Observational Study

Medicine

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# Identifying authorial roles in research

## A Kano model-based bibliometric analysis for the *Journal of Medicine (Baltimore)* 2023

Willy Chou, MD[a,b], Julie Chi Chow, MD[c,d,*]

**Abstract**

The landscape of research roles within academic journals often remains uncharted territory, with authorial contributions frequently reduced to linear hierarchies (e.g., professor and assistant professor). The Kano model, traditionally used in customer satisfaction research, offers a nuanced framework for identifying the multifaceted roles of authors in scholarly publications. This study utilizes the Kano model to dissect and categorize the roles of authors in the medicine field. To conform to the hypothesis, China is the research leader while the US is the research collaborator, as reflected in the publications of the journal of *Medicine (Baltimore)* in the year 2023. We conducted a comprehensive bibliometric analysis of all research articles published in the journal of *Medicine (Baltimore)* in 2023. The Kano model was applied to classify authors into 5 categories reflective of their research roles: followers, leaders, partners, contributors, and collaborators. Data on author publications and co-authorship networks with multi-author rates (MARs) were analyzed to assign Kano categories based on the authorship positions of first and corresponding authors. Descriptive statistics and network analysis tools were used to interpret the data, including radar plots, geographical maps, and Kano diagrams. The analysis covered 1976 articles, uncovering a complex network of author roles that extends beyond the conventional binary distinction of lead and supporting authors (i.e., leading, and following researchers). A research leader in China and a collaborator in the US were conformed to support the hypothesis, based on their publications (1148 vs 51) and MARs (12.20% vs 19.61%). The Kano classification was visually adapted to classify authors (or entities) into 5 categories. The combined choropleth and geographical network maps were illustrated to identify author roles in research briefly. The Kano model serves as an effective tool for uncovering the diverse contributions of authors in medical research. By moving beyond the lead and follower dichotomy, this study highlights the intricate ecosystem of authorial roles, emphasizing the importance of each in advancing knowledge within the field of medicine. Future application of the Kano model could foster a more collaborative and inclusive recognition of contributions across various disciplines.

**Abbreviations:** FAP = faculty appointment and promotion, FLCA = Follower-Leading Clustering Algorithm, JIF = journal impact factor, MAR = multi-author rate, US = United States.

**Keywords:** academic journals, authorial roles, bibliometric analysis, choropleth map, collaborative network map, Kano model

## 1. Introduction

An effective faculty appointment and promotion (FAP) system is essential for fostering scholars' well-being and nurturing a thriving academic environment in any institution.[1] This encompasses various aspects: students initiating research in medical schools as first authors under corresponding author guidance; assistant professors contributing with solo-authored publications; associate professors collaborating on published articles with colleagues; and full professors demonstrating extensive publication records and mentoring students in research. However, not all professors attain research leadership, and students are not uniformly classified as research followers. Hence, there's a need for more discerning delineation of research roles, recognizing exceptional contributions to academic society.

### 1.1. Faculty appointment and promotion

Amidst the rapidly evolving academic landscape, various stakeholders, including academics themselves, are questioning the relevance of traditional methods for FAP.[2] For instance, an expert panel convened to address the limitations of conventional FAP criteria and proposed alternatives like incentivizing open publishing practices, fostering responsible research conduct, and

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**Features:**

1. Kano model was utilized to identify complex author roles in medical research, challenging traditional linear hierarchies of author contributions with leading and following researchers only.
2. Bibliometric and network analysis on the journal of *Medicine (Baltimore)* in 2023 were applied to categorize author roles; highlights China and US dynamics.
3. Diverse author roles were found, confirming China as a research leader and the US as a collaborator through Kano model adaptation as reflected in the publications of the journal of *Medicine (Baltimore)* in the year 2023.

supporting research on evaluation metrics.[3] However, a global cross-sectional study analyzing FAP documents in biomedical research institutions found that "non-traditional" criteria such as open access, citation metrics, or adherence to publishing standards are rarely considered.[4] Instead, most surveyed institutions still rely on simplistic, easily quantifiable metrics like journal impact factor (JIF) or publication count to gauge research productivity.[4–6]

Several studies have systematically scrutinized FAP documents from universities in Western nations, evaluating their adoption of diverse criteria and metrics.[3,4,6,7] However, similar comprehensive examinations of the FAP system in Asian medical schools are notably lacking.[1]

### 1.2. Research gaps and questions

While the CAL score was initially suggested for use in FAP,[1] it did not incorporate citation numbers. Subsequently, the CJAL score with Yk-index[8] was examined, focusing on both 1st and corresponding authors.[9,10] The Kano model,[11] originally devised for product development and customer satisfaction analysis, categorizes product attributes based on customer perception.[12–14] The potential applicability of the Kano model to categorize author roles in the medical field warrants investigation.

Author collaborations are commonly examined in bibliometrics,[15] often employing cluster analysis[16] like thematic maps.[17,18] An issue frequently encountered in collaboration (or thematic) maps is the positioning of edges, representing connections between collaborators in the network, predominantly in quadrant III of the map on the left side the x-axis due to limited links with other network elements compared to prolific ones situated at the top of the y-axis. The multi-author rate (MAR), calculated as the number of collaborations divided by the count of publications, serves as a measure of collaboration achievement in research. Higher MARs, along with either higher or lower publication counts (or CJAL score[8]), indicate research leaders or followers respectively, positioned on the right side of the x-axis when applying the Kano model.[11] However, to date, no research has been conducted that classifies research roles based on their publications and author collaborations.

Another challenge regarding author collaborations pertains to the geographical distribution on a country basis, considering both publications and collaborations as 2 dimensions. Traditionally, only 1 dimension, either publications across countries on a choropleth map[19] or collaborations on a network map,[20,21] is considered. Integrating both choropleth and network maps into a single view presents a challenge in this study.

Another issue often neglected in bibliometric analysis is the absence of reference co-citations and keyword co-occurrences in the identified results, which reflect recent hotspots in this field, as noted in previous studies.[22–26] There is a need to develop methods for succinctly reporting this information on trends and hotspots from referenced and targeted articles, respectively.

### 1.3. Research roles in China and the US

Numerous researchers[27–30] have delved into the prevalence of certain countries in various research domains within the field of bibliometrics. While China's substantial advancements in science over the past quarter-century have been extensively documented,[26,31–33] it is noteworthy that China and the United States have emerged as each other's primary collaborators.

Recent investigations[27,30,34,35] have highlighted the rapid expansion of Chinese scientific publications overall. Adams[36] revealed that China had become the world's second-largest producer of scientific articles, trailing only the United States. Recently, the Royal Society, the UK's national science academy, issued a report based on Scopus data predicting that China would surpass the US[21] in terms of publication numbers within 2 years,[37,38] particularly in the field of *Medicine (Baltimore)*.[39–41] However, owing to the prevalence of articles in English in international journals, non-native English-speaking researchers may have a higher likelihood of collaborating with authors from the US than with those from China. Regrettably, there has yet to be any research specifically focused on classifying research roles based on publications and author collaborations in this field.

### 1.4. Study aims

In this study, the Kano model was employed to analyze and classify the roles of authors within the field of medicine. The findings will confirm the hypothesis: China emerges as the primary research leader, while the US assumes the role of research collaborator. This trend might be evident in the publications of the journal of *Medicine (Baltimore)* in the year 2023. Additionally, this research illustrated recent hotspots

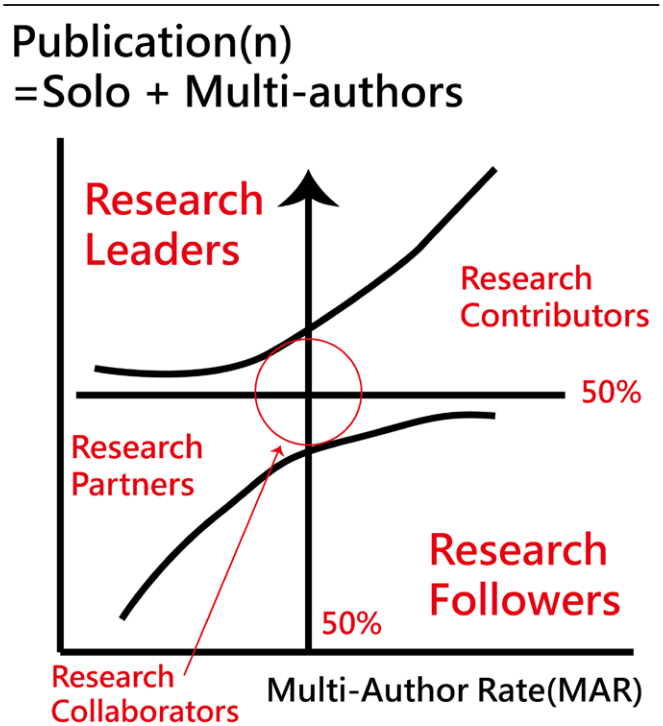


**Figure 1.** Using Kano model to identify author research roles in academics (data on axes x and y have been normalized from the central point of 0). MAR = multi-author rate.

in the field through reference co-citations and keyword co-occurrences.

## 2. Methods

### 2.1. Data sources

We conducted a search on the Web of Science core collection database to collect article metadata in the journal of *Medicine (Baltimore)* 2023, ending in July. A total of 1976 articles were analyzed. The data on reference co-citations covered the entire year of 2023 and included 3969 documents, focusing solely on original articles and reviews.

Since all data shown in Supplemental Digital Content 1 http://links.lww.com/MD/N343 were retrieved from Web of Science, ethical approval was not required for this study.

### 2.2. Using Kano model to identify research roles

The Kano model was applied to classify authors into 5 categories reflective of their research roles: followers, leaders, partners, contributors, and collaborators, as shown in Figure 1. Data on author publications and co-authorship networks with multi-author rates (MARs, calculated as the number of collaborations divided by the count of publications, serve as measures of collaboration achievement in research) were analyzed to assign Kano categories based on the authorship positions of first and corresponding authors. Data of publications and MARs on axes y and x have been normalized from the central point of zero.

### 2.3. Descriptive statistics

This section comprises 3 components for 2 scenarios (i.e., country-based collaborations as well as countries and provinces in China, and states in the US):

1. Descriptive statistics, including radar plots,[8] depicting the top 10 elements in article entities.
2. Network analyses utilizing choropleth maps,[19] geographical network maps,[20,21] and combined the last 2 maps.
3. Application of Kano diagrams[11–14] to classify research roles.

Notably, combined choropleth and geographically collaborative network maps were showcased using the layer technique on Google Maps.

### 2.4. Reference co-citations and keyword co-occurrences

Reference co-citations and keyword co-occurrences were analyzed across 3 topics using referenced articles, journals, and targeted keywords in the Web of Science, based on 3969 and 1976 articles published in *Medicine (Baltimore)*. For each of these 3 topics, 3 graphs were presented, featuring network diagrams, trend bar plots, and line charts, to illustrate their research trends and hotspots over time, as produced by CiteSpace software.[42] Inflection points and hotspots were identified based on previous studies.[43,44] Four growth patterns were categorized by analyzing growth rate and momentum on the y and x axes, respectively, using data from the last 4 time points.[45,46] References were acquired by selecting the plain text file downloaded from the Web of Science core collection or using PubMed identification codes (PMID) downloaded from the iCite website[47]; details in Supplemental Digital Content 2. http://links.lww.com/MD/N344

### 2.5. Drawing software and packages

Through the cluster analysis of author collaborations, the collaboration patterns among authors can be observed. The highest weighted centrality degree[48] in each cluster is designated as the representative of that cluster. The top 10 elements with the most publications are selected and shown on radar plots. The cluster analysis was performed using the Follower-Leading Clustering Algorithm (FLCA).[49–52] The ways to draw Kano diagrams and geographical maps can be referred to the references.[15,53] Tutorial material about how to conduct this study presents in Supplemental Digital Content 2. http://links.lww.com/MD/N344

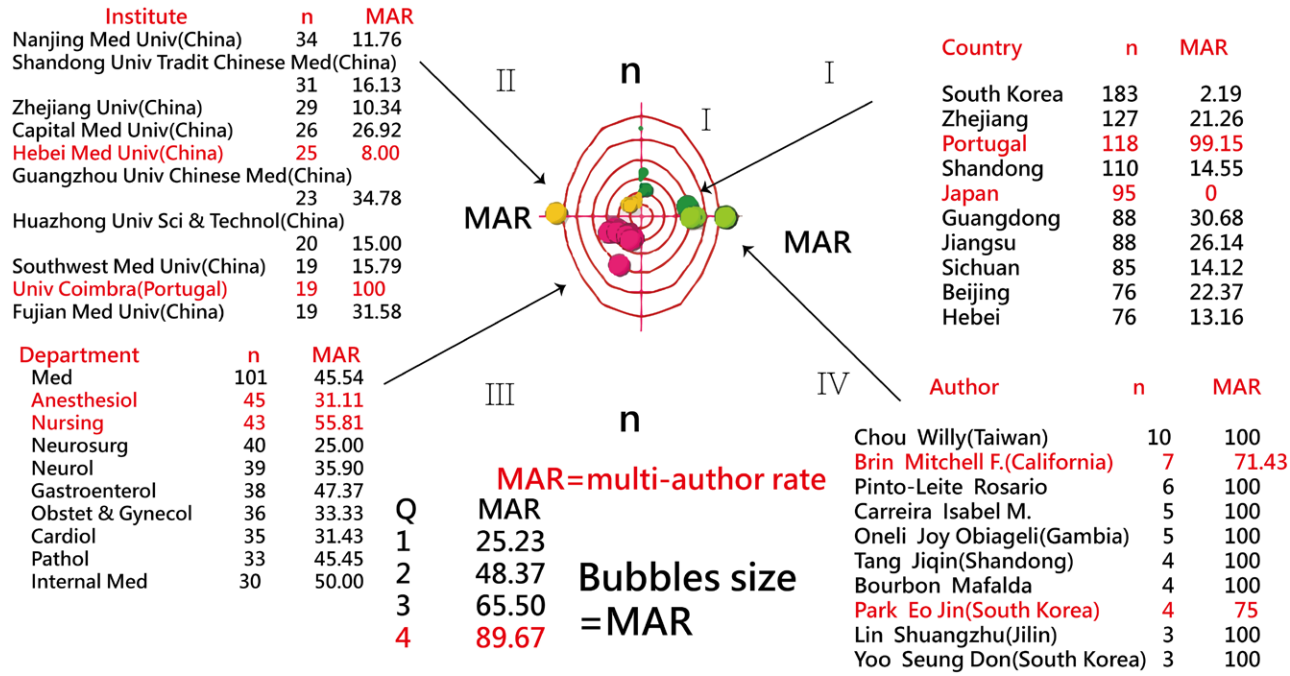


**Figure 2.** Top 10 elements in 4 entities with publications in *Medicine (Baltimore)* 2023 (note: bubbles are sized by MAR; elements from top to bottom are ranked by publication; all of those are either research leaders or research contributors based on Kano model in Fig. 1). MAR = multi-author rate.

## 3. Results

### 3.1. Scenario 1 (country-based collaborations)

Figure 2 presents the top productive countries/regions, institutes, departments, and authors in the journal of *Medicine (Baltimore)* for the year 2023. Notable entities include South Korea, Nanjing Medical University in China, Medicine, and Willy Chou from Taiwan, along with their respective multi-author rates (MARs). Currently, there is no available information regarding classified research roles.

Figure 4 presents combined choropleth (Fig. 3A) and geographical network (Fig. 3B) maps. In Figure 3A, darker colors indicate a greater number of publications. Figure 3B showcases larger bubbles representing higher MARs, with bubbles colored by clusters. Upon a quick examination of Figure 4, it is evident that no information regarding classified research roles is currently available as well.

Figure 5 illustrates the research roles classified by the Kano model. For example, South Korea is identified as a leader, Portugal as a contributor, Tibet in China as a follower (i.e., a few published articles with a higher MAR: advised by corresponding authors), and numerous others as collaborators within the central circle.

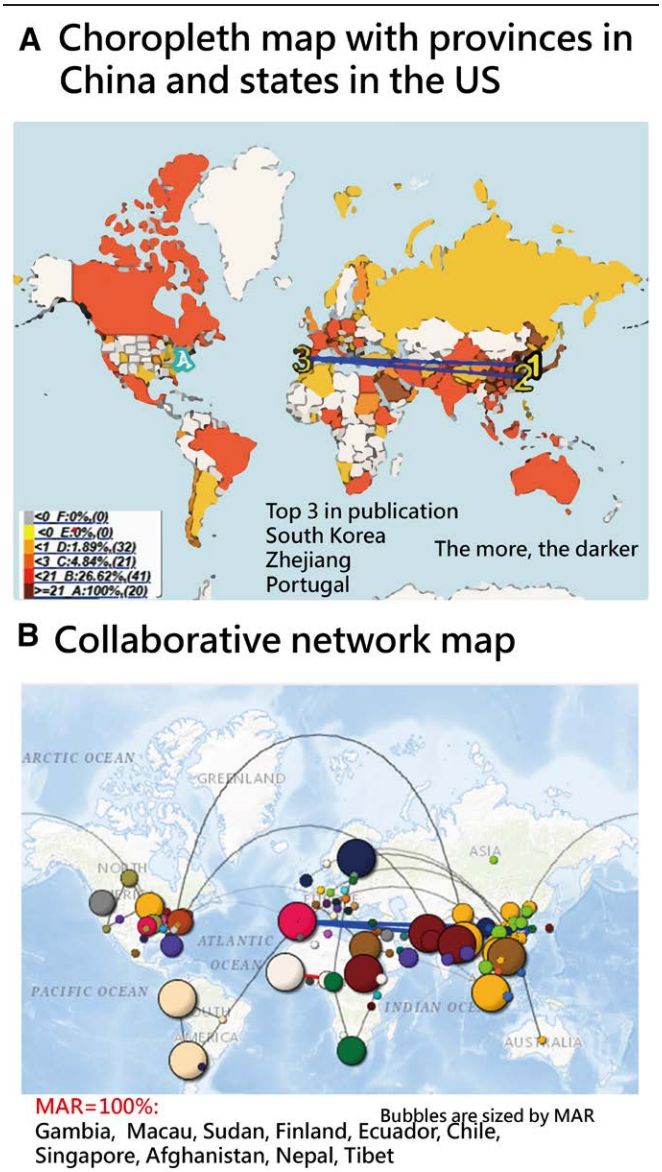


**Figure 3.** Traditional graphs with choropleth map or collaborative network map in bibliometrics. MAR = multi-author rate.

### 3.2. Scenario 2 (countries and provinces in China, and states in the US)

Figure 6 presents the top 10 productive countries in the journal of *Medicine (Baltimore)* for the year 2023, led by China and followed by South Korea and Portugal, based on first and corresponding authors only. A productive leader in China (n = 1148) and a higher MAR (=19.61%) in the US were conformed, but no information regarding classified research roles is currently available.

Like the preceding section, Figure 8 displays combined choropleth (Fig. 7A) and network (Fig. 7B) maps. In Figure 7A, darker colors signify a higher number of publications. Figure 7B exhibits larger bubbles indicating higher MARs, with bubbles color-coded by clusters. Upon a cursory review of Figure 8, it is apparent that no information regarding classified research roles is presently available.

Figure 9 illustrates the research roles classified by the Kano model. For example, China is identified as a leader, Portugal as a contributor, Finland as a follower, and numerous others as collaborators within the central circle. Obviously, a research leader in China and a collaborator in the US were conformed to support the hypothesis, based on their publications (1148 vs 51) and MARs (12.20% vs 19.61%).

### 3.3. Reference co-citations and keyword co-occurrences

Figure 10 (top) displays the top 10 references observed in *Medicine* 2023, each identified by PMIDs. Complementing this, the trend line chart (bottom of Fig. 10) serves as an adjunct to the traditional burst bar plot generated in CiteSpace software.[42] The most frequently cited reference points to the article by Shannon (2003), titled "Cytoscape: A software environment for integrated models of biomolecular interaction networks," with PMID = 14597658. Another highly cited article, "Cancer statistics" by Siegel (2022), has PMID = 21296855 and was the most cited in *Medicine* 2023. Using bibliometric tools like VOSviewer[54] and CiteSpace,[42] the top 10 references, including PMIDs 20585380 and 14724295, indicate the prevalence of such research in *Medicine*. The classification of growth trends in Figure 10 distinctly contrasts with the traditional burst spot plot in CiteSpace software.[42]

Figure 11 displays the most frequently cited journals, with *PLOS ONE* ranking first, followed by the *New England Journal of Medicine* and *Medicine* itself. The citation counts for the top 10 journals remained consistent as of March 2023, indicating that the trend line chart (bottom of Fig. 11) significantly supplements the traditional burst bar plot (middle of Fig. 11).

Figure 12 illustrates that the keyword "MANAGEMENT" surpasses others in keyword co-occurrence analysis, showing an increasing pattern alongside "ASSOCIATION" and "PREVALENCE." This highlights that the trend line chart (bottom of Fig. 12) is crucial in analyzing research trends and identifying keyword hotspots.

### 3.4. Online dashboards shown on Google Maps

Figures 2 to 9 feature dashboards. Readers interested in exploring them are invited to references.[55–64]

## 4. Discussion

### 4.1. Principal indings

The analysis encompassed 1976 articles, uncovering a nuanced array of author roles beyond the conventional binary of leaders, and supporting authors (i.e., leading, and following researchers). Validation of the hypothesis was achieved

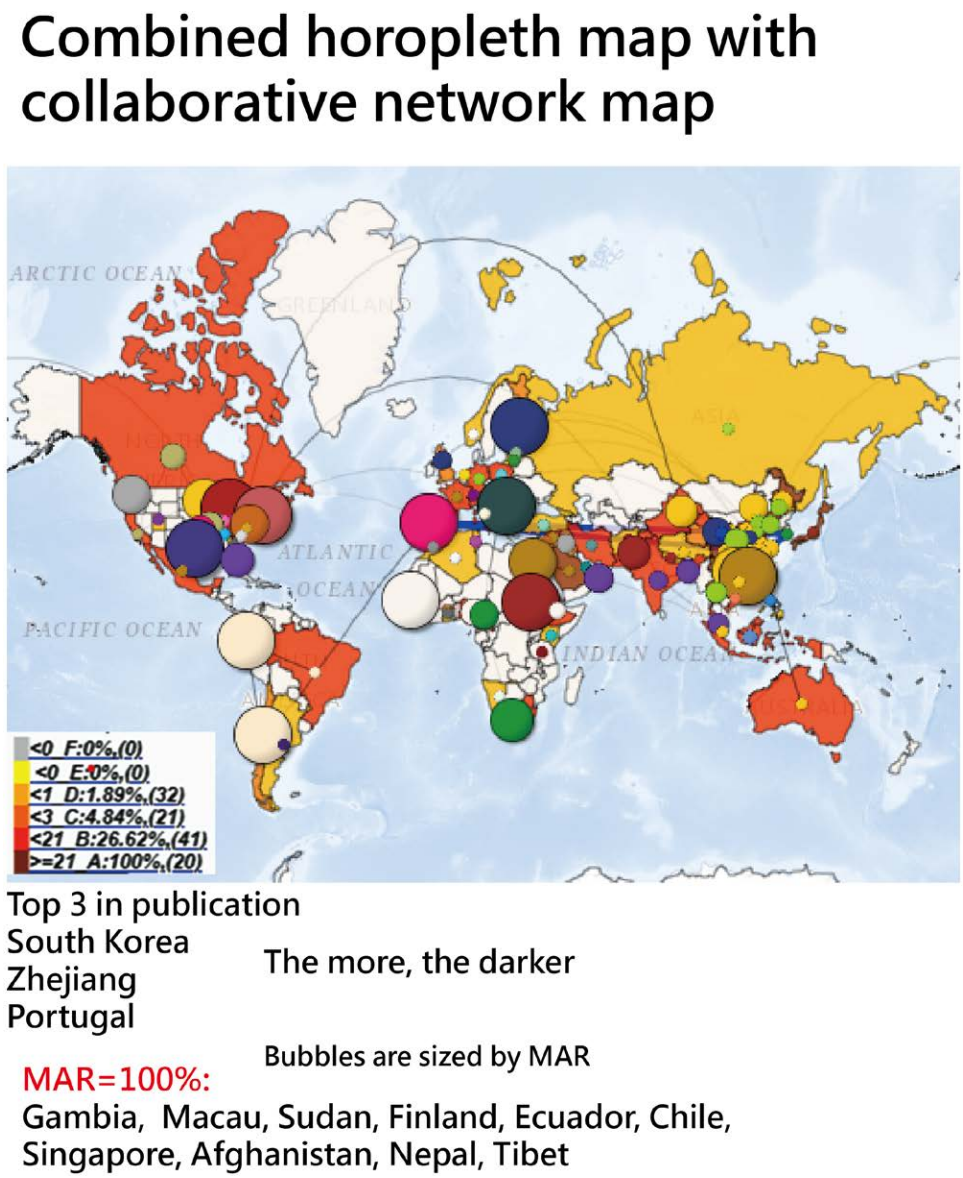


**Figure 4.** A novel way to combined both choropleth and collaborative network maps used for bibliometrics. MAR = multi-author rate.

through the identification of a research leader in China and a collaborator in the US, supported by their respective publications (1148 vs 51) and MARs (12.20% vs 19.61%). The Kano classification was visually applied to categorize authors (or entities) into 5 distinct categories. Additionally, combined choropleth and geographical network maps were utilized to swiftly discern author roles in research. Additionally, this research illustrated recent hotspots in the journal of *Medicine (Baltimore)* in 2023 through reference co-citations and keyword co-occurrences.

### *4.2. Additional information*

The present study represents the pioneering investigation into various types of classification methodologies in academic research, particularly focusing on the comparison with peers. It systematically examines the FAP as it pertains to researchers in academia. Unlike the way of conducting traditional country-based collaborations, this research evaluates the process using Kano diagrams,[11] employing a strictly quantitative approach that considers 2 dimensions: MARs and publications. These metrics could potentially be substituted with other bibliometric indicators such as h-index, g-index, a-index, x-index, ht-index, hx-index, impact factor (i.e., mean citation per article), Y-index, IPcase index,[65–75] Yk-index,[8] CJA score,[1] or CJAL score.[8]

In the current CJA system, the JIF holds significant influence as it serves as the primary criterion for assessing research quality.[1] However, the CJA score does not incorporate article citations, despite evidence showing the poor correlation between JIF and citation numbers due to skewed distribution.[1,76–78] Hence, the CJAL score is suggested as a better proxy for research classification roles.

The FAP system is crucial for supporting scholars' well-being and fostering a vibrant academic environment. It considers various aspects, including research roles such as students (research followers), assistant professors (research partners), associate professors (research collaborators), and full professors (research leaders or contributors). The Kano model[11] is employed to classify these roles based on specific journals and can be extended to other academic fields.

Author collaborations are commonly analyzed in bibliometrics,[15] often utilizing cluster analysis[16] like thematic maps.[17,18] Challenges such as the positioning of edges in collaboration maps predominantly in quadrant III due to limited links are addressed. The MAR serves as a unique measure of collaboration

achievement, with higher MARs indicating research collaborators or contributors and lower MARs indicating followers. Geographical distribution challenges are overcome using layer techniques on Google Maps, integrating both choropleth and geographical network maps into a single view, as shown in Figures 4 and 8.

Due to the scarcity of bibliometric analyses that incorporate reference co-citations and keyword co-occurrences, we have specifically highlighted these aspects through visualizations in Figures 10 to 12, offering a unique and innovative approach. For details on how these diagrams were created, readers are referred to Supplemental Digital Content 2. http://links.lww.com/MD/N344 The trend line chart serves as an effective complement to the traditional burst spot plot generated by CiteSpace software.[42] Inflection points and hotspots were determined based on prior studies.[43,44] Additionally, the classification of 4 growth patterns based on the last 4 time points[45,46] is both unique and practical, offering valuable insights for future bibliometric research.

### 4.3. Implications and possible changes

The detailed examination of research roles classified by using Kano diagrams presented in this paper leads to several key insights and potential areas for further exploration:

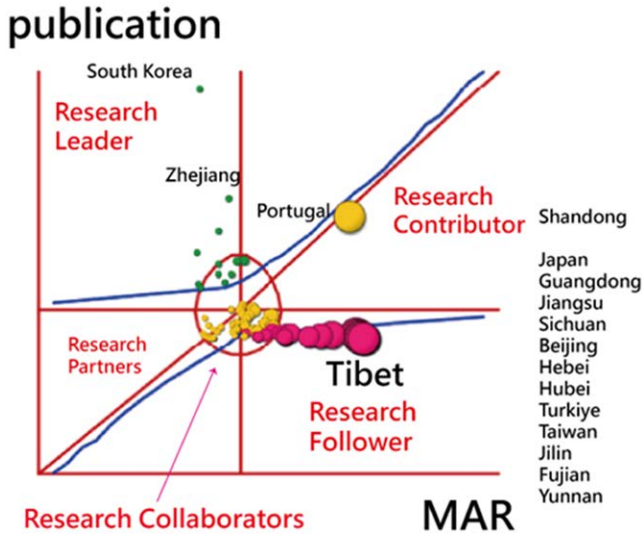


**Figure 5.** Using Kano model to identify author research roles in academics. MAR = multi-author rate.

#### 4.3.1. Relevance of traditional FAP criteria.

The manuscript points out that traditional methods for FAP are being questioned in the evolving academic landscape. Stakeholders, including academics themselves, advocate for alternatives such as incentivizing open publishing practices and supporting research on evaluation metrics.[1] However, a global study reveals that most institutions still rely on simplistic metrics like JIF or publication count. This suggests a potential need for institutions to reconsider the relevance of traditional FAP criteria and adapt to the changing demands of academia.

#### 4.3.2. Addressing research gaps.

The study highlights research gaps, particularly in the evaluation of FAP systems in Asian medical schools and the need for more discerning delineation of research roles. While the CAL score and subsequent CJAL score with Yk-index[8] have been examined, the potential applicability of the Kano model[11] to categorize author roles in the medical field is emphasized (i.e., those scores on axis y of the Kano diagrams). This underscores the importance of addressing these gaps through comprehensive examinations and innovative methodologies to ensure fair and effective evaluation of researchers' contributions.

#### 4.3.3. Utilization of advanced metrics and methodologies.

This study advocates for the utilization of advanced metrics and methodologies in FAP evaluation, beyond simplistic metrics like JIF or publication count. It suggests considering metrics such as the MAR and employing techniques like the Kano model[11] for classification of research roles. Additionally, challenges in analyzing author collaborations, such as geographical distribution, are addressed through innovative techniques like layer techniques on Google Maps. This highlights the importance of adopting more nuanced and comprehensive approaches to FAP evaluation to accurately assess researchers' contributions and foster a vibrant academic environment.

Additionally, we showcased reference co-citations and keyword co-occurrences using visualizations. Unlike other researchers who rely on professional bibliometric software such as CiteSpace[42] and VOSviewer,[54] we provided R code[79] as an alternative method for creating visuals in bibliometric analysis.

### 4.4. Limitations and suggestions

The applicability of the study's findings is limited by its focus on the research roles of classification for article entities in the journal of *Medicine (Baltimore)*. Future studies should examine the use of collaborative maps and Kano diagrams across various disciplines to ensure broader applicability.

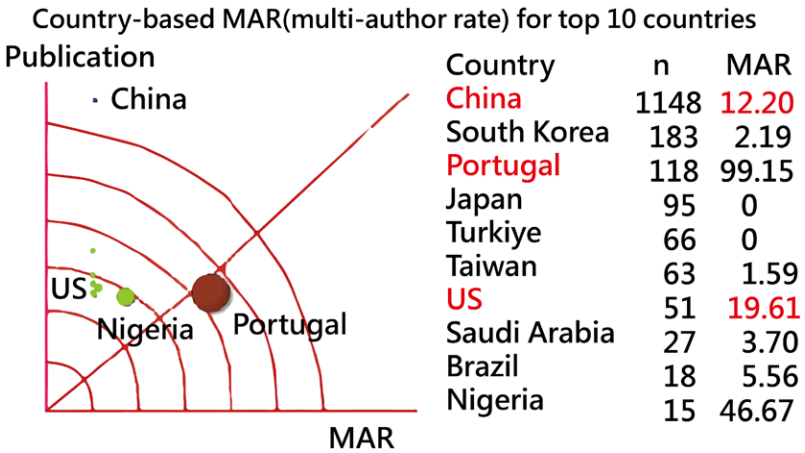


**Figure 6.** Country-based MAR for top 10 countries in *Medicine (Baltimore)* 2023 (note: bubbles are sized by MAR; Portugal is a research follower, China and the US are research leaders, but the US contributed more than China in research contribution). MAR = multi-author rate.

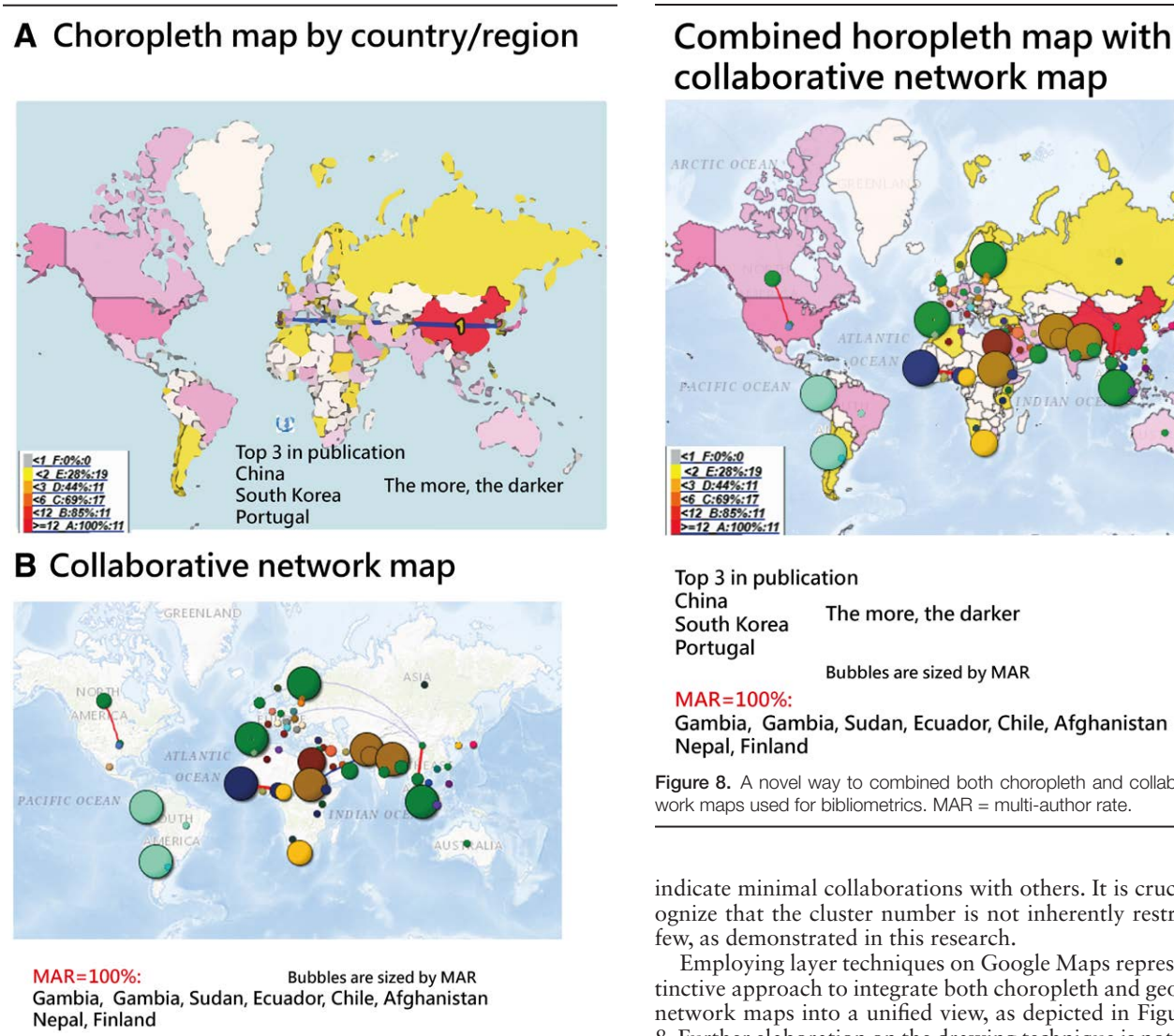


**Figure 7.** Traditional graphs with choropleth map or collaborative network map in bibliometrics. MAR = multi-author rate.




**Figure 8.** A novel way to combined both choropleth and collaborative network maps used for bibliometrics. MAR = multi-author rate.

The analysis encompassed 1976 articles from 2023 in *Medicine (Baltimore)*, a smaller sample compared to the initially expected 3969 articles. This reduction occurred because the data was downloaded as of August 20, 2023, thus limiting the scope of the results to only a portion of the year. Therefore, caution must be exercised when generalizing the findings to the entire year of 2023. Despite this, the methods used in this study to visualize data could be emulated in the future.

Figures 2 to 9 showcase dashboards on Google Maps. Utilizing the Google Maps application programming interface necessitates a paid project key for the Google Cloud Platform, rendering these installations not free of charge. One limitation of these dashboards is their lack of public accessibility, making it challenging for other researchers to replicate them promptly.

Enhancing the clarity of Kano diagrams necessitates additional visual cues such as color-coding for clusters, adjusting bubble sizes based on MARs, and marking collaborative efforts along the horizontal axis. These enhancements, not detailed within this study's context, are vital for a deeper understanding of Kano diagrams.

While this study primarily focused on clustering countries using FLCA,[49–52] it is notable that only the larger bubbles with color codes are clearly identifiable, as numerous tiny bubbles indicate minimal collaborations with others. It is crucial to recognize that the cluster number is not inherently restricted to a few, as demonstrated in this research.

Employing layer techniques on Google Maps represents a distinctive approach to integrate both choropleth and geographical network maps into a unified view, as depicted in Figures 4 and 8. Further elaboration on the drawing technique is not provided, as the method involves a straightforward overlay of the 2 layers on Google Maps.

This research introduces the use of Kano model[11,12] applied to classify the research roles as tools for visual analysis, suggesting the potential value of investigating other graphical methods to further enhance the evaluation and classification of individual research achievements.

In addition to MARs on Kano diagrams, another metric reflecting the publication count is utilized. Various alternative metrics could be considered in the future, including h-index, g-index, a-index, x-index, ht-index, hx-index, impact factor (i.e., mean citation per article), Y-index, IPcase index,[65–75] Yk-index,[8] CJA score,[1] or CJAL score.[8]

Although some bibliometric studies have explored reference co-citations and keyword co-occurrences, the evaluation of authors' research achievements should not be confined merely to ranking them. More effort should be directed toward classifying research roles in future studies.

## 5. Conclusion

This study underscores the need for nuanced evaluation criteria in FAP systems, especially in medical fields. Employing innovative methodologies like the Kano model and FLCA for author role classification and country-based collaboration analysis reveals significant insights. Challenges such as limited


| Country | n | MAR(%) |
|---|---|---|
| China | 148 | 12.20 |
| South Korea | 183 | 2.19 |
| Portugal | 118 | 99.15 |
| Japan | 95 | 0.00 |
| Turkiye | 66 | 0.00 |
| Taiwan | 63 | 1.59 |
| US | 51 | 19.61 |
| Saudi Arabia | 27 | 3.70 |
| Brazil | 18 | 5.56 |
| Nigeria | 15 | 46.67 |
| Germany | 12 | 8.33 |
| India | 12 | 33.33 |
| Canada | 11 | 45.45 |
| Thailand | 11 | 36.36 |
| Malaysia | 11 | 36.36 |
| Spain | 9 | 11.11 |
| Pakistan | 7 | 57.14 |
| Romania | 7 | 0.00 |
| Ethiopia | 7 | 28.57 |
| Iran | 6 | 0.00 |

**Figure 9.** Using Kano model to identify author research roles in academics (note: The US has a higher MAR than China on the research role of collaborations). MAR = multi-author rate.

accessibility of Google Maps dashboards and the complexity of integrating multiple metrics highlight areas for improvement.

Overall, this study underscores the necessity of modernizing academic evaluation practices to precisely evaluate research contributions more and to foster a collaborative atmosphere that enhances scholarly development further. Hence, we suggest that it is time for a thorough overhaul: developing a FAP system that acknowledges the real impact of research papers and the genuine accomplishments of academics in medicine and other fields.

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## Author contributions

**Conceptualization:** Willy Chou.
**Data curation:** Willy Chou.
**Investigation:** Julie Chi Chow.

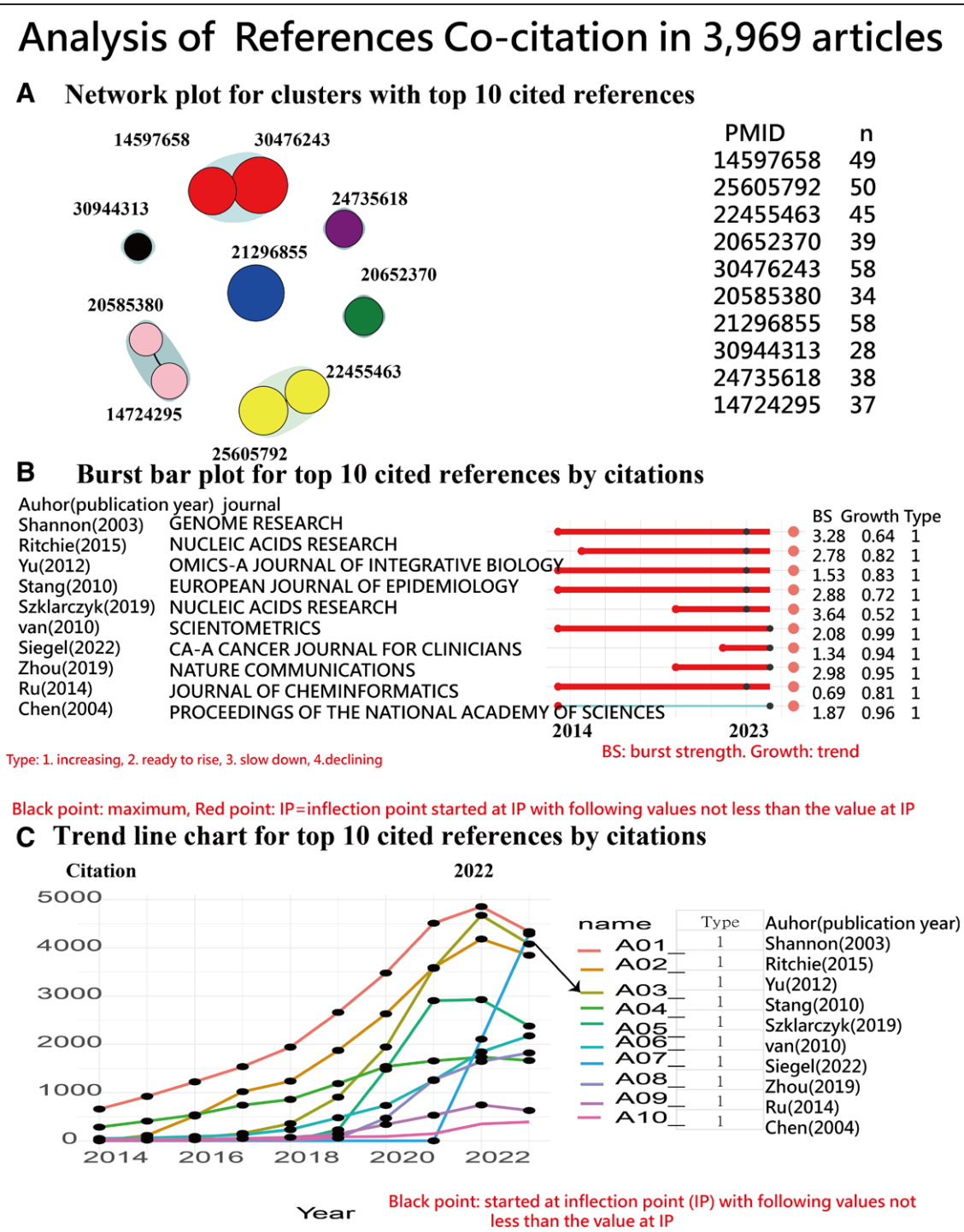


**Figure 10.** Recent hotspots of references cited by articles in the journal of *Medicine (Baltimore)* in 2023 using network plots, bust bars, and trend line charts. IP = inflection point, PMID = PubMed identification codes.

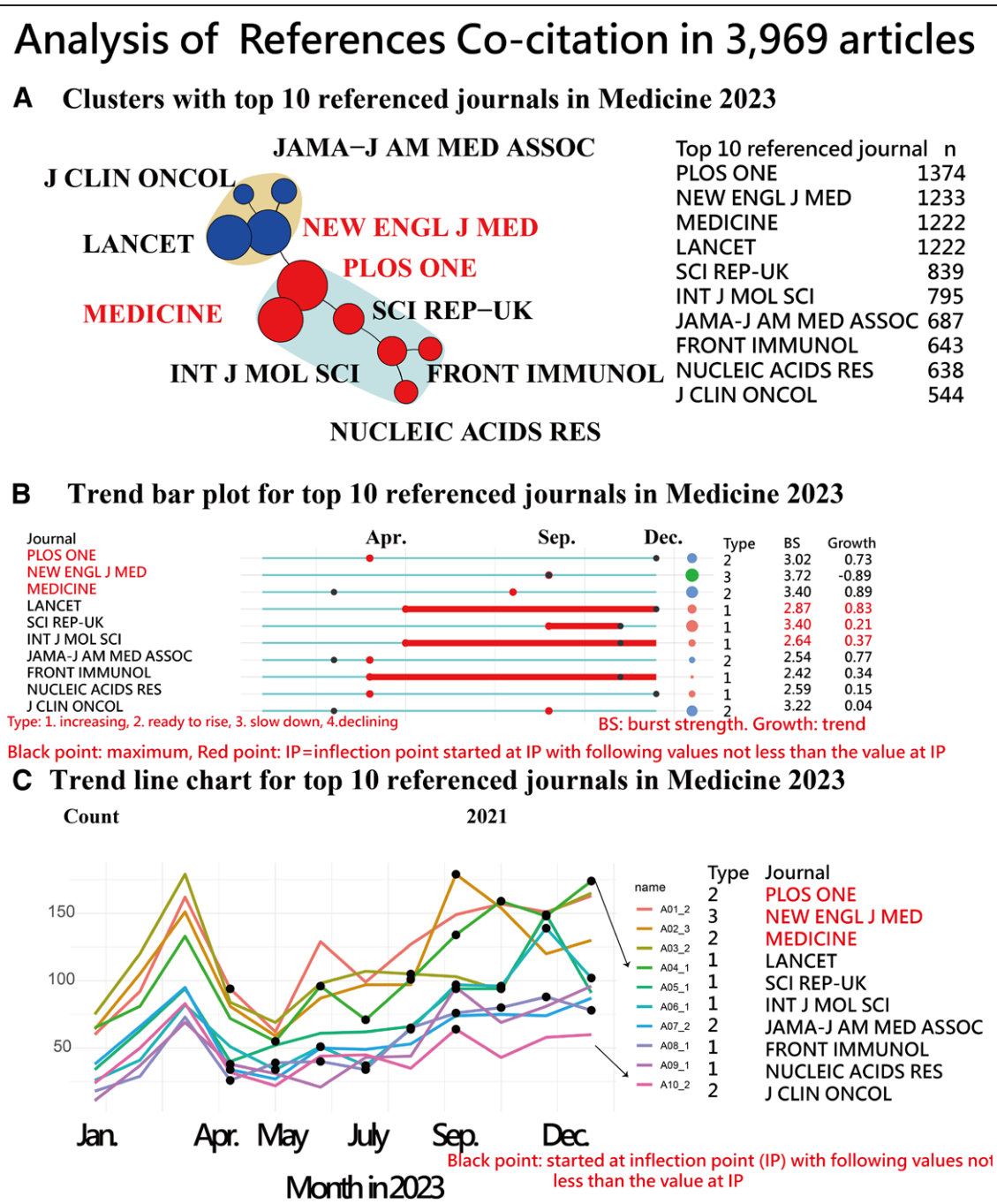


**Figure 11.** Recent hotspots of references cited by journals with articles in the journal of *Medicine (Baltimore)* in 2023 using network plots, bust bars, and trend line charts. BS = burst strength, IP = inflection point.

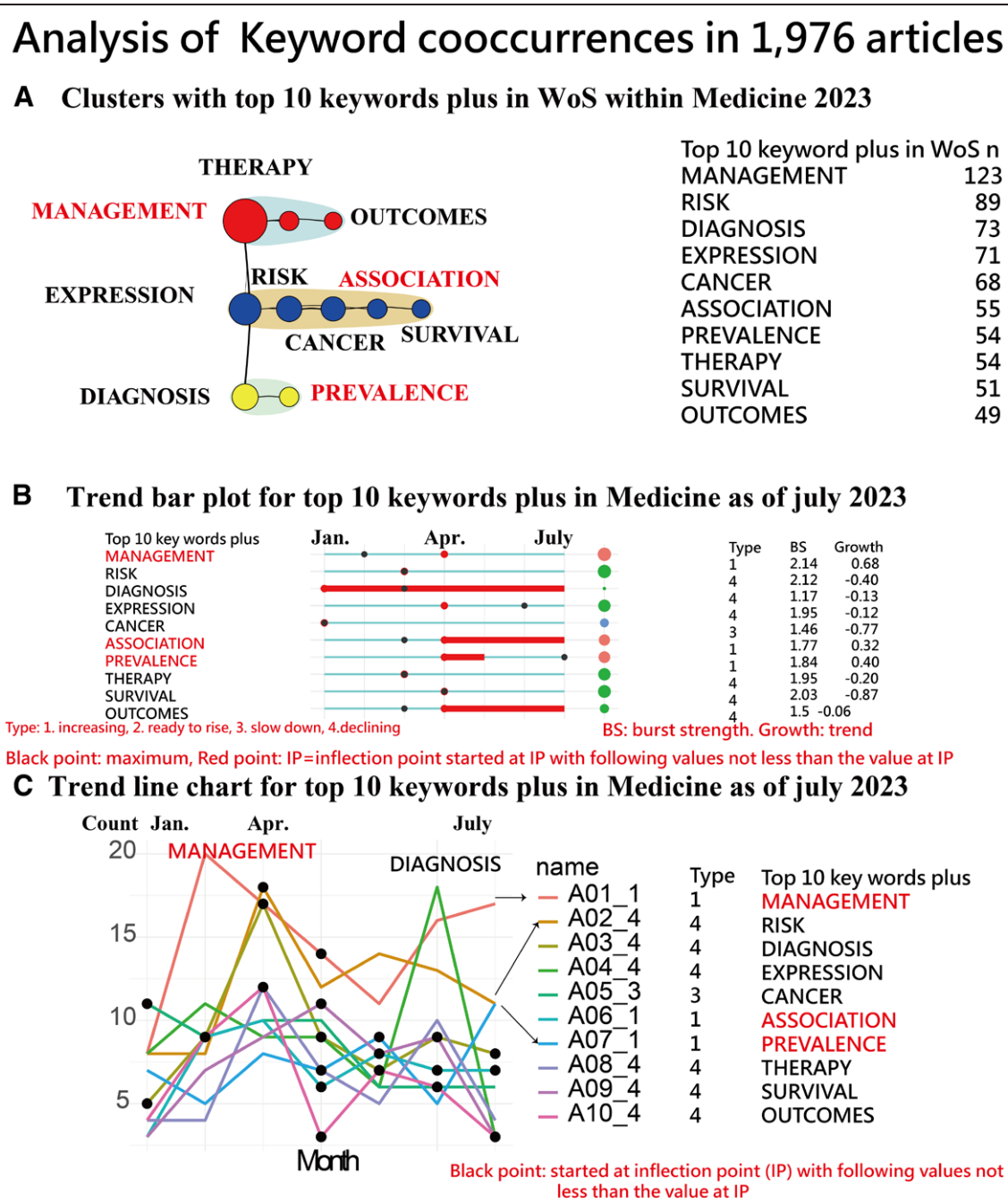


**Figure 12.** Recent hotspots of keywords indexed in articles published in the journal of *Medicine (Baltimore)* in 2023 using network plots, bust bars, and trend line charts. BS = burst strength, IP = inflection point.

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