Research Paper

University of Birjand

Applied Linguistics Inquiry

Fall 2023, Vol. 1, No. 2, pp. 74-92

Applied Linguistics Inquiry

https://doi.org/10.22077/ali.2023.7268.1029

112 Years of Medical English: A Scientometric Analysis

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ARTICLE HISTORY

Received: 14 May 2023
Revised: 09 July 2023
Accepted: 10 August 2023
Published: 30 September 2023

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ABSTRACT

This study addresses the science mapping and visualization of the 112 years of academic literature on medical English. The data for the present study was retrieved from the Web of Science database, which contains all English-only articles from 1912 to 2024. The scientometric techniques and analysis were done using VOSviewer. These methods of analysis include publication and citation patterns, co-authorship and co-occurrence networks, and bibliometric coupling of items. The findings indicated that the total number of articles published in Medical English from 1912 to 2024 was 10396. The publications surged from 1988 to 1992 and had a steady rise until its peak in 2023. Citations, however, differ from publication trends and have fluctuated during this time frame. Furthermore, authors, institutions, and the country's collaborative networks were examined to have a snapshot of the relationships across disciplines. The findings revealed a strong correlation between co-authorship and bibliometric coupling of countries, which shows that the USA, the UK, Australia, and Canada collaborate the most within the literature. Universities of San Francisco, Toronto, and Washington are considered among the leading research institutions in terms of output, while universities such as San Francisco, Harvard University, and Toronto rank among the top in terms of citations. Moving to author-level metrics, the output and citation patterns indicate that De Lusignan and Schillinger are the most prolific authors. At the same time, Shimada, Yoshida, and Grumbach have the most citations. Moreover, keyword co-occurrences showed that keywords such as "care," "impact," "healthcare," "health," and "quality" tended to appear most frequently in the literature.

KEYWORDS: Medical English; Scientometric analysis; English for specific purposes (ESP); Bibliometric review; Science mapping

1. Introduction

According to Hutchinson and Waters (1987), English for Specific Purposes (ESP) emerged in the late 1960s. They state three main developments underlying the emergence of ESP: "the demands of a Brave New World," "a revolution in linguistics," and "focus on the learner." Specifically, after World War II, there was significant worldwide expansion in science, technology, and economics led by the United States, which created a need for many people to learn English not for leisure but to meet practical needs. The second factor, as they put it, was a shift in linguistics from studying language usage and grammar to studying actual language use in communication, which raised awareness of differences in the English needed for different fields. Finally,

Cite this article: Hekmati, N., & Behdani, A. (2023). 112 years of Medical English: A scientometric analysis. *Applied Linguistics Inquiry*, *1*(2), 74-92. doi: 10.22077/ali.2023.7268.1029

changes in educational psychology led to a shift from teacher-centered to learner-centered approaches focusing more on students' needs and interests (Hutchinson & Waters, 1987).

The emergence of ESP was based on recognizing that language learners have varying needs, and identifying them carefully should underpin the design of any syllabi or materials. Paltridge and Starfield (2013) state that analyzing students' language needs lies at the core of ESP. Therefore, many researchers have underlined the crucial role of needs analysis in developing ESP courses, including Bachman and Palmer (1996), Dudley-Evans and St John (1998), Hyland (2006), Long (2005), and Richards (2001).

Initially, ESP focused mainly on technology and business (Benesch, 2001). However, its scope has expanded over time to cover other areas like English for occupational, academic, vocational, business, legal, sociocultural, and medical purposes (Belcher, 2009). Discussing English for Medical Purposes (EMP), Salager-Meyer (2014) traces its origins to 1983 when cross-pollination between ESP and health sciences was first evidenced at a conference which led to the launch of the first EMP publication, the "EMP Newsletter" journal.

While proficiency in English as the international language is vital across scientific and technical fields, it is especially imperative for students pursuing medical sciences. This is not only due to the predominance of English-language publications but also the rapid advances and frequent updates in medical knowledge. Medical students must continually access the latest sources to ensure they will become effective practitioners. Thus, understanding English is crucial for keeping up with the swift pace of change in the field and applying cutting-edge information to enhance patient care.

Given the importance of medical English, education scholars have endeavored over the past century to advance understanding of this research area. Conducting a bibliometric analysis of these works would provide valuable meta-level perspectives into publication trends, influence dynamics, and other dimensions within this substantial body of literature. Examining factors such as production volume, citation counts, co-authorship networks, institutional flows, geographic dispersion, topical evolution, and more offers crucial insights. Similarly, highlighting the role of particular nations, journals, and authors spotlights pivotal framing hubs. Additionally, tracing bilateral citations can uncover underappreciated contributions linking different language-teaching communities. Gaining such comprehension of the epistemic landscape around medical English assists researchers, experts, and reformers in positioning their efforts for optimal impact. The significance of this bibliometric study on medical English is compounded by the need for prior inquiries directly examining this specific domain.

Therefore, the present study aimed to thoroughly review and synthesize the vast scholarly works focused on medical English published over 112 years. This study aimed to provide enhanced clarity surrounding the evolutionary trajectory that has defined research developments within this domain across the twentieth and early twenty-first centuries by comprehensively examining this extensive body of literature. In particular, detailed analysis targeted elucidation of underlying patterns, trends, and shifts in the foci and methodological orientations of inquiry over time to reveal a coherent portrait of how the investigation into medical English has progressed. Mapping the complex publication topography further highlighted remaining gaps and unresolved issues, meriting additional research attention.

2. Methodology

This study utilized a keyword search in the “Topic” domain of the Web of Science (WoS) core collection. The term was “Medical English,” the results were then filtered to English-only articles. This method returned 10,395 documents. The descriptive statistics tools available in WoS showed that within these documents, there are metadata for 43,102 authors, 8,787 affiliations, 3,206 sources, 872 publishers, 130 research areas, 156 countries, 207 WoS categories, and 4,444 funding agencies. The period these datasets were a part of covered an astounding interval of 112 years from 1912 until January 2, 2024. The bibliographic data was then analyzed using bibliometric tools. VOSviewer (Eck & Waltman, 2010) was utilized to conduct co-authorship, bibliometric coupling, and co-occurrence network visualizations. Tackling these visualizations can provide further insight into the collaboration patterns between authors, the relationship between keywords, and the structure of medical English as a research field.

Moreover, network visualizations of VOSviewer present a handful of information for us to analyze, such as clusters and prominent nodes that represent the main topics, collaborations, and impactful publications, overlay visualizations, and density maps, which are a part of analyzing the data based on frequency and time. These features are addressed in the result and discussion section. Figure 1 shows a thorough visualization of the methodology.

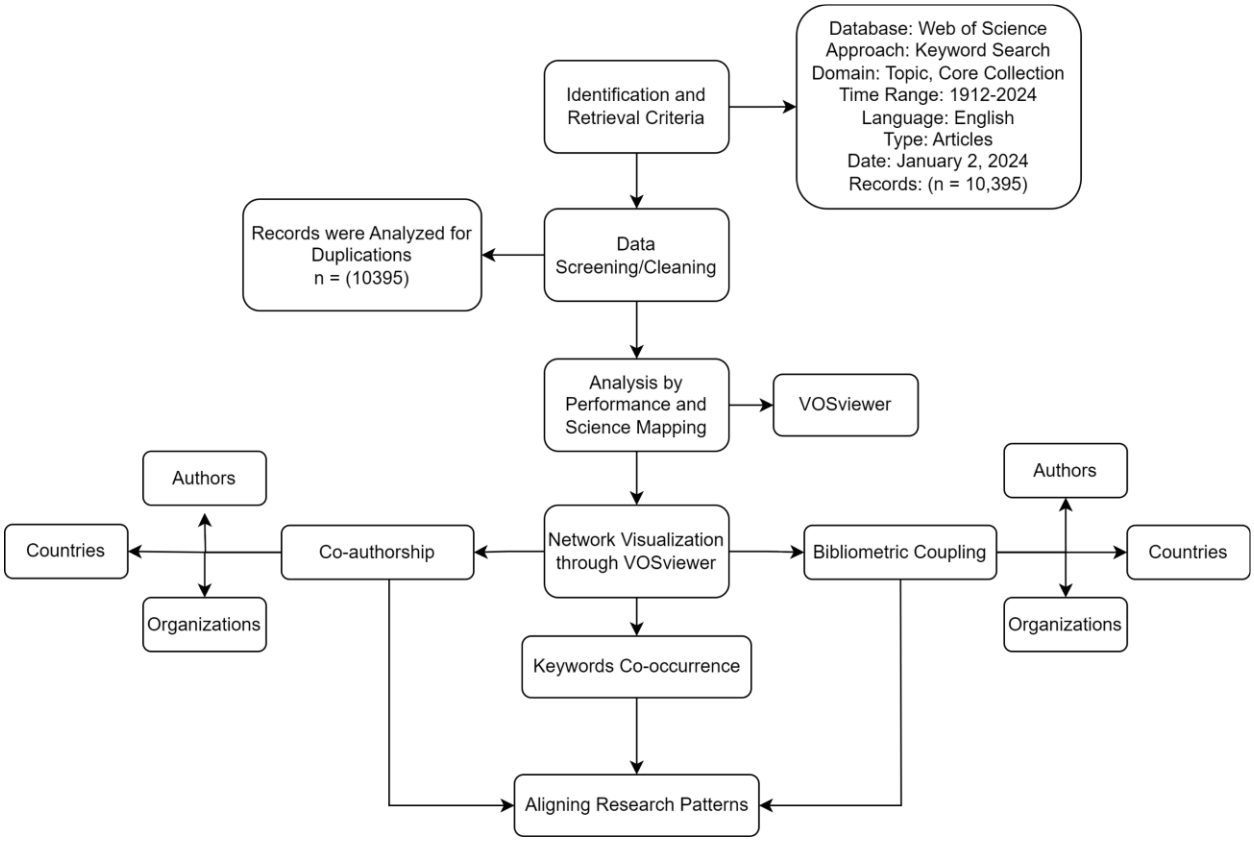

Figure 1. Data selection process and methodology review

2.1. Scientometric terminologies

Scientometric techniques differ from one study to another. Some tend to analyze data themselves, whereas others utilize applications. However, the benefit of applications surpasses those doing the analysis themselves. VOSviewer is one of those applications with a handful of measurement and analysis techniques delving deep into the dataset. Another benefit of using VOSviewer is the eye-catching visualization that comes with the analysis. The measurement techniques brought to bibliometric and scientometric analysts include co-authorship, co-occurrence, bibliometric coupling, references, citation patterns, and co-citation patterns across the dataset. Each technique can be used on a specific group, e.g., countries, authors, organizations, etc.

This study utilized three measurement techniques for all groups: co-authorship, co-occurrence, and bibliometric coupling. Along these approaches, there are other methods, which we will discuss later in the section. To comprehensively analyze the visualization data, we briefly explain the terms to avoid confusion.

Co-authorship refers to two or more groups (countries/authors/organizations) writing a document within the literature together (Ullah et al., 2022). For example, the co-authorship of the United States is an "N" number, which means the United States has had "N" documents co-authored in the literature.

Co-occurrence is another measurement used for these types of studies. It focuses on the counts of co-occurring entities in a text corpus (Zhou et al., 2022). However, this technique is only used to analyze keywords present within the dataset. There are two keywords: Author Keyword and Keyword Plus. Author keywords, as the name shows, are keywords authors give to their paper, which is more specific but limits the analysts to study the trends and thematic evolution. On the other hand, keywords plus are frequent words and phrases present in the title of the references but do not appear in the article's title. This group has broader terminology and is better for bibliometric studies based on Zhang et al.'s (2015) findings.

According to Kessler (1963), Bibliometric coupling measures how similar documents are based on their shared references. This type of measurement can find the relationship between the documents, countries, and authors.

For a better understanding of these terms, the following flowcharts are provided which are designed using the images from flaticon.com (Figure 2 & 3).

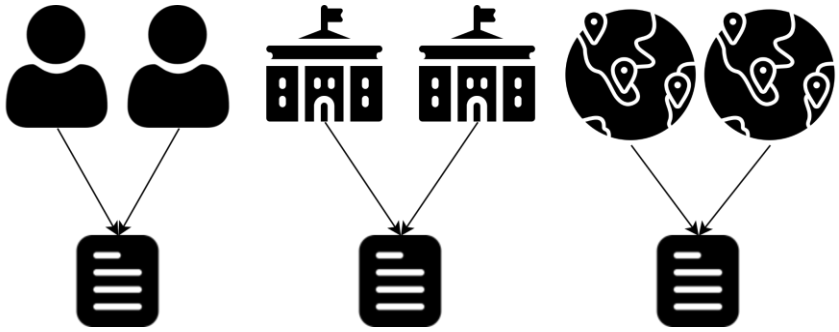

Figure 2. Co-authorship of authors, organizations, and countries

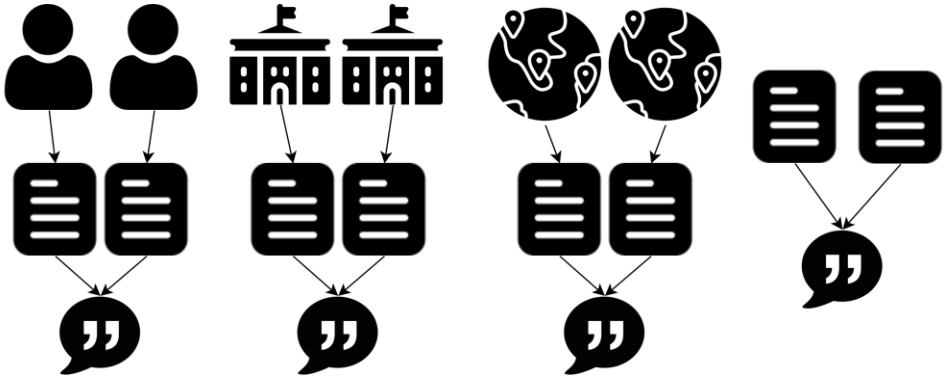

Figure 3. Bibliometric coupling of authors, organizations, countries, and documents

Beside the general terminology, we need to understand the specific terminologies for each map that VOSviewer creates. These terms include Nods, Links, and Clusters.

A nod is a circle in the network presenting an idea, a theme, an author, an organization, a country, a document, or a reference. If this nod gets bigger it means the frequency is more significant compared to other nods.

A link is the tile or the connection between the nods. It can be spotted by looking for interconnected curved lines between the nods. These links show the relationship of the nods with each other.

Clusters are groups of people, organizations, references, documents, and so on, which can be presented in different colors in the network. An example of the terms in one setting could be a dark blue cluster that has 10 authors which are presented by nods with different sizes indicating the frequency. These nods then are connected with links that show the relation between them. Figure 4 is presented for better comprehension of the terms.

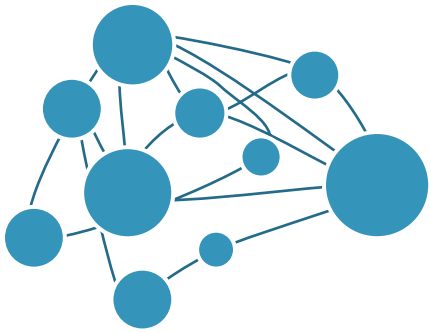

Figure 4. Nods, links, and clusters

3. Results and discussions

Having introduced the terminologies in the previous section, we now move to the result and discussion sections of the study. The findings are presented separately based on the groups (Authors, Organizations, Countries, and Keywords). Moreover, in each section, different methods were used to visualize and comprehend the dataset.

3.1. Overview

In this section, we address the journal-level metrics, which include the number of publications/citations and the most cited documents. Figure 5 indicates the number of publications from the early decades. As shown in the figure, annual scientific publication for medical English was relatively infrequent, with only two or three papers published annually up to the late 1980s. In the 1990s, production had a slow upward trend, with about 50 papers published annually. The publication rate grew with a significant number of documents, well over 100 papers per year in most years. In the past decade, productivity has increased dramatically, from 300 papers per year in 2010 to over 800 by 2021. Consequently, medical English research attention and output have grown exponentially in recent years.

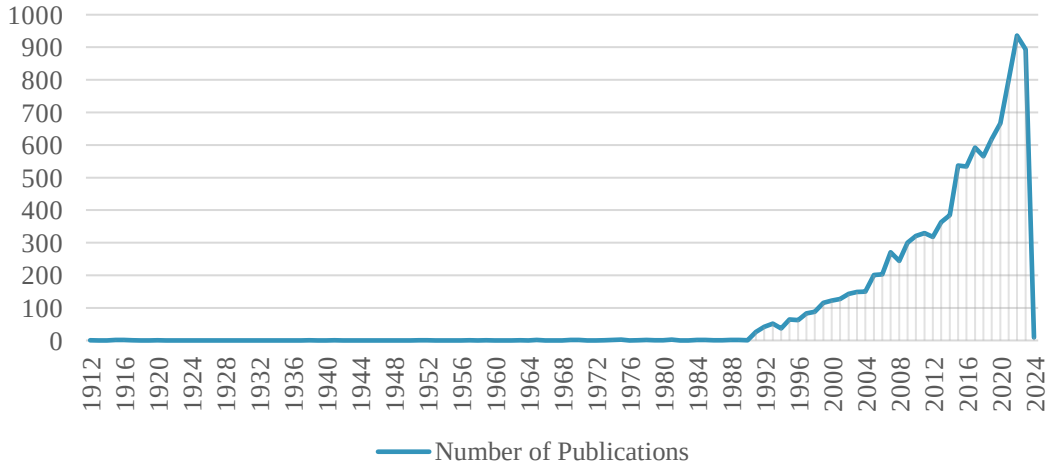

Figure 5. Annual scientific production

Scientific production mirrors the findings for citation patterns (Figure 6), which showed an upward trajectory from the beginning of the research in the early 20th century to 2007. Papers from 1912 to 1989 had an average citation of 0 to a little over 0.5. However, with the start of the year 1990, the average number of citations of articles began to rise, with fluctuations in between. This upward trend continued up until 2007, which was the peak average citation of articles in the medical English discipline. From 2008 forward, a downward trend started with plenty of fluctuations, finishing in 2023 with an average citation

of less than 0.5. Based on these findings, it is clear that the research conducted during this period laid essential foundations and had a more significant influence on scholarly discourse. However, since 2007, the average number of citations per paper has declined to around 2 per year. Furthermore, the recent increase in publications has yet to be translated into a higher impact on citations.

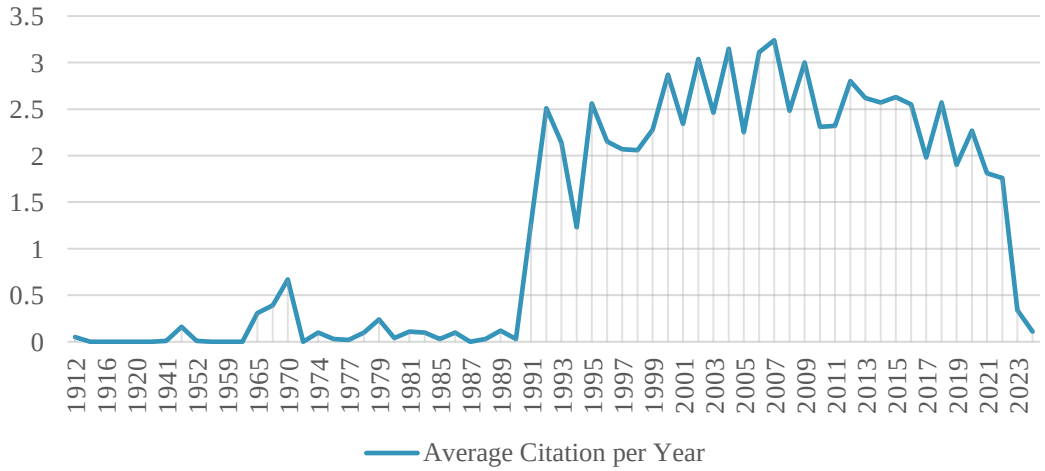

Figure 6. Average citation per year

Aside from the patterns of publication and citation for the discipline, addressing the most cited documents can provide further insight into the literature and help us delve deeper to find the core ideas related to the field. Notably, many of these highly impactful papers (Table 1) relate to health communication, medical education, heart diseases, and heart failures, as well as improving outcomes through enhanced provider-patient relationships. For example, the top-cited article by Merikangas et al. (2007) highlights the prevalence of bipolar spectrum disorder nationally. Additionally, Schillinger et al. (2002) and Jack et al. (2009) address research areas such as health literacy and discharge programs/rehospitalization. Other highly-cited papers are tackling heart failure, education in medicine, staffing patterns, clinical outcomes, shared decision-making, and neurodevelopmental outcomes.

Table 1. Top ten most-cited articles

Paper	DOI	Total Citation
Merikangas Kr, 2007, Arch Gen Psychiat	10.1001/archpsyc.64.5.543	1669
Schillinger D, 2002, Jama-j Am Med Assoc	10.1001/jama.288.4.475	1181
Jack Bw, 2009, Ann Intern Med	10.7326/0003-4819-150-3-200902030-00007	1103
Antman Em, 1992, Jama-j Am Med Assoc	10.1001/jama.268.2.240	1064
Pronovost Pj, 2002, Jama-j Am Med Assoc	10.1001/jama.288.17.2151	1043
Frank Jr, 2010, Med Teach	10.3109/0142159X.2010.500898	1035
Makoul G, 2006, Patient Educ Couns	10.1016/j.pec.2005.06.010	1009
Marino Bs, 2012, Circulation	10.1161/CIR.0b013e318265ee8a	1006
Heidenreich Pa, 2022, Circulation	10.1161/CIR.0000000000001063	986
Goldstein Dj, 1992, Int J Obesity	NA	979

3.2. Authors

Author-level metrics include the most cited and published authors within the literature and co-authorship and bibliometric coupling of the writers who contributed to the field of medical English.

Identifying central authors and analyzing their co-authorship structures sheds light on patterns of ideation, team dynamics, and influence shaping the medical English field. Figure 7 shows De Lusignan S with 26 papers, followed by Schillinger D with 21 as top authors. The other top authors include Karliner LS, Sarkar U, Sudore RI, and Pérez-Stable EJ, with 14-17 publications each.

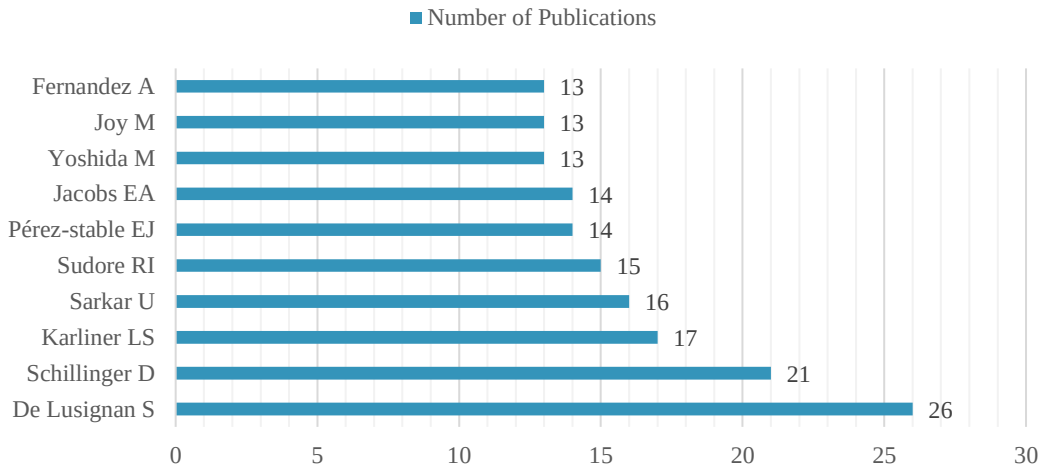

Figure 7. Top ten most-published authors

While prolific authors contribute extensively to the volume of medical English literature, citation data (Figure 8) reveals those producing the most impactful scholarship. A total of 2,899 citations are reported by Shimada Y, indicating the researcher's significant contribution to the field. Following Yoshida M and Grumbach K, both have accumulated substantial impact through their work. Several highly cited Japanese authors, including Ishida H, Itabashi M, Sugihara K, and Ito Y, each with citation counts of approximately 2,600, indicate a highly cited regional research community. Ajioka Y and Hamaguchi T. further demonstrate Japan's strength in influential scholarship. It is apparent from comparing citations and publication leaders that productive authors contribute to the foundation of literature. However, less prolific yet highly insightful authors may generate genuine field-shaping insights.

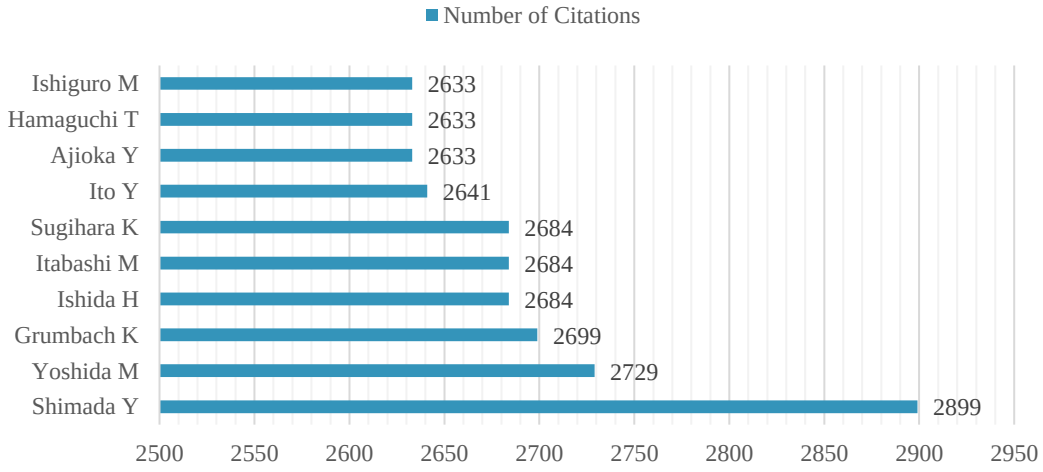

Figure 8. Top ten most-cited authors

Complementing the citation analysis, co-authorship networks among authors were also examined further to reveal collaborative patterns within the medical English literature. Figure 9 visualizes the co-authorship network of the top 100 most

connected authors, clustered into 13 components linked by 243 ties. The most significant clusters in red, green, and dark blue contain 13, 12, and 11 members, respectively, representing the densest collaborative groups. Research communities centered around shared interests and frequent interaction between members can be identified when mapping these co-authorship structures. The degree of cooperation and isolation in knowledge production can be determined by examining the connectivity within and between clusters. Highly interconnected clusters indicate a deep collaboration and exchange of ideas within a particular subject area. Spare connections between separate components indicate fragmentation of the field. As these co-authorship network patterns evolve, we can determine how team dynamics and research networks evolve in medical English scholarship.

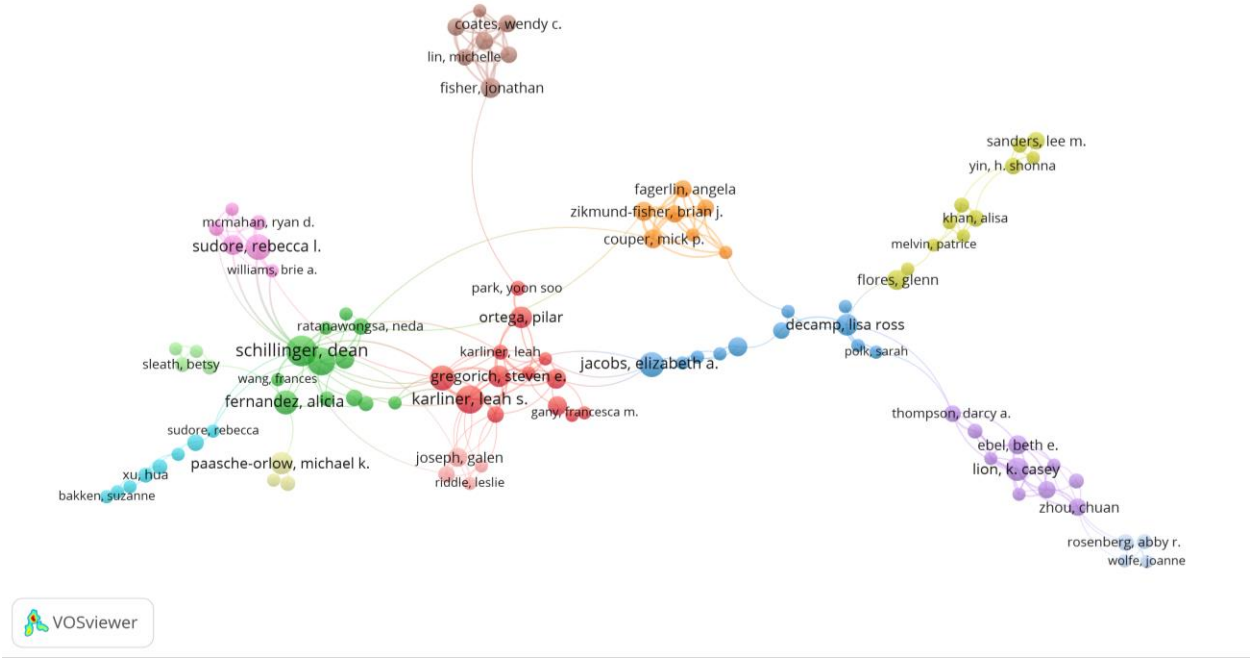

Figure 9. Authors' co-authorship network

Furthermore, as mentioned before, bibliographic coupling analysis identifies the connections between published documents based on shared references. An in-depth examination of coupling relationships is an excellent method of discovering the links that hold a research field together. The bibliographic coupling network visualized in Figure 10 contains 541 of the most connected papers clustered into seven components. The largest red cluster accounts for nearly three-quarters of all items, representing a dense core of related literature. The second and third places go to green and blue clusters containing 43 and 38 members, respectively, signifying smaller secondary groupings. The predominance of the central red cluster suggests a unified conceptual framework with many papers building on overlapping references.

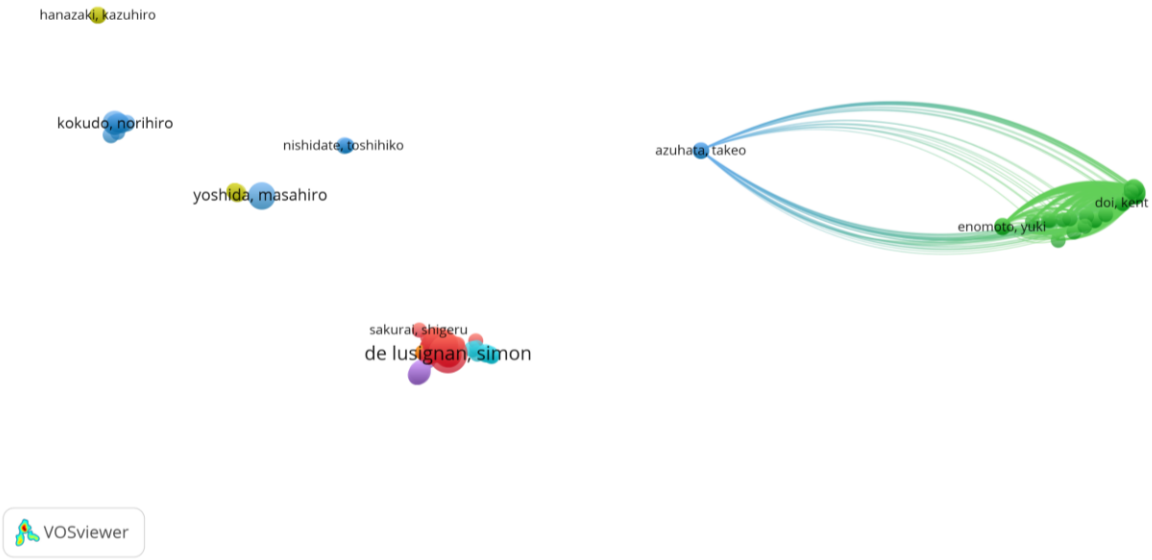

Figure 10. Authors' bibliometric coupling network

3.3. Organizations

In the realm of scientometric studies, organizational metrics remain a prominent aspect, giving an overview of the institutional research landscape. Figure 11 is provided to visualize a part of this landscape. The University of California San Francisco leads in medical English research output with 282 total publications, showing the institute's significant contribution. The University of Toronto ranks second with 235 papers, emerging as a critical research center in Canada. The University of Washington places third with 182 publications, representing rising productivity from this establishment. Other top producers include the University of California Los Angeles (168 papers), Harvard Medical School (165), Harvard University (150), and the University of Michigan (138), reflecting ongoing scholarship from these established research hubs. Moreover, Columbia University (124 papers) and Johns Hopkins University (122) are emerging as new research organizations. Rounding out the top 10 is Stanford University, with 119 publications.

Matching the data in output patterns, the citation pattern (Figure 12) of The University of California San Francisco again tops the list with 14,241 citations in the data analysis, indicating the highly influential nature of the university, its policy, and the researchers contributing to the literature through the institute. Harvard University holds the second place with 12075 citations, followed by one level demotion of The University of Toronto with 11452 citations in total. The University of California Los Angeles, the University of Michigan, and Johns Hopkins University also make the top citation list, with 9942, 8246, and 7300 citations, respectively. Finally, The University of Washington, The University of Pennsylvania, Sanford University, and Northwestern University are the top ten most-cited organizations with 6142, 5977, 5562, and 5410 each. Identifying organizations with a high or low influence can be achieved by comparing citation counts to publication numbers. A few examples include Northwestern University and the University of Pennsylvania, which are ranked among the top ten most-cited organizations but need to appear in the top ten most-published organizations, suggesting their contribution to have lower output at a higher level.

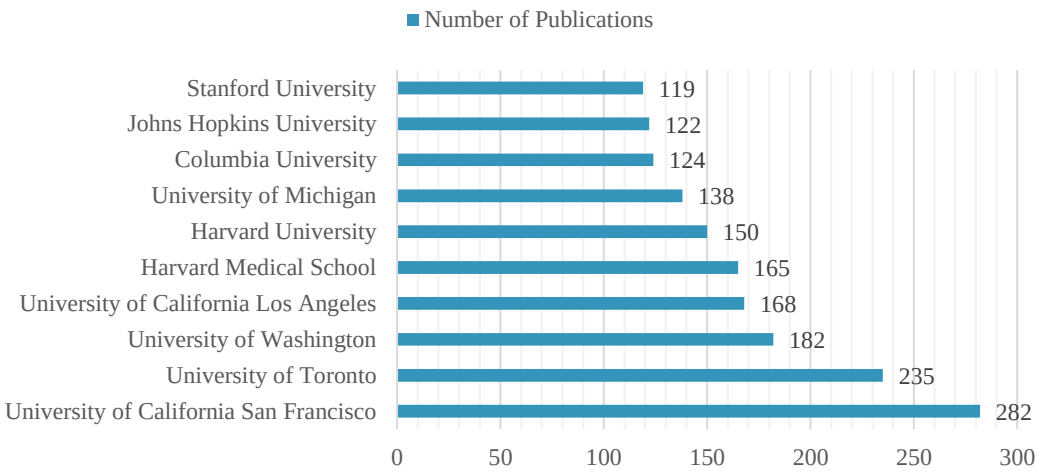

Figure 11. Top ten most-published organizations

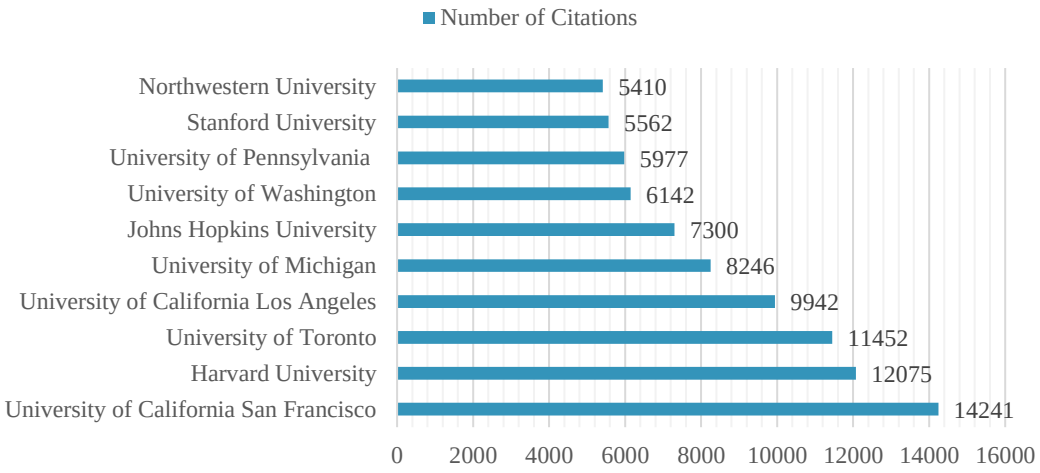

Figure 12. Top ten most-cited organizations

In addition to publication and citation patterns in the mentioned figures, Figure 13 visualizes the dense collaboration network between organizations researching medical English globally. This map contains 937 institutional nodes clustered into 15 components. The nods present in these clusters are connected with 13,730 links. In addition, the largest cluster colored in red contains 233 items, followed by the green and dark blue clusters with 173 and 172 members, respectively. According to the figure, the mentioned components have a high degree of collaboration and knowledge exchange within the literature. The smaller clusters with lower member counts represent niche topics and research interests.

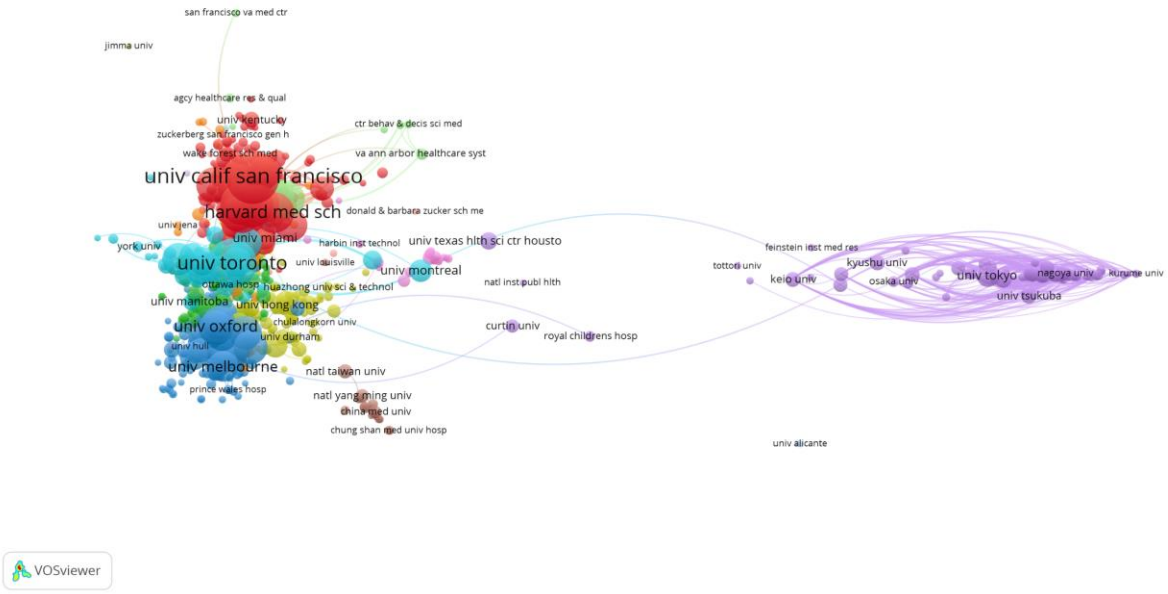

Figure 13. Organizations' co-authorship network

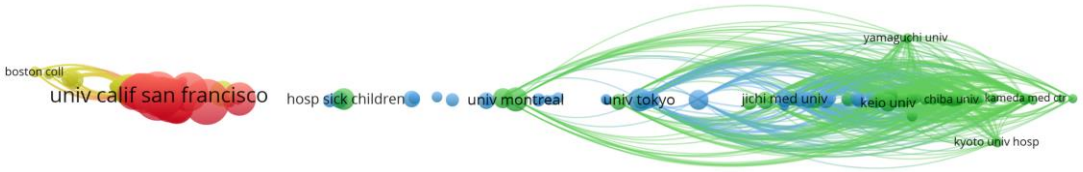

Figure 14. Organizations' bibliometric coupling network

Looking at Figure 14, we can see a dance coupling among the institutional networks. This visualization, with 946 institutional nodes clustered into four components connected by 184,134 links, shows significant coupling in the literature. The most dense cluster colored in red contains 854 items, followed by the second-order green and dark blue clusters in third place, having just 45 and 32 members, respectively. The significant size of the clusters shows the amount of coupling they have within the dataset. Larger clusters show the overlap of references within the documents, and smaller-sized clusters show differing references.

Analyzing the networks and visualizations provided through maps and charts can provide a deeper insight into the breadth and insularity of cooperation in medical English research worldwide. This can let researchers discover the changing dynamics and institutional interactions and tackle further investigation for emerging trends.

3.4. Countries

A highly debatable topic in scientometric domains is country metrics, which can provide convenient data for scholars worldwide. These data metrics can explain why one country contributes more to a discipline than others. Sometimes, this matter is self-explanatory and does not need further elaboration. However, this is not the case in some fields, and addressing these issues can lead to eye-opening results. Furthermore, these results can mirror the publication patterns (what to publish, when to publish, where to publish) of top countries in the lower rank countries regarding publications and collaborations.

Moving to publication output patterns for medical English (Figure 15), the United States leads the list with 4,312 papers. The UK is in second place with 1,476 publications, followed by Canada (817), Australia (682), and emerging output from China (539). Notably, the presence of English-speaking countries continues. However, the landscape shows a broader

global participation. For instance, European countries, including Germany (283 papers), Italy (251), Spain (242), and France (218), demonstrated expansion of contribution, along with Japan (275) representing Asia. Looking at the results, the geographic distribution has become more balanced, though North America and Western Europe still account for the majority of outputs.

The United States also leads in total citations (Figure 16) with 151,249, followed by the UK, which again holds second place with 37,535 citations. Matching the two figures for Figures 12 and 13, we can see that alongside a high output rate, citation rates also top the list, indicating a high volume of impactful work for these two countries. Canada follows with 29,625 citations; however, its citation number exceeds its publication output, indicating success in publishing impactful scholarship. Australia and Japan also perform well on both output and citation measures. Emerging countries like China (6,919 citations) have notably lower citation rates than output. Comparing citation rates reveals that non-English speaking countries like Switzerland, Italy, Germany, and the Netherlands have more influential research in terms of citation than output.

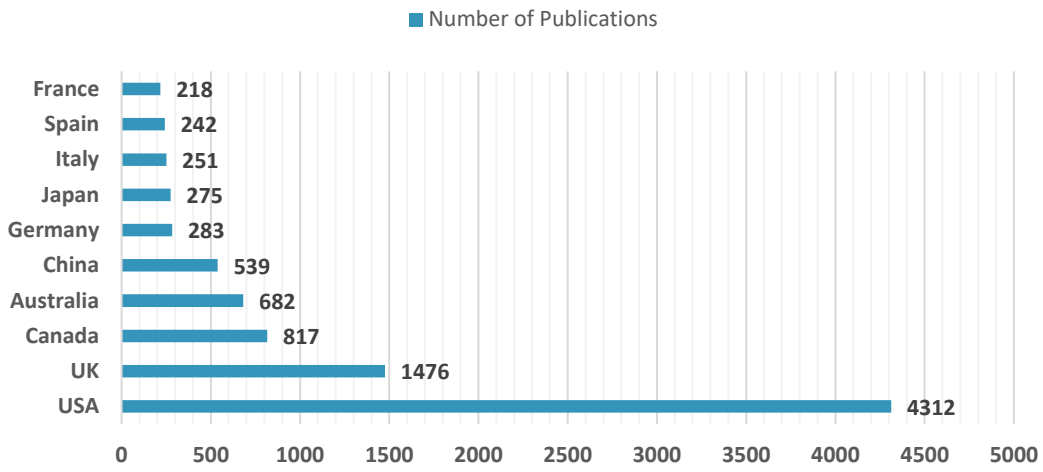

Figure 15. Top ten most-published countries

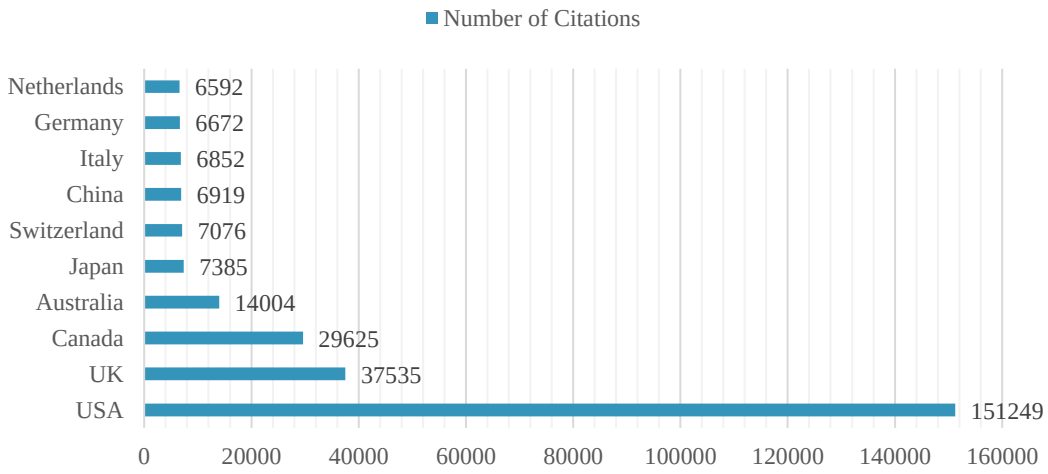

Figure 16. Top ten most-cited countries

Using VOSviewer, we generated the collaboration and coupling network of the countries. Figure 17 visualizes the dense relations between the countries in publishing scholarly output. The map comprises 102 country nodes clustered into eight components, with 1,766 links between them. The largest cluster colored in red contains 29 items, followed by the green and dark blue clusters, which comprise 17 and 15 members, respectively. The largest nods present on the map are the USA, England, Canada, Australia, and France. These significant components represent regional collaborative groupings, with densely interconnected links reflecting close cooperation between nations.

Figure 18 shows the bibliometric coupling relationships between the countries. Similarly, this analysis revealed 107 country nodes clustered into seven components, connected by 3,849 coupling links. The most significant clusters colored in red, green, and dark blue contain 26, 24, and 21 members, respectively. As with the co-authorship network, the United States, England, Canada, and Australia are critical nodes across all clusters, pointing to their broad influence.

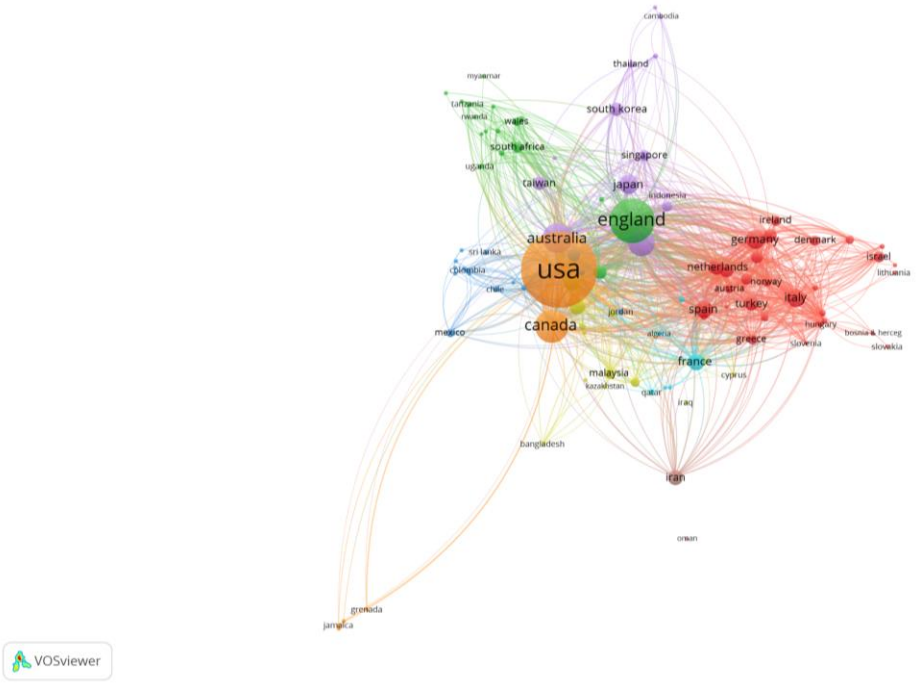

Figure 17. Countries' co-authorship network

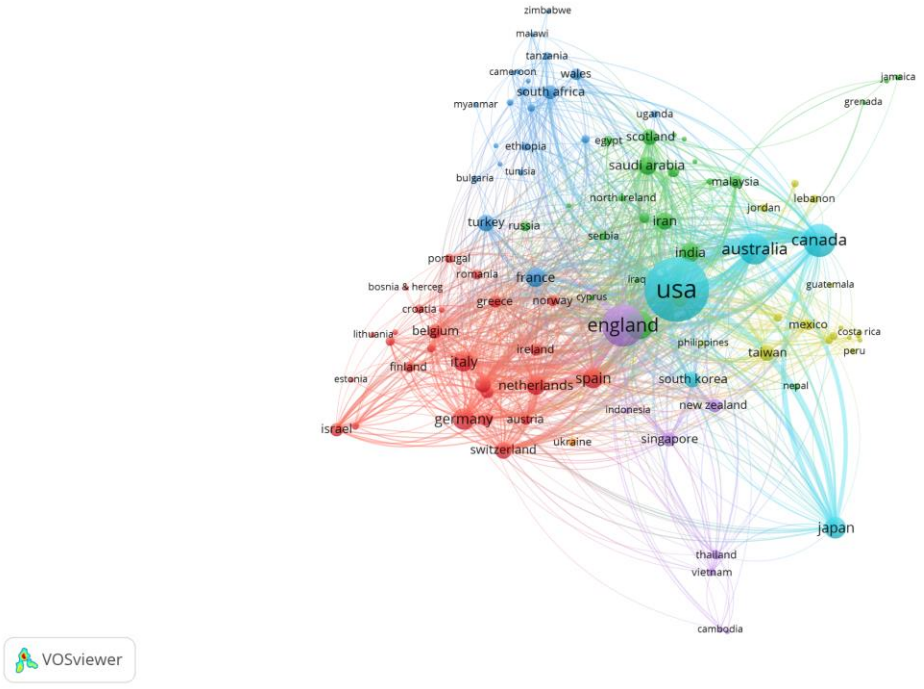

Figure 18. Countries' bibliometric coupling network

3.5. Themes and keywords

Moving to themes analysis, the authors provided five different networks alongside the frequency of top-occurring themes in the dataset. These visualizations provide comprehensive insights into the thematic evaluation and hot/cold topics across time. To better decode the networks, the maps were created using different color palates to ensure maximum clarity for the readers; before going into the analysis of the networks, we first address the most-occurring keywords across the dataset. Scientific and analytical studies heavily rely on keywords and thematic analysis as part of the scientometric analysis. Visualizing these keywords can delve into the core, past/present, and future themes, which can then be compared and contrasted to eventually indicate the evolution of themes. Table 2 shows the top 20 most-occurring keywords in the entire article. The variables for this analysis were Authors' Keywords and Keywords Plus. Authors' Keywords are exactly what the names suggest: the keywords authors give to their work. These keywords can sometimes be limiting because they represent the core themes. Keywords Plus, however, are more general than authors' ones. These keywords occur in the titles of the documents' references in the dataset but not in the documents' titles.

This analysis revealed that the most frequent terms are broad keywords like "care," "health," "quality," "management," and "outcomes," followed by other top keywords including "education," "language," "communication," "disparities," and "United States." The prominence of terms like "women," "children," "risk," "cancer," and "diagnosis."

Table 2. Top 20 most frequent keywords

Keyword	Frequency	Keyword	Frequency
care	770	education	350
impact	529	language	343
health-care	501	women	338
health	501	risk	326
quality	481	disparities	315
management	467	united-states	309
outcomes	436	quality-of-life	294
communication	407	cancer	270
prevalence	406	validation	270
children	400	diagnosis	264

(Authors' Keywords & Keywords Plus)

Visualizing the keyword co-occurrence revealed a dense connection between the thematic and knowledge evolution of medical English literature. This network visualization (Figure 19) shows 2,614 terms clustered into 12 components, with 116,936 links between them. The three most significant clusters colored in red, green, and dark blue contain 643, 635, and 242 members, respectively. These major clusters represent broader groups, while smaller clusters indicate more specialized niche topics. The density map overlay (Figure 20) helps in further understanding the clusters colliding with each other.

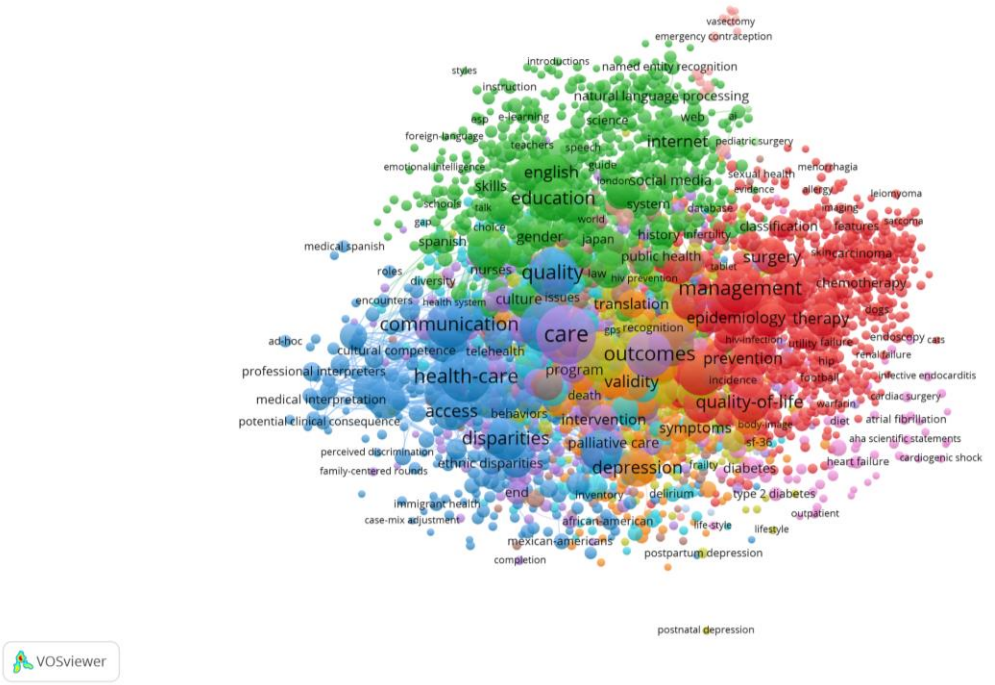

Figure 19. Keywords co-occurrence network

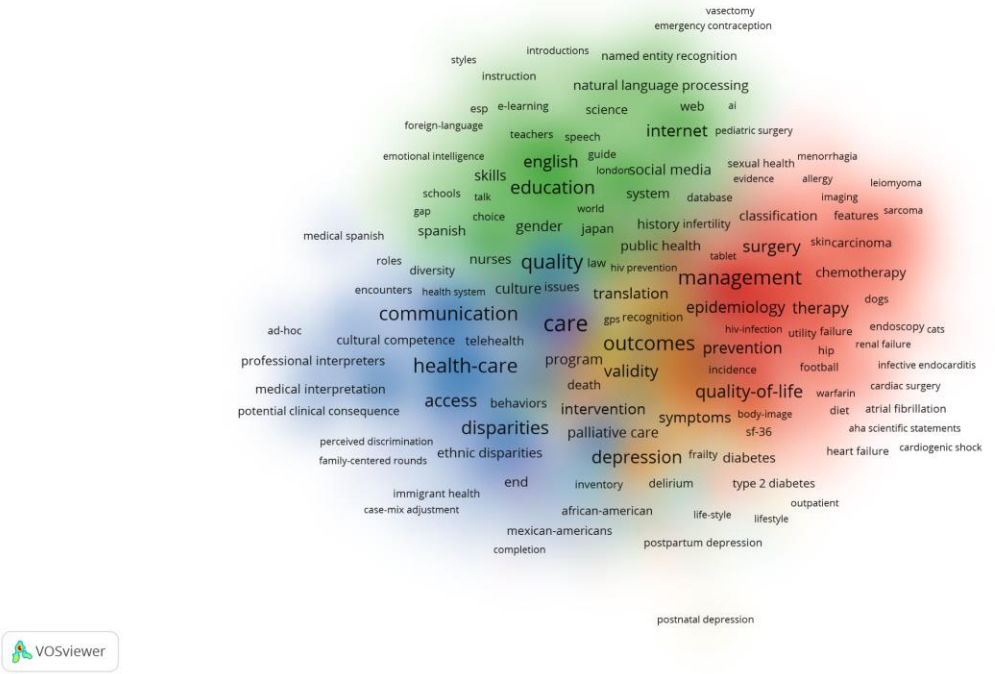

Figure 20. Keywords co-occurrence network

Additionally, Figure 21 provides a heat map of keyword frequencies across the literature. Darker red shading shows terms with higher prominence, while lighter orange and yellow indicate relatively insufficient keywords. The terms with the deepest red saturation include "care," "impact," "healthcare," "health," "quality," "management," and "outcomes." In contrast, niche keywords like "ad-hoc," "postnatal depression," "styles," "heart failure," "outpatient," and "case-mix adjustment" appear with little to no shading. Looking at the clusters, we can see that Medical English has been divided mostly into 3 sections with some mutual themes in-between the clusters. The green cluster is related to the applied linguistics aspect

of Medical English containing English, education, internet, and e-learning. Red cluster addresses the quality of the healthcare system containing management, quality-of-life, therapy, and classification as the prominent keywords. The blue cluster contains the themes related to the cultural aspect of the Medical English field. This cluster has keywords such as communication, ethnic disparities, access, and health care.

Moreover, Figure 22 visualizes keyword impact through a heat map of average citations. Dark blue shading indicates terms with the lowest citation rates, while dark red shows highly cited keywords. Niche topics like "heart failure," "skills," "chemotherapy," "Mexican-Americans," and "cardiogenic shock" appear in deep red. Meanwhile, broader terms like "vasectomy," "e-learning," "natural language processing," and even "English" themselves exhibit very low average citations.

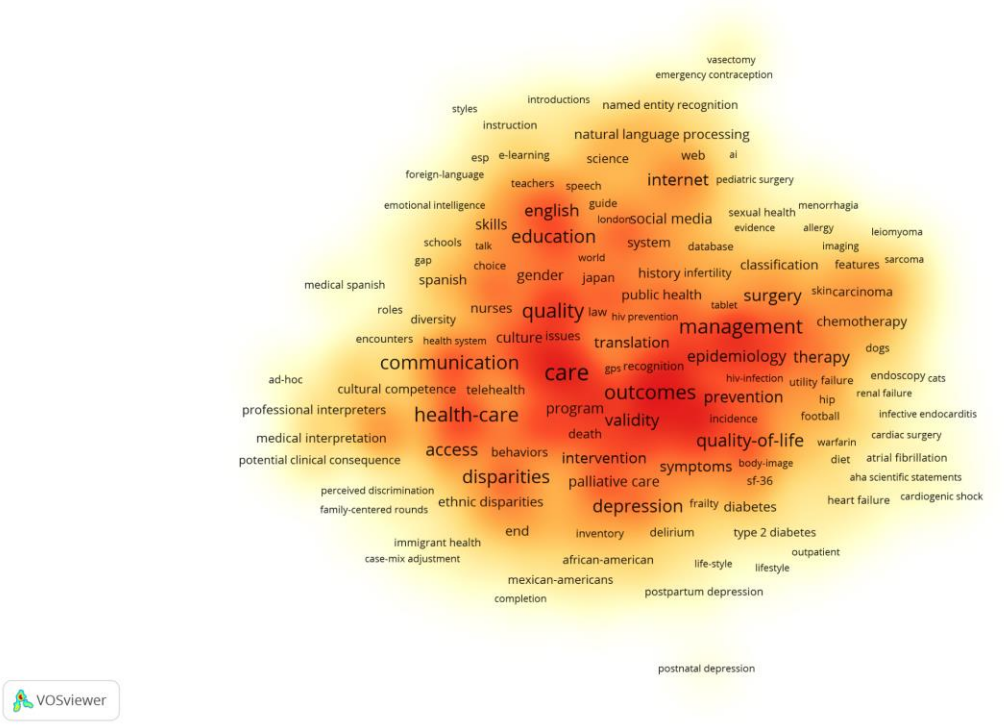

Figure 21. Keywords co-occurrence item density

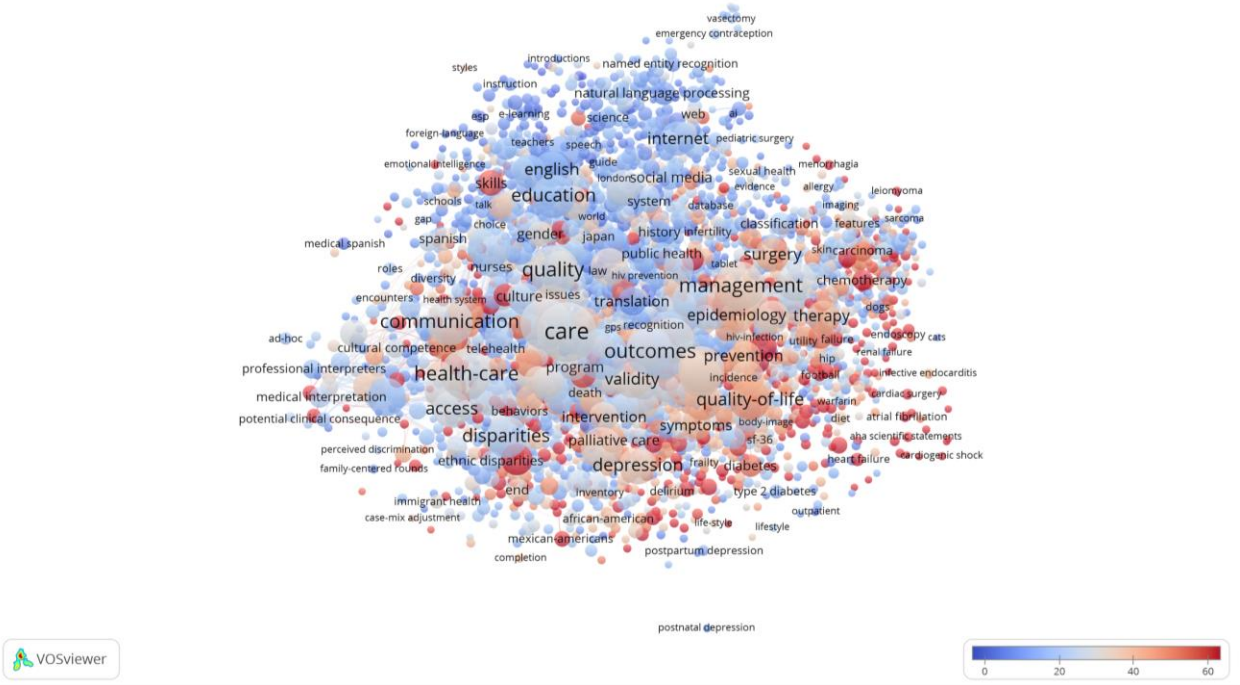

Figure 22. Keywords co-occurrence average citation

Lastly, Figure 23 provides an overlay visualization of keyword frequencies spanning 2010-2018. A color spectrum from purple to yellow indicates the relative periods when keywords first emerged in the literature. The purple, blue, and dark green shades represent earlier topics from 2010-2014, while light green to yellow indicate more recent keywords from 2015-2018. For instance, terms like "sarcoma," "allergy," "renal failure," and "emergency contraception" appear in the earlier time bands, whereas more contemporary keywords such as "professional interpreters," "esp," "ai," and "foreign-language" date to the later 2015-2018 period.

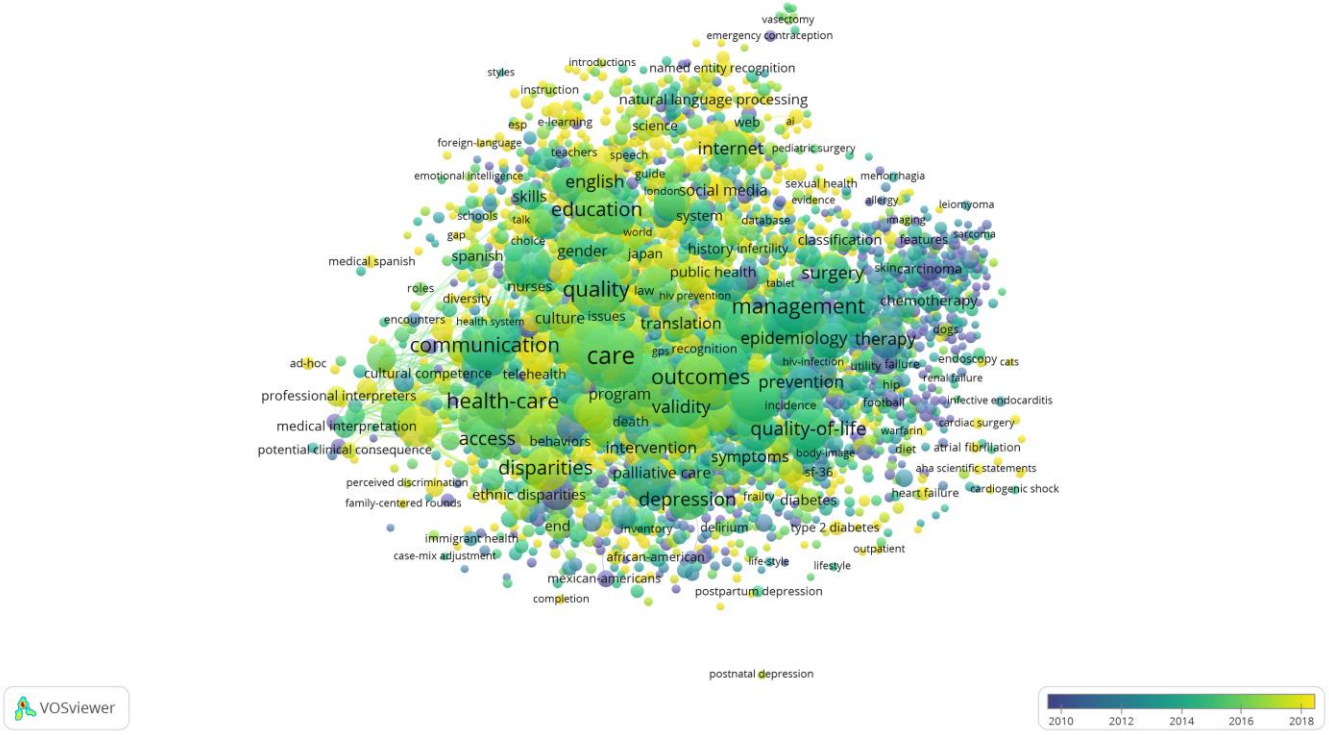

Figure 23. Keywords co-occurrence timeline

4. Conclusion

Overall, scientometrics has evolved to be the main aspect of knowledge and science mapping around the world. The 112-year analysis of “Medical English” showcases a dynamic field with an increasing number of citations and publications with dense collaborative networks among authors, organizations, and countries. Looking at the publication patterns, we can see that the year 2022 was its peak with 936 articles published throughout the year. For citation patterns, however, we can see an upward trend followed by a downward trend with fluctuations. 2007 was the peak year for citation with an average citation of almost 3. Despite the upward trajectory Medical English had up until 2007, there has been a consistent plummet in the citation patterns up to the present.

Citations, publications, and the collaborative network of authors reveal prominent authors who dedicated their time and effort to the field. De Lusignan S, Schillinger D, and Karliner LS were the most prolific authors in terms of publication numbers with 26, 21, and 17 articles respectively. In terms of citation numbers, Shimada Y, Yoshida M, and Grumbach K had the all-time highest citations in the dataset with 2899, 2729, and 2699 citations each.

Organizations followed a trend similar to authors’ networks in terms of collaborative and bibliometric networks. All-time highest publication numbers belonged to the University of California San Francisco with 282, the University of Toronto with 235, and the University of Washington with 182 number of articles. Notably, we can see the University of California San

Francisco at the top universities in terms of citation numbers as well. This university has 14241 citations at the time of writing this paper which shows the fact that this organization has had an increase in the number of publications in addition to maintaining the quality of the articles. In the second place, we have Harvard University with 12075 citations followed by the University of Toronto with 11452 citations.

Countries' citation and publication patterns were not as balanced as the other two. The USA topped the charts with 4312 articles containing 151249 all-time citations. The UK followed second in both tables with 1476 articles related to Medical English generating 37535 citations as of 2nd January 2024. Following the trend, Canada was placed third in both charts with 817 articles gaining 29625 citations overall.

Moving to the most important part of scientometric studies, theme, and keyword analysis was done by addressing the two types of keywords existing in the dataset. Care, impact, health-care, health, and quality were most prominent across the documents. In addition to the keyword and theme analysis, the co-occurrence of the keywords was analyzed to gain an in-depth snapshot of the relations and connections between the words

These findings can help scholars, stakeholders, and educators find their way in the intertwined academic field of Medical English. Understanding the trends in Medical English can help future training programs and guide research priorities. Researchers can also use these findings and predict the future of Medical English as a discipline, find the trending topics, and in the end, make this discipline trending once more.

As for the limitations of this study, although we have thoroughly analyzed every document accessible to us, some of the articles, including the top documents based on citation patterns, were not related directly to Medical English. This happened because the authors of those articles have written “Medical English” as one of the keywords of those documents. A more precise analysis containing fewer documents but more in-depth analysis could reveal a more error-free result in terms of top documents cited in the field.

Another avenue for researchers to explore can be the analysis of abstracts within the literature. This can help us achieve total control over the thematic evolution of the field. This is because the usual analysis of themes is done by just titles, reference titles, and the actual keywords. However, if there is a thematic analysis of abstracts within the literature, we can precisely plan future directions for the academic programs. Additionally, scholars can address these techniques for each of the three clusters that were mentioned before to gain a more precise map of each domain. We hope to see more scientometric and bibliometric analyses like this study for other disciplines to gain a better understanding of what has happened and what we can expect to come next.

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