by collecting data from Medline and to visualize data using Google maps and social network analysis (SNA).

Methods: Selecting 3,063 abstracts, author names and countries, keywords, and medical subject headings (MESH) on November 23, 2017 from the Medline based on the paper abstract comprising keywords of nursing and burnout, we reported following features of nursing and burnout: (1) nation and journal distribution; (2) main keywords frequently presented in papers; (3) the prominent author and the research domain defined by the MESH terms. We programmed Microsoft Excel VBA routines to extract data from Medline. Google Maps and SNA Pajek software were used for displaying visual representations on features of nursing and health care.

Results: We found that (1) the most number of nations are from U.S. (718,32.44%) and Canada (173,7.82%); (2) the most number of journals in production of nurse and burnout are J Adv Nurs (156,7.05%) and J Nurs Manag (115,5.20%); (3) the most linked keywords are burnout and district nurses; (4) the research domains defined by MESH terms are psychology and intensive care units for the prominent Author Bara Ricou.

Conclusion: Social network analysis provides wide and deep insight into the relationships among entities or subjects. The results drawn by Google maps can be provided to readers for future paper submission in academics.

Keywords: Abstract keywords; Authorship collaboration; Google maps; Social network analysis; Medline

Introduction

Burnout is a global problem in service-originated societies, especially among nurses in the healthcare setting [1-3]. Several research studies have reported that burnout affects the physical and psychological well-being of a worker [4-6], this worker's organizational well-being [7-10] and patient outcomes [5,9]. Maslach [11] defined burnout as a syndrome of emotional exhaustion, reduced personal accomplishment, and depersonalization that can occur in individuals within people-related jobs, such as healthcare or education. The Maslach Burnout Inventory is validated by extensive research conducted for over 35 years since its initial publication and has been translated into

several languages to examine nurse burnout in the workplace [12].

Burnout issues around the world

Burnout and stress are now more commonly associated with the nursing profession than ever before [12]. A burnout in nursing conference had been held on September 7-9, 2017 in Sydney, Australia [13]. The complex combination of stressors brought about by burnout can result in impaired well-being, costly sick leaves, decreased quality care, and increased risk. Burnout and stress are strongly associated with career misery [13], leading

to the loss of highly experienced nurses from the profession. Combating mental health issues and addressing the vulnerabilities of nurses is necessary to understand the psychology underpinning stress and burnout and to motivate the publication of academic papers promoting the development of the resilience required to prevent these professional dangers from occurring. In this regard, knowledge of the most prominent journals and authors reporting nursing burnout in the literature is necessary.

Burnout and nurse papers are increasing

According to the Science Citation Index, the rate of growth of scientific publications has declined in coverage over the last 15 years [14]. Thus, we aim to determine

- A. Whether the rate of growth of published papers on burnout is increasing or decreasing,
- B. Which journal and author have published the most number of burnout papers, and
- C. What core research domains are related to nurse burnout.

As of May 20, 2017, over 6,976 (or 574) papers can be found on Pubmed.com by searching for the keyword “burnout” (or “burnout” and “nurse”). We attempted to emulate previous studies [15,16] by applying social network analysis (SNA) to MESH terms to investigate the core research domain for a specific journal and an individual author. In the literature, several longitudinal studies [17-19] on trends have been conducted using MESH terms to report the most frequently cited topics; however, all of these works merely use the traditional occurrence count on a specific MESH term (i.e., topic, instead of using a pair of terms within a network) to draw their plot bar (or line) charts over topics or years. A novel way to explore the relation between topics (i.e., MESH terms in this study) and actors (i.e., journals or authors) incorporating SNA with Google Maps is studied in the current work.

Social network analysis

All possible pairings of major MESH terms (i.e., with an asterisk * symbol) in an article that can be used to select the key actor (or topic) based on centrality measures [20-22] were determined. Thus, the current study applied SNA to analyze journal features and their MESH terms; this methodology is similar to that applied in other studies [21-23], but is different from focusing on research domains instead of co-authorship relations within a social network.

As data-driven discovery is increasingly used to gain knowledge in the course of inquiry [24-26] and construct the so-called knowledge concept map, we demonstrate a method to develop new knowledge in the field of nursing management by drawing author research domain maps. These maps are similar to

the knowledge concept map required for further development in the literature.

Study aims

The aims of the current study are to report (i) whether papers on nursing burnout are increasing or decreasing, (ii) which burnout and nursing-related journals (or authors) are prominent, and (iii) what is the core research domain of the related journal and author using SNA.

Methods

Data source

We programmed Microsoft Excel VBA (visual basic for applications) modules for extracting abstracts and their corresponding coauthor names as well as keywords on November 23, 2017 from Medline library. Only those abstracts involving nursing and burnout and labeled with Journal Article were included. Others like those labeled with Published Erratum, Editorial or those without author nation were excluded from this study. A total of 3,063 eligible abstracts were obtained from Medline since 1979. Only 2,213 papers are labeled with 1st author nation in Medline database.

Data arrangement to fit SNA requirement

We analyzed all eligible papers with complete data including author countries, MESH terms. Prior to visualize representations using SNA, we organized data in compliance with the SNA format and guidelines using Pajek software [27]. Microsoft Excel VBA was used to deal with data fitting to the SNA requirement.

Graphical representations to report

Author nations and their relations: Two cross tables (i.e., columns for publication years and rows for the 1st author nations as well as journals) were made for presenting the distribution of nations and the most number of journals publishing papers of nursing and burnout. The bigger bubble means the more number of the nodes (i.e., nations, authors, or MESH terms in this study). The wider line indicates the stronger relations between two nodes. Community clusters are filled with different colors in bubbles.

Keywords, authors and MESH terms to present the research domain: Keywords are defined by authors. Research domain can be highlighted by the relation between any pair of two keywords using SNA. The presentation for the bubble and line is interpreted similar to the previous section.

Statistical tools and data analyses

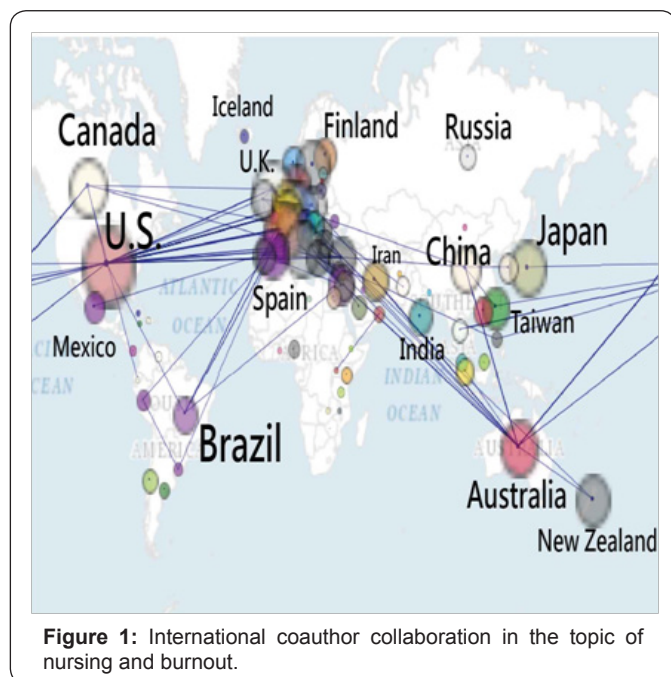
Google Maps [28] and SNA Pajek software [27] were used to display visualized representations for papers published in the field of pharmacology and pharmaceuticals. Author-made Excel VBA modules were applied to organize data.

Results

Table 1: Nation distribution based on the 1st author for papers regarding nursing and burnout.

Nation	1079-2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total	Corr.	%
U.S	332	36	40	54	31	32	43	29	35	33	50	718	-0.03	32.44
Canada	81	12	9	13	9	12	5	7	9	6	10	173	-0.5	7.82
Australia	66	7	9	8	8	8	11	8	15	14	9	163	0.61	7.37
U.K	83	11	7	5	3	2	5	4	1	9	7	137	-0.21	6.19
Sweden	40	9	1	5	2	3	3	2	5	2	3	75	-0.37	3.39
China	6	2	2	3	5	6	6	6	14	10	13	73	0.91	3.3
Japan	19	5	5	6	4	3	4	5	5	6	3	65	-0.2	2.94
Italy	16	6	4	2	2	5	6	2	8	6	5	62	0.32	2.8
Spain	10	3	2	4	3	3	6	1	4	7	15	58	0.64	2.62
Taiwan	15	4	3	5	4	1	1	2	5	8	6	54	0.39	2.44
Turkey	10	7	7	4	2	1	1	3	3	8	7	53	0.03	2.39
Iran	3	1	3		1	5	1	7	8	10	9	48	0.85	2.17
Netherlands	23	3		3	4	3	2	2	3	2	3	48	0.12	2.17
France	11	3	6	3	1	1	2	1	3	4	7	42	0.2	1.9
Germany	7		5	5	3	3	4	4	2	3	4	40	0.14	1.81
Belgium	4		3	1	3	2	5	6	2	2	7	35	0.6	1.58
Ireland	12	1	4	1	1		3		2		3	27	-0.06	1.22
Israel	8		2		5	1		2	1	5	3	27	0.41	1.22
Norway	6	3	2	3	1	1	1	1		3	1	22	-0.44	0.99
Poland	5		1		3	1	1		1	6	4	22	0.61	0.99
Brazil	5	1		3	1		1	2	2	2	2	19	0.42	0.86
Finland	8	1	2		1	3	2	1			1	19	-0.28	0.86
Greece	8		2	1	1			2	2		3	19	0.35	0.86
Switzerland	4	1		1	2	2		2	2	2	2	18	0.57	0.81
Jordan	9	2	2		1	1		1			1	17	-0.56	0.77
New Zealand	7	2	2	1	1			2		1	1	17	-0.4	0.77
Portugal		1			1	2	2	3		4	4	17	0.71	0.77
South Korea	3			1	1	1		1	1	6	1	15	0.52	0.68
Hong Kong	6			1	1		1		1			10	-0.07	0.45
India	1	1	1			1	1		2		2	10	0.28	0.45
Others	22	5	7	5	5	6	10	10	12	10	18	110	0.85	4.97
Total	830	127	131	138	110	109	127	116	148	169	204	2213	0.65	100

Author nations and their relations



A total of 2,213 eligible papers with complete author nations based on journal article since 1979 are shown in Table 1. We can see that the most number of nations are from U.S. (718,32.44%) and Canada (173,7.82%). The trend in the number of publications with authorship from countries is present in the column of correlation (denoted by corr.) 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 Europe. China (corr.=0.91) and Iran (corr.=0.85) also placed a distinct portion and an increasing trend. Any nation collaborated with other nations are shown with a blue line. Interested authors are recommending to click the bubble of interest to see details on a website at reference [29].

Journals and the trend

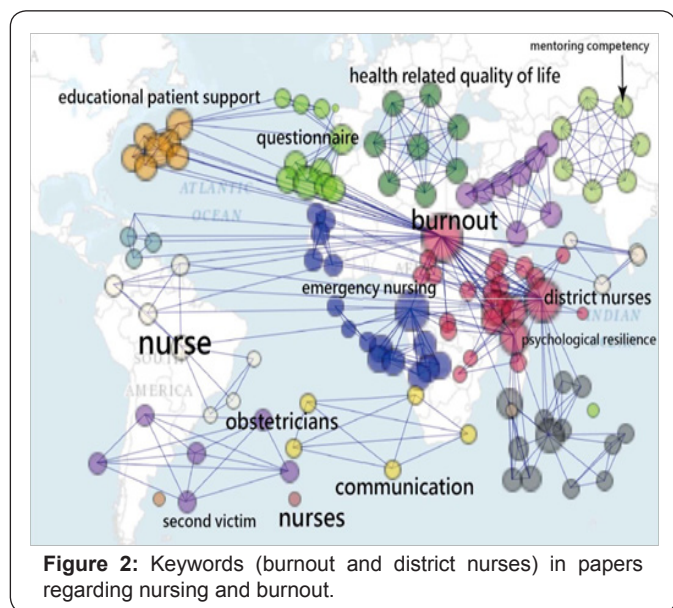
A total of 3,063 eligible abstracts were analyzed regarding journals in nursing and burnout. The most number of journals in production of nursing and burnout are J Adv Nurs (156,7.05%) and J Nurs Manag (115, 5.20%). The trend in the number of publications for a journal is shown in the column of correlation in Table 2. We can see some journals are increasing and some are decreasing in papers regarding nursing and health care.

Table 2: Journal distribution for papers regarding nursing and burnout.

Journal	1979-2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total	Corr.	%
J Adv Nurs	92	8	5	7	7	3	10	6	1	5	12	156	0.06	7.05
J Nurs Manag	38	6	10	5	3	6	5	6	15	10	11	115	0.52	5.2
Int J Nurs Stud	40	8	5	11	4	8	9	5	7	11	3	111	-0.12	5.02
J Nurs Adm	38	5	3	1	4	4	4	5	2	6	7	79	0.48	3.57
J Clin Nurs	23	9	3	4	3	6	5	4	5	6	9	77	0.24	3.48
Br J Nurs	26	2	1	1	2		2			4	6	44	0.46	1.99
Nurs Ethics	18	4	1	2	5		4	1	4	1	4	44	0.02	1.99
J Psychiatr Ment Health Nurs	24		2		4		2	2	2		1	37	0.01	1.67
Nurs Stand	19	1			1	2	2	2		8		35	0.38	1.58
Nurs Health Sci	12		4	3	2	1		2	1	1	1	27	-0.33	1.22
Nurse Educ Today	9	1	1	3			4	1		5	2	26	0.3	1.17
Curationis	14	5							1	3	2	25	-0.01	1.13
Int Nurs Rev	9	2	4	1				1	1	4	3	25	0.14	1.13
Nurs Manage	17	1	2					2		1	1	24	-0.02	1.08
Holist Nurs Pract	15	3	1	1						1	2	23	-0.25	1.04
J Nurs Scholarsh	8	1	3	1	1	1		1	4	2	1	23	0.11	1.04
Contemp Nurse	13	1	2	2	1	1				2		22	-0.48	0.99
Int J NursPract	6	2				2	1		4	4	3	22	0.62	0.99

Issues Ment Health Nurs	9	1	2	1	2	3	1	1	2			22	-0.44	0.99
Dimens Crit Care Nurs	7		1	1	1	2	3	3	1		1	20	0.16	0.9
J Prof Nurs	12	1	2	2	2			1				20	-0.72	0.9
OncolNurs Forum	8			2			4			5	1	20	0.37	0.9
Clin J Oncol Nurs	3		2	2		1		3	2	3	3	19	0.61	0.86
J Psychosoc Nurs Ment Health Serv	15		1						1		1	18	0.27	0.81
Nurs Econ	12		2				1	2	1			18	-0.04	0.81
Nurs Res	11			3	1					2	1	18	0.09	0.81
AAOHN J	14	1		1	1							17	-0.65	0.77
ApplNurs Res	2		1	2	2	2		1		5	2	17	0.38	0.77
G Ital Med Lav Ergon	7	2	3			1			2	1		16	-0.38	0.72
Int J Ment Health Nurs	9	3	1				1	1			1	16	-0.41	0.72
Others	817	89	92	97	89	89	99	111	148	132	164	1927	0.86	87.08
Total	1347	156	154	153	135	132	157	161	204	222	242	3063	0.79	138.41

Keywords to present the feature of research domain

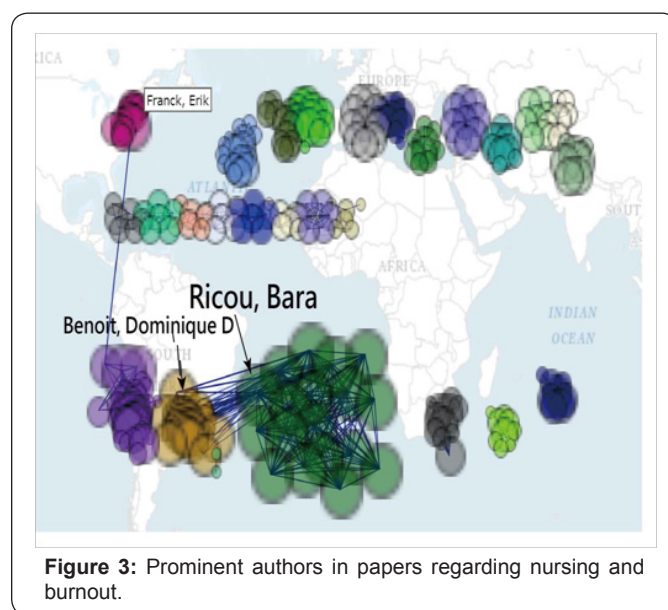


The most linked keywords are burnout and district nurses, see Figure 2 or click it on the reference [30]. We can see that the two bigger bubbles are of burnout and district nurses in pink cluster at the right-middle part in Figure 2.

Prominent authors selected by SNA

The most prominent authors are shown in Figure 3 or click it on the reference [31]. We can see that the two bigger bubbles are authors Bara Ricou and Dominique D Benoit in those green and

yellow clusters.



MESH terms to present the feature of research domain

After extracting 49 papers in a search by a keyword Bara Ricou [Author-Full] on Medline, we analyzed data by SNA and present the most linked MESH terms (psychology and intensive care units), see Figure 4 or click it on the reference [32] to see the research domain of Bara Ricou. We can see that several bigger clusters that can represent the research domain of the author.

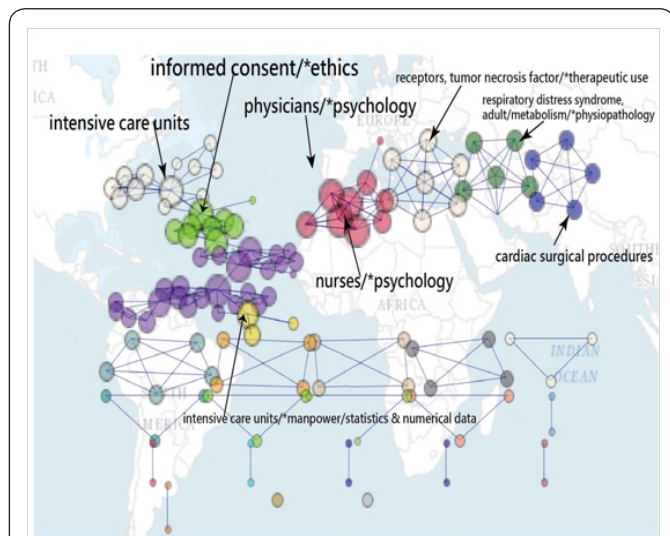


Figure 4: Research domain for an author (Bara Ricou) in nursing and burnout.

Discussion

This study used SNA techniques to report that (i) papers on nursing burnout are increasing, especially for China and Iran (Table 1), (ii) the most number of nations are from U.S. (718,32.44%) and Canada (173,7.82%), (iii) burnout and nursing-related the prominent journals (or authors) related to nursing burning are J Adv Nurs (journal) and Bara Ricou(author), and (iv) the core research domain for the author Bara Ricouis psychology related to intensive care units.

What this adds to what was known

No study has yet demonstrated how to obtain results with a useful statistical technique. We applied SNA and Google maps on a field of nursing and burnout to determine their research domains according to major MESH terms; this technique has never been reported in the literature. Determination of the research domain is achieved by the mapping-technique [33], which is a tool supporting the cognitive representation of complex domain knowledge. Several mapping techniques, such as concept mapping [34], mind mapping [35], and knowledge mapping [36], have been developed. From the figures shown in this study, we observe that the knowledge concept can be easily drawn and interpreted according to MeSH terms. The unique feature lies in its inspection of a journal’s (or an author) research domain by using a combination of MESH terms through SNA and Google maps. Many journals and authors should have their own core research domain maps that can be shown up to their peers in future.

What it implies and what should be changed?

Burnout and stress are commonly associated with the nursing profession [12]. We determined that the number of nursing burnout papers continues to increase on a yearly basis and that the most prominent journal in this field is J AdvNurs. Bara Ricou was identified as the most popular author in the nurse burnout field. The way we adopted in this study is worth recommending to

readers in future researches for exploring core research domains of their journals or authors in an interesting field such as nurse burnout in the current study.

An apocryphal story is often told to discover the co-occurrence about beer and diaper sales [35-39]. It is hard to find out all possible pairs of our observed phenomena in a short moment. In literature, no such a study like the current study can illustrate an example of coauthor collaboration in academics combing SNA and Google maps. Informative messages were thus provided to readership. There are two papers [40,41] incorporated MESH into SNA to explore interesting informative knowledge.

However, no any that can be found in incorporating SNA with Google maps to show more value information like linkages in reference [29-32]. The way we illustrated is novel and promising in future, especially in the field of nursing and burnout.

Strengths of this study

Google maps were shown at linkages in reference [29-32]. Future studies can apply this approach to other fields. The proposed methodology is different from that applied in other studies, which use simple search and extraction methods applied to SNA [21-23,42]. In contrast to the approaches applied in other studies on health issues [42-44], we used SNA to analyze keyword associations for a topic (nursing and burnout). Figure 1-4 show that the close link with a wider line between two nodes because the closest association pairs are centered, which indicates that exploratory data analysis (EDA) is fairly different from initial data analysis (IDA) [45], which focuses more narrowly on checking assumptions required for model fitting and hypothesis testing and on handling missing values and transforming variables as required. Thus, EDA encompasses IDA to facilitate policy-making.

Limitations and future scope

The interpretation and generalization of the conclusions of this study should be cautious. First, the data of this study were collected from Medline for a single journal. It is worth noting that any attempt to generalize the findings of this study should be made in the similar journal domain with similar topic and scope contexts. Second, although the data were extracted from Medline and carefully dealt with every linkage as correct as possible, the original downloaded text file including some errors in symbols such as period and comma in author address that might lead to some bias in the resulting nation distribution.

Third, there are many algorithms used for SNA. We merely applied separation components showing in Figures. 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 [46] and Gephi [47] are suggested to readers for use in future.

Conclusion

Social network analysis provides wide and deep insight into the relationships among nations, coauthor collaborations, and

abstract keywords or MESH terms. The results drawn by Google maps can be provided to readers for future paper submission in academics.

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