

# Global trends of researches on psycho-oncology during 1999-2019: A 21-year bibliometric study based on VOSviewer

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## Research article

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# Abstract

## Background

The studies on psycho-oncology are growing rapidly, but there were no bibliometric studies regarding psycho-oncology. This study was to explore a bibliometric analysis of psycho-oncology in the past 21 years at a global level.

## Methods

The literature was searched in Web of Science (WOS) by using subject terms. VOSviewer software was used for bibliometric analysis of the retrieval results.

## Results

The literature search yielded 1921 papers. After screening process, 968 papers were included, which came from 55 countries/regions, 1,452 organizations and 4,152 authors. The top three countries/regions, organizations and authors ranked by the number of published papers were the United States of America (USA) (286), Germany (143) and Australia (130); the Memorial Sloan-Kettering Cancer Centre (MSKCC) (New York, USA) (34), Newcastle University (Newcastle, Australia) (29) and McGill University (Montreal, Canada) (28); Luigi Grassi (University of Ferrara in Italy) (26), Tatsuo Akechi (Nagoya City University Hospital in Japan) (20) and Anja Mehnert (University of Leipzig in Germany) (18), respectively. Moreover, the 968 papers contained 1,768 author keywords, involved in 300 journals and cited 28,311 references. The top three co-occurrence author keywords, most-involved journals and most-cited references were "Quality-of-life", "Depression" and "Breast cancer"; Psycho-Oncology, Supportive Care in Cancer and Journal of Psychosocial Oncology; "Zigmond AS, 1983", "Zabora J, 2001" and "Mitchell AJ, 2011", respectively.

## Conclusions

There was a growing trend in published papers related to psycho-oncology, with the organizations and authors from developed countries leading the field. "Quality-of-life", "Depression" and "Breast cancer" reflected the most hotspots, and the latest progress can be tracked in Psycho-Oncology.

# Background

Medical model has changed from biomedical model to biopsychosocial model since 1970s. The influence of psychosocial factors on the occurrence, treatment and prognosis of various diseases, especially cancers, has been paid more and more attention around the world [1, 2]. In these several decades, psycho-social oncology, also called psycho-oncology, has been an interdisciplinary discipline and developed as a specialized branch of clinical psychology [3]. Psycho-oncology studies the psychological, emotional and spiritual reactions caused by cancers, the psychosocial care of cancer patients and their families, as well as the role of psychological and behavioral factors in the occurrence,

development and prognosis of cancers [4]. With the increasing incidence of cancers, the prevention and treatment of cancers has become an important public health problem. Meanwhile, psycho-oncology has become an essential component of the multi-disciplinary treatment (MDT) for cancers [5, 6].

Mapping knowledge domains (MKD) came into being at the beginning of the 21st century and has been widely used in business, education, health care and other fields these years [7]. MKD rising in the field of scientometrics and knowledge metrology is a visual graphic mode of analyzing knowledge structures, exploring research hotspots and deeply mining knowledge information [8]. There have been more than thirty kinds of tools for MKD, such as VOSviewer, CitNetExplorer, Citespace, HisCite, CRExplorer and RPYS i/o and so on [9–12]. Most of the tools are easy to operate and have powerful features. Among them, VOSviewer, developed by Leiden University Science and Technology Research Center in the Netherlands, has a unique advantage to map and visualize the network of countries/regions, organizations, authors, keywords that are related to psycho-oncology [13].

In 2014, Hack TF et al. conducted a historical review of psycho-oncology and supportive care research in Canada using citation analysis [14]. Citation analysis is useful for examining the research performance of psycho-oncology and supportive care researchers and identifying leaders among them. However, citation analysis is less intuitive than MKD to demonstrate the course and current situation of psycho-oncology. Thus, the purpose of this study was to conduct a worldwide development trend research on psycho-oncology during 1999–2019 based on VOSviewer. The present study will be helpful for researchers to select relevant hotspots and to find suitable teams to collaborate with and research platforms to use.

## Methods

### Data sources, search strategies and data extraction

The core collection database of Web of Science (WOS) was used to search for literature on psycho-oncology in a single day February 22, 2020 by two authors (CJZ, GFH) independently. All data were downloaded from public database and had nothing to do with human subjects. Thus, ethical approval was not required. The theme index was presented as follow: “psycho oncology” OR “psychosocial oncology” OR “oncology, psychosocial” OR psychooncology OR psycho-oncology, and the time span was set from 1999 to 2019. The search results were subsequently filtered to include peer-reviewed articles and reviews in English. Detailed process of the enrollment and screening was shown in Fig. 1. The original .txt data were downloaded from the WOS, including title, publication year, journal information, countries/regions, organizations, authors, author keywords, abstract and cited references, and so on. Two independent authors (CJZ, GFH) conducted the data extraction simultaneously to ensure that the search data were accurate and comprehensive.

## Bibliometric Analysis

The bibliometric analysis in this study was performed and visualized using VOSviewer 1.6.14 (Leiden University, Leiden, Netherlands) by two authors (CJZ, XCQ) independently. VOSviewer 1.6.14 can be downloaded and used freely from <https://www.vosviewer.com/download>.

We analyzed the cooperation situation in the field of psycho-oncology among countries/regions, organizations and authors via co-authorship analysis; the author keywords in the field of psycho-oncology via co-occurrence analysis; the publication of journals via bibliographic coupling analysis; and the cited references via co-citation analysis. Additionally, the global publications distribution was analyzed by bibliographic coupling analysis of countries/regions, and the visualization result was selected "Overlay Visualization".

Furthermore, the data of the top 10 countries/regions, organizations, authors, journals ranked by the number of documents published, the top 10 author keywords ranked by the number of co-occurrence and the top 10 cited references ranked by the citation frequency were subsequently inputted into Word Processing System (WPS) office 2020 XLS (Kingsoft Office Corporation, Beijing, China, <https://www.wps.cn/>) for quantitative analyses.

## Results

### Overview of publications on psycho-oncology

A total of 1921 papers were detected through a comprehensive literature search. After the screen strategies, a total of 968 published papers met the inclusion criteria for this study. On the whole, there was a growing trend both in publications and citation in the past 21 years (Fig. 2A). The year 2019 ranked the most productive year with 109 publications, followed by the year 2018 with 97 papers and the year 2017 with 90 papers. Moreover, by the last retrieval time the citation frequency was 16,865, which reached a peak of 2,375 in year 2019, followed by 2,064 in year 2018 and 1,707 in year 2017.

The 968 publications were drawn from 55 countries/regions. The 55 countries/regions distributions were divided into 7 different colors of clusters according to the appearance for the average time (Fig. 2B). It is worth mentioning that South Africa, Mexico, Qatar, Saudi Arabia and Lebanon had recently begun to make most contributions to this field.

The 968 publications involved 48 researching directions by intrinsic analysis function of WOS. Except for the two largest but non-specific researching directions of oncology and psychology, the article numbers of main researching directions were shown in Fig. 2C.

### Co-authorship Analysis Of Countries/regions

In this study, the VOSviewer 1.6.14 software was used to analyze the network visualization of co-authorship relationships between 55 different countries/regions. Only countries/regions with a minimum

of five articles were included. A total of 32 countries/regions were identified, however, among which Singapore was not connected to each others. Thus, the remaining 31 countries/regions were divided into seven clusters, as shown in Fig. 3A. Furthermore, the co-authorship analysis involved in 55 different countries/regions was shown in Supplementary Fig.S1.

The top 10 countries/regions ranked by the number of documents published were shown in Fig. 3B. The United States of America (USA) was the clear leader in terms of documents quantity (286) followed by the Germany (143) and Australia (130), total link strength (131) followed by the Australia (79) and Germany (55), and Norm. citations (345.36) followed by the Germany (146.01) and Australia (128.10), respectively.

## Co-authorship Analysis Of Organizations

A total of 1,452 organizations were represented in the published 968 articles. Only organizations with a minimum of 10 articles were included in co-authorship analysis. A total of 39 organizations were identified, which were divided into five clusters, as shown in Fig. 3C. This co-authorship analysis revealed that Newcastle university ( Newcastle, Australia) had closely collaborations with Hunter Medical Research Institution (Newcastle, Australia), University of Sydney (Sydney, Australia) and McGill University (Montreal, Canada). Furthermore, the co-authorship analysis involved in 1452 organizations was shown in Supplementary Fig.S2.

The top 10 organizations ranked by the number of documents published were shown in Fig. 3D. Among these 10 organizations, three organizations were respectively located in Canada and Australia, and one organization was respectively located in USA, England, Italy and Germany. The most productive organization in terms of published articles was Memorial Sloan-Kettering Cancer Centre (MSKCC ) in New York, USA (34), followed by Newcastle University (29) and McGill University (28). Newcastle university had the highest total link strength (44), followed by University of Sydney (35), McGill University (22) and University of Queensland (Queensland, Australia) (22). In addition, University of Sydney had the highest Norm. citations (43.81), followed by University of Ferrara (Ferrara, Italy) (39.73) and Harvard University ( Boston, USA) (30.87, not in Fig. 3D).

## Co-authorship Analysis Of Authors

Analysis using the VOSviewer 1.6.14 software revealed that the 968 articles totally included 4,152 authors, in which the same one author's name may had several different ways of writing. Only authors with a minimum of five articles were included in co-authorship analysis. A total of 54 authors were identified, which were divided into 12 clusters, as shown in Fig. 3E. Some of the 54 authors in the network map were not connected to each other, while the network map also showed massive collaborations between authors, such as Luigi Grassi and Rosangela Caruso both from University of Ferrara in Italy.

The top 10 authors ranked by the number of documents published were shown in Fig. 3F. Luigi Grassi published the greatest number of papers (26), followed by Tatsuo Akechi from Nagoya City University Hospital in Japan (20) and Anja Mehnert from University of Leipzig in Germany (18). The authors who had the three highest total link strength were Luigi Grassi (50), Tatsuo Akechi (49) and Rosangela Caruso(38), respectively. Nevertheless, the authors ranked by the three highest Norm. citations were Luigi Grassi (40.95), Anja Mehnert (32.55), and Alex J Mitchell (25.76, not in Fig. 3F) from Leicester Partnership Trust (Leicester, UK).

## Co-occurrence Analysis Of Author Keywords

A total of 1,768 author keywords in the 968 papers on psycho-oncology were extracted by the VOSviewer 1.6.14 software. As shown in Fig. 4A, 37 author keywords defined as terms that co-occurred the minimum number of 10 times within title and abstracts in all papers were analyzed using a co-occurrence network analysis tool in the VOSviewer 1.6.14 software. In this analysis, these 37 author keywords were classified into 4 large clusters. In addition, the distribution of these 37 author keywords according to the average time they appeared in the articles showed that “Fear of cancer recurrence” may indicate the main research hotspots in recent years (Supplementary Fig.S3). Furthermore, the co-occurrence analysis of 1,768 author keywords was shown in Supplementary Fig.S4.

The top 10 author keywords ranked by the number of co-occurrence were shown in Fig. 4B. The most commonly used keywords were “Quality of life”(131), “Depression”(90) and “Breast cancer”(68), respectively. Furthermore, the author keywords with the three highest total link strength were “Quality of life”(139), “Depression”(127) and “Anxiety”(95), respectively.

## Bibliographic Coupling Analysis Of Journals

A total of 300 journals had published articles in field of psycho-oncology. Using the VOSviewer 1.6.14 software, 33 journals published 5 or more papers were included in the bibliographic coupling analysis of journals, as shown in Fig. 4C. These 33 journals were classified into 5 large clusters.

The top 10 journals ranked by the number of published documents were shown in Fig. 4D. More than half of the publications were published in the top 10 journals (578, 59.71%). Obviously, Psycho-Oncology had taken a leading position in terms of published documents (190), total link strength (11,279) and Norm. Citations (260.40). It indicated that Psycho-Oncology could be considered the most influential journal in the field of research for psycho-oncology. Of note, Supportive Care in Cancer ranked the second for the total number of publications (64), total link strength (5,489) and Norm. Citations (57.90). Journal of Psychosocial Oncology ranked the third for published papers (44) and total link strength (3,328), while Cancer ranked the third for Norm. Citations (44.64).

# Co-citation Analysis Of Cited References

By the VOSviewer 1.6.14 software, the analysis revealed that the 968 articles totally cited 28,311 references. Forty-four references with a citation frequency greater than 20 were selected to create the co-citation map, as shown in Fig. 4E. All of them were classified into four clusters. These cited references were published between 1983 and 2014, meanwhile 6 of them were published in Journal of Clinical Oncology. Among the first author of these 44 articles, Jimmie Holland from MSKCC (New York, USA) contributed 3 articles, while no other first author contributed more than 3 articles [15–17].

The top 10 most-cited articles were shown in Fig. 4F. Zigmond AS and Snaith RP from St. James' University Hospital (Leeds, Yorkshire, England) had published the first most-cited article (126 times), which were about Hospital Anxiety and Depression Scale (HADS) [18]. The HADS was a self-rated screening questionnaire detecting mild degrees of anxiety and depression. Although it was designed for general medical hospital outpatients, it had been widely used in primary care. Citation frequency of the second most-cited article was 95 time, which was contributed by Zabora James from the Johns Hopkins University School of Medicine (Baltimore, USA). This article entitled "The prevalence of psychological distress by cancer site" was published on Psycho-Oncology in 2001 [19]. The third most-cited article (72 times) was written by Alex J Mitchell from Leicester Partnership Trust (Leicester, UK), which was a meta-analysis study aimed to quantitatively summarise the prevalence of depression, anxiety, and adjustments disorders in oncological, haematological and palliative-care settings [20]. Besides, the aforementioned three papers also ranked respectively the top three for the total link strength.

## Discussion

### The development of psycho-oncology between the East and the West

Our study showed that the top 10 countries/regions, organizations and authors ranked by the number of publications were totally from developed countries, which inevitably dominated the psycho-oncology field of research. Given the fact that the definition of psycho-oncology was initially proposed by Jimmie Holland at MSKCC (New York, USA) in 1970s, developed countries have fostered integration and implementation of psycho-social care much earlier than developing countries [21–23]. On the other hand, the condition of basic medical research, clinical trials and academic advantage appear to be superior in developed countries, which may play an important role in this phenomenon.

However, over last two decades, gained lots of experience, guidance and strengthened support from the scholars of developed countries, low- and middle-income countries in Asia, Africa, Latin America, such as Mainland China, India, Nigeria, Kenya, South Africa, Brazil and so on have developed their own working groups or societies in the field of psycho-oncology [24–26]. In 2006 Jimmie Holland was invited to Mainland China to join in the preparation work of building Chinese Psychosocial Oncology Society (CPOS) and give academic lecture to Chinese colleagues [23, 27]. Moreover, in 2016 CPOS published the

first Chinese Psychosocial Oncology Therapy Guidelines for Cancer patients in China, which represented a milestone in the development of Chinese psycho-oncology clinical practice [28]. Notably, nowadays the International Psycho-Oncology Society (IPOS), which represents over 9000 psycho-oncology professionals in more than 90 countries around the world, is committed to fostering the science of psychosocial and behavioral oncology and improving the quality of life for those affected by cancer globally [29].

## **The hotspots and emerging field of psycho-oncology**

It is clear that psychosocial oncology researchers includes individuals with diverse clinical and research backgrounds, including physicians, psychologists, psychiatrists, rehabilitation specialists, physiotherapists, genetic counselors, nurses, social workers, epidemiologists, social scientists and educators. Thus, the research themes of psychosocial oncology correspondingly cover a broad range. Of note, our analysis of the 48 research directions suggested that the biomedical social sciences and health care sciences services had received enough attention or study over the last two decades. From the social and public health perspective, it can extensively and unambiguously advocate toward the adoption of Standard of Quality in Cancer Care and Clinical Practice Guidelines[17, 30, 31]. Moreover, our co-occurrence analysis of author keywords identified that “Quality of life”, “Depression” and “Breast cancer” were the three most hotspots in psycho-oncology research. Breast cancer is the most common malignancy among women with a relative long-term survival; addressing survivors’ unique post-treatment needs is critical to providing quality cancer care, which partially explain why we come to this conclusion in this analysis [32, 33].

Additionally, we should pay some attention to the emerging field or innovative ideas of psycho-oncology research, such as psychosocial issues in genetic testing and internet-based psychosocial interventions. In fact, “Genetic testing”(1 time), “Genetic mutation”(1 time), “Genetic counseling”(1 time), “Genetic panel testing”(1 time), “Telephone”(9 times), “online”(7 times), “Telehealth/ehealth/mhealth”(5 times) and “Internet-based/IT-based”(4 times) have emerged in titles of the 968 articles. For instance, a study investigated the psychosocial consequences of genetic counseling and testing for hereditary breast and ovarian cancer. The results suggested that the psychological needs of undecided counselees warranted ongoing attention and potential follow-ups [34]. Another recent article entitled “Development and usability evaluation of an online self-management intervention for fear of cancer recurrence (iConquerFear)” indicated that iConquerFear had the potential to address the unmet supportive care needs reported by burgeoning numbers of cancer survivors [35]. In particular, during the outbreak period of 2019 New Coronavirus (2019-nCoV) pneumonia, psychological crisis intervention has been initiated via remote (telephone and internet) and onsite medical services to help medical workers, patients, and others affected to overcome any psychological difficulties [36]. Thus, online psychological therapy programs may have the feasible, tailored and interactive advantage in psychological interventions, and further research is necessary to explore ways to optimize the use of this approach.

## **Study limitations**

Although our data analysis was relatively comprehensive and objective, this study had some shortcomings. First, the literature was only searched in WOS core collection database. There are indeed other database for bibliometric analysis, such as Pubmed and Scopus. However, to the best of our knowledge, Thomson Reuters' WOS is the most appropriate database for performing bibliometric analysis [37]. Second, some important studies related to research area of psycho-oncology in non-English language were not included and analyzed. Third, there were differences between the bibliometric analysis results and the real research situations, since some latest published high-quality studies were not focused on because of their low citation frequency [37]. Therefore, it may be necessary to update the bibliometric analysis in the future. In fact, every database or method has its merits and weaknesses. In our opinion, bibliometric analysis is just a useful method to comprehend rapidly the performance statistics, research hotspots, latest frontiers and trends in some field but not "complete picture".

## **Clinical implications**

As we all know, the predominant purpose of psycho-oncology is to guide cancer patients, their families or caregivers to cultivate positive coping styles and ultimately improve quality of life, emotional function, and social function in patients with cancer [4, 38]. In our study, an overview of the global research on psycho-oncology was presented, which provided a better understanding of the global trends in the research on psycho-oncology and indicated the directions for further studies. Thus, the clinical implications of our study were indirectly but profound. Additionally, this study indicated that there was not enough randomized controlled trial (RCT) research on psycho-oncology, and high-quality evidence was limited. It is indeed essential for potential future developments, which also urges for further clinical applications of psycho-oncology.

## **Conclusion**

Our study detailed the performance statistics, research hotspots, latest frontiers and trends in psycho-oncology field. The developed countries made the most outstanding contribution within this important field, as well as assisting the developing countries with experience and guidance. "Quality-of-life", "Depression" and "Breast cancer" were the most common related area and should be closely followed. Authors interested in this field should pay more attention to Psycho-Oncology.

## **Abbreviations**

MDT:Multi-disciplinary treatment; MKD:Mapping knowledge domains; WOS:Web of Science; USA:United States of America; MSKCC:Memorial Sloan-Kettering Cancer Centre; (CPOS:Chinese Psychosocial Oncology Society; IPOS:International Psycho-Oncology Society; RCT:Randomized controlled trial

## **Declarations**

Availability of data and materials

The datasets used and/or analysed during the current study available from the corresponding author on reasonable request. All bibliometric analysis could be replicate again.

#### Ethics approval and consent to participate

All data were downloaded form public database and had nothing to do with human subjects. Thus, ethical approval was not required. The need for consent was waived by our medical ethics committee of Shanghai Mental Health Center. It was deemed unnecessary according to our medical ethics committee and national regulations.

#### Consent for publication

Not applicable.

#### Competing interests

The authors declare that they have no competing interests.

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#### Authors' contributions

CJZ and GFH conducted the literature search strategies and data extraction. CJZ and XCQ conducted the bibliometric analysis. LYP and CW designed the study methodology. CJZ, GFH and CW wrote the paper. CW supervised the study. All the authors read and approved the final manuscript.

#### Acknowledgments

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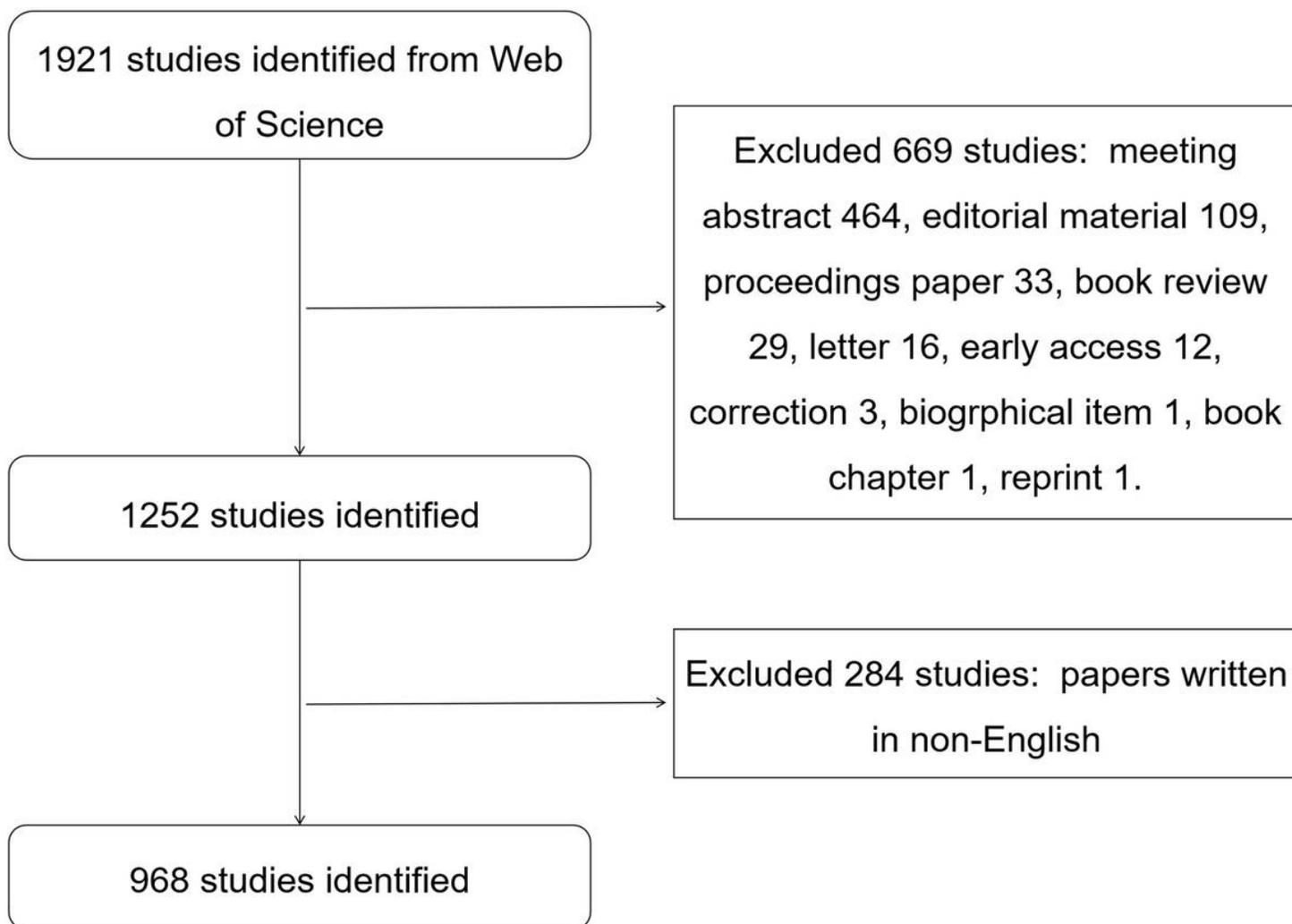
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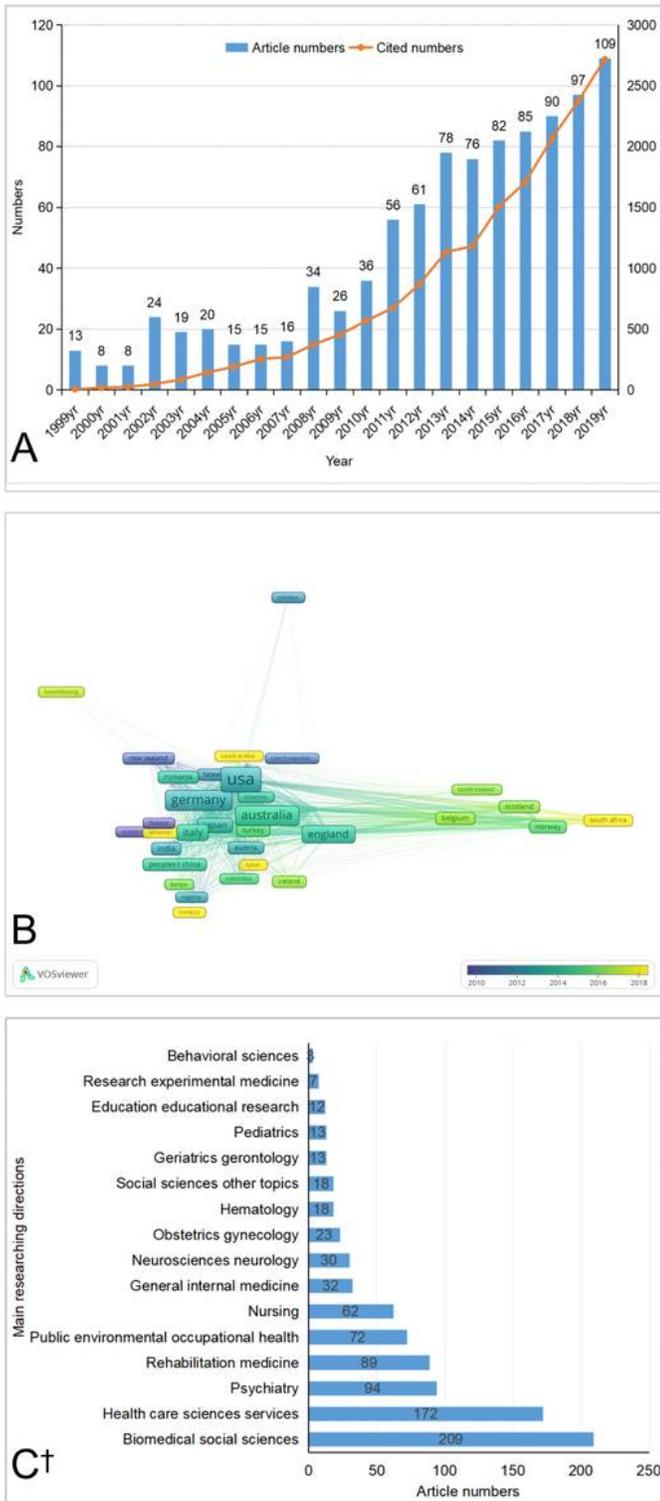
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## Figures



**Figure 1**

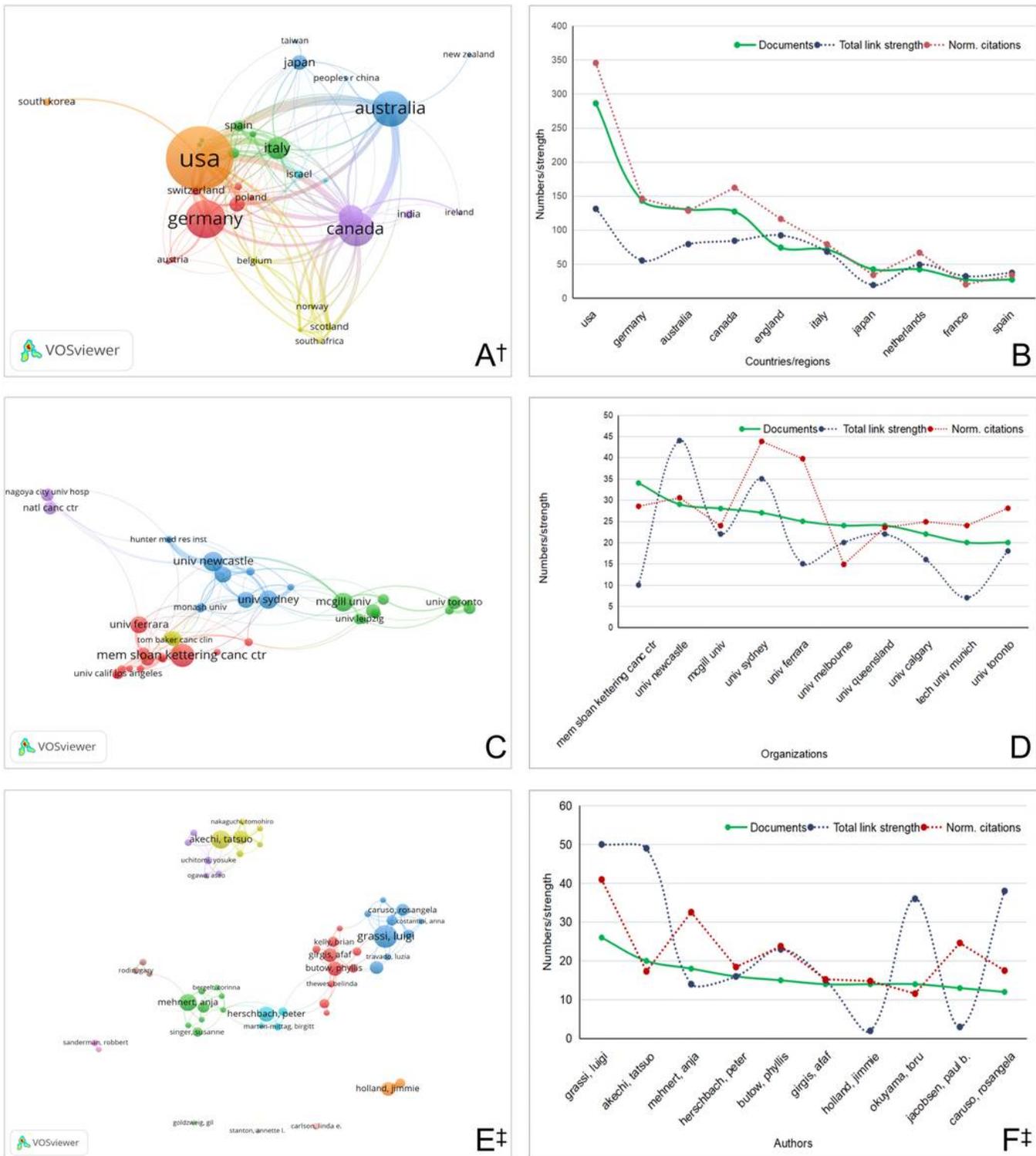
Flow diagram detailing the strategy adopted for the literature search described in this article.



**Figure 2**

Overview of 968 publications on psycho-oncology. (A) The trend of annual publications and citations from 1999 to 2019. (B) 55 Countries/regions distribution was presented according to the appearance for the average time. The blue color represented for early appearance and yellow colored for countries/regions that appeared recently. The larger size of the circle, the more papers the countries/regions published. The smaller the distance between two countries/regions, the higher the

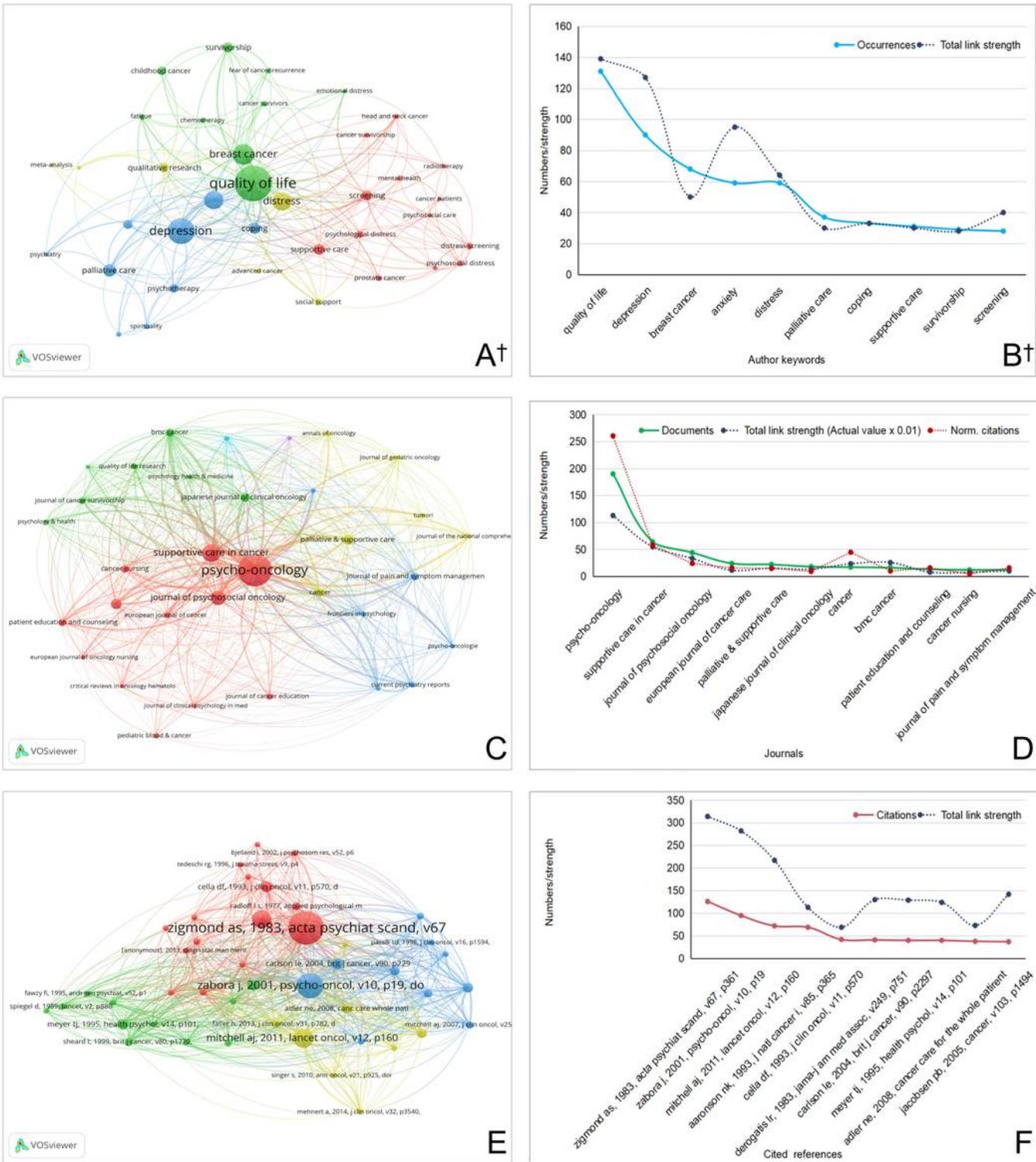
coupling strength. (C) The article numbers of the main researching directions. †We deleted the two largest but non-specific researching directions: oncology with 550 articles and psychology with 339 articles.



**Figure 3**

Co-authorship analysis of countries/regions, organizations and authors. The different colors represented of different clusters according to the default settings. The size of node represented the number of documents, and the thickness of the line represented the degree of co-authorship. (A) Co-authorship

analysis of 31 countries/regions with a minimum of five articles. (B) The top 10 countries/regions ranked by the number of documents published. (C) Co-authorship analysis of 39 organizations with a minimum of 10 articles. (D) The top 10 organizations ranked by the number of documents published. (E) Co-authorship analysis of 54 authors with a minimum of five articles. (F) The top 10 authors ranked by the number of documents published. †Singapore had been deleted from the network map because of no connection to other countries/regions. ‡Through supplementary function in VOSviewer 1.6.14, eight authors' name were merged respectively into only one way of writing, including "akechi, tatsuo", "butow, phyllis", "ernst, jochen", "grassi, luigi", "herschbach, peter", "holland, jimmie", "mehnert, anja" and "okuyama, toru".



**Figure 4**

Co-occurrence analysis of author keywords, bibliographic coupling analysis of journals, and co-citation analysis of cited reference. The different colors represented of different clusters according to the default settings. The size of node represented respectively the number of co-occurrence, document or co-citation frequency, and the thickness of the line represented the degree of link strength. (A) Co-occurrence analysis of 37 author keywords co-occurred a minimum of 10 time. (B) The top 10 author keywords

ranked by the number of co-occurrence. (C) Bibliographic coupling analysis of 33 journals published a minimum of 5 papers. (D) The top 10 journals ranked by the number of published documents. (E) Co-citation analysis of 44 most-cited references. (F) The top 10 most-cited articles †Through supplementary function in VOSviewer 1.6.14, some non-specific author keywords were deleted as follow: psycho-oncology, psychooncology, psychosocial, psychosocial oncology, psychology, oncology, cancer, neoplasms and review. Furthermore, “pediatric oncology” and “health-related quality of life” were merged into “childhood cancer” and “quality of life”, respectively.