Research Article

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Title: Bibliometric analysis of the top 500 most cited articles in cancer epidemiology.
Short title: Bibliometric analysis: cancer epidemiology.

Abstract

Purpose: The objective of this work is to provide perceptions for future research by creating a comprehensive bibliometric analysis of the literature on "cancer epidemiology".

Material and methods: Article data was collected from the Web of Science Core Collection (WoSCC) and advanced search was performed using the following keywords: “cancer*” and “epidemi*” between 2010-2024. The results were then refined according to the publication type of Science Citation Index Expanded and Emerging Sources Citation Index, which only consist of original English articles in the WOS database. A summary of the data analysis results examined along with open-source R package Bibliometric and VOS viewer (Version 16.20) programs.

Results: The 500 most cited documents published in 180 different sources in the time period 2010-2024 showed a negative annual growth rate of 18.97%, indicating a decrease in publication output. An average of 70.1 co-authors per document was observed, and 60.8% of the collaborative efforts in these articles were found to be foreign co-authorship. The most frequently appearing keywords were found to be "epidemiology" with a total link strength of 625, followed by "cancer" with a total link strength of 372. According to the bibiliometric analysis result, the article by Ferlay, J. mm was found to have more than 72,000 citations.

Conclusion: This bibliometric analysis has yielded quantitative data on the expansion of the cancer epidemiology discipline, the level of scientific excellence, and the identification of keywords, so facilitating the determination of the most accomplished topics.

Keywords: Bibliometric analysis, cancer epidemiology, bibliometrix, VOSwiever.

Makale başlığı: Kanser epidemiyolojisinde en çok atıf alan ilk 500 makalenin bibliyometrik analizi.

Kısa başlık: Bibliyometrik analiz: kanser epidemiyolojisi.

Öz

Amaç: Bu çalışmanın amacı, “kanser epidemiyolojisi” konusundaki literatürün kapsamlı bir bibliyometrik analizini oluşturarak gelecekteki araştırmalar için öngörüler sunmaktır.

Gereç ve yöntemler: Makale verileri Web of Science Core Collection'dan (WoSCC) toplandı ve 2010-2024 yılları arasında "cancer*" ve "epidemi*" anahtar sözcükleri kullanılarak gelişmiş arama yapıldı. Sonuçlar daha sonra yalnızca WOS veri tabanındaki orijinal İngilizce makalelerden oluşan Science Citation Index Expanded ve Emerging Sources Citation Index yayın türüne göre rafine edildi. Veri analizi sonuçlarının bir özeti, açık kaynaklı R paketi Bibliometric ve VOS görüntüleyici (Sürüm 16.20) programlarıyla birlikte araştırıldı.

Bulgular: 2010-2024 zaman aralığında 180 farklı kaynakta yayınlanan en çok atıf alan 500 belge, yıllık %18,97'lik bir negatif yönde büyüme oranı gösterdi ve bu da yayın çıktısında bir düşüş olduğunu gözlemlenmiştir. Belge başına ortalama 70,1 ortak yazar olduğu gözlenmiş ve bu makalelerdeki iş birliği çabaların %60,8'ini yabancı ortak yazarlık oluşturduğu bulunmuştur. En çok görünen anahtar kelimeler, toplam bağlantı gücü 625 olan "epidemiyoloji” olarak bulundu, daha sonra 372 toplam bağlantı gücüne sahip olan "kanser" olduğu gözlenmiştir. Bibiliometrik analiz sonucuna göre Ferlay, J. makalesi 72.000'den fazla atıf aldığı tespit edilmiştir.

Sonuç: Bu bibliyometrik analiz, kanser epidemiyolojisi disiplininin genişlemesi, bilimsel mükemmellik düzeyi ve anahtar kelimelerin belirlenmesi hakkında nicel veriler sağlamış ve böylece en başarılı konuların belirlenmesini kolaylaştırmıştır.

Anahtar kelimeler: Bibliyometrik analiz, kanser epidemiyolojisi, bibliometrix, VOSwiever.

Introduction

Cancer epidemiology offers methods and approaches to comprehend cancer issues in all societies, ranging from local to worldwide scales. An in-depth and accurate comprehension of cancer epidemiology yields crucial insights into the possible aetiology of these illnesses and population patterns, enabling the formulation of prompt and suitable healthcare interventions targeted at devising efficacious policies for screening, diagnosis, and prevention [1]. With the ongoing development of cancer epidemiology, there is a strong focus on enhancing research methodology. Since the 1950s, there have been advancements in research design, such as improved case-control studies, which enable more rigorous selection of case and control populations and the use of better statistical analytic tools [2]. These developments are expected to enhance the dependability of discoveries about the causes and risk elements of cancer.

In recent decades, a significant number of diligent researchers and institutions worldwide have established themselves in the subject of cancer epidemiology [3]. As a result of this growing interest, there has been a rise in scientific investigations, the entire extent of which has not yet been quantified in the field. A comprehensive bibliometric research study is in underway to evaluate the quantity and progression of scientific output across different nations. Bibliometrics is the study of the scientific output of a scientist, research unit, institution, or country [4]. It involves evaluating the historical progress of a discipline, determining its significance in the scientific community, and identifying potential areas for future research [4].

However, no bibliometric analysis of publications on “cancer epidemiology” has been published till now. Therefore, this article aims to provide a bibliometric analysis report on the scholarly output in the subject of cancer epidemiology across different countries.

Materials and methods

This search covers articles published between 2010 and 2024 and was conducted on July 14, 2024. Article data was collected from the Web of Science Core Collection (WoSCC) and advanced search was performed using the following keywords: “cancer*” and “epidemi*”. This search covers articles published between 2010 and 2024 and was conducted on July 14, 2024. Article data was collected from the Web of Science Core Collection (WoSCC) and advanced search was performed using the following Medical Subject Heading (MeSH) keywords: “cancer*” and “epidemi*”. Our choice was largely influenced by WoSCC's exceptional capacity to offer thorough and in-depth descriptions of highly cited and popular papers a capability that is unmatched in other databases.

Accurately identifying and evaluating the most influential literature in the field of cancer epidemiology research depends on this feature [5].

The results were then refined according to the publication type of Science Citation Index Expanded and Emerging Sources Citation Index, which only consist of original English articles in the WoSCC database. The search was adjusted to include articles published between 2010 and 2024. As a result of these inclusion criteria, 195.265 were reached. Top 500 Most cited All bibliographic data was exported from the WoSCC database and interpreted using analytical bibliometric methods.

A summary of the data analysis results is provided along with visualizations. The open-source R package Bibliometric was used to run bibliometric analyses and create data matrices for publication trends, journal rankings, authorship analysis, most prolific countries, author collaboration patterns, trend subjects, and most cited papers [6]. The VOSviewer (Version 16.20) program was also used to display bibliometric connections of data for Co-authorship, Co-occurrence keywords. Two standard weight attributes are applied which are defined as “Total link strength attribute” [7]. Additionally, Microsoft Office Excel 2019 was used to perform quantitative analysis of the publication.

Bibliometric analysis, ethics committe approval is not required.

Results

Overview of obtained bibliographic data

The research output in the field of "cancer epidemiology" is depicted in Table 1, which presents a summary of bibliometric data from 2010 to 2024. The 500 documents published over this time span across 180 different sources showed a minus 18.97% annual growth rate, indicating a decrease in publication volume.

With an astounding average of 2.148 citations per document and an overall reference count of 43.687, the average document is 7.23 years old. Out of the 19.951 authors in the dataset, only 12 authored single documents. The dataset also contains 2.246 Keywords Plus and 604 author's keywords. The average number of co-authors per document is 70.1, and international co-authorship accounts for 60.8% of the collaborative efforts in these publications. The variety of document types, which include 340 articles, 145 reviews, and a few other formats, reflects the wide range of output in the field of research. Overall, this data demonstrates the complexity and richness of scholarly publications in the designated field over the specified time period.

Scientific output and average annual article citations

Figure 1 displays the yearly scientific output for the top 500 most cited articles related with “cancer epidemiology”, along with the average number of citations per year. From

2010 to 2019, there is a noticeable overall increase in scientific production, indicating a rising inclination and allocation of resources towards research during this time frame. Nevertheless, there is a significant decrease commencing in 2020. The peak of production is achieved approximately in 2019. The subsequent significant decline can be ascribed to a multitude of factors, including global occurrences like the COVID-19 pandemic and changes in research emphases.

Figure B exhibits substantial year-to-year fluctuations, in contrast to the relatively consistent upward trend observed in Figure A. This implies that the influence of research, as quantified by citations, is more unpredictable and affected by factors beyond the sheer quantity of publications. There is a significant increase in citations around 2021, followed by a decrease. This could suggest a profoundly influential research article or a collection of studies published during that year that received substantial recognition from the scientific community.

Most relevant sources

Figure 2 displays the most relevant sources from which the first 500 most cited articles in the field of cancer epidemiology are published. This table displays a hierarchy of scientific journals, organised according to the frequency of citations in the field of cancer epidemiology. The substantial number of citations received by prestigious journals such as *The Lancet*, *Cancer Journal for Clinicians* and *New England Journal of Medicine* serves as a strong indication that cancer epidemiology research holds significant influence within the wider medical community.

Most relevant countries

The distribution of publications on cancer epidemiology research across 15 countries is shown in Figure 3, which makes a distinction between publications that are country-specific and those that involve multiple countries. In both categories, the United States is at the top, closely followed by nations in Western Europe like Germany, France, and the United Kingdom. There is a clear emphasis on cancer epidemiology research in these areas. The proportion of multiple-country publications is higher in Germany and Switzerland, suggesting that these countries place a strong emphasis on international collaboration in their research.

Thematic map

A thematic map based on density and centrality was created and is presented in Figure 4. The results were derived from a semi-automatic algorithm that examined the titles of all analyzed references, along with additional relevant keywords to identify more complex variations.

The upper right quadrant displays topics characterized by high density and centrality; these topics, such as “United States”, “risk factors”, and “body mass index”, could be further developed and studied due to their importance for future research. Also, the upper left quadrant displays rapidly evolving but underrepresented topics characterized by high density and low centrality, such as “glioma”, “cancer incidence”, “high grade”, “quality of life”, “open label”, and “chemotherapy”.

The lower left quadrant covers topics that have been used with low centrality and density but show a decreasing trend; this area includes “landscape”, “somatic mutation”, and “signatures”. Additionally, the lower right quadrant covers key topics characterized by high centrality and low density; These topics are important for research as general themes and it was observed that they include "risk", "mortality", "epidemiology", "genome-wide association" and "classification".

Bibliometric analysis of co-occurrence keywords and WorldCloud

Keywords that appeared in the WOS core database more than 15 times and were supplied by the paper's authors were included. The most frequently occurring keywords were "epidemiology," which had a total link strength of 625, and "cancer," which had a total link strength of 372 (Figure 6). The WorldCloud provided in Figure 5 provided a visual representation of the most frequent terms found in the top 500 most cited articles on cancer epidemiology. This WorldCloud highlights key concepts and areas of research that have been the focus of extensive research in this field (Figure 3). Prominent terms include specific types of cancer (e.g., breast cancer, prostate cancer), risk factors (e.g., smoking, obesity, genetic factors), and epidemiological concepts (e.g., incidence, prevalence, mortality).

Bibliometric analysis of co-authorship and most cited authors

A total of 19951 authors have contributed to the "cancer epidemiology" publication for the 500 most cited articles. Figure 7 displays the co-authorship map of authors, which shows the authors who collaborate in the field of cancer epidemiology. The number of publications is indicated by the size of the circles, while different colours correspond to different clusters. The authors' strength of connection is indicated by the thickness of the lines.

Moher, D. received more than 122.000 citations for his articles on "cancer epidemiology" with total strength link 5. Ferlay, J. (total strength link 123) received more than 72.000 citations for his research on cancer incidence and global estimates of cancer prevalence, making him the second and third most frequently referenced author. In both 2017 and 2021, Siegel, R. was the author whose research on cancer statistics received the highest number of citations. These authors, who are associated with prestigious

institutions in their respective fields, have made substantial contributions to the comprehension of cancer epidemiology and statistical patterns, and have influenced the discussions in cancer research. Their research, which has been published in prestigious academic journals, has been extensively embraced by researchers across the globe.

Discussion

A bibliometric analysis of the 500 most frequently referenced papers on cancer epidemiology showed a compound annual growth rate of minus 18.97%, which suggests that the number of documents has decreased over time.

The mean number of citations per paper, which is 2148, suggests that cancer epidemiology research is being extensively referenced. In addition, the substantial average number of co-authors per document (70.1) and the notable proportion of foreign co-authorships (60.8%) suggest a cooperative research setting. In general, the findings of the bibliometric study indicate a decline in the quantity of publications. However, there exists research of exceptional quality that is extensively referenced and necessitates rigorous collaboration among scholars.

Bibliometric examination of annual scientific output yields significant insights into the dynamics of scientific production in the field of cancer epidemiology. Understanding these trends enables researchers and policy makers to make well-informed decisions to progress the field and enhance cancer prevention and treatment.

The analysis of the top 500 cited articles in cancer epidemiology indicates that the most often referenced sources are general medical journals such *The Lancet*, *New England Journal of Medicine*, *Nature*, and *JAMA*. This implies that innovative research in cancer epidemiology frequently receives publication in these influential, interdisciplinary journals. In addition to the prevalence of general medical journals, there is a notable presence of cancer-specific journals such as *Lancet Oncology*, *Journal of Clinical Oncology*, and *Cancer Epidemiology, Biomarkers & Prevention*. These specialized publications are essential for the dissemination of research that is specifically focused on cancer epidemiology. The presence of such variation implies that cancer epidemiology is a wide-ranging discipline that encompasses research on numerous aspects of the disease. The prevalence of general medical publications indicates that research in cancer epidemiology has substantial consequences for wider medical practice and public health objectives.

This bibliometric analysis demonstrates that cancer epidemiology research is a global endeavor, and the collaborative nature of research, as evidenced by articles published by multiple countries, highlights the importance of international partnerships in addressing this

complex disease. United States was the clear leader in English written publication with a significantly higher number of publications than other countries. This suggests that the United States is a major center for cancer epidemiology research. European countries, including the United Kingdom, France, Germany, and Italy, are significant contributors to the field. While the United States and European countries dominate, other countries such as Canada, Australia, and China also have a significant presence, indicating a growing global interest in cancer epidemiology.

Important study fields in cancer epidemiology encompass the discovery of environmental and genetic variables that increase the risk of cancer, progress in research techniques, and the assessment of screening and prevention approaches [8]. The field also highlights the influence of socio-economic position on the occurrence and death rates of cancer, exposing significant variations in cancer treatment and results among various global locations [8]. Although there have been notable improvements, there are still difficulties that need to be overcome, especially in dealing with the changeable elements that lead to the occurrence of cancer. Ongoing research endeavours seek to augment comprehension of these variables, advocate for healthy behaviours, and diminish the overall prevalence of cancer, especially among populations at greater risk [9]. The advancements in cancer epidemiology will have a pivotal impact on the development of efficient public health interventions and policies targeted at preventing and managing cancer.

Thematic analysis results showed that "risk", "mortality", "genome-wide association", "classification" and "epidemiology" are important for research and the future study trend may shift in this direction. The most studied and intensive topics were “risk factor”, “body mass index” and the “United States”. This may be due to the fact that cancer epidemiology studies are mostly conducted on cancer cohorts in the United States, and they mostly examine risk factors through obesity.

There were various restrictions on our study. Initially, our analysis of articles was restricted to citation counts, which hindered our ability to examine more recent developments in our field. Second, there might be a restriction associated with using the WOS Journal Citation Report. It has previously been questioned if citation indices are a reliable indicator of the importance and relevance of a piece of work [10]. Technical constraints may have resulted in the unintentional omission of specific articles from our analysis. Nonetheless, our study exhibits numerous strengths. No prior bibliometric analysis has been performed on cancer epidemiology. My current analysis encompassed only the 500 most cited articles in the field, which may be inadequate for a thorough

examination of trends in this subspeciality. Furthermore, articles published in languages other than English were omitted, potentially constituting a limitation.

In conclusion, this bibliometric analysis represents the first effort to examine the distribution and development of the cancer epidemiology field worldwide. It has been observed that there is currently an additional need for not only a formal definition but also a functional definition that can precisely define the boundaries of the discipline. This analysis will enable both clinicians and researchers to readily determine the popularity of articles on cancer epidemiology and the predominant topics that receive more citations. Lastly, the findings of this bibliometric analysis will serve as a reference for research investigating cancer epidemiology.

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Authors contributions: Y.A. constructed the main idea and hypothesis of the study. Y.A. developed the theory and arranged/edited the material and method section. Y.A. has done the evaluation of the data in the Results section. Discussion section of the article written by Y.A. Y.A approved the final version.

Conflict of interest: The authors declare that they have no conflict of interest.

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Table 1. Summary of bibliographic statistics (n=500)

Description	**Results**
Authors	
Authors	19951
Authors of single-authored docs	12
Authors Collaboration	
Single-authored docs	12
Co-Authors per Doc	70.1
International co-authorships %	60.8
Document Contents	
Keywords Plus (ID)	2246
Author's Keywords (DE)	604
Document Types	
Article	340
Article; Book chapter	2
Article; Proceedings paper	3
Correction	1
Editorial material	6
Letter	1
Review	145
Review; Book chapter	2
Main Information about Data	
Timespan	2010:2024
Sources (Journals, Books, etc)	180
Documents	500
Annual Growth Rate %	-18.97
Document Average Age	7.23
Average citations per doc	2148
References	43687

Table 2. Most cited first 15 authors

Paper	Title of articles	DOI	TC	TC per Year	Ref
Moher D, 2010	Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement	10.1016/j.ijsu.2010.02.007	122456	8164	[11]
Siegel Rl, 2017	Cancer statistics, 2017	10.3322/caac.21387	72934	9117	[12]
Siegel Rl, 2021	Cancer Statistics, 2021	10.3322/caac.21654	72934	18234	[13]
Sung H, 2021	Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries	10.3322/caac.21660	31327	7832	[14]
Ferlay J, 2015	Cancer incidence and mortality worldwide: Sources, methods and major patterns in GLOBOCAN 2012	10.1002/ijc.29210	21741	2174	[15]
Siegel R, 2014	Cancer statistics, 2014	10.3322/caac.21208	16474	1498	[16]
Torre La, 2015	Global cancer statistics, 2012	10.3322/caac.21262	14847	1485	[17]
Chen W, 2016	Cancer statistics in China, 2015	10.3322/caac.21338	14400	1600	[18]
Ferlay J, 2010	Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008	10.1002/ijc.25516	12826	855	[19]
Bolyen E, 2019	Reproducible, interactive, scalable and extensible microbiome data science using QIIME 2	10.1038/s41587-019-0209-9	11178	1863	[20]
Koboldt Dc, 2012	Comprehensive molecular portraits of human breast tumours	10.1038/nature11412	9002	692	[21]
Schulz Kf, 2010	CONSORT 2010 statement: updated guidelines for reporting parallel group randomised trials	10.1136/bmj.c332	8827	588	[22]
Altshuler Dm, 2015	A global reference for human genetic variation	10.1038/nature15393	8459	846	[23]
Siegel Rl, 2022	Cancer statistics, 2022	10.3322/caac.21708	8279	2760	[24]
Siegel Rl, 2020	Cancer statistics, 2020	10.3322/caac.21590	8120	1624	[25]

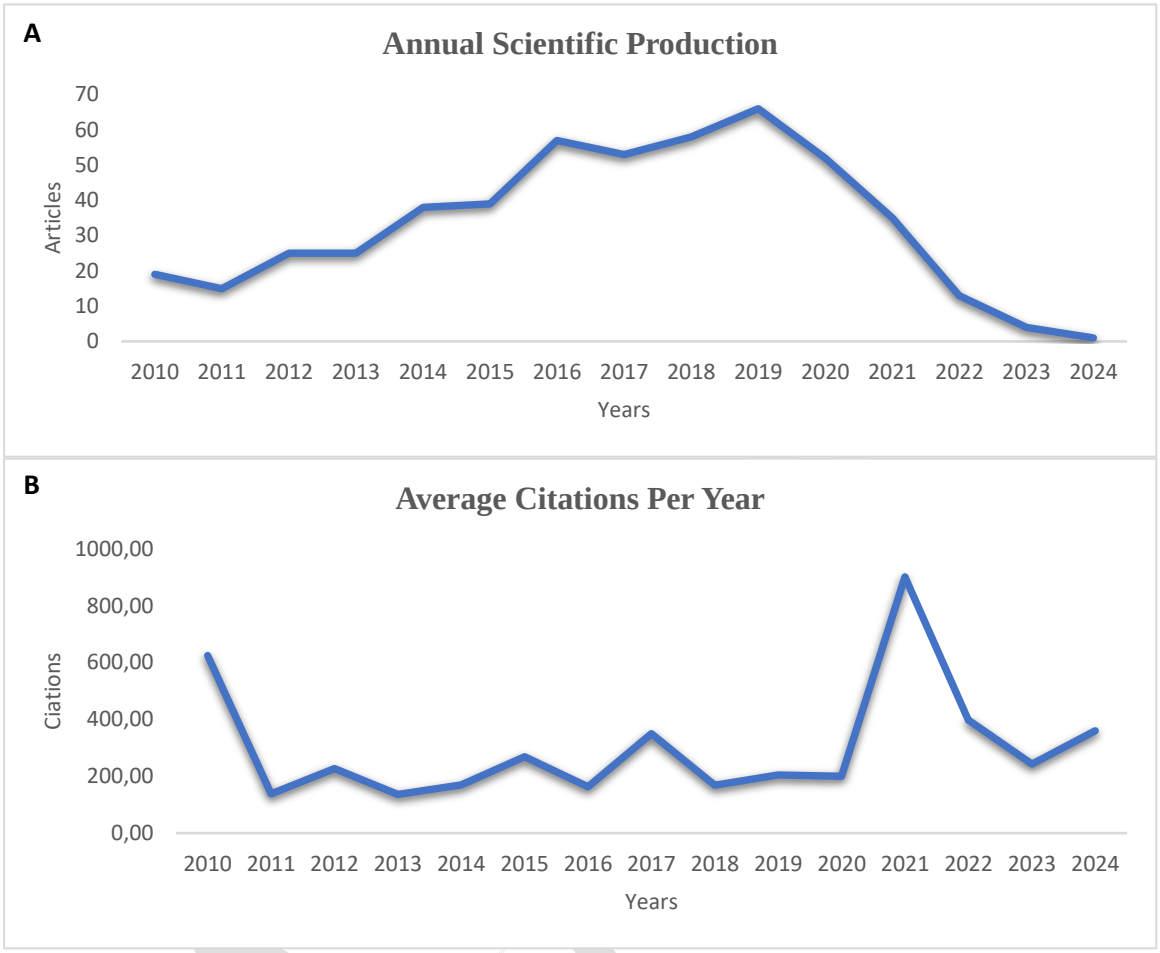

Figure 1. Annual scientific production over the years for the most cited 500 articles (A) and average citation per year (B)

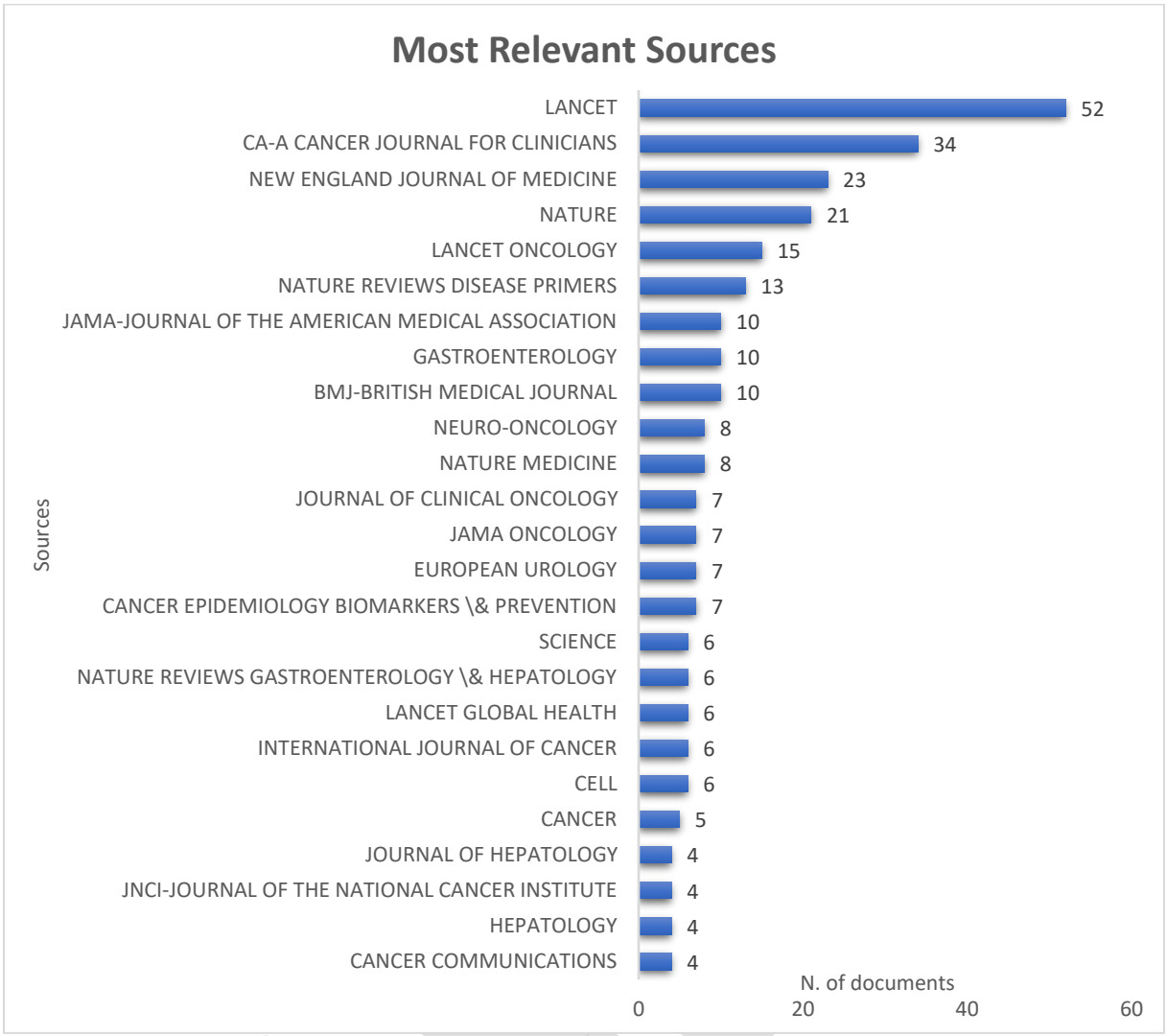

Figure 2. The most relevant sources of the 500 most cited articles in the field of cancer epidemiology

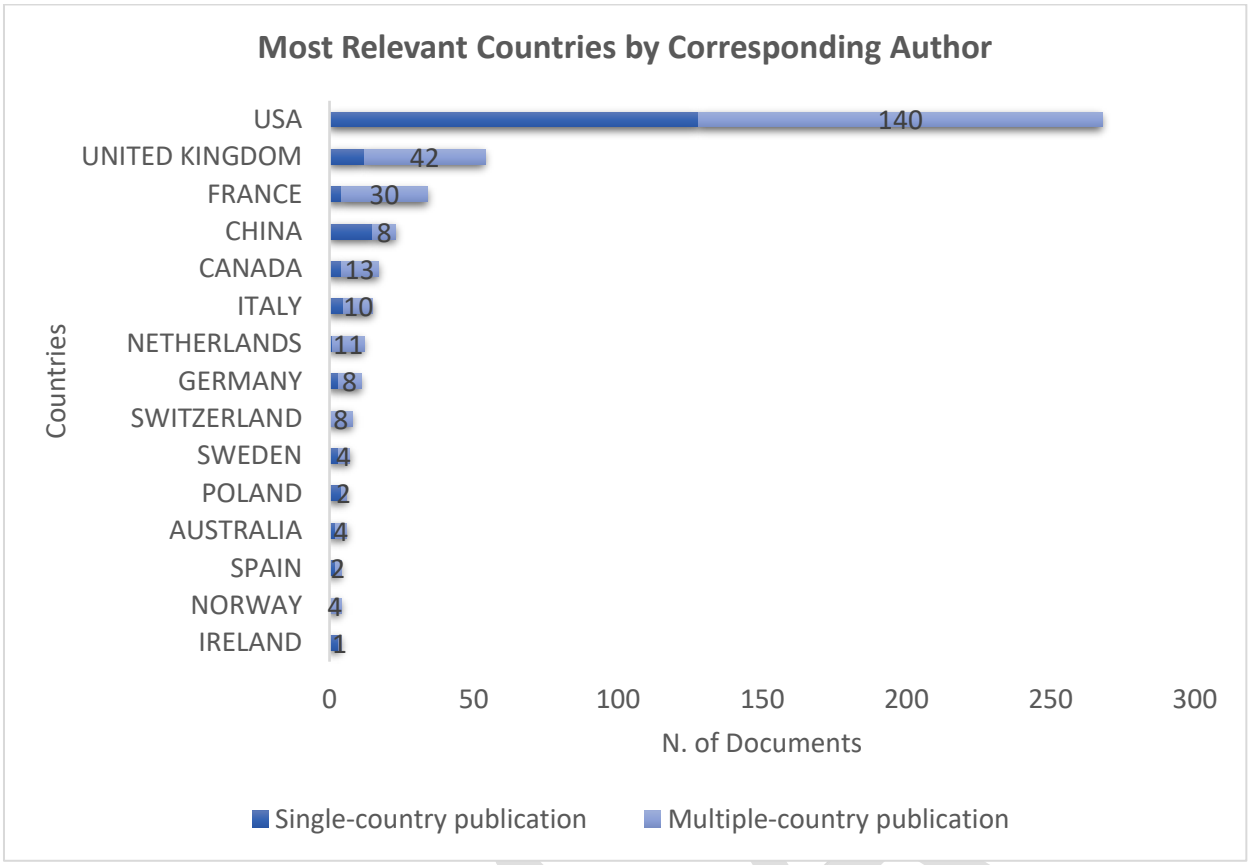

Figure 3. Most relevant countries by corresponding author

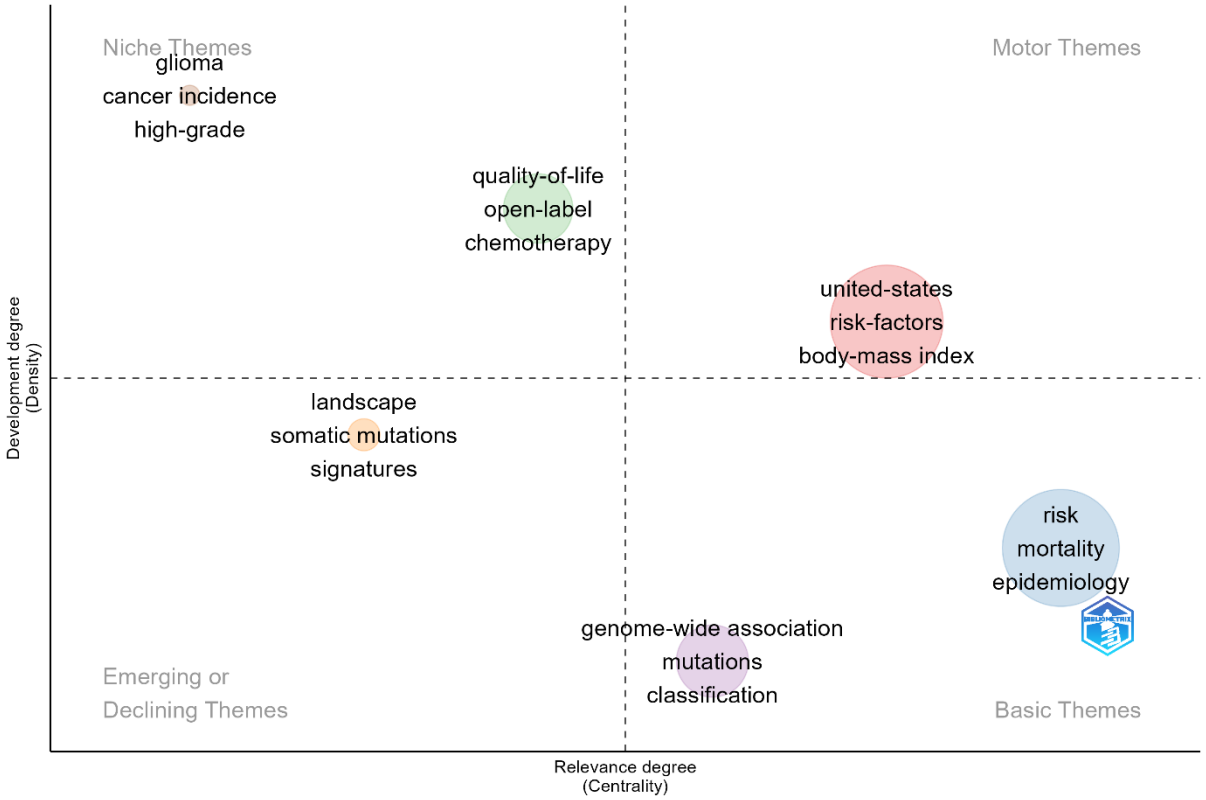

Figure 4. Thematic map based on density and centrality, divided into four topological regions

Figure 5. WordCloud

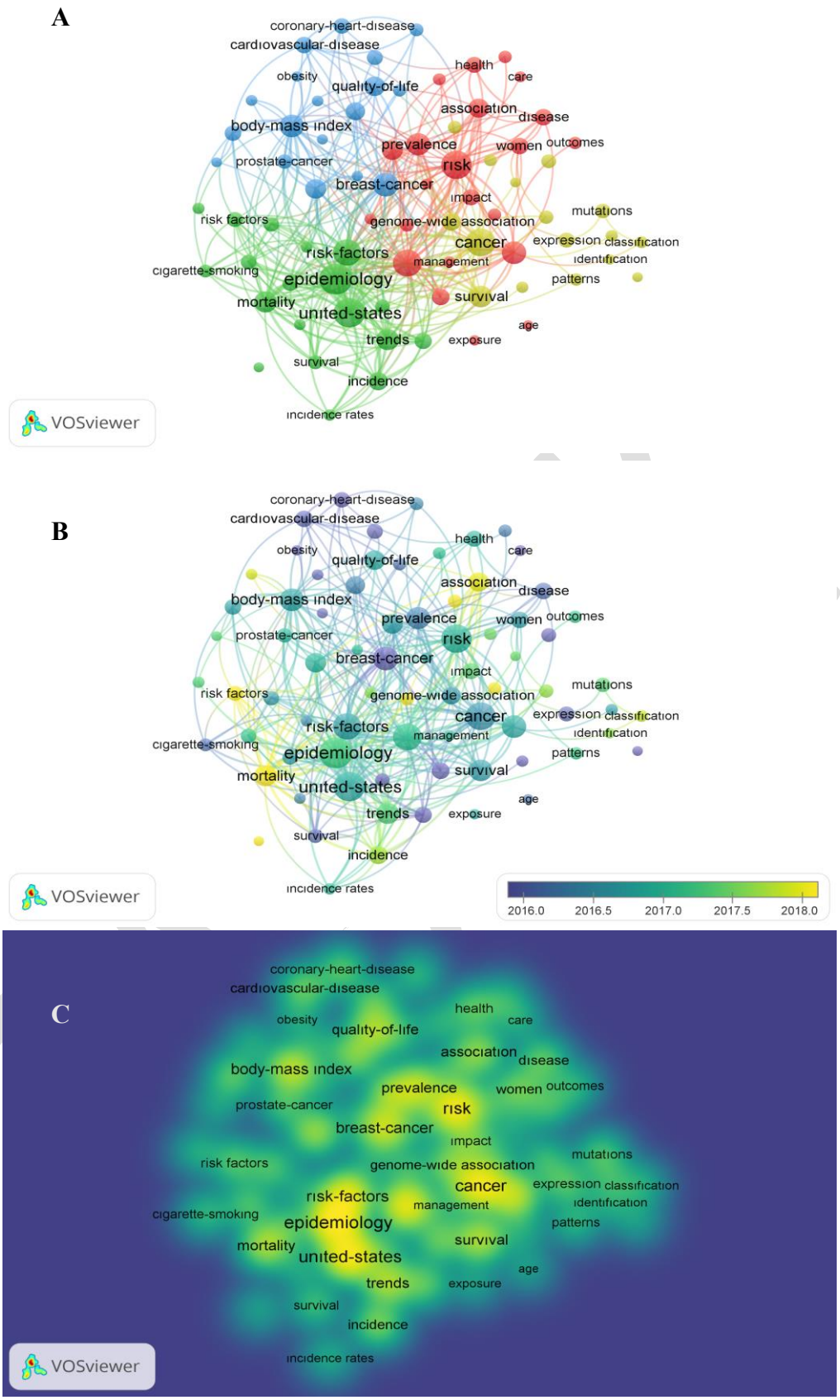

Figure 6. Co-occurrence keywords. (A) network visualisation, (B) overlay visualisation (C) density visualization

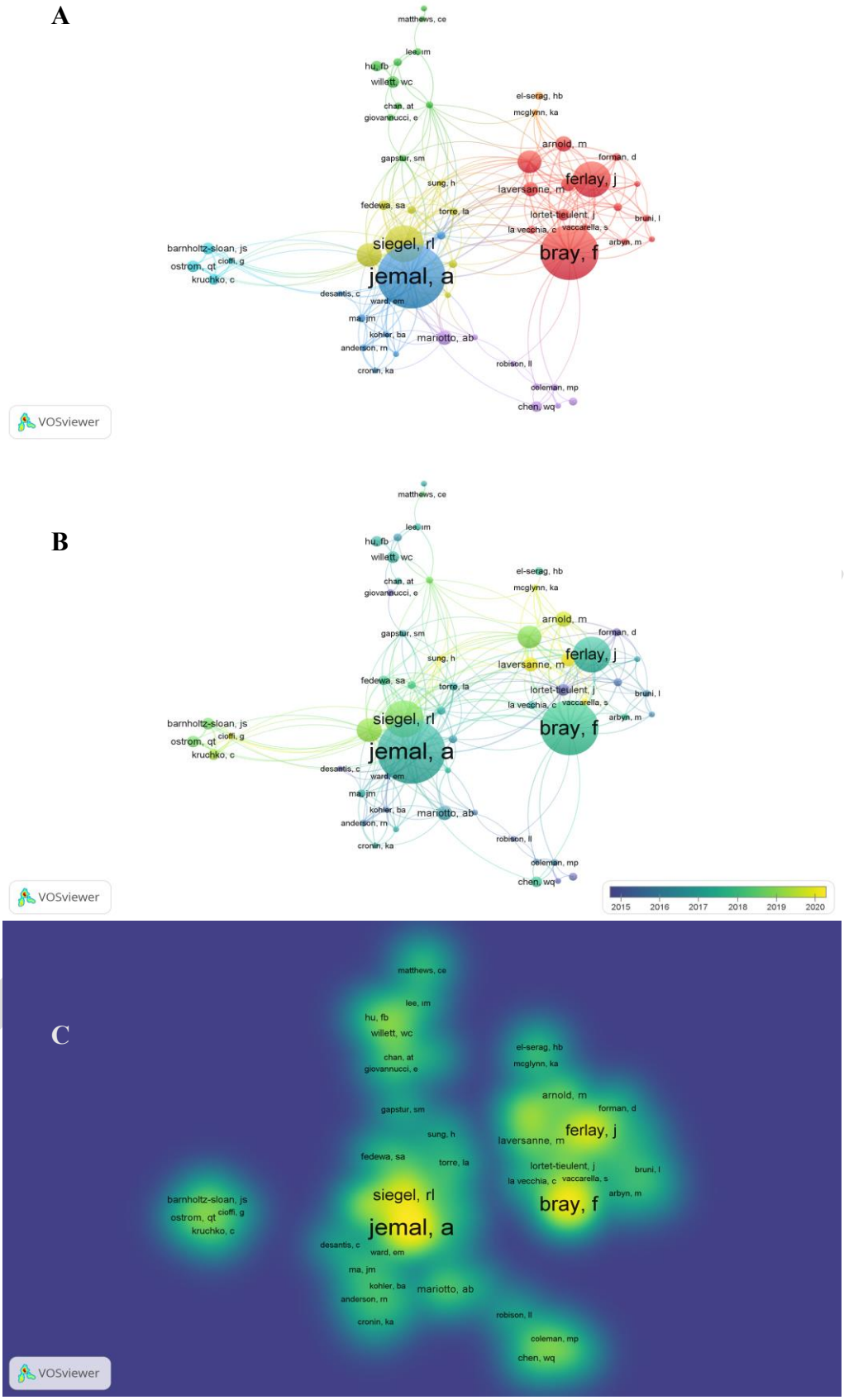

Figure 7. Co-occurrence authorship (A) network visualisation, (B) overlay visualisation (C) density visualization

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Yasemin Adalı, Asst. Prof. Pamukkale University, Faculty of Medicine, Department of Biophysics, Denizli, Türkiye; Centre for Public Health, Queen's University Belfast, School of Medicine, Dentistry and Biomedical Sciences, Belfast, United Kingdom- Visiting Scholar, e-mail: yadali@pau.edu.tr (https://orcid.org/0000-0002-7482-709X) (Corresponding Author)