The Subject Structure of Randomized Controlled Trials : An Author Co-Citation Analysis

Ming-yueh Tsay

mytsay@nccu.edu.tw
Graduate Institute of Library, Information and Archival Studies, National Chengchi University, Taipei, 116 , Taiwan

Introduction

In order to understand the state of Randomized Controlled Trials (RCTs), its relationship with other subjects, and the linkage between RCT literatures, the present study employs author co-citation analysis (ACA) to examine the structure of subject relationships among RCT authors. The specific research questions are: in RCT literature, what are the relationships among authors? And what are the authors' major research areas?

Methodology

This study has adopted well-established methodology in the literature. The bibliometric data from 1990 to 2007 are retrieved from database of MEDLINE and generates 108,893 authors in total publishing RCT-related articles within 18 years. However, most of these authors published one or two papers only. Indeed, 67.2% of authors published only one paper; 17.4% published two papers, and 6.9% published three papers. This is consistent with the Lotka's law of author contribution to a certain subject area. Therefore, to serve the need of the present study, forty-one of the most productive authors who published 25 or more articles identified were included as the author sample for the study. These 41 most productive authors may be regards as the opinion leaders in the subject field. Their citation is believed to be of representative. Care has been exercised to identify and verify the allonym of author name. The selected authors were then paired. It should be noted that only co-citations of papers of which two particular authors were first authors are retrieved. This is because the cited articles listed in the SCIE include only the first authors.

Every author of all 41 authors is paired with the other 40 authors. SCIE was used to search the number of times each paired author was co-cited and the exact number was filled into each cell in the table. The diagonal is for self-paired authors. The frequency matrix table was then converted to the correlation matrix table to understand the relatedness of paired authors. McCain's technique has been employed to treat the diagonal values as missing data and calculate the author correlation accordingly.[1] These matrices were analyzed using the hierarchical agglomerative clustering to determine clusters employing CLUSTER in SPSS. Multidimensional scaling in SPSS was used to identify every author's position in the two-dimensional map. Authors' research areas were identified based on the titles and journals of their published papers, affiliations, and their professional information available on the Internet. The details of cluster analysis techniques and multidimensional scaling were presented and discussed by Andrews.[2]

Research Results and Analysis

Co-Citation Frequency Analyses

Forty-one sampled authors have formed 820 pairs/sets. The number of co-citations ranges from 0 to over 100 times. 6 sets of the total 820 sets (0.73%) are co-cited at least 100 times; around 0.5% (4 pairs) of authors are co-cited between 50 and 99

times; about 6.83% (56 sets) are co-cited 10 - 49 times; about 30.6% (251 pairs) fall into 1 – 9 range; while 61.3% (503 out of 820 sets) of the sets are not co-cited at all. This may be due to that cited articles listed in the SCIE include only the first authors. A senior scientist may very possibly be the last author instead. Combining the two least co-cited set groups together, almost 92% of the authors are co-cited less than 10 times.

Correlation Coefficient Analyses

Correlation coefficient (*r*) is used to reduce the difference between raw data to avoid outliers in addition to guide clustering analysis. The correlation coefficients of 820 paired sets rang from –0.01 to 0.28. According to the P value of correlation coefficient analysis, all 820 paired sets do not reach significance ($.01<p<.05$), suggesting that there is no significant positive or negative correlation among these authors. In other words, the disciplinary fields of 41 sample authors may be similar in some parts, but only have small overlap on the whole.

Clustering and Two-Dimensional Map Analysis

Based on the co-citation frequencies between every two of the 41 sampled authors, the author two-dimensional map and clustering is drawn (See Figure 1).The stress measure was 0.20 and the R-square was 0.93 by using SPSS. The boundary of each cluster was drawn based on the cluster analysis using CLUSTER in SPSS. In Figure1, each point stands for one sample author. The closer distance between one point and another point is, the higher similarity exists between two authors; furthermore, the closer an author is to the central point, the stronger connection exists between that author and others.

From the author two-dimensional map it can be found, since only the authors of Cluster C are significantly congregate in quadrant 2 and the rest of Cluster A, B, D cross at least two quadrants, it can be explained that the authors in Cluster C belong to similar disciplinary backgrounds and those in the other three clusters have relatively higher discrepant foci on their researches. Authors in four clusters are shown in Table 1.

Table 1 Authors in cluster A,B,C,D

cluster A
Aviles A ; Cagnacci A ; Fisher B; Laine L; Lissoni P; Palomba S; Reginster JY; Saletu B
cluster B
Belcaro G ; Boldt J ; Casati A ; Fassoulaki A ; Fujii Y ; Halperin SA ; Johnson BA ; Kovarik JM ; Koytchev R ; Mikawa K ; Naguib M ; Nakamura T ; Nishiyama T ; Pichichero ME ; Sato Y ; Sowunmi A ; Stewart WC ; Tanaka M ; Zacny JP
cluster C
Cazzola M; Ciprandi G; Lipworth BJ; Meltzer EO; Simons FE
cluster D
Davidson MH; Derosa G; Diener HC; Fogari R; Koh KK; Kostis JB; Lacourciere Y; Singh RB; Stone GW

According to the cluster analysis, the authors may be roughly divided into four groups in terms of their research areas: Oncology is the major area for authors in Cluster A. Hematology, lymphoma, antineoplastic, neoplasms, breast neoplasms, radiation oncology, chemotherapy, polycystic ovary syndrome, uterine neoplasms etc., are the subjects of their interests. Authors in Cluster B are mainly majored in anesthesiology, including cardiovascular surgical anesthetics, pain management, anesthesia for breast cancer operation, muscle anesthesia, high blood pressure and anesthesia, anesthetic psychology, etc. Another major field of authors in Cluster B is medicine, e.g. psychiatry medicine, pharmacology, neuro-pharmacology, immune-pharmacology and clinical pharmacology. The disciplinary backgrounds of the authors in Cluster C majorly belong to respiratory disease and allergic immunology. Authors in Cluster D are almost cardiovascular diseases orientation. Their research interests involve hypertension, coronary disease, high bold pressure, heart rate, cardiac arrhythmia and so forth.

Conclusions

As indicating from the results, the author co-citation of using the RCTs at the research fields among authors has great differences in effect. Or, even the authors belong to the same discipline, but their respective subjects are quite different, then low probability of co-citation appears. The field consists of several specialties around a weak centre. However, the field lacks a strong central author or group of authors whose work orients the work of others across the board.

Possible explanations would be that RCTs are not a traditional research area, per se, but a methodology used by a host of biomedical researchers. The literature that these co-cited authors produced might be the use of clinical trials to support their research rather than about the trials themselves i.e. about the design and validity of these tools.

Evidence-based research extends across all health sciences disciplines. The results of this study revealed that there is a low connection among authors who adopting RCTs to their medical research. However, four major clusters of medical area that adopt the RCT methodology related to each other closely. These four areas include oncology and cancer treatment, anesthesiology and clinical medicine, respiratory disease, and cardiovascular disease.

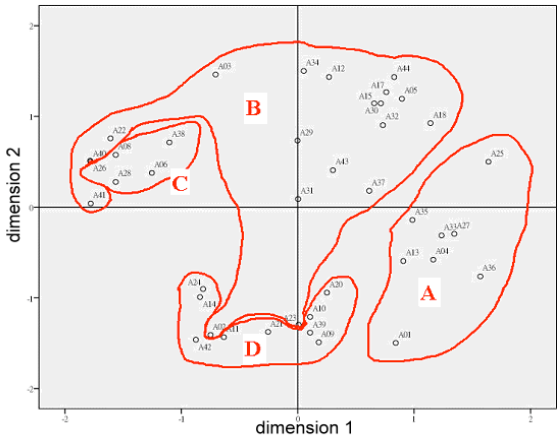

Figure 1. Author co-citation two-dimensional map

Acknowledgment

Data collected by Chiung-fang Liu, Department of Information and Library Science, Tamkang University, Taiwan is very much appreciated.

References

McCAIN, K.W. Mapping authors in intellectual space: a technical overview, *Journal of the American Society for Information Science*, 41(6) (1990) 433-443.

ANDREWS, J.E. An author co-citation analysis of medical informatics, *Journal of the Medical Library Association*, 91(1) (2003) 47-56.