Comparing the similarity and differences in MeSH terms associated with spine-specific journals using the forest plot
A bibliometric analysis

Chao-Hung Yeh, MD⁠, Tsair-Wei Chien, MBA⁠, Jui-Chung John Lin, DC⁠, Po-Hsin Chou, MD, PhD⁠,*

Abstract

Background: A common concern in the literature is the comparison of the similarities and differences between research journals, as well as the types of research they publish. At present, there are no clear methodologies that can be applied to a given article of interest. When authors use an effective and efficient method to locate journals in similar fields, they benefit greatly. By using the forest plot and major medical subject headings (MeSH terms) of Spine (Phila Pa 1976) compared to Spine J, this study: displays relatively similar journals to the target journal online and identifies the effect of the similarity odds ratio of Spine (Phila Pa 1976) compared to Spine J.

Methods: From the PubMed library, we downloaded 1000 of the most recent top 20 most similar articles related to Spine (Phila Pa 1976) and then plotted the clusters of related journals using social network analysis (SNA). The forest plot was used to compare the differences in MeSH terms for 2 journals (Spine (Phila Pa 1976) and Spine J) based on odds ratios. The heterogeneity of the data was evaluated using the Q statistic and the I² index.

Results: This study shows that: the journals related to Spine (Phila Pa 1976) can easily be presented on a dashboard via Google Maps; 8 journal clusters were identified using SNA; the 3 most frequently searched MeSH terms only show significant differences with the keyword “surgery” between Spine (Phila Pa 1976) and Spine J with homogeneity at $I^2 = 17.7\%$ ($P = .27$).

Conclusions: The SNA and forest plot provide a detailed overview of the inter-journal relationships and the target journal using MeSH terms. Based on the findings of this research, readers are provided with knowledge and concept diagrams that can be used in future submissions to related journals.

Abbreviations: CD = centrality degree, CIs = confidence intervals, RDs = research domains, MeSH = major medical subject headings, OR = odds ratios, SNA = social network analysis, VBA = visual basic for application, WCD = weighted centrality degree.

Keywords: forest plot, Google maps, MeSH terms, similar articles, SNA, social network analysis

1. Introduction

Spinal deformities are abnormalities of the formation, alignment, or shape of the vertebral column,¹,² which have existed in human bodies for thousands of years.³ There are records that mention scoliosis correction as far back as 5000 years ago.⁴ Although spinal deformity research has grown over the past few years, there is a lack of knowledge of similar articles and major medical subject headings (MeSH terms) across different spine journals.

1.1. To understand similar features between journals

A search for the keyword “spine” (or “spinal”) in scholarly journals in PubMed Central between 2020 and 2022 identified 5986 articles in 9 journals, including CLIN SPINE SURG, EUR SPINE J, J NEUROSURG-SPINE, JOINT BONE SPINE, J SPINAL CORD MED, J SPINAL DISORD TECH, SPINAL CORD (Phila Pa 1976), and SPINE J. There has been no research conducted in academics to determine whether articles published in 1 journal are similar to those published in other
1.2. Journal features explored using mesh terms

It has become popular recently for authors to conduct bibliometric analyses to identify the target journal’s features. The utility of bibliometric analyses extends beyond the field of information and library science. In addition, it requires efforts to present an assessment of the scientific literature on a given topic for a specified journal. A journal’s topics can be derived from publications that present features in medical subject headings (MeSH terms). Data of this type using MeSH terms hold great potential for generating useful knowledge for readers and the general public. The bibliographic analysis provides a novel, easy, and interesting method for summarizing a large amount of information related to publications in a target journal. There is a need to verify whether these 5 spine-related journals: The Spine Journal, European Spine Journal, Spine, Journal of Neurosurgery: Spine, and Journal of Spinal Disorders and Techniques selected by authors are truly similar in terms of their contexts, as the authors did not mention the reasons for their similarity in features. Additionally, numerous articles use keyword frequency as a method of inferring article types (or research domains [RDs]) rather than the association between keywords (or other entities), such as the centrality degree (denoted by centrality degree [CD]) in social network analysis (SNA). SNA has been used to represent article types (or RDs) using MeSH terms but no similar research has been conducted in similar journals in comparison before.

1.3. Visualizing the characteristics of journal features using coword analysis

In this age of information explosion, the ability to visualize article types and associated information for 1 particular journal (or research topic) is extremely important. Using an example based on a research discipline, it is necessary to explore their features through a series of visualizations. Therefore, we are motivated to examine the similarities and differences between spine-related inter-journal articles using MeSH terms.

Coword network analysis offers complementary views to the content analysis used in previous review studies. The manual review process in content analysis is time-consuming. With the aid of MeSH terms in PubMed that utilize MeSH terms, a controlled vocabulary of biomedical terms allows the indexing of papers and other documents to improve its search algorithm. MEDLINE experts manually indexed each article with 10 to 15 MeSH terms. The National Library of Medicine updates the MeSH dictionary every year (over 30,000 terms in 2020). The dictionary is organized hierarchically into 16 categories, including Anatomy, Diseases, Chemical Compounds, and Analytical Methods. As such, there is a possibility that the bibliometric method may be a satisfactory method for uncovering complex relationships among a large body of literature.

Bibliometric analysis is a branch of library science that involves taxonomizing literature based on certain characteristics. In recent years, the amount of academic literature has mushroomed at an unimaginable rate, making such bibliometric approaches particularly important today. Although coword network analysis has been frequently applied to bibliometrics, the presentation of coword networks is insufficient for a better understanding of their relationship within and between clusters. In this study, we attempted to employ coword network analyses (i.e., SNA interchangeable) to visualize the network structure of journals and article MeSH terms on their co-occurrences, particularly with 2 other visualizations to complement the traditional coword representations.

1.4. Study aims

Our study aims to: display the relative similarity of related journals for a given journal online displayed through visualization techniques and identify the effect of similarity odds ratios (OR) compared to similar journals using MeSH terms and the forest plot.

2. Methods

2.1. Data sources

Microsoft Excel’s Visual Basic for Applications (VBA) modules were used to extract the most similar articles (defined in PubMed using its specific algorithm) related to the Spine (Phila Pa 1976) journal with PubMed IDs (i.e., PMID) on June 20, 2020, from the PubMed database. The only articles included were those labeled journal articles. Others, such as those marked “Published Erratum, Editorials, or Conference Proceedings,” were not included. In total, 1000 PubMed IDs from recent publications were obtained (see Supplemental digital content 1, http://links.lww.com/MD/H778). The MP4 video shows a VBA routine that extracts journals related to Spine (Phila Pa 1976) through PubMed links (called similar articles). The top 20 best-match articles were retained. SNA was used to cluster journals related to a given article once or more (i.e., with repetition).

2.2. Data arrangement to fit the SNA requirement

The data were first organized in accordance with the guidelines and format defined by Pajek software [in Koeln; Pajek Man in Osoje (Ossiach, Austria)] before we visualized the results using SNA. Excel’s VBA routines were used to perform data processing to meet SNA requirements (see Supplemental digital content 1, http://links.lww.com/MD/H778, MP4 video).

According to Equation (1), the top 20 best-match articles were ranked in descending order based on the weight (Wi), where L denotes the number of similar journals (due to the targets being journals in this study), and i represents the order in which the best-match articles are ranked for an article published in Spine (Phila Pa 1976). In the SNA, each journal defined as a node earns the CD, which is calculated using Equation (2), where n (1000) indicates the sample size, and the CD for a given similar article is calculated based on the sum of the 2 similar journals (i.e., at L and g, respectively, and L-g).

\[ W_i = \frac{(L - i)}{L} \]
With the help of the journal names associated with Spine (Phila Pa 1976), a cluster analysis (or named coword network analysis or SNA) was conducted to assess the journal’s similarity. As a measure of the importance of a specific cluster, the absolute density (journal weighted centrality degrees (WCDs)/total weights) was used (namely, the largest bubble size was observed in each cluster). In contrast, the relative density represents other features separated from the target journal (in this study, Spine (Phila Pa 1976)) and existed in With the help of the journal names associated with Spine (Phila Pa 1976), a cluster analysis (or named coword network analysis or SNA) was conducted to assess the journal’s similarity. As a measure of the importance of a specific cluster, the absolute density (journal weights/total weights) was used. In contrast, the relative density represents other features of the target journal (in this study, Spine (Phila Pa 1976)) shown in other clusters.

Similar to journal features, keywords symbolized by major MeSH terms were used to classify RDs. Equation (3) has been substituted for Equation (1) in the computation of WCD. In an article, each term is given equal weight.

\[
W_{ij} = \frac{1}{L_i} \quad (3)
\]

2.3. Task 1: locating journals related to the target journal on google maps

The clusters were separated using the SNA community algorithm in Pajek software [14] and then plotted on Google Maps. The larger the bubble is, the larger the number of weighted counts in Equation (2), that is, the number of journals that are part of the cluster (or subnetwork). The wider the lines are, the stronger the relationship between the 2 nodes. In any given cluster, bubbles are filled with the same color.

To understand the characteristics of a particular article (i.e., Spine (Phila Pa 1976) in this study), MeSH terms were applied to denote article domains. Correlation coefficients were used to evaluate the frequency of MeSH terms in journals and determine the journals most similar to Spine (Phila Pa 1976).

2.4. Task 2: identifying the odds ratio in similarity compared to the counterparts using mesh terms

The forest plot [22,24,25] (often used in meta-analysis) is used to display the estimated results from numerous paired observations and events (i.e., counts in a MeSH term for a given journal) addressing the same article type and feature, as well as the overall effects or average results. The right-hand column displays a plot showing the estimated effect (e.g., OR) for each observed study (i.e., the MeSH term) with confidence intervals (CIs) included.

For a MeSH term, the area of each square is proportional to its weight, (i.e., 1/variation). On the plot, a diamond represents the overall measure of effect. The lateral edges of the diamond indicate the CIs for the overall estimate.

No effect is represented by a vertical line (e.g., OR = 1). In the event that the CIs for individual studies overlap with this line, it indicates that the effect sizes do not differ from those of the no-effect scenario at a given level of confidence (e.g., 0.05). Similarly, if all the points of the diamond touch the line of the no-effect scenario, then at a given level of confidence, the overall result does not differ from the no-effect scenario. For each of the observed studies (i.e., MeSH terms in this study), we drew the forest plot on a dashboard of Google Maps to take advantage of its zoom-in and zoom-out functions.

2.5. Task 3: creating dashboards on google maps

We used the author-made modules in Microsoft Excel and the SNA in Pajek [14] to obtain the CD of each related journal. The SNA diagrams provided insufficient information for the reader, so box plots were generated using MedCalc 9.5.0.0 for Windows (MedCalc Software, Ostend, Belgium). We also used a forest plot to verify the difference in density between the 2 spine-related journals. Hypertext Markup Language (HTML) pages were created for Google Maps. According to the study flowchart in Figure 1, all relevant information was linked to dashboards on Google Maps.

3. Results

3.1. Centrality degrees for each cluster in SNA

SNA was used to separate 10 clusters with corresponding journals with the highest WCD in its cluster (Table 1). Journal of Spine (Phila Pa 1976) ranked first, followed by J Cheminform, and Psychol Sci, suggesting that other articles have little in common with Spine (Phila Pa 1976).

3.2. Task 1: locating the journals related to the target journal on google maps

As shown in Figure 2, there are 8 clusters. We can easily identify the journals’ features based on their names. It is useful to compare the target journal’s features with those of similar journals on a graph to gain insight into its research domains, which may be different or similar depending on the use of MeSH terms.

3.3. Task 3: locating the mesh terms related to the target journal on google maps

In Figure 3, several MeSH terms have been highlighted to illustrate the most significant features of the Spine (Phila Pa 1976) journal. We can see that the most commonly used MeSH terms are surgery, diagnostic imaging, and methods. As described in the next section, the 9 other commonly used representative MeSH terms (symbolized by boxes) are used to compare article types between Spine (Phila Pa 1976) and Spine J using the forest plot. According to Table 2, only these 6 journals have higher correlation coefficients (>0.90) in terms of similarity between their MeSH terms.

3.4. Task 4: identifying the similarity odds ratio compared to similar journals

MeSH terms with the keyword “surgery” show significant differences between Spine (Phila Pa 1976) and Spine J inhomogeneity with \( I^2 = 17.7\% \) (\( P = .27 \)).

3.5. Task 5: creating dashboards on google maps

Figures 2–4 are provided with reference links.[26–28] The dashboard laid out on Google Maps provides detailed information to the readers.

4. Discussion

4.1. Principal findings

The visualization techniques were used to explore the aims and scope of Spine (Phila Pa 1976) and found that: the journals

\[
W_{CD} = \sum_{i=1}^{n} \sum_{L=1}^{L-1} \sum_{g=2}^{L} (W_L + W_g) \quad (2)
\]
related to *Spine (Phila Pa 1976)* can be easily visualized on Google Maps; using SNA, 8 journal clusters were identified; the top 3 MeSH terms are surgery, diagnostic imaging, and methods; and the odds ratios of MeSH terms showed significant differences with the keyword “surgery” between *Spine (Phila Pa 1976)* and *Spine J* in homogeneity, with $I^2 = 17.7\%$ ($P = .27$).

### 4.2. Additional information

In light of the increasing popularity of information discovery and big data recently,\[1\] we searched for the latest 1000 articles published in *Spine (Phila Pa 1976)* to gain a better understanding of the journal’s features by searching for similar journals in an identical cluster, as shown in Figure 2.

By doing so, authors can quickly identify the journal’s research domains at a glance. The MeSH terms in Figure 3 are also analyzed. The SNA diagrams are inadequate for readers (e.g., messy in terms of surrounding terms). As shown at the bottom of Figures 2 and 3, box plots complement the SNA diagrams by providing additional information to the reader.

### 4.3. Implications and changes

As shown in Table 2, only six spine-related journals are similar to *Spine (Phila Pa 1976)*. The 5 spine-related journals are: The Spine Journal, European Spine Journal, Spine, Journal of Neurosurgery: Spine, and Journal of Spinal Disorders and Techniques. Based on MeSH terms and article similarities (red fonts in Fig. 2), they are truly similar. Only *Spine J* was found to be similar to *Spine (Phila Pa 1976)* in 9 spine-related journals when searching the PubMed database with the keyword “spine” (or “spinal”) in scholarly journal names. Accordingly, we compared the similarities and differences between *Spine (Phila Pa 1976)* and *Spine J* in terms of MeSH terms, as shown in Figure 4. By observing similar articles to the articles in the search, PubMed provides a method to identify journal similarities. No articles have been found that use the scheme in bibliometrics for a better understanding of journals in similarity, as we did in this study.

A journal’s publications provide valuable insight into its features and research domains. This study relied on 3 major approaches: similar articles searched in PubMed, journals related to similar articles, and a visual representation using SNA. A visual display provides researchers with a better understanding of the target journal’s features and research domains, which has never been seen in past research reports.

Through a visual display (Figs. 2 and 3), authors can easily submit their manuscripts to the appropriate journal. This study displays all related journals on a dashboard on Google Maps via SNA and provides a breakthrough reference point for future studies on other journals of interest. Readers are invited to click on the links in the reference section,\[26–28\] Such a network yielded by a visualization technique can be defined as a co-occurrence pattern, which is a phenomenon found in previous studies.\[29–31\]

There is a novel approach to creating the forest plot that is presented in the references,\[28\] which is displayed clearly and interpreted on dashboards laid on Google Maps. Any 2-pair comparison with 2 observed events and nonevent counts can be analyzed using the online forest plot. This method has been employed in numerous meta-analyses in the literature, but few have been used in bibliometrics.\[22\]

We conducted a bibliometric analysis of articles indexed in PubMed using 1000 downloaded recent top 20 most similar articles related to *Spine (Phila Pa 1976)*. In addition to the methods and instrumentality of this study, we offer distinct conceptual tools that can assist researchers in analyzing this study with a systematic and comprehensive understanding of the research question, such as the journals most relevant to the target journal, and additional box plots are provided to complement SNA diagrams, which have not been mentioned in previous bibliometric analyses.

### 4.4. Strengths of this study

It is a highly adroit, competitive, and labor-intensive process to prepare a scientific paper for publication in a research journal.\[17\] There are 2 strengths to the study: identifying highly related journals to *Spine (Phila Pa 1976)* displayed on Google Maps

### Table 1

Clusters and their corresponding centrality degrees.

| Cluster | Journal                  | $n$  | CD       | Total CD | %   |
|---------|--------------------------|------|----------|----------|-----|
| 1       | Spine (Phila Pa 1976)    | 1612 | 6597.28  | 22,202.69| 29.71|
| 2       | J Cheminform             | 1578 | 68.69    | 2022.01  | 3.40 |
| 3       | Psychol Sci              | 5    | 8.35     | 56.76    | 14.71|
| 4       | JAMA                     | 13   | 13.20    | 19.92    | 66.29|
| 5       | J Chem Phys              | 13   | 6.44     | 17.46    | 36.89|
| 6       | J Cell Biol              | 263  | 3.63     | 16.88    | 21.48|
| 7       | J Clin Rheumatol        | 5    | 4.03     | 129.67   | 3.11 |
| 8       | Acta Psychol (Amst)      | 8    | 3.75     | 12.84    | 29.21|
| Total   |                          | 3497 | 6705.37  | 24,478.23| 27.39|

CD = centrality degree.
and utilizing forest plots to facilitate the intuitive understanding of the clusters of Spine (Phila Pa 1976) by comparing similarity odds ratios with 95% CIs with related journals. Several studies[29–31] merely presented patterns of interest on a map. As part of the interpretation of the visual displays, network density indices are also essential. Spine (Phila Pa 1976) has a density of 29.71 (222202.69/6597.28) in our study, which indicates its importance in the cluster (Table 1) but has been neglected in many bibliographical studies to provide readers with the network density.

Google Maps is sophisticated. Links are provided in the references.[25–27] By manipulating the dashboard, the reader will be able to gain a better understanding of the features of Spine (Phila Pa 1976). For more detailed information, readers may navigate to any aspect of the site. We provide readers with an easy-to-understand guide to the research process with an MP4 video,[23] which is not commonly seen in other studies.

4.5. Limitations and suggestions
The current study has made a combined effort to make a systematic and comprehensive approach to collecting and analyzing relevant articles; however, a number of limitations remain. First, when performing bibliometric and SNA techniques for statistics, the SNA software used in this study may present slightly different features from other SNA software, such as Usenet[32] and Gephi.[33] Second, when interpreting and generalizing the visual display, caution should be exercised since the data were merely extracted from PubMed, and some journals indexed in other databases were not included. Note that any generalization should be made in similar fields of article contents and inclusion conditions to Spine (Phila Pa 1976).

Third, the data were extracted from 1000 recent top 20 most closely matched articles; this is a weak explanation for how related journals evolved at earlier stages (e.g., prior to 2017). Future studies should include more data points to make more precise conclusions.

Finally, although the term “surgery” has a higher proportion of counts in favor of Spine J, the sample was chosen from a sample of the 100 most recent top-20 most similar articles on Spine in PubMed. To determine whether the difference persists with larger sample size and from other bibliometric databases, further research is necessary.

5. Conclusions
Using bibliometric and SNA methods, this study provides a detailed overview of the features of Spine (Phila Pa 1976), laying the foundation for future research. This study aims to combine SNA with the dynamics of Google Maps to present relevant features and research domains of the designated journals we are interested. Additionally, it can serve as a reference for future studies that display dynamic knowledge concept maps. Furthermore, the forest plot provides a good visual comparison. Odds ratios can be used in the future to evaluate the similarity between journals using MeSH terms. A demonstration of the study methods and results using Google Maps may inspire future studies to replicate the approaches used in this study across other research disciplines.

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Author contributions

CH developed the study concept and design. JCJ and TW analyzed and interpreted the data. TW monitored the process of this study and helped in responding to the reviewers' advice and comments. PH drafted the manuscript, and all authors provided critical revisions for important intellectual content. The study was supervised by PH. All authors read and approved the final manuscript.

Conceptualization: Chao-Hung Yeh, Po-Hsin Chou.
Data curation: Po-Hsin Chou.
Funding acquisition: Jui-Chung John Lin.
Investigation: Tsair-Wei Chien.
Resources: Jui-Chung John Lin.
Software: Tsair-Wei Chien.
Supervision: Tsair-Wei Chien.
Table 1. Comparison of odds ratios for frequencies of main MeSH terms related to Spine (Phila Pa 1976) and Spine J. MeSH = major subject headings.

| MeSH term                      | Effect 95% CI | 1.0 | n1/n2 | Z   | p   | W(%) |
|-------------------------------|---------------|-----|-------|-----|-----|------|
| surgery                       | 0.73 0.59 0.91| 936/519 -2.82 0.005 21.2 |      |      |     |      |
| diagnostic imaging            | 1.11 0.84 1.47| 936/519 0.73 0.463 12.4 |      |      |     |      |
| methods                       | 1.16 0.87 1.55| 936/519 0.98 0.325 11.7 |      |      |     |      |
| trends                        | 0.97 0.67 1.40| 936/519 -0.16 0.873 7.3 |      |      |     |      |
| adverse effects               | 0.82 0.59 1.16| 936/519 -1.12 0.262 8.5 |      |      |     |      |
| epidemiology                  | 1.09 0.76 1.55| 936/519 0.45 0.652 7.8 |      |      |     |      |
| physiology                    | 1.14 0.75 1.73| 936/519 0.59 0.554 5.6 |      |      |     |      |
| diagnosis                     | 1.22 0.73 2.02| 936/519 0.76 0.447 3.8 |      |      |     |      |
| etiology                      | 1.14 0.75 1.73| 936/519 0.59 0.554 5.6 |      |      |     |      |
| spinal fusion                 | 0.88 0.57 1.34| 936/519 0.76 0.447 3.8 |      |      |     |      |
| statistics/numerical/Data     | 0.77 0.50 1.19| 936/519 -0.61 0.544 5.4 |      |      |     |      |
| Overall                       | 0.85 0.56 1.30| 936/519 -1.20 0.231 52.9 |      |      |     |      |

Heterogeneity = CHIDIST(13.366, 11) p = 0.27 Favors: Spine J

Figure 4. Comparison of odds ratios for frequencies of main MeSH terms related to Spine (Phila Pa 1976) and Spine J. MeSH = major subject headings.

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