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USING SOCIAL NETWORK ANALYSIS TO UNDERSTAND A HEALTH-RELATED JOURNAL

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Abstract

Our aims were to investigate journal features by collecting data from Medline and to visualize the journal characteristics for Eur J Cancer Care (Engl) (EJCC). Selecting 1611 abstracts and their corresponding coauthor names and keywords on September 3, 2017 from the Medline, we analyzed author names and keywords to report following features: (1) nation distribution and coauthor collaboration; (2) journal features represented by paper keywords; (3) the most productive authors and their authorship clusters; (4) the top 10 journals most similar to EJCC. We programmed Microsoft Excel VBA routines to extract data from Medline. Rasch model and SNA Pajek software were performed to display visualized representations for EJCC features. We found that (1) the most number of papers are from nations of UK (28%) Australia (10%), and Sweden (5%); (2) The most linked Keywords are cancer and breast cancer; (3) the most productive author is R Sanson-Fisher; (4) The top one ranked journals most similar to EJCC is Support Care Cancer.. Social network analysis provides wide and deep insight into the relationships among nations, coauthor collaborations, abstract keywords, and journals most similar to EJCC. The results can be offered to strategy and decision making for the target journal.

Keywords: abstract keywords, authorship collaboration, Rasch analysis, social network analysis, Medline

Introduction

Comorbid is defined in medicine as existing simultaneously with and usually independently of another medical condition. As for cancer care patients, psychological distress problems are often comorbid with and can usually complicate the treatment of patients with breast cancer (Stefanic, et al., 2017). Chronic pain problems also commonly and often co-occur with other anxiety problems (Wurm, et al., 2016). In many situations, it is very hard to observe the association of two or more symptoms at one moment.

An apocryphal story often told to illustrate the concept of co- occurrence is about beer and diaper sales. It usually goes along with both beer and diaper sales which were strongly correlated (Domingos, 2012; Verhoef, et al., 2016; Power, 2017) in a market place. As such, all possible pairs of our observed phenomena can be combined and analyzed using computer techniques. However, we have not seen any computer algorithms that help us selecting the most possible pairs co-occurred with each other.

Social Network Analysis (SNA)

Social network analysis (SNA) (Sadoughi, et al., 2016; Osareh, er al., 2014; Liu et al., 2005) has applied to authorship collaboration in recent years. It is because co-authorship among researchers that forms a type of social network, called co-author network (Osareh, er al., 2014). We are thus interested in using SNA to explore the most pair relations (e. g., beer and diaper in marking sales) for a journal through what we observed and collected from data, such as abstract keywords, coauthor collaborations, and other journals similar to the target journal.

Authors are usually required to provide three to ten key words that represent the main content of the article for an article (International Committee of Medical Journal Editors, 1997; Nadim, 2005; Rhodes, 2010; Day. & Gastel, 2006). Keywords or short phrases published with an abstract can assist indexers in cross- indexing the article. However, few study investigated whether keywords are substantially associated with the abstract and what keywords that can represent the researched journal in academics.

Author Collaborations And International Relations

Many papers have been collected and saved at the US National Library of Medicine National Institutes of Health (Pubmed. com). Meanwhile, we have seen some computer scientists placing high hope on those machine-learning algorithms, data mining or artificial intelligence to quantify research information and even to create a structured database (Luo, et al., 2016; Knoblock, et al., 2003) for use in academics. Accordingly, extracting the Pubmed (or say Medline) published papers may be possible for us to apply those data to understand the features and characteristics of a specific journal. For instance, we are interested in investigate what are the nation distribution and what are the top 10 journals similar to a specific journal.

For the reason that using internet information is increasing the yield of knowledge from data generated in the

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course of inquiry (Ohno-Machado, 2017; Ohno-Machado, 2016; Shah & Tenenbaum, 2012). How to further display and develop new knowledge for a target journal is required to explore and further study.

Aims of the Study

Our aims are to investigate journal features by collecting data from Medline and to visualize the journal characteristics for Eur J Cancer Care (Engl) (EJCC) in following representations: (i) nation distribution and coauthor collaborations; (ii) journal features represented by a couple of keywords; (iii) the most productive authors and their authorship clusters; (iv) the top 10 journals most similar to EJCC.

Methods

Data Sources

We programmed Microsoft Excel VBA (visual basic for applications) modules for extracting abstracts and their corresponding coauthor names as well as keywords on September 3, 2017 from the US National Library of *Medicine National Institutes of Health (Med*line), see Additional file 1. Only those abstracts published by Eur J Cancer Care (Engl) (EJCC) and labeled with Journal Article were included. Others like those labeled with Published Erratum, Editorial or without author name (s) were excluded from this study. A total of 1611 abstracts were retrieved from Medline since 2005.

Data Arrangement to Fit SNA Requirement

Prior to visualize representations of research findings using SNA, we should organize data in compliance with the SNA format and guidelines using Pajek software (de Nooy, et al., 2011). Microsoft Excel VBA was used to arrange data fitting the SNA requirement. For more information about the data extraction and the data arrangement, see Additional 1.

Graphical Representations To Report

(1) Author nations and their relations
A cross table (ie. columns for publication years and rows for the 1st author nations) was prepared for presenting the distribution of nations and their corresponding collaborations by separating isolated and clustered nodes (e. g., nations). The bigger bubble means the more number of authors (including their coauthors) in papers. The wider line indicates the stronger relations between two nodes. Community clusters are filled with different colors in bubbles.

(2) Keywords to present the journal research domain
If keywords represent the research domain for EJCC, the stronger relations between two keywords can be highlighted through the SNA, like the concept of co-occurrence about beer and diaper sales. The presentation for the bubble and line is interpreted similar to the previous section.

(3) The most productive authors and their authorships
Coauthor collaborations for EJCC can be also drawn sung SNA and interpreted by their bubbles and connected lines. Through which, we selected the most productive authors who published the most number of papers

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in EJCC with their colleagues. With this in mind, only those with many contributions to EJCC are illustrated in the diagram for focusing and narrowing the prestigious ones in the diagram.

(4)   Journals similar to EJCC
Each paper in Medline can be linked to those similar articles by the algorithm of Pubmed MeSH (Medical Subject Headings) terms. Through which, all those 1611 EJCC papers can be identified with similar journals by their papers including EJCC himself. A total of 2577 journal were retrieved and 46, 386 counts were recorded across years since 2000. Rasch model of continuous items (Rasch, 1960, Chien, et al., 2017) were applied to analyze the dataset (i. e., 2577 journal rows and 13 year columns).

Rasch analysis overcomes the inherent weakness of conventional analytical techniques based on classic test theory (CTT), such as factor analysis, requiring linear, interval scale data input (Wright, 1997). Raw data collected through Likert-type scales are always ordinal since their categories indicate its ordering without any proportional levels of meaning (Bond & Fox, 2007; Linacre, 2017). Therefore, it is highly possible misleading conclusions if applying CTT to raw scores which are ordinal data (ie., response from 1 to 5 ordered category for instance) in nature. We applied Rasch model of continuous items (Chien, et al., 2017) to compare the journals most similar to EJCC, see Additional File 3..

Statistical Tools And Data Analyses

Rasch model of continuous items

(Chien, et al., 2017) and SNA Pajek software (de Nooy, et al., 2011) were used to display visualized representations for EJCC features. Author-made Excel VBA modules were applied to organize data, see Additional File 1.

Results

Author Nations And Their Relations

A total of top 20 extracted from the 1611 study papers limited in journal article since 2000 are shown in Table 1. We can see the top 3 nations are UK (28%) Australia (10%), and Sweden (5%). The diagram shown by SNA in Figure 1 presents author collaboration among nations based on EJCC publication. The strongest authorship collaboration are come from USA, UK and Australia. The Australia in blue cluster has the most number of connections and collaborations with other countries. Some isolated nodes without any international collaboration are not shown in this diagram. The bigger bubble represents the more number of papers and coauthors in the past 13 years.

Keywords To Present The Journal Research Domain

The top 7 keywords (weighted connection counts in parentheses) are listed as below: Cancer, breast cancer, quality of life, prostate cancer, supportive care, oncology, and symptoms. We can see that the two bigger bubbles with a wider connection line in the green cluster are quality of life and prostate cancer in Figure 2, indicating these two are commonly co-occurred and discussed in EJCC papers.

Table 1. Papers in Eur J Cancer Care (Engl) summarized by nation and year

| Nation	<--2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
UK	201	18	19	22	19	30	20	18	24	14	26	14	31	456
Australia	16	4	4	4	3	5	11	11	11	17	7	25	39	157
Sweden	24	3	6	8	6	5	5	5	1	2	1	5	6	77
USA	20	4	4	1	6	3	5	4	5	7	6	3	8	76
Germany	6	2	5	2	3	8	4	8	3	9	4	9	8	71
Italy	8	1	3	2	5	9	3	5	1	3	1	9	15	65
Canada	5	5	3			4	2	3	5	4	2	9	5	47
China	0			1	2	4	2	1	2	3	4	6	19	44
Greece	6	1	9	6	5	8	2		1		1		4	43
Netherlands	1	4		2	2	3	3	1	2	1	3	7	10	39
Turkey	2		4	5	4	2	1	2	2	2	1	7	5	37
Taiwan	1		3	3	2	2	2	3	2	2	2	4	9	35
France	3	1			2	2	5	5	2	1	2	6	3	32
Spain	2		1		3	5	2	1	4	1	3	7	3	32
Belgium	7	1			1		1	1	1	2	4	4	4	26
Ireland	4			2	1	2	3	1		1	3	6		23
Japan	5	2	1	2		1		2	5	1	2		2	23
Denmark	2	1					2	5	3	3	1	3	1	21
Brazil	4			3	1	2	1	1				3	2	17
Finland	9	1		1					1	1		1	2	16
Total	326	48	62	64	65	95	74	77	75	74	73	128	176	1337
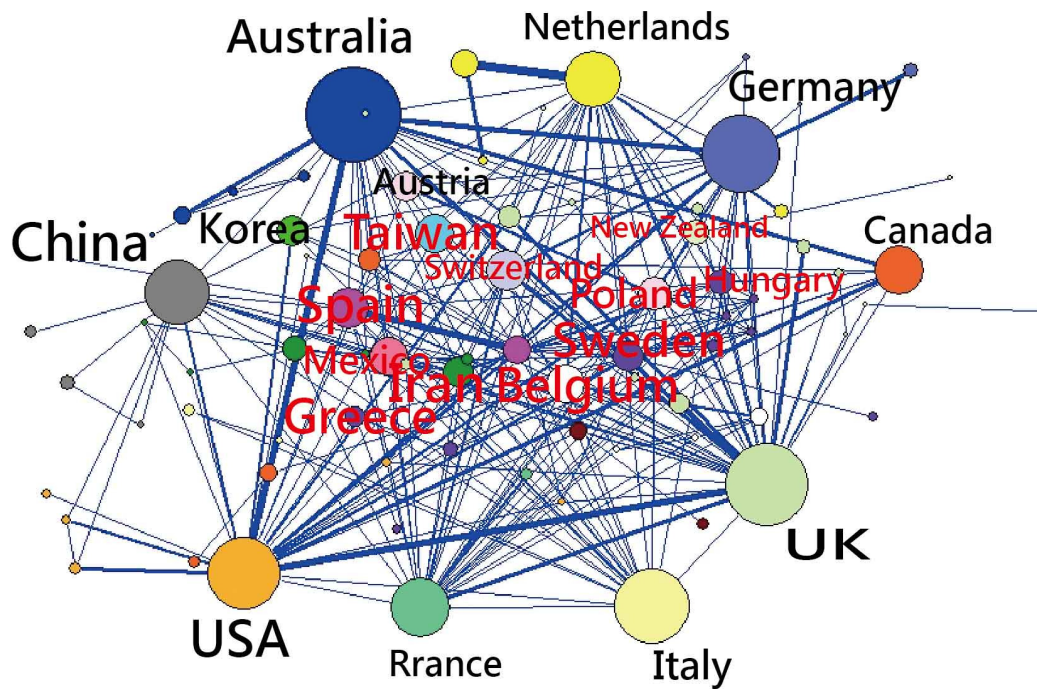
Figure 1. Author collaboration among nations (areas) for Eur J Cancer Care (Engl)
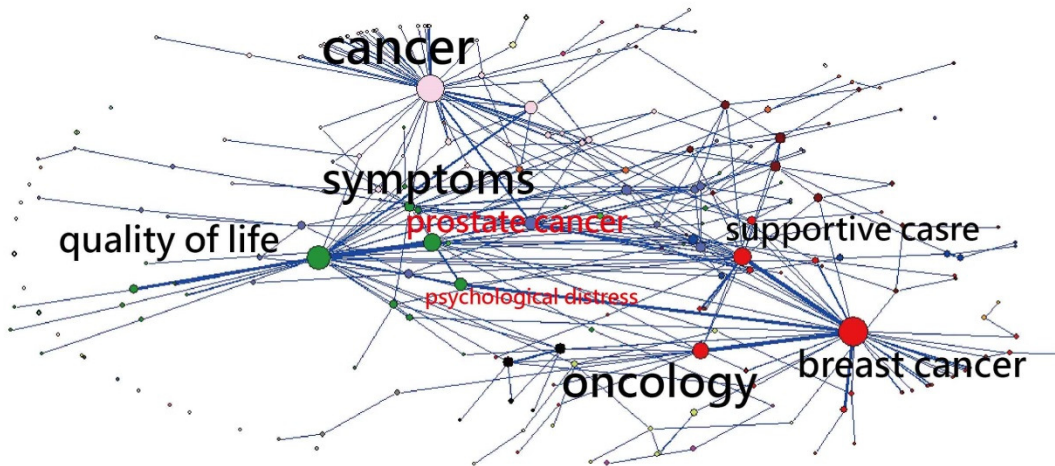

Figure 2. The Most Two Occurrences In Keyword Are Cancer And Breast Cancer

The Most Productive Authors And Their Authorships

The top 10 productive authors (including coauthors in papers) are listed as below: Sanson-Fisher, R; Chambers, S K; Carey, M; Gonzalez- Ojeda, A; Aranda, S; Arroyo-Morales, M; Benedit, P; Caballero, D; Cantos, B; Carabantes, F. Eight big clusters la-

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belled with names are represented in Figure 3.

Journals similar to EJCC

The top ten journals most similar to EJCC are listed in Figure 4, such as Support Care Cancer,

Psychooncology, J Clin Nurs, Eur J Oncol Nurs., Br J Cancer, Oncol Nurs Forum, Cancer Nurs., J Clin Oncol., Cochrane Database Syst Rev., and J Adv Nurs. We can see the similarity distance for other journals from EJCC in Vertical Axis.

Discussion

This study used SNA techniques to demonstrate that (1) the most number of papers are from nations of UK (28%) Australia (10%), and Sweden (5%); (2) The most linked Keywords are cancer and breast cancer; (3) the most productive author is R Sanson-Fisher; (4) The top ranked journals most similar to EJCC are those Support Care Cancer., Psycho- oncology, J Clin Nurs. et al..
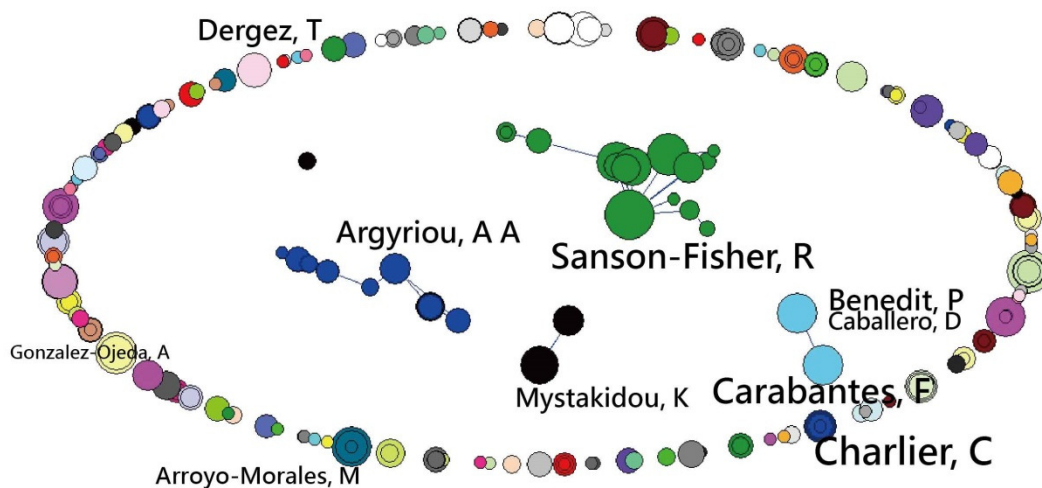

Figure 3. The most linked cluster for authors is related to R Sanson-Fisher

What This Adds to What Was Known

Many previous researches (Sadoughi, et al., 2016; Osareh, er al., 2014; Liu et al., 2005) have investigated coauthor collaboration using SNA. An apocryphal story often told to discover the co-occurrence about beer and diaper sales (Domingos, 2012; Verhoef, et al., 2016; Power, 2017). However, we have not seen any demonstrating a concrete way to show how

to conduct this exploration (or, say, how to dance on data) and to present informative messages to readership. We add a MP4 video in Additional File 1 showing how easy the SNA can display all possible pairs of our observed phenomena at a short time using the free-charged Pajek software.

Again, Rasch analysis can transform ordered category scores into interval logit scores and overcome the

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inherent weakness of classic test theory (CTT) that requires linear, interval scale data input (Chien, et al., 2016; Bond & Fox, 2007; Linacre, 2017; Wright, 1997;) for data analysis. We applied Rasch model of continuous items (Chien, et al., 2017) to compare the journals most similar to EJCC shown in Figure 4, see Additional File 3..

Journal authorship collaboration can be compared with each other, see Figure 3. We can see that five or more author-pattern was the prevailing pattern which is similar to the previous study (Sadoughi, et al., 2016). Hence the EJCC researchers have good collaboration in the subject category of psychiatry which is consistent with the previous studies that investigated scientific collaboration of Iranian Psychology and Psychiatry Researchers (Erfanmanesh, et al., 2014; Osareh, et al., 2010).
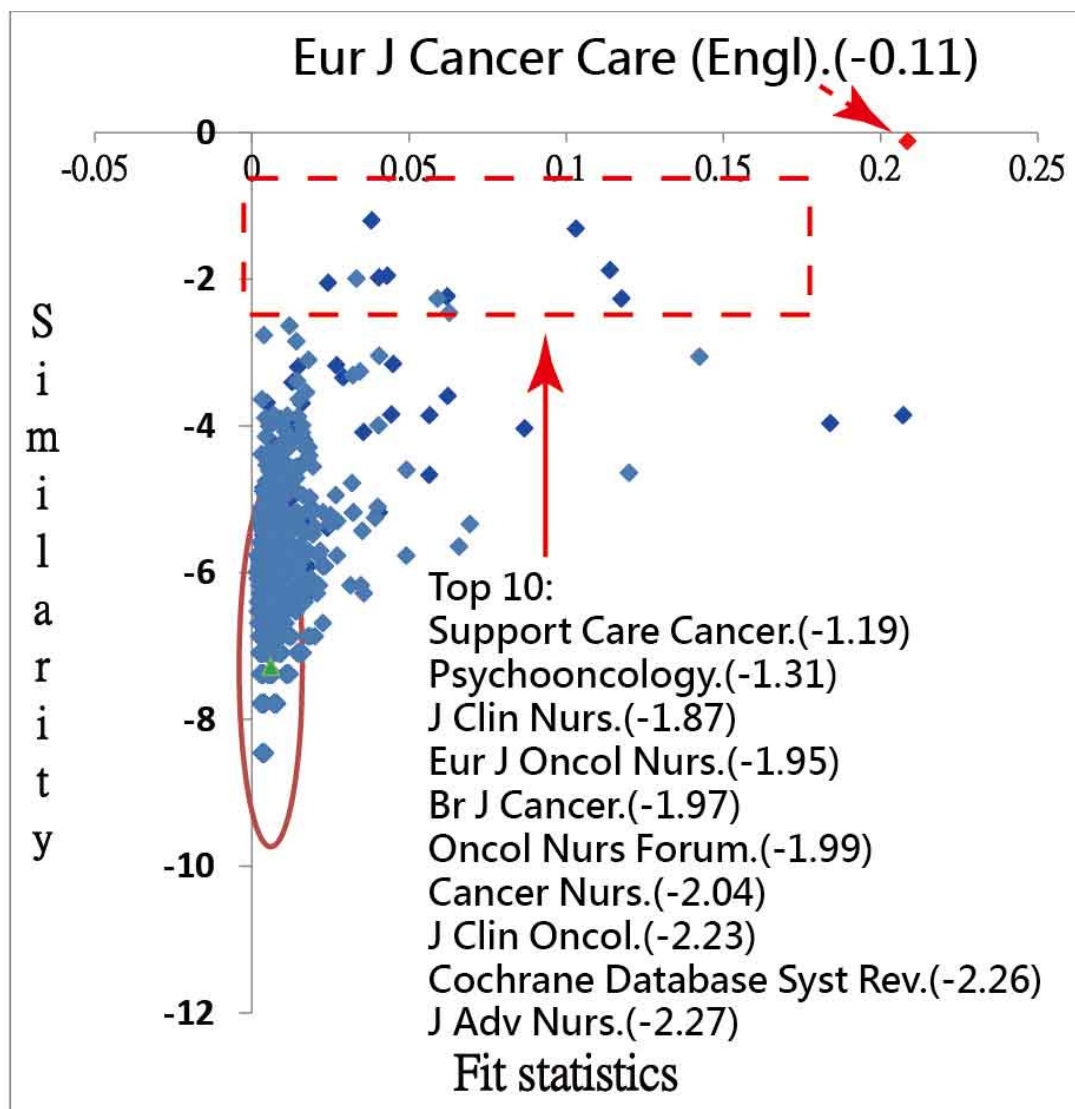

Figure 4. The Most Similar Journals To Eur J Cancer Care (Engl) Are Those Support Care Cancer Et Al.

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There are 1611 papers with the keyword terms in title abstract when searching Pubmed database in 2017 September 1. Two papers (Hu, 2017; Coelho, 2014) incorporated MeSH into social network analysis to explore interesting journal knowledge, but failed to demonstrated it with MP4 video, like we did in this study. The way we illustrated the strongest relation in all possible couples of interest is novel and promising in future, especially in the field of bibliometrics and medicine researches.

What It Implies and What Should Be Changed?

Scientific publication is one of the objective measurements to evaluate the achievements of a medical specialty or discipline (Chang, 2017). Many journals are included in the Thomson Reuters Science Citation Index (SCI). Since the advent of bibliometrics, citation analysis has been widely used in many disciplines to evaluate the influence of academic articles (Hu et, al., 2017; Coelho et, al., 2014; Baltussen et, al., 2004; Brandt et, al., 2010; O'Sullivan et, al., 2025; Kelly et, al., 2010; Kavanagh et, al., 2013; Pagni et, al., 2014; Cao et, al., 2012). It is worth using SNA to report journal features in future.

Several algorithms and measures have been developed and used with SNA to graphically explore data. If we investigate whether any author or paper most fits the research domain of a journal and its scope within the journal's keyword network, the centrality measures using SNA can be applied (Sadoughi, 2016). It means that the core subject can be analyzed using the centrality measure (Osareh et al., 2014; Liu et al., 2005) yielded in SNA.

Strengths of This Study

We applied Rasch model of continuous items (Chien, et al., 2017) to analyze the dataset (i. e., 2577 journal rows and 13 year columns) and compare the similarity of journals to EJCC, which is never seen before in literature.

Another strength and feature for this study is the MP4 video added to the manuscript for interested readers who can quickly understand the author's research approaches and processes. The nation distribution in Figure 1 is merit in easily under- standing the feature of international collaborations for the journal. Most authors of EJCC come from Europe, USA, and Australia (see Figure 1). China is increasing paper publication in EJCC (see Table 1). One picture is worth ten thousand words. We hope following studies can report more such kinds of information using SNA to readers in future.

Limitations and Future Study

The interpretation and general- ization of the conclusions of this study should be carried out with caution. 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

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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 Pajeck software we used in this study, Others such as Ucinet (Borgatti et al., 2002) and Gephi (; Bastian et al., 2009) are suggested to readers for use in future.

Conclusion

Social network analysis provides wide and deep insight into the relationships among nations, coauthor collaborations, abstract keywords, and journals most similar to EJCC The results can be offered to strategy and decision making for the target journal.

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Availability Of Data And Materials
This research results are available in tables and Additional file 1.

Authors' Contributions
TWC developed the study concept and design. TWC and YS analyzed and interpreted the data. FC monitored the process of this study and help responded to the reviewers' advices and comments. TWC drafted the manuscript, and all authors provided critical revisions for important intellectual content. The study was supervised by FC. All authors read and approved the final manuscript.

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Competing Interests
The authors declare that they have no competing interests.

Consent for Publication
Not applicable.

Ethics Approval And Consent To Participate
Not applicable because all data were downloaded from Medline.
List of Abbreviations:
EJCC: Eur J Cancer Care (Engl)
CTT:classic test theory
S. E. : standard error
SCI: Science Citation Index
SNA: social network analysis
VBA: visual basic for applications

Additional Files:
Additional file 1:Mining online author's Publication from Medline and drawing SNA using Pajek
http://www. healthup. org. tw/marketing/course/marketing/JMIR_ abstract. mp4
Additional file 2: Dataset
Additional file 3: Download Rasch model of continuous items for use
http://www. healthup. org. tw/marketing/course/marketing/JMIR_ abstract. mp4

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